Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances

INDEX FOR VOLUME XXIII, 1910

Illustrated Articles marked *

I

L

M

O

P

Q

R

S

T

V

W

Railway and Locomotive Engineering

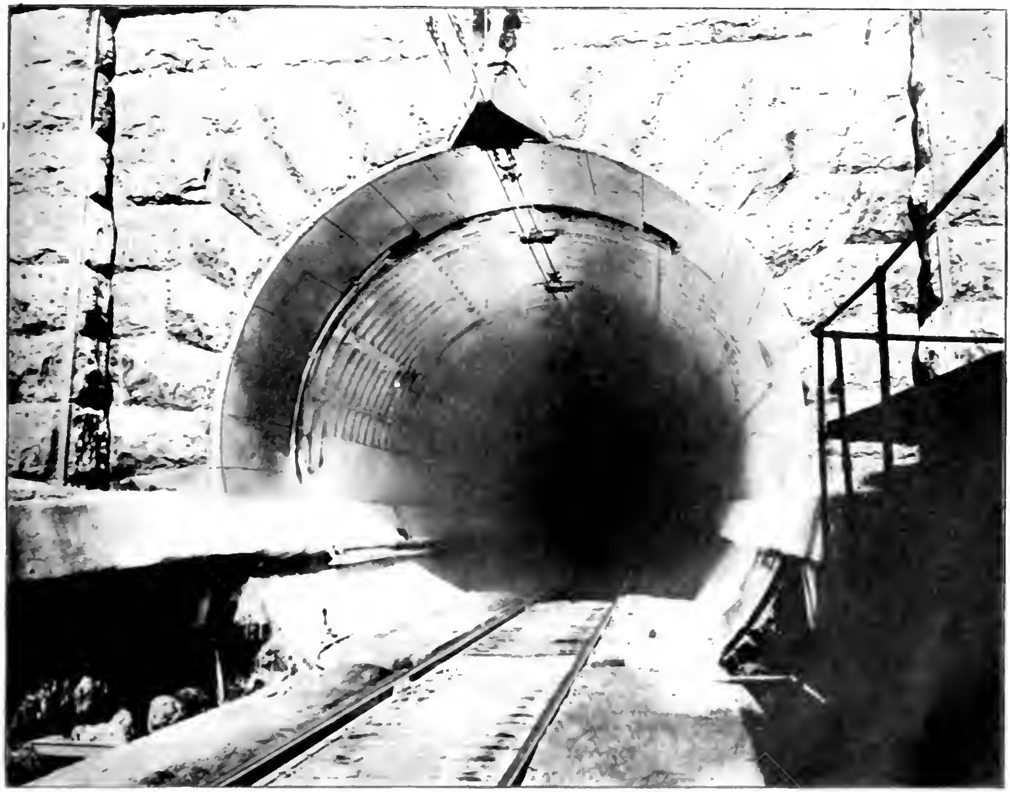
A Practical Journal of Motive Power, Rolling Stock and Appliances

Vol. XXIII. | 114 Liberty Street, New York, January, 1910. | No. 1

The St. Clair Tunnel.

Some months ago the Grand Trunk Railway tunnel connecting Port Huron on the American side with Sarnia on the Canadian side, and which passes under the St. Clair River, was equipped for electric operation. Previous to this, trains passing through the tunnel had been hauled by specially designed steam locomotives. Our frontispiece this month gives a view at close range of the Port Huron portal photographed when the icy breath of winter had whitened this gateway to the under-river [illegible]. Another illustration shows the interior of the tunnel with its string of incandescent lamps along the sides, the overhead trolley wires and the ribbed rings of the tube itself. Still another [illegible] gives the outlook from [illegible] [illegible] Port Huron grade. Mr. E. A. Sager, assistant engineer of the work of electrification, has prepared a technical description [illegible] rived.

The St. Clair tunnel was opened for traffic in 1890 by the St. Clair Tunnel Company, organized as a subsidiary company to the Grank Trunk Railway System. The tunnel under the St. Clair River is the connecting link between the terminal of the western division at Port Huron, Mich., and the terminal of the eastern division at Sarnia, Ont. The length of the tunnel from portal to portal is 6032 ft. The tunnel approaches are both open, that on the Port Huron side being slightly over 2,500 ft. in length while that on the Sarnia side



[illegible] WAY SYS[illegible]

is nearly 3,300 ft. in length, the total distance between the American and the Canadian summits being 12,000 ft., or about 2¼ miles. The grade on the tunnel

INTERIOR OF THE ST. CLAIR TUNNEL SHOWING LIGHTING SYSTEM.

approaches and the inclined sections of the tunnel is 2 per cent., while the flat middle section of the tunnel, about 1,700 ft. in length, has a grade of 0.1 per cent. downward toward the east, just enough to provide for the proper drainage of any seepage water. A single track extends through the tunnel, while a double track is laid in both of the tunnel approaches. The necessary tracks for handling the freight and passenger traffic are provided in the yards at Port Huron and Sarnia.

The tunnel shell consists of cast iron rings built up in sections, the inside diameter being about 19 ft. The disposal of rain-fall on the tunnel approaches was a very important consideration. The area of the Port Huron approach is about 11 acres and that of the Sarnia approach is about 13. Provision had, therefore, to be made for the complete drainage of 24 acres. This is accomplished in several ways. Retaining levees have been built and so arranged as to impound a large portion of the water falling on the approaches, and the water precipated during a rainstorm is discharged into waste ditches situated on the bank above, by the operation of pumps of large capacity. By this means the pumps handle only the water falling on the central portion of the approaches during a storm, and the water impounded by the retaining levees is pumped out later.

Three locomotives have been provided, each consisting of two half-units, each half-unit mounted on three pairs of axles driven through gears by three single phase motors with a nominal rating of 250 h.p. each, the nominal horse power of the complete locomotive unit being 1,500. The half-units are duplicates in every respect, and as the multiple unit system of control is used, they can be operated when coupled together with the same facility that a single phase half-unit can be operated.

As previously stated, the locomotives are designed to develop a drawbar pull of 50,000 lbs. at the comparatively low speed of ten miles an hour. The locomotives are powerful enough to start a 1,000-ton train on a 2 per cent. grade in case this should be necessary. At a test made on a half-unit, using a dynometer car, it was found that a single half-unit developed 43,000 lbs. drawbar pull before slipping the wheels. This was done on a comparatively dry rail, with a liberal use of sand. The maximum speed of these locomotives is 35 miles an hour, but, it is not the intention of the company to operate the locomotives at a speed in excess of 30 miles an hour. Speed indicators are provided, which show on a large dial in the cab near the motorman's seat the speed at which the locomotive is running, and at the same time records the speed throughout the length of the run.

The work of electricification of the tunnel, the design and construction of the locomotives, power house, etc., was done by the Westinghouse Electric and Manufacturing Company of Pittsburgh.

Industries on the Erie.

In commenting on what was seen during journeys over the Erie Railroad, we have frequently referred to the numerous manufacturing establishments seen all along the wayside from Jersey City to Chicago a stretch of about one thousand miles. Mr. Louis Jackson, industrial commissioner of the Erie Railroad has completed a statement concerning the manufacturing plants on the Erie Railroad, which makes interesting reading.

"During the fiscal year ending June 30, 1909, 114 industrial establishments located on the Erie Railroad. Of these, 75 have direct side track connection. Of the 114 establishments, 64 are manufacturing plants, and 50 are grain elevators, ice houses, storage warehouses, etc. Side tracks were constructed to 11 establishments not heretofore reached, and side tracks of greater capacity were furnished during the year at 22 industries, previously served with sidings, to care for increasing business.

These many industries have been attracted to the territory on account of its merits, or established by local parties. The company endeavors to create conditions favorable to the securing of factories and further development. By effective methods it makes the resources and advantages of its territory thoroughly known in general, while the business organizations and others along the line make it known in particular. Together, the organization, co-operation and resultant information are so complete that results are obtained.

The Erie is a railroad on which to locate industries. The company's own rails connect the two largest cities of America. It is one of the greatest of trunk lines. It traverses the States of New York, New Jersey, Pennsylvania,

FRONT VIEW OF P. R. R. ELECTRIC.

Ohio, Indiana and Illinois, all comprising a territory rich in resources and enterprise. Fuel, the paramount factor in manufacturing, is at hand or within easy reach throughout its territory. A plant located on the Erie has direct rail from its own door to Chicago, West, and to New York, East, besides reaching the most important cities between these two points. To be located on a line of such great reach means to be located on an important highway of the commercial

ST. CLAIR TUNNEL LOCOMOTIVE.

world, quickly commanding all markets—United States and export.

It is important, in this age of modern facilities, for manufacturers to locate where they can obtain side tracks so as to receive from and ship directly into cars at the factory. Information can be promptly furnished in this connection about every point on the system between New York and Chicago.

The cities on the Erie Railroad are highly enterprising, thoroughly organized, and prepared to treat with manufacturers. New manufacturing plants are constantly locating on the system, and the development of local resources is rapidly going on.

Two-thirds of the United States is undeveloped. South America, Africa, Australia and Asia are to be covered with railroads, and whether business be slack or rushing, demand will go on forever. Erie territory has commanding advantages relative to supplying the world in the matter of progressive manufactured products.

Every section of the line has its particular merits. Profitable locations exist. Prompt attention is given to inquiries from manufacturers contemplating new establishments. The information furnished covers matters in relation to resources, traffic, side tracks and the general data required by them. The constant handling of matters pertaining to the location of various industries and the development of resources gives the company's officials experience. Parties contemplating the establishing of an industry can secure information either by applying to the company' agents, who will take up the matter. Manufacturers' inquiries as to locations are treated in strict confidence."

Carry Your Own Drinking Cup.

With railways as an easy object on which to point a moral and adorn a tale, the Legislature of Nebraska has passed a law forbidding railway companies to supply drinking glasses or cups to thirsty travelers. When a thirsty person, with habits formed in regions west of the Missouri River goes to the water tap in a car and finds no drinking vessel he curses the trainmen, then the railroad company. He never thinks of his friends who made the laws to preserve his health. An organization of trainmen has been formed to enlighten Nebraska voters on the source of their discontent at the water tap in the railway car.

The Legislature of Nebraska are not unique in warning people against the dangers of the water drinking cup. That high moral organ, the *Ladies' Home Journal,* gives the cup this blast:

"Let there be no mistake about this fact: that while it is becoming the fashion to alarm the public about almost everything that it eats, drinks or wears, and while there is no doubt that certain faddists are carrying their warnings too far, there can be no two sides to the danger that lies in the public drinking cup. The danger here is not fancied, but real. The mouth is one of the most sensitive of all our organs for the communication of disease. And any woman with the least common sense can figure out for herself what it means for us to

LOOKING OUT OF THE TUNNEL UP THE TRACK TO PORT HURON.

touch our lips to the same spot where another pair of lips has just been. It is one of the most direct of all human communications. The leading bacteriologists agree that the rinsing of a cup does not remove from it the danger of contagion. Spend half an hour at any public drinking fountain and watch the people who drink out of the one or two glasses or cups, and not only will the filthiness of it, but the positive danger of the practice impress itself upon even the most thoughtless mind. Whatever other precaution we may disregard, we cannot lightly consider the public drinking cup used by all. It is a menace, real and grave. The trouble is that we do not clearly realize how grave it really is, and at this season, when thousands thoughtlessly drink out of public drinking cups, no public warning against the practice can be made too strong or be too carefully heeded."

The Mounted Flagman.

In the old prints of early railway operating there appears a horse and rider trotting along the track in front of the engine, warning people to clear the way for the puffing horse not made of bones, flesh and skin. It strikes most beholders as a ridiculous means of preventing accidents. Yet, in this tenth year of the twentieth century, a similar spectacle may be seen any hour on West street, New York City, where freight car trains are hauled by a dummy locomotive led by a mounted horseman. The street cars on the same line run twice as fast as the freight trains, but the law requires the latter to have the horse attachment. It is the same species as the ancient blue laws that are incongruous when applied to modern conditions of life, but stupid laws resemble those of the Medes and Persians that changed not, or like the mind of a city alderman having neither variableness nor shadow of turning. In our April, 1908, issue of RAILWAY AND LOCOMOTIVE ENGINEERING we printed an illustrated article descriptive of the mounted flagman of New York

Traveling Engineers' Convention at Denver

FUEL ECONOMY.

(Discussion continued from page 514 of December, 1909, issue.)

The President said: "We have with us today the chief fuel inspector of the Santa Fe, Mr. C. F. Ludington, whom we shall be glad to listen to."

FUEL HANDLING ON THE SANTA FE.

Mr. C. F. Ludington of the A. T. & S F. said: I have had charge of the fuel on the Santa Fe system for the past two years, and of course am deeply interested in the fuel proposition. Had I known that I was to be called upon for remarks at this meeting I would have come prepared to furnish you data and figures as to what we have done in the past two years. As it is, I can only tell you hurriedly the manner in which we are handling the fuel proposition, and, in a general way, the results that we have obtained.

I listened to the remarks yesterday and the able paper on fuel that was read, and I want to say that it is a step in the right direction. The proposition of economy in fuel is one that all the railroads are coming to, and very rapidly. The fuel, as you all know, is the largest single item of expense in the cost of operation. Therefore the managements are bound sooner or later to go into the proposition thoroughly.

DEAL WITH EXISTING CONDITIONS.

While there are a great many fuel saving devices, as were mentioned yesterday, such as superheater engines, hollow brick arches, and so forth, I believe that the sense of this meeting goes a little further than that, as expressed yesterday, and that is that you must take the conditions that you have on each of your own railroads and try to improve with those conditions. I venture to say that every gentleman present, most of you, of course, being traveling engineers, can without any trouble at all get on an engine and instruct the fireman and engineer how to run the engine economically. The question then arises, have you the time to instruct all of your men? Do you know which of the men are economical and which are extravagant? You are wasting your time to a certain extent if you do not know those conditions. Again, if you wait for thirty or sixty days before you know—or before your performance sheet is out—to know just which are the extravagant men, the conditions have changed in the meantime: the man is running a different engine; he is running probably in a different kind of service, and he has made his loss in fuel and you cannot bring about an improvement.

A DAILY FUEL RECORD SYSTEM.

The system that we have is what we call a daily fuel system. I maintain that the accounting feature of fuel is the first thing and the first step that the railroad company should take in bringing about better results. Put in the hands of your mechanical department, your master mechanic and your traveling engineers, data which is absolutely correct, or as nearly correct as it can be made, and put it in their hands as soon as you can. If it is thirty days old it is of no value. In organizing a fuel department on the Santa Fe system, the first thing that I attempted to do was to get correct accounting. Engineers complained that they were overcharged at the fuel stations. There was no way of accurately measuring the coal in the different kinds of coal chutes that we had, and therefore any results that we would get would be of no use as a matter of comparison. We took over not only the accounting of the fuel, but every man that is employed in handling the fuel was taken over and carried on my payroll. What is known as the fuel department was taken out of the hands of the mechanical and transportation departments entirely. We then had traveling fuel inspectors appointed, the same as you traveling engineers are appointed, for certain districts. They in turn found men employed at coal docks that were absolutely incompetent to accurately measure coal and to account for it. The first thing, then, they had to do was to get competent men, men that had a fairly good education. It is a hard thing, of course, to get a scholar and a good coal shoveler. However, we did it. In some cases it was necessary to pay a little more money than we had been paying, but we got fairly intelligent men.

IMPROVING THE CHUTES.

We then had the old style, or what we called gravity chutes. We had the pockets calibrated according to the cubic contents of a ton of coal, and got as nearly correct measurements as we could for that kind of chute. The management at the same time issued instructions that all coal chutes which should be built in the future would be of the mechanical type—that is, chutes that would weigh the coal as it was issued to the engine. We are building nothing else on the Santa Fe at the present time. We have some twenty-five or forty mechanical chutes. Of course, with that class of chutes you can absolutely and accurately weigh the coal to the engine.

GIVING THE ENGINEMEN A FAIR DEAL.

The first thing that you have got to do is to convince the enginemen that you are giving them a square deal, convince them that it is to your interest and to their interest that they are charged with only such coal as they consume. I told them this: that I was employed by the Santa Fe to reduce the consumption of fuel; I could not do it by overcharging them; I could not give them five tons of coal and charge them six and reduce the consumption. That appealed to them very strongly, and with the co-operation of the mechanical department and the road foremen of engines we went to work along those lines.

TALLY SHEETS PROMPTLY ISSUED.

The next step was to be able to know promptly what the different engines and engineers were doing. To find out who were the extravagant men, so that we could get after them first, we got up what is known as a train tally sheet and daily fuel consumption, combined. On all railroads the transportation department gets out what is known as a tally sheet. We enlarged on that sheet and included the fuel features. In other words, the tonnage handled between stations (taking from six to eight tonnage changes at the principal points between terminals), the hours on the road, the number of stops, and so forth; all these enter into fuel consumption. Those tally sheets, in addition to the copies that have always gone to the car accountant and the ticket auditor, and so forth, for statistical purposes, were sent to my office in triplicate. We then figured the ton miles and entered the coal that was consumed or paid for by the engineer on that particular trip, figuring it out in pounds of coal per 100 ton miles for each trip on the whole system every day. Those reports reach my office from the farthest points on the Atchison proper within three days. They are figured promptly. They are got out the same day that we get them. The ton mile figures and all the other information are shown on each of the three copies. They are then placed on my desk and I in turn pick out from those tally sheets the extravagant men and make it a point to find one or two men on each tally sheet who have, according to the information shown on the tally sheet, been extravagant on fuel. One copy of that tally sheet goes to the master mechanic and the other copy to the superintendent, the third copy being retained in my office for getting out the monthly performance sheets. With the copy that I send to the master mechanic and the superintendent, I write a letter calling the master mechanic's attention to Engineer So-and-so, who has consumed so many pounds of fuel per 100 ton-mile in excess of other men in the same service under like conditions. The master mechanic immediately puts that in the hands of his road foreman of engines, who rides with that man and finds out what the trouble is. If the trouble lies in the engine, the engine is repaired; if it lies with the man, he instructs him. The next day it is some other man, and so on.

MONTHLY PERFORMANCE SHEETS.

At the end of the month we get out a performance sheet, which for the month of August is now out. I left Topeka the day before yesterday, and I knew what the August performance was for the entire line. I knew that we had made a decrease. In fact, I knew every day of the month what the performance was, whether we are better or whether we were worse, whether we were going up or going down, and with that information I kept hammering the master mechanics and they in turn kept hammering the road foremen of engines to get after this fellow and to get after that fellow. So that we are in touch with the situation at all times, and it is not thirty to sixty days old, as it is on most of the railroads.

FUEL TICKETS.

We took the making of the fuel ticket out of the hands of the engineer. We got up a tank ticket form which we call a service ticket. That ticket is carried in the cab of the engine, and the engineer has to fill it out as to the service that he has given, the kind of service, the points and direction he is going in, his name and the name of his fireman, and the estimated amount of coal that he requires to fill his tank. He draws up to the coal dock and he hands the ticket to the coal chute foreman, who puts that amount of coal on the tank. Understand, now, our pockets are calibrated. We do not open up the cut-offs and allow coal to run through the pocket and fill up the tank, and then say, "Well, I guess you got seven tons or six tons." We fill the pockets the four tons. We give the man four tons of coal. If he requires more to fill his tank we make him move on to another track, where we have got a two-ton pocket, and we can come to within a few hundred pounds of the correct weight every time, even with our old style chutes. The coal chute foreman gets this ticket, and he gives the engineer the amount of coal that he asks for, and if in the engineer's judgment or hostler's judgment they need more coal he puts the additional amount on, having the hostler change the service ticket to read the increased amount of coal. From that ticket the coal chute foreman makes up the regular fuel ticket, which is made in triplicate, the original going to the engineer for his information, the duplicate coming to me with the daily fuel report and the triplicate copy retained, the stub in the book as authority for the issue, which can be checked up at any time.

PREVENTS CHEATING THE ENGINEER.

In this way the engineer knows how much coal he was given and how much he was charged with, and if he is interested in his fuel consumption he knows pretty nearly whether he has made an extravagant or an economical performance. They have got now to the point where, if conditions are such that they are bound to consume more fuel than they should, such as long hours on the road or other things that enter into the question of fuel consumption, they immediately make a note of it so that when the traveling engineer gets on the engine they can explain why they burned more coal than they ought to. If it is due to poor train dispatching, or if it is the fault of the transportation department, he explains and tells the master mechanic that that is the trouble. The master mechanic then in turn puts it up to the transportation department. If the blame is on their shoulders we make them take it. This daily system is entered in our office in individual books, according to the different engineers, firemen and engines. Between ten and fifteen days after the close of the month we have the performance sheet out showing the performance of engineers, another performance sheet showing the performance of firemen and a third performance sheet showing the performance of engines, segregated as to class of service and each engine ranked with the same train that the other man has. We do not compare our local passenger train men with our fast and heavy passenger train men. We show them, compared class with class. We compare two slow men and two fast men, so that we have a fair comparison, and a man can not say that he is not given a square deal.

YEAR'S DECREASE OF FUEL $1,284,000.

In the two years we have decreased the consumption of fuel in freight service 18 per cent. Those figures are absolutely correct and any of you can verify them by writing the management of our road. I cannot tell you how much we have reduced the passenger performance, for the reason that in the old records prior to the time of the organization of the fuel department we have no record of passenger service. Nobody knew what we were doing. Nobody seemed to care. But they did keep a performance of freight locomotives; therefore we can say absolutely that we have decreased the performance 18 per cent. from that of two years ago. Our fuel bill for the year ending June 30, 1909, decreased $1,284,000. Now I do not say that that is all decreased consumption, but you can be certain that 50 per cent. of it is. We are paying more money for our fuel in certain localities, especially where we are burning oil as a fuel, than we were a year ago. We handled within six tenths of one per cent. of the same amount of business one year than we did the other, and yet we decreased the fuel. That is, decreased it in money; not in tons but in money. So it can be seen very readily that we are on the right track, we are moving in the right direction, and we have only just started. If we cannot decrease it 18 per cent. more in the next two years, I will be willing to throw up my job. We are just getting the men interested. We are able to point out to the mechanical department promptly two or three days after and tell them that this or that engine needs a little fixing up, the packing is not right or something of that kind, it is burning too much fuel; and that information is very valuable to the mechanical department.

CHECK ON THE CHUTES.

We find, further, that by this system we can accurately check the chutes. I will cite a little instance that I found in taking over the fuel. I made a personal inspection over the entire line, visited every fuel station, before taking over the accounting. The accounts were handled by the agent in most cases, the superintendent having charge of the fuel station. I went into one station one day, I remember it was on the 27th of the month, and I introduced myself to the agent and told him who I was, that I wanted to look over his fuel accounts. He was very kind and took me into his private office and had the clerk bring in his daily fuel report. I found by that report that he was carrying over 1,000,000 pounds of fuel on hand; that is, the difference between his receipts which he had charged up to himself and the issues which he had charged out. I made a mental note of the 1,000,000 pounds of fuel that he was carrying on hand, knowing that he could not hold it in the chute, and then invited him to go out with me to the coal chute. After looking over the chute, I said, "Where is your 500 tons of coal that you are carrying on hand?" "Oh," he said, "I am short." "Well," I said, "it is very apparent that you are short, but how do you account for this shortage?" "Well," he said, "the engine men take coal and don't leave the tickets." I asked, "Is this a regular thing, does it happen every month?" "Yes, sir, it does." "Well, aren't you criticized by some one for having this large shortage every month?" "Oh," he said, "I make up that shortage. I have got a coal book up there and I look over my daily fuel reports and I make out enough tickets to cover the 500 ton shortage. I was criticized once and they will never catch me again."

DIVIDING ROUND THE SHORTAGE.

Now you see that the honest enginman that draws up to the coal chute and pays for his coal by ticket was charged with what he had paid for, and at the end of the month he was charged again with a lot that the other fellow did not pay for. His name would appear on the daily fuel report oftener than anybody else's would because he paid for his coal every time he took it, and in consequence the agent when he made out these tickets at the end of the month when making up this shortage would charge him with a little more. That man may have been the best engineer on the division but his fuel performance would show up the poorest, for the reason that he was not being given a square deal. With our daily system of accounting for fuel this cannot happen, for the reason that if our coal chute foreman through carelessness does overlook charging out an issue of coal to a certain engine or engineer we know it immediately in my office. On the talley sheet we trace the engineer into the terminal. The tally sheet the next day shows him on another train. There is no coal charged up to him. We immediately go after that coal chute foreman to know whether he issued coal to that engine, and after we have called the turn on him a few times and made him produce tickets to cover certain issues that through carelessness he had overlooked, he becomes more careful and gets all the tickets. It is very seldom now that we have to write for tickets. Further, we have charged the enginemen with only such coal as they actually consume in road service.

COAL USED IN FIRING UP AT TERMINALS.

The engines, on getting out of the roundhouse go to the coal chute and take one or two tons of coal, as may be necessary to fill their tanks. Understand, they were filled going in and we fill them going out. That coal is charged to roundhouse; that is, the ticket is made out "Roundhouse." It is not charged to any individual engineer, although, of course, it goes to the engine. Now from an accounting standpoint the coal is not charged against that engineer's individual performance, for the reason that the amount taken the second time was consumed for firing up the engine or for keeping her under fire for an extra long time. That fuel was consumed by the roundhouse force. The engineer has nothing to do with it. He can not help it if they burn one ton or five tons, and we found points where they were burning three and four tons to fire up an engine. We got after the mechanical department and had them go after their fire builders; got after the transportation department and had them stop firing their engines so early, but to give the mechanical department an hour and a half or two hours notice only instead of four and five hours and require them to keep these engines fired up that length of time burning fuel. We found engines that were being put in the roundhouse and never killed, fired up all night and burned an excessive amount of coal. We found all kinds of conditions and we found them from the fact that we were charging this extra amount of coal to the roundhouse. Now, do not misunderstand me that this roundhouse coal goes against the shop expense and enters into the expense of handling your roundhouse or your mechanical department. It does not. The classification of accounts will not allow us to charge coal consumed for firing-up purposes against shop expense. It goes into road service in the final accounting, but it does not appear on the engineer's individual performance sheet. Therefore when we criticize an engineer for his consumption he can not say "My engine was fired up six or seven hours before I got it and burned three or four tons of coal. That is the reason for my poor performance." We eliminate that feature, and we eliminate that excuse. We find that the engineers always have an excuse for their poor performance. They will get around it some way by saying "poor coal," or something of that kind. But after we have taught them to tell the truth and teach them that by telling that truth they are not letting any secrets out that should not be known, in other words, that they are not bringing criticism on the mechanical department, then they commence to tell the truth; they commence to speak of little defects in the engine that the master mechanic knew nothing of, which have been there for months. That, of course, brings about better engine conditions, and in turn a reduced fuel consumption.

REDUCING GAPS BETWEEN GOOD AND INFERIOR MEN.

I might say, further, that the performance sheet at the end of the month shows the engineer's name, miles run, the ton-miles handled, total, of course, pounds of fuel consumed, the average pounds of fuel per 100 ton miles, the average weight of all trains handled and the loss or gain due to economical or extravagant performance. That is figured in dollars and cents; money figures. Of course, those figures are based on the division average and you will always have men that lose, you will always lose as much as you gain, but we aim to reduce the gaps between the best men and the poorest men. Get your poor men up where they make a better performance and then compliment your good men on what they have done, send them a nice little letter at the end of the month, just the same as you do the men that you criticize. Pat them on the back, tell them they are doing well and you appreciate what they are doing, and they like it. They show that letter around among the rest of the men and they try to do better. They say, "Here, we are getting a square deal. The management appreciates that we are economical on fuel. We will just try to save a little more."

HAS IMPROVED CONDITIONS.

It has brought about a much better condition. It not only has improved the fuel consumption but it has brought about better conditions on the road as to transportation. We get our trains over the road in better time. We have fewer failures due to engine defects. We have fewer failures due to poor coal, simply from the fact that we watch the matter closely. We do not charge coal to road service that is not consumed in that service. We found there were a good many cars of coal that were being used by the mechanical department at the pump house along the line. They would run out of their own coal and they would take a car of ours. Now at the end of the month we had no record of the car. We would trace it, find out if the mechanical department used it or if some other department had used it, and we would charge it up to them. In our system of accounting we trace every car from the time it leaves the mines until it is finally used up and charged up to its proper account.

A desultory discussion ensued concerning the cost of the system described by Mr. Ludington, the expense of starting fires, the advisability of banking instead of drawing fires and other minor matters. Messrs. Eubank, Hayes, Emerson, Summers and Meadows took part in these discussions. A very decided inclination was manifested to prolong the discussion but the claims of time for other papers prevailed and the discussion closed.

Specialists.

Illustrating the distinctions that natural ability makes between workmen, Andrew Carnegie tells about two street sweepers in Pittsburgh discussing the skill of a third sweeper, who is declared good enough for ordinary plain sweeping but no good for corners. The *Silent Partner* depreciates skill as an elevating influence and remarks: "There was a time when the boy who swept out the corners without being told, became president; but not now. This is an age of specialists. If you become an expert sweeper they will keep you at it. Efficiency is the watchword. The way to rise is to get caught bossing another boy that you have hired to do the sweeping. Then they'll put you on the road and you can get rich padding your expense account."

This is not good morals and it is not always true either.

Learning How to Learn.

One of the most important things that a young man can learn is how to learn. To be groping in the dark all uncertain of what there may be one step in advance, or one step to the right or to the left, and with no means of finding out until some obstruction is stumbled over, or some pit fallen into, is the miserable condition of many hard working men, only because they have never learned to find out the things which they need to know.

One day, wanting an errand done, I said to the youngest boy in the shop: "Henry, do you know where Mr. McIntosh is at work?" "No sir, but I can find out," was the quick response. I knew at once that I had found the kind of boy who would make a good messenger.

General Correspondence

Powerful and Economical Boiler.

Editor:

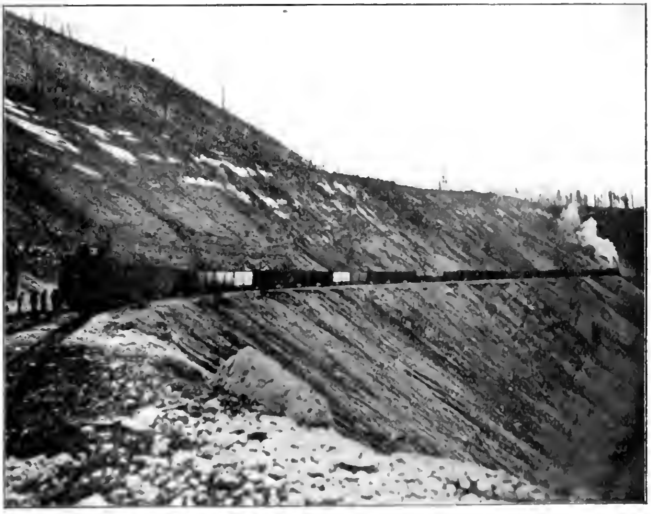
On a road where fuel is cheap and good the boiler should be designed with reference to power, and no especial attention should be paid to efficiency, unless the efficiency is so low that the boiler has to be forced to the extent that the firebox sheets are damaged and the repairs too much increased. Let us consider what constitutes the most powerful boilers.

In the first place, the grate must be as large as possible, because more fuel can be burned in a large firebox than in a small one. It is self evident that the more coal that can be burned effectively in a given time, the greater evaporation we should expect. In the second place, the crown sheet must not be too far from the fire, and lastly, the tubes should be short and large in area of opening, so as to offer a free passage to the gas. A 2½ or 3-in. tube will give more power than a 2-in. tube, but good practice limits the diameter of tubes to 2¼ ins. The maximum power is obtained when the blast is as strong as possible to get it without tearing the fire in starting, and without causing excessive back pressure in the cylinders. When power is the only requisite, the above combination will give it.

The most powerful boilers applied to locomotives are those of the modified Wootten type, with 75 to 100 sq. ft. of grate area and tubes about 15 ft. long and 2 ins. in diameter. Many engines of this class are in service on the Lehigh Valley and the D., L. & W. In passenger service, most of these engines are fired with anthracite coal, but in freight service bituminous coal is used. The large 10-wheel passenger engines on the D., L. & W. are capable of developing 2,000 horse power. They have, perhaps, the most powerful boiler yet applied to any locomotive. The firebox has a heating surface of 228½ sq. ft. and a grate area of 103.8 sq. ft. There are 398 tubes, 15 ft. 3 ins. long, which provide a heating surface of 3,158.5 sq. ft. The most remarkable feature of these engines is the grate area, 103.8 sq. ft. The ability to produce great horse power per square foot of heating surface is obtained by the enormous grate surface available for the almost perfect combustion of the fuel.

With a large grate area a less violent exhaust will supply the air necessary for combustion, and therefore the Wootten boiler of equivalent heating surface will always develop greater horse power than the narrow firebox. The violence of the exhaust is, in a measure, regulated by the area of the grate. Here it might be said that a variable exhaust would make it possible to increase the power of a boiler, for with it the violence of the exhaust in starting could be reduced, and thus holes would not be torn in the fire.

We have considered what constitutes the most powerful boiler, and now it is in order to decide as to the most economical boiler. The most economical boiler must have just as large heating surface as possible, especially in the firebox, and the combustion must be slower—that is, combustion must be nearly perfect, and with the present method of getting air to the fire perfect combustion can only be fore, the smaller the boiler in proportion to work it must do, the less will be its economy. The rapid combustion in a small boiler is produced by a contracted nozzle, with the result that the back pressure on the piston is very much increased; the violent blast also causes considerable unconsumed coal to pass through the flues, and, due to the greater velocity of the gases, they are in contact with the heating surface a shorter length of time. This has its influence in reducing economy. No locomotive boiler is too large for economy if the above is true. Hence, passenger locomotives for hauling heavy trains at high speeds should have boilers as large as the weight of the locomotive will permit.



TRAIN ON THE SOUTHERN PACIFIC HAULED BY BALDWIN MALLET.

obtained with slow combustion. When the rate of combustion is high, the mere passage of the air through the fuel does not give an adequate mixing, when high efficiency is wanted. This is the reason, above all others, why forcing a boiler reduces its efficiency, and is the reason why an engine with a small grate area, when forced, does not give the efficiency of a larger grate in which the coal is burned slower and the air has more time to mix with the fuel. It is evident that in a small boiler, that is, one in which a large amount of steam has to be generated in proportion to the heating surface, the fire must be urged; and there

The Atlantic and Pacific type engines generally have the most economical boilers. It is not uncommon for an engine of the Pacific type to have 2-in. flues 20 ft. long, with 50 sq. ft. of grate area. On through runs, where the trains are heavy, there is no loss from the large grate area.

From what has been said above, we see that both the most powerful and the most economical boilers must have all the firebox heating surface possible, and as much tube heating surface as can be obtained without interfering with the draft. Therefore, the size of the tubes, and the fire part of the grates, are the only differences which enter in actual construction.

One fundamental design will answer for both by getting as large a firebox and as large a shell as the total weight will permit, and then perhaps brick off the grate in the most economical boiler and use the whole of it in the most powerful boiler. As an example, the class E 3 a, Atlantic type engines on the Pennsylvania have what might be considered a powerful boiler. They have 315 tubes, 2 ins. in diameter, and 55½ sq. ft. of grate area. On the Atlantic City division the runs are short, and an economical boiler is able to handle the high speed trains. For that reason a part of the grate near the flue sheet is bricked off, leaving an effective area of about 40 sq. ft. On the New York division, however, the service is more exacting, and the same type engines are run with the entire grate area effective, that is, 55½ sq. ft. In both cases the firebox heating surface is retained.

W. Smith,
Asst. R. H. Foreman, B. & O.
Benwood, W. Va.

Erroneous Instruction.

Editor:

I have in my collection a catechism on locomotive breakdowns. This book has for its author a mechanical engineer of wide reputation. This criticism is not made for the purpose of reflection upon the author or the book, but is mainly for the purpose of calling attention to the advisability of critical study by the student. This is required if the student is to reap the greatest benefit from the instruction, and also to guard against absorbing erroneous ideas.

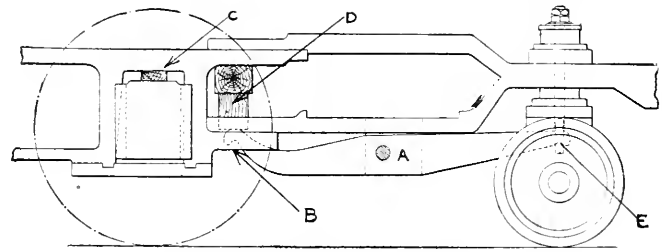
In a book of several hundred pages, especially if it is a first edition, we would be expecting too much if we look for entire absence of error. In collecting and collating such a fund of matter as is contained in a large book it would be almost superhuman to avoid making any errors.

The figure shown herewith is taken from the work in question, and the question it is used to illustrate is: "What should be done if a cross equalizer on a Mogul or Consolidation engine is broken? Answer: Jack up the front end of engine and put blocking over the forward driving axle boxes to carry the frame. Also remove the springs and broken part and block the intermediate equalizer down as shown in the figure."

In this figure *a* is the point where the intermediate equalizer takes the weight of the front end of the engine, and the weight is sustained at the points of suspension (*b*) and (*c*). The point (*b*) is where the intermediate equalizer fits into the slotted end of the hanger suspended from the middle of the cross equalizer, and the cross equalizer is of course suspended to the forward end of the forward driving box springs. The point (*c*) of the intermediate equalizer is suspended to the "Alex" bolt. Now being suspended at each end, and the weight coming on the equalizer at the middle, it does not require an exceptionally analytical mind to note that if the suspending device at either end gives way, that end of the equalizer will naturally *drop down,* instead of having to be blocked down as advised. The blocking over the front driving axle box, and over the intermediate equalizer is indicated respectively by (*c*) and (*d*) as advised.

Now the proper remedy would be to lift the back end of the intermediate equalizer and chain it up. This would necessitate raising the front end of the engine. Then we could either chain down the front ends of the forward driving springs, or, which would be most likely compulsory, for want of chain, we could remove the springs, block over front driving axle boxes.

William Westerfield.
Lincoln, Neb.



INCORRECT METHOD OF BLOCKING.

Some Observations on Firing.

Editor:

It is very gratifying to read the interesting discussions on fuel economy published in the November issue of your valuable magazine. It is also easy for me to understand how hard it is for Dr. Angus Sinclair, the well posted and observant editor of this paper to remain quiet on the subject. It is perhaps best to allow the expression of opinion to come from those who can express themselves at a lesser expense. The discussions all the way through are very interesting. There is nothing like practical experience, whether it be your own, or the experience of others, it amounts to the same so long as the benefit thereof is conveyed to you. One of the greatest mistakes that railroad men make is in turning down what is called "book knowledge." It seems hard for them to understand that the majority of books written on these subjects are written by practical men and that the knowledge which enables them to express themselves is gained through experience. This is something that progressive railroad men will not do, and that which others can ill afford to do, for in so doing they turn down that which is usually gained through a lifetime of practice, study and close observation.

We will admit that our engineers are usually intelligent men, and it may be up to the road foreman of engines to appeal to the pride of all the men and work up a friendly rivalry. That would be all right as far as it goes. But the general reformation of the present system of firing which is prevalent on different roads that I know of is too great a task for the road foreman of engines together with the many other duties which most road foremen are called on to perform. I do not believe, in the first place, that enough attention is given to the men hired to become firemen. They make their student trips, and thereafter, so long as they keep up the steam pressure, are considered capable, regardless of how it is done or the expense in fuel to the company. I have heard firemen spoken of as being good firemen. On getting these same men out on the road it was easy to see that their qualifications did not extend beyond their abilities to clean out the tank between coal chutes, thereby reducing their occupation to that of a common laborer.

To my mind, the qualifications of a fireman should be of a higher standard than those of most any other man on the road, as there is a constant call, almost a demand, for the continuous exercise of good judgment, careful management and close observation in the fulfillment of his duties. The habit of throwing in six or seven scoops of coal at time of shutting off usually means that many scoops wasted. The habit of running over the division without moving the grates means obstruction of air through the grates, which results in the loss of one-third of the heat to be obtained from the fuel. It is an indisputable fact that with modern engines and their large grate area one should be able to carry a lighter fire and create sufficient draft with lighter exhaust, which means larger nozzle. While recently riding on one of the modern engines I took note of the number of scoops the fireman used at a charge, which was usually about twelve. His signal for another charge was the closing of the pop valve. When I asked him what his system was, he admitted that he had none, but had the audacity to tell me that he knew all there was to know about firing a locomotive.

I have had new firemen whom I considered were of the best material, but when asked to improve on their way of firing, I was informed that engineer so and so had told them to throw in a good fire and let it burn. Examinations and brief instructions do not seem to give

ACTIVITY IN THE CANAL ZONE.

results. Practical demonstrations are the only thing that will convince a fireman that cracking the lumps, keeping the fire unobstructed by clinker, light charges at frequent intervals, closing the fire door between scoops, is not a hardship, but well directed work that will many times repay him. The fireman's tendency to work for the interest of the mine owners should not be lost sight of. The bridge epidemic generally overcomes all slight derangements in front ends. I have known as engine 22x30-in. cylinder, 54 sq. ft. grate area, to have $5\frac{1}{4}$-in. nozzle with a $\frac{3}{4}$-in. bridge. This may be hardly believable, but is nevertheless a fact. Student firemen should first be taught that a white heat is the most intense, that the maximum temperature obtained in the fire box is not far above the igniting temperature of the fuel. That his main object should be, when using bituminous coal, to admit sufficient oxygen to the fire and maintain the igniting temperature of the volatile matter at all times. He should also be taught the importance of an invariable temperature and the proper use of the blower. His willingness or unwillingness to comply with such teachings should decide whether he is qualified to remain in the service.

Motive power departments have been aware for some time of the unnecessary expense incurred by improper practices on locomotives, and have also been desirous of overcoming the deplorable conditions. The title of traveling fireman and fuel expert, while not common, have not been wholly unknown in the past. The majority of them have been unsuccessful in demonstrating their usefulness to the management, and not in all cases was it because they were deficient either in firing a locomotive or in drafting same, but principally because too much was expected of them at the start. It might be that he endeavored to fire an engine according to his ideas which was drafting according to the other fellow's ideas. It might have been because he took the engine in the middle of the division and attempted to carry a light fire on a bed of clinkers. Perhaps he lacked co-operation with the enginemen and officials, which may all have been due to his being a little previous or ahead of time, as Mr. Roach says. A man who applies for a position of this kind is looking for strenuous exercise, and in order that he may get results he must have the co-operation of the officials and the men. He should also be given a fair trial to practically demonstrate what his abilities are in that line and not be burdened with other duties, too numerous to mention, and to say nothing about the prejudice of those in authority above him, whose ideas may conflict with his. Above all, he cannot be expected to change a system in three months' time that has been in practice for years.

My opinion as to fuel and nozzle is identical with that of Mr. Summers, inasmuch as we have to be governed by conditions altogether. I once had an amusing experience on an engine which I caught as a regular engine, one of a number of the same class working on that division. At first the fireman would clean out the tank between coal docks. The diaphragm was changed, the bridge removed from nozzle, and the engine soon got the reputation among the firemen as being a hard steamer. I remember that several firemen were called, but they suddenly became ill when they discovered the number of the engine they were to go out on. I finally got a fireman who had fired for me two years previously when a student, who at that time I considered an ideal fireman. His reputation as being a good fireman had clung to him during this period of time, but on this occasion I was surprised to note his downfall. The careless and indifferent way he had gradually fallen into resulted in a heavy fire and no steam before we had proceeded half way up the hill. On perceiving that he was up against it, his first inclination was to get a hook and stir it up, which was objected to. Being well acquainted with him, I felt at liberty to give him a good lecturing in a friendly way. Taking the scoop and through very hard work, I got the fire in condition, and thereafter kept the engine hot with two and three scoops to a charge, closing the door between scoops. The fireman's face brightened up, and he remarked that now he had the engine he was going to keep her, which all goes to prove what a little practical demonstration will do.

Fearing that I have already taken up too much of your valuable space, and for fear of being barred from future participation in the discussions of this important subject, which I believe is becoming more important every year, I will conclude with best wishes for the future progress along this line.

J. F. Brothers,
Mint, N. D. Engineer.

Suggestion Re Valve Gear.

Editor:

Assuming that with the Stevenson valve gear, having piston type of valve, inside steam admission, that the forward end of the piston valve chamber bushing be bored $\frac{1}{8}$ in. larger in diameter than the back end. Assuming that the back end of the piston were 10 ins., the front end $10\frac{1}{8}$ ins., the centre 8 ins., or the area of the inner side of the 10-in. is 28.275 sq. ins., the area of the inner side of the front disc is 30.251, the area of the centre is 50.265, giving a difference in area of 1.07 sq. ins., and assuming that the steam pressure within the heads is 200 lbs. per square inch, same would furnish an unbalanced force of 395 lbs., which would tend to force the piston valve ahead at all times when throttle valve is open.

The foregoing refers to an indirect motion; whereas, with a direct type of construction the large bore of the piston valve chamber bushing would be at the back end. In both cases the object is to prevent chucking of the valve gear, and to cause the heavy or front half of the eccentric strap to be in contact against the eccentric at all times, causing the blades to be under compression. This would eliminate, to a certain degree, the fracturing of the eccentric blades and straps and the loosening of the bolts and nuts through the valve gear. It is necessary, however, to shorten the length of the port proportionally at the end of the cylinder having the greater diameter; or an easier method would be to lengthen

CARTAGENA COLUMBIA RAILWAY.

the port at the end having the smaller diameter.

In setting valves having differentiated heads it is recommended that a spring of approximately 400 lbs. tension be used, and anchored ahead of and connected to the top end of the rocker arm on an indirect engine, and back of the rocker arm on a direct engine. The differential mentioned will afford a greater unbalancing effect than is required when running po miles per hour, or less, and not sufficient to bring about the desired effect when the speed is over 60 miles per hour.

With the Walchaerts valve gear it is suggested that the back end be bored larger, which will put the radius rod under compression and put the eccentric rod under tension, putting the strain on the back side of the crank arm, therefore taking the strain off the liner and key ahead of the crank arm.

It is also recommended that the front valve chamber head be removed (in case of a breakdown requiring the lapping of the steam ports) and a block of wood inserted against the piston valve head, and long enough to touch the chamber head, when reapplied on an indirect engine, and at the back end of the chamber on a direct connected engine. It would not be considered safe to clamp the valve stem in attempting to maintain the valve in a central position. J. E. Osmer,
Master Mechanic, Northwestern El. Rd.
Chicago, Ill.

Valve Setting of Duplex Pump.

Editor:

I submit the following as likely to interest your readers: To Set Valves of a Duplex Pump.—Put the pistons in the centre of their travel, bringing the rocker arms into a vertical position. Take off the steam chest covers and place the valves so that their outside edges will be line and line with the outside edges of the steam ports.

The check nuts or the adjustable blocks on the valve stems must be so adjusted that the lost motion will be the same in both directions. No positive rule can be given for the amount of lost motion that should be allowed, as it must be decided by the engineer.

If only a trifle is allowed, the strokes will be short, and if more is given they will be longer. Before replacing the steam chest covers move one of the valves so that a steam port will be open, as otherwise the pump will not start.

T. H. G.
Walpole, Mass.

Saving by Feed Water Heater.

Editor:

Referring to the proceedings of the Traveling Engineers' Convention, in the November issue of your magazine, page 493, Mr. John McManamy, of the Pere Marquette, explains under the head of "Feed Water Heating," that by heating the feed water an additional 50 degs. as many B. T. U. would be saved as could be produced by the complete combustion of 321 lbs. of pure carbon in one mile in passenger service or 643 lbs. in freight service. I do not see how he obtains these results. I followed his figures through for the passenger service thus:

We know 1 gallon of water weighs 8 1/3 lbs. One B. T. U. will raise the temperature of 1 lb. of water 1 deg. Therefore 8 1/3 B. T. U. will raise 1 gallon 1 deg. To raise 1 gallon 50 degs. would require 50x8 1/3 B. T. U. or 416½ B. T. U. Now a passenger train will use about 100 gallons of water per mile, so we would save per mile 100x416½ B. T. U. Now, 1 lb. of carbon gives off 14,500 B. T. U., and since we save 41,650 B. T. U. per mile, the equivalent in carbon would be 41,650 ÷ 14,500, or 2.87 lbs. That is, we would save the equivalent of about 3 lbs. of carbon per mile instead of 321 lbs., as Mr. McManamy figures it.

If I am wrong, will you please show me where my mistake is and how Mr. McManamy obtains his result?

E. McBurney,
W. Oakland, Cal.

Flange Lubrication.

Editor:

Let me say to the readers of Railway and Locomotive Engineering, I am a bona fide subscriber of this highly appreciated paper, and in its columns I have noticed discussions of several different and beneficial subjects, but there is one subject which has been omitted which I am very much interested in, and I think it is getting to be one of the great necessities of the railroad today, both steam and electric.

Flange lubrication is a hard proposition to figure the savings from.

First to be considered is flange wear to engine tires and cars. Second is wear of rail. Third and best of all, the reducing of friction in long trains, resulting in the hauling of more tonnage. Take flange wear, with the proper lubrication it can be reduced to very surprising figures, and rail wear is in proportion. Hoping to hear from the editor and readers about this subject, L. J. Maloy.
Copperhill, Tenn.

Injector at Semaphore.

Editor:

Referring to page 512 of the December number of Railway and Locomotive Engineering, I will say that I do not agree with Mr. Harry Bentley in regard to careful boiler feeding, that is, that you should not shut off the injector when you stop, for if you do the engine will blow off. If you have too much fire that is a waste of steam and coal, and not only that but when you put the injector on again you will have to work it harder to get the water back that is lost by blowing off. There is the steam heat and air pump, and other things that steam is used for so that you are using extra coal. I claim that the regular feeding of water into the boiler is the best, not only for steam but it is not so hard on the boiler.

As Mr. Miller says, follow up the engine and keep all leaks out; then let traveling engineers go out on the engine with the firemen and show them how to save coal instead of trying to tell them how in the roundhouse or office. Have the firemen watch the injector and steam gauge instead of telegraph poles. Too much cannot be said in favor of good firing and saving of coal on railroads, and it obviates a great expense and waste.

D. B. Hines,
Loco. Engineer, Union Pac. Ry.
Norfolk, Neb.

ERECTING SHOP. C. R. I. & P. REPAIR PLANT AT SILVIS, ILL.

Hints Concerning the Machine Shop.

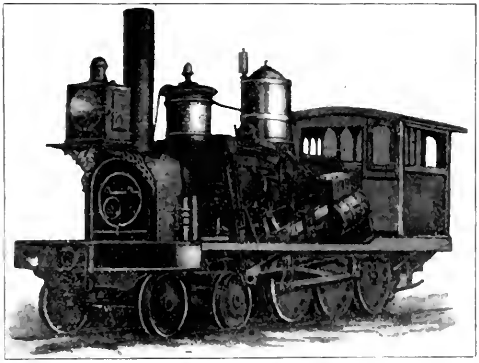
Editor:

Machine shop economy is summed up by developing every machine to its utmost efficiency and obtaining the maximum output from each consistent with the requirements of the work, which can only be accomplished by a good system in management and tool work. A portion of the shop should be devoted to the manufacture and repairing and storing of tools for the whole shop requirements, discriminating between poverty and excess and discountenancing all waste.

An attendant should be appointed for the purpose of supplying the wants of the men requiring tools for the work they are doing. Each employee is supplied with disk checks made from sheet brass, with his register number thereon; he deposits one check with the attendant for each tool he takes. The workman, when finished with the tool, turns it in to the stores and the attendant returns his check. Should there be any damage to the tool, a record is kept in a suitable book, with workman's name, check number and date and remarks. Taps, dies, stocks, gauges, twist drills, mandrels, milling cutters, ratchets, etc., are all dealt with in this manner.

What is a shop without system and organization but simply chaos, whereas, with system, everything is reduced to order, every man knows what to do and when and where to do it. System does not require any more workmen, but it does reduce the work of existing workmen and everything is done well, because each workman is individually responsible for the particular work or tool in his care. At the same time the responsibility is reduced to a minimum, for every individual knows the system and that it will be rigidly carried out. In fact, it is impossible to grapple with large concerns without it, and even small ones become utter failures. System also insures that nothing is interrupted, not only in one shop but in every portion of the works, by the absence of the foreman, journeyman or apprentice, the work proceeds.

Every machine should be fixed according to a plan, so that heavy or light work can be done expeditiously. Suitable crane power or lifting hoist is found exactly where wanted. At any time, should alterations be required in machinery or fixtures, drawings should be made giving full particulars. This is very important and of great assistance to all concerned. I have known where alterations have been made in shops and no record kept. This has caused delays and expense where there are a quantity of steam and air and water pipes. No one appears to know when or where the alteration has been made under ground. If there had been a proper plan in the first place, and if when the alterations were made the changes were noted on the drawing, it would have prevented a world of trouble and experimenting, which is costly. It may happen the foreman has been transferred to another shop; he would be aware of the changes, but the foreman who has taken his place has no drawings nor any records for his guidance.



THE OLD CAMDEN & AMBOY "MONSTER" REBUILT.

The beneficial effect of accuracy in tool work is well and easily illustrated by the twist drill. The circumferential speed for one half inch to seven-eighths of an inch is 20 to 30 ft. a minute on mild steel, and a good feed is about 1-100 of an inch for each revolution, that is, half that amount per lip for each revolution; consequently, if the drill is ground with uneven lips the whole cut comes on one edge, therefore the drill is soon damaged and the driller reduces the feed until the one edge cuts well. This amounts to about one-half the feed. Therefore, to drill at the smallest cut absolute accuracy is required. Throughout each edge must be of equal length for obvious reasons, and have the same angle with the center of the drill. It is clearly understood that grinding is an important factor. Two important points in all tools are the cutting and clearance angles.

It may be stated that in all ordinary lathe work deep cuts and coarse feeds are first principles, one roughing and one finishing, bringing down the speed to suit the cut rather than suit the cut to the speed, for the greatest amount of work will be done in a given time; that is, let it be a maximum of feed rather than have the finishing a good sliding cut.

Too much cannot be said for the Universal milling machine. No machine shop is complete without it. One from eighteen to twenty hours' work of the first essentials is to "well man" the machines and then keep the cutters in order, for success depends entirely upon the facility for production and regrinding the cutters, it being an absurdity to use a cutter beyond its profitable period of service. A 3-inch cutter will do, probably, on an average before regrinding, which is only a few minutes' work. The cost of grinding in each case would not be more than 8 or 10 cents.

There is one important point which should not be lost sight of, and that is that all machines should have good foundations. Machines cannot be too rigid. Let any part of a machine be defective, and it will rebound upon the work done. H. J. VARLOW.

Fort William, Ont., Can.

Engine Driver.

Editor:

Referring to Mr. J. Snowden Bell's letter in the December number on "Engine Driver," I have always understood that a man who served his time as a machinist and then served firing, is an engineer, and that a man that only served his time firing is a driver. I am an apprentice and my time is not up until August, and after serving my time firing, I think I will highly appreciate being called engineer. But a fellow that only served time firing don't deserve to be called engineer. It hurts a man's feelings for one to serve twice as long, and then only be classed with the shorter service man. I don't mean to say one man's character is better than another's. MERTON JACKSON.

Lynbrook, N. Y.

[Our correspondent is under a misapprehension about the use of the terms. They do not indicate length or kind of apprenticeship. Engine driver is the correct and quite honorable term used in Great Britain and in many parts of the British Empire. In this country engineer is the word that custom has established.—EDITOR.]

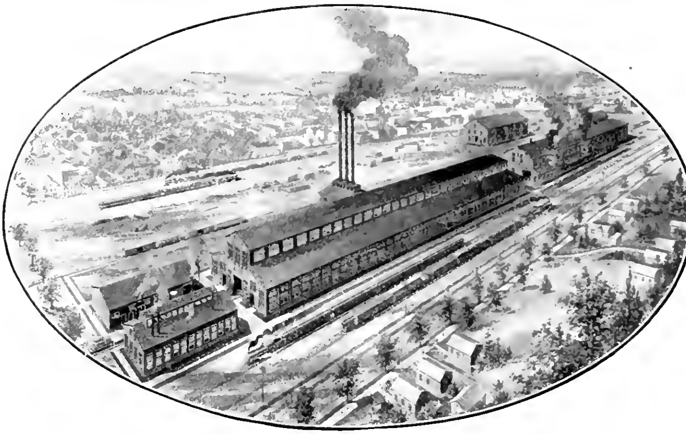
Vulcan Iron Works of Wilkes-Barre

No better proof of the complete revival of business activity, especially in the railroad world, could be found than in the Vulcan Iron Works at Wilkes-Barre, Pa., where the extensive locomotive and machine shops are being run to their full capacity with the result that a new locomotive is being completed every working day in the year, and the outlook bids fair to speedily surpass this large output. There are two separate establishments of the works, one being confined almost entirely to the making of mining and other machinery, while the other which is shown in our illustration, is devoted to locomotive construction. In the latter, there are between five and six hundred skilled mechanics at work. The machinery includes every modern improvement, and the visitor is struck with the high speed at which the various machines are run. The milling machines seem to be worked at a remarkable velocity while the elegant finish of the products could not be surpassed. Nearly all the tools are electrically driven, many of the motors being cleverly concealed in the lower framing of the machine, thus giving a desirable overhead clearance.

Of the locomotives in course of construction the variety was endless, ranging from the heavier class of contractors' locomotives for use in excavating and other operations, to the lighter kind of plantation locomotives. Some had the appearance of miniature engines adapted for the narrow gauge roads, both for passenger and light freight service. The finished locomotives of the American type were particularly elegant in appearance. Orders were being filled for nearly every country in the world. The lighter and smaller classes of engines were mostly for foreign service, large orders having been recently received from Japan, India and Siam.

Of the general kind of switching engines we reproduce an illustration of a six-wheel type, for industrial railway purposes. From the reports already at hand these engines are admirably meeting the requirements of the service for which they are intended. The cylinders are 15 ins. x 22 ins. Gauge of track, 4 ft. 8½ ins. This locomotive is used for general shifting service around their furnaces and possesses many features of interest. The locomotive is designed for a height limit of 12 ft. and a width of 9 ft. The combined weight of the engine and tender with two gauges of water in the boiler and tank two-thirds full, is approximately 120,800 lbs. The total weight on drivers is approximately 81,000 lbs.; which gives an average weight per axle of 27,000 lbs. The tractive force of this engine exerted under a running steam pressure of 180 lbs. is 18,033 lbs., which gives an adhesive factor of 4.27.

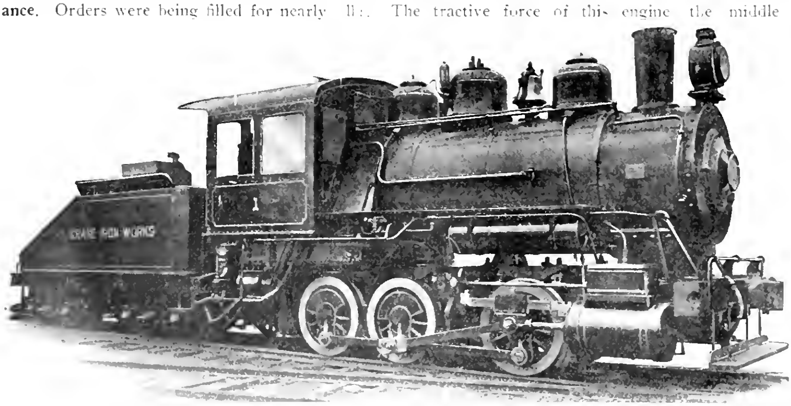
The boiler is of the radial stay, straight top type, made in two rings; the front ring being 54 ins. in diameter at the head. The firebox is arranged for burning the finest screenings of anthracite coal, and for this reason is unusually large, being 74 x 78 ins. It is equipped with a separate combustion chamber 12 ins. deep. The heating surface of the fire-box is 92 square feet; the combustion chamber 25 square feet, and that of the tubes 750.34 square feet; or a total heating surface of



VIEW OF THE VULCAN IRON WORKS, WILKES-BARRE, PA.

867.34 square feet; the grate area being 39.52 square feet. The driving wheels are 40 ins. in diameter, fitted with cast iron centers and 4½ in. rolled steel tires. The middle pair of drivers are flangeless. The driving axle journals are 6½ x 8 ins.

Frames of open-hearth cast steel, of double-bar section. The equalizers are placed in front of drivers and between the middle rear drivers. Steam chest valves are of the Richardson balanced type fitted with relief valve. Crossheads, rocker arms, cab window sashes, doors, tool boxes, running boards, steps, etc., all are made of steel.



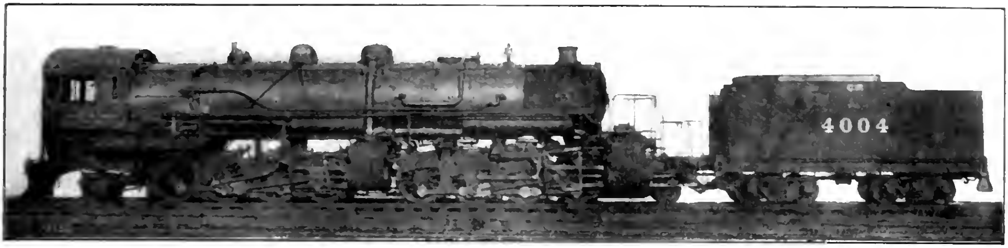
SIX WHEEL SWITCHER BUILT BY THE VULCAN IRON WORKS.

The tender has a sloping back, fitted with a U-shaped tank of 2,500 gallons capacity, and a bunker space for 7,600 lbs. of coal. The weight of the tender in working order is approximately 46,000 lbs. This is a powerful locomotive for its style and size, equaling in weight and tractive force many larger standard gauge railway engines. It is simple in construction with ample strength in all parts. On account of the service imposed upon this locomotive around the furnaces of the Crane Iron Works it was found necessary to make all exposed parts of the engine of steel or iron instead of wood.

Baldwin Mallet Articulated for the Southern Pacific

The Baldwin Locomotive Works have recently completed 21 Consolidation Mallet type locomotives for the Harriman Lines, or as they are also called, the Associated Lines. It is part of an order for 105 engines, placed with these works by the Associated Lines in the spring of 1909. The heavy Mallet en- [illegible] ment [illegible] way interferes [illegible] the convenience of the cab fittings.

The main frames are securely braced. Under the cab [illegible] steel casting, to which the bumper is [illegible]. The latter supports a stub pilot. The bumper is placed well forward to protect the occupants of the cab from buffing and collision shocks. [illegible] red. The latter engine has [illegible] in service a sufficient length of time [illegible] strate its value; and the fact that 21 additional locomotives of the same type have been built for the Associated Lines, proves that the performance of these engines has been fully up to expectations. A few of the leading dimensions of the



HEAVY MALLET COMPOUND OIL BURNER FOR SOUTHERN PACIFIC COMPANY

H. J. Small, General Superintendent of Motive Power. Baldwin Locomotive Works, Builders.

gines have been assigned as follows: Three coal burners for the Union Pacific Railroad, three for the Oregon Railroad & Navigation Co., and 15 oil burners for the Southern Pacific Co. Apart from modifications necessary because of the change of fuel, the six coal burners are practically duplicates of Southern Pacific locomotives Nos. 4000 and 4001, which were built by the Baldwin Locomotive Works early in 1909. These engines were described and illustrated in RAILWAY AND LOCOMOTIVE ENGINEERING for June, 1909, on page 260.

Experience gained in operating these engines through tunnels and snow-sheds has proved the desirability of placing the engine crew where a better view of the track can be obtained. Accordingly the new Southern Pacific locomotives are designed to run with the firebox end first and the tender back of the smoke-box. With a coal burning locomotive such plan would, of course, be impracticable but no difficulty is anticipated when using oil as fuel.

In the new design the cab is entered through side doorways, reached by suitable ladders. An unobstructed view of the track is obtained through the front windows. The cab fittings are conveniently arranged within easy reach of the engineman, who occupies the right hand side when looking ahead. The Ragonnet power gear is employed, and its cylinder is placed as on the previous locomotives. This gear was described in our October, 1909, paper on page 436. With this gear so placed it has been necessary to run a shaft across the boiler back-head, in order to make connection with the operating lever. This arrange-

The deck plate at the smoke-box end of the locomotive is of cast steel, and is provided with a chafing block and a suitable pocket for the tender draw bar. The tender is of the Associated Lines stand-

VIEW OF BALDWIN MALLET COMPOUND FOR THE SOUTHERN PACIFIC CO. THIS ENGINE RUNS CAB FIRST.

ard design, with rectangular tank, and equipped [illegible] oil burning locomotives.

So far as the boiler, cylinders, machinery and running gear of this locomotive are concerned, the design is practically a duplicate of Southern Pacific engine No. 4000, to which we have already

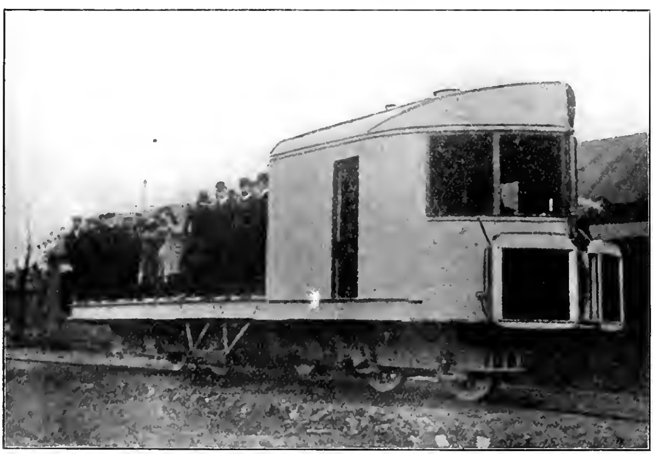
Mallet here described are appended for reference:

Cylinders, 26 ins. and 40 ins. x 30 ins.
Valves, balanced piston.
Boiler—Type, straight; material, steel; diameter, 84 ins.; thickness of sheets, 13/16 in. and [illegible] in.; working pressure, 200 lbs.; fuel, [illegible]; staying, T crown bars.
Firebox—Material, steel; length, 126 ins.; width, [illegible] ins.; depth, front, [illegible] ins.; back, [illegible] ins.; thickness of sheets, sides, [illegible] in.; back, 3/8 in.; crown, 3/8 in.; tube, [illegible] in.
Water Space—[illegible] ins. all round.
Fire Tubes—Material, steel; thickness, steel, 0.125 in.; number, 401; diameter, 2¼ ins.; length, 21 ft. 0 in.

Heating Surface—Firebox, 232 sq. ft.; fire-tubes, 4,941 sq. ft.
Feed-Water Heater Tubes—Number, 401; diameter, 2¼ ins.; length, 5 ft. 3 ins.; tubes, 1,220 sq. ft.; total, 6,393 sq. ft.; grate area, 68.4 sq. ft.
Driving Wheels—Diameter, outside, 57 ins.; journals, main, 11 ins. x 12 ins.; others, 10 ins. x 12 ins.
Engine Truck Wheels—Diameter, front, 30½ ins.; journals, 6 ins. x 10 ins.; diameter, back, 30½ ins.; journals, 6 ins. x 10 ins.
Wheel Base—Driving, 39 ft. 4 ins.; rigid, 15 ft. 0 ins.; total engine, 56 ft. 7 ins.; total engine and tender, 83 ft. 3 ins.
Weight—On driving wheels, 394,700 lbs.; on truck, front, 22,100 lbs.; on truck, back, 20,200 lbs.; total engine, 437,000 lbs.; total engine and tender, about 610,000 lbs.
Tender—Wheels, diameter, 33 ins.; journals, 6 ins. x 11 ins.; tank capacity, 9,000 gals. water; fuel capacity, 3,150 gals. oil; service, freight.
Engine equipped with Baldwin smoke-box superheater.
Superheating surface, 655 sq. ft.

Gyroscopic Monorail Car.

Our illustration shows a monorail car 40 ft. long, 13 ft. high, 10 ft. wide and weighing 22 tons. It is carried on four wheels. A gasoline engine furnishes the motive power, and as all the wheels are in line, the car would very quickly fall over if it were not for the effect of the two gyroscopes, operated by the gasoline engine These gyroscopes weigh together about three quarters of a ton. The flywheels, for such they practically are, each measure 42 ins. in diameter and make 3,000 revolutions a minute in a partial vacuum. The gyroscopes are carried in the cab, shown on the front of the car, in which the power and brake mechanism is operated.



THE BRENNAN GYROSCOPIC MONORAIL CAR.
(Photo Courtesy of N. Y. Tribune.)

When Mr. Louis Brennan, C.B., the inventor of this type of vehicle, brought out his model a few years ago and exhibited it to the British War Department the demonstration was entirely satisfactory. In the August, 1907, issue of RAILWAY AND LOCOMOTIVE ENGINEERING, page 360, a brief description was given of the action of the gyroscope, or rather the gyrostat, as the modification by the late Lord Kelvin is now called. The gyroscope offers no resistance to a motion of translation, that is, it does not affect, nor is it affected by the motion of the car along the rail. In this car the gyroscopes have nothing to do with whether the car is in motion or standing still. The car goes forward or stops in obedience to the power derived from the gasoline motor, as manipulated by the operator. The function of the gyroscopes is to keep the car standing upright or "on an even keel" as a sailor might say.

If the car tips to one side, it is really beginning to revolve about an axis formed by the monorail. To illustrate this matter of revolution about an axis: Suppose you stand a walking stick on the floor, point down and handle up, and remove all support, the stick will fall down. The handle will describe an arc of a circle from perpendicular to horizontal, with the point as the center. The whole stick may thus be said to have made a quarter of a revolution about the point. In the same way if the car tips to one side or the other, it is beginning to revolve about the monorail as the walking stick did about its point. To such motion the gyroscopes offer great resistance. Their axis of rotation is normally at right angles to the line of the track A tendency to tip, however, would cause the gyroscopes to revolve upon their supports in an effort to bring their axis of rotation parallel to the monorail. This kind of movement, is what is called precessional motion.

A precessional motion is apparent when an ordinary pegtop is spun on the ground. There is a knob on the upper rounded surface to which the string loop is attached for throwing. This knob may be observed slowly revolving in a circle, giving the top a wabbling motion while it spins rapidly about its axis. The precessional motion of the top gradually becomes less and less and at last it disappears when the spinning top "sleeps."

The precessional motion of the gyroscopes produced by the slight tipping of the car cause them to revolve slowly around as if they desired to place their spinning axis over the monorail, and here a curious law of gyroscopic motion comes in. It is stated thus, "Hurry on precession and the body rises in opposition to gravity." In the monorail car mechanical means are provided for hastening the precessional motion of the gyroscopes and the lower side of the car rises in obedience to the law, as gyroscopes are so to speak, part and parcel of the car. The rising of the depressed side causes a precessional motion in opposite direction and prevents the car oscillating or swaying from side to side on the monorail. The car goes round a curve with an inward inclination like a bicycle rider, and whether on a curve or on straight track every slight tendency to overturn is instantly and automatically checked by the gyroscopes, in a way that is almost uncanny.

The full-sized car shown in our illustration is said to be more successful in operation than the model was. It was exhibited in working order on the War Office grounds at Chatham, England, before professional experts and members of the Royal Society. A speed of 7 miles an hour was attained on the trial, but higher speeds are confidently expected. Sudden shifting of weights in no way endangered the equilibrium of the car.

Wants Our Postage Increased.

In his message to Congress, President Taft complains about the loss caused the Government by second class mail matter being carried at rates so low that a large annual deficit results The President is shrewd enough to refrain from recommending an increase of rates for newspapers, but he expresses himself strongly in favor of raising the postal rates on magazines and such publications. One important cause of loss to postal revenues is left unnoticed. That is the carrying of papers free within every county. Newspaper publishers are privileged to send their papers through the mails free within the county where the publication office is located, but the curtailing of that concession to rustic news circulation would excite the wrath of rural members, a thing that no President with desire for popularity would dare to risk.

Contributions for Presents to Officials.

The time was when nearly every railroad on the American Continent was cursed with the practice of giving gifts to officials and to others in authority. Toadies in the singular or plural number would make it known that Superintendent Brown or Master Mechanic Johnson was a good man with the employes interests at heart, or that he deserved a testimonial to show the appreciation of the men. The chief toady would head a subscription list with the idea of favors to come, and most of the other victims would be afraid to refuse to contribute dollars they could not afford. By this practice some of the most contemptible officials who ever abused a brakeman received testimonials certifying to worth and popularity they never possessed.

These practices have almost entirely disappeared from American railway life. It seems the evil had appeared in the railways of the Philippines, but had made only small progress when arrested by the highest authority as shown by the subjoined general order which one of our subscribers denominated "one of the best orders that has been sent out in any country."

THE PHILIPPINE RAILWAY COMPANY

Office of the Vice-President.

GENERAL ORDER NO. 10.

Gifts to Officers, Foremen and Others.

Officers and employes of the Philippine Railway Company are advised that it is contrary to the policy of the company, and is forbidden, that subscriptions be taken up for the purpose of presenting foremen, officers or others with presents or tokens or entertainment upon the occasion of their leaving the service of the company, or upon any other occasion.

It is considered unfair and improper that employes should be called upon to contribute, often unwillingly, from their wages for purposes of this kind, and they are requested to refuse to make such contributions. Officers or other employes connected with the getting up or assisting in such collections will be held accountable therefore.

WM. B. POLAND,

Vice Pres. and Chief Engineer.

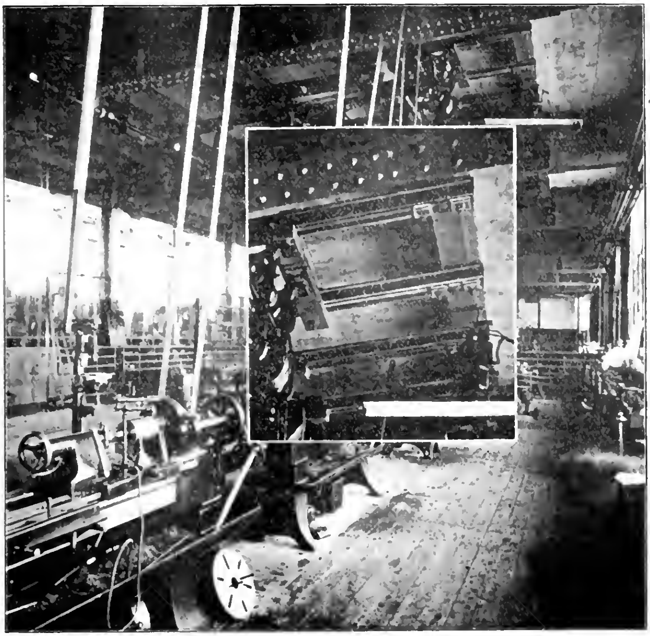
To all Officers and Employes and to be Posted at Registered Stations.

Iloilo, P. I., October 23, 1909.

Shelving and Shaft Hangers.

In the tool room of the new shops of the St. Louis & San Francisco Railway at Springfield, Mo., are two or three features of special interest, some of which represent standard items of equipment designed and arranged by the Arnold Company and used in most of the shop plants for which that company contracts. The tool room is about 87 by 39 ft. and is surrounded by steel shelving with wire partition above. The wire netting is built in sections, each on a steel frame, and the sections are all of uniform size for all the places in which they are used in the whole plant. The top is stiffened and the separate sections fastened together by a continuous channel section band running around the whole top. The shelving is also made in sections of the same width as the sections of the partition and is mounted upon supports so that the sections can be put together in much the same manner as are sectional book cases. The shelves are so arranged that they may be fixed in a horizontal or in a tilted position. Some of the sections are fitted with doors forming cabinets for the smaller or more valuable tools. In case of removal or rearrangement of the size or position of the room, the sections both of shelving and wire partition may be disconnected, removed and replaced with but little labor and at a small expenditure of time. The tops of the shelving and cabinets are covered with steel plate forming a counter.

Another interesting feature shown in the engraving of the tool room equipment is the means provided for hanging shafting adjustably. In the shop generally belting is avoided as much as possible, but in the tool room belts are a necessity for the operation of the small machines. The overhead hangers for these are supported in a manner which has been adopted by the Arnold Company as standard practice. The connection to the overhead floor beams is made by pairs of channel sections bolted to the beams back to back at uniform distances apart and uniformly punched for bolt holes before erection. These channels are all of the same section and cut to the same length for the whole shop plant, some 1,300 pieces being used in these shops of the Frisco system.



SPRINGFIELD, MO., SHOPS OF THE FRISCO. SQUARE IN CENTER OF PICTURE SHOWS ENLARGED VIEW OF SHAFT HANGERS.

The fastening may be adjusted to any size of hanger by the use of filling pieces or thimbles through which the hanger bolt passes, or the hanger bolts may pass on either or both sides of the channel sections. On account of the uniform character of the channel-section supports, the hangers are always at the same height, are perfectly level and the hangers may be shipped along toward one end or the other or removed from one set of supports to another with the assurance that the alignment of the shaft will be perfect and that no further adjustment will be required to make the shaft run true. In our illustration we have shown this feature in the enlarged square in the cut.

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances.

Published Monthly by
ANGUS SINCLAIR CO.
114 Liberty Street, New York.
Telephone, 984 Cortlandt.
Cable Address, "Loceng," N. Y.
Glasgow, "Locoauto."

Business Department:
ANGUS SINCLAIR, D.E., Prest. and Treas.
JAMES KENNEDY, Vice-Prest. and Gen. Mgr.
HARRY A. KENNEY, Secretary.

Editorial Department:
ANGUS SINCLAIR, D.E., Editor.
GEORGE S. HODGINS, Managing Editor.
JAMES KENNEDY, Associate Editor.

Advertising Department:
JAS. R. PATERSON, Manager, Chicago.

Boston Representative:
S. I. CARPENTER, 170 Summer St., Boston, Mass.

London Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., 3 Amen Corner, Paternoster Row, London, E. C.

Glasgow Representative:
A. F. SINCLAIR, 49 Jamaica Street, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid in the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribe in a club, state the name of the agent.

Please give prompt notice when your paper fails to reach you regularly.

Entered at the Post Office, New York, as Second-class Mail Matter.

$1,284,000 Saved in One Year.

In this issue we have published the conclusion of the discussion at the Traveling Engineers' Convention of the paper on "Fuel Economy" presented by Mr. S. D. Wright, Central Railroad of Georgia. We consider that paper and the discussion that resulted the most valuable contribution ever made for promoting the economical operation of railways. "There is millions in it" is a facetious expression generally used to cover some extravagant proposition, but the expression may be used in all seriousness towards Mr. Wright's excellent paper and the information it brought forth.

We have insisted that railway officials were "barking up the wrong tree" in their periodical fits of scolding engineers and firemen for failing to make better use of the coal supplied to their engines. The enginemen were not zealous to make economical records because the coal was thrown upon the tenders with such scant desire for accuracy that the quantity supplied was merely a rough guess, and that the skillful and careful fireman received no more credit for economical performance than the careless slouch whose only desire was to get over the road with the least possible personal exertion. The same with the engineers. The man who had studied the most economical methods of operating the engine to make the steam perform the highest possible duty received no more credit than the runner noted for keeping the reverse lever near the corner.

The remarks made by Mr. C. F. Ludington, chief fuel inspector of the Santa Fe during the discussion on Mr. Wright's paper and reported in this paper, vindicate the position we have held regarding the importance of accurate methods for supplying fuel to locomotive tenders. By the introduction of exact means for ascertaining the quantity of coal supplied, the officials were justified in keeping the enginemen to strict account for the coal used. When they found that they were treated justly in the coal charged to their use the enginemen began to display rivalry as to who could make the best fuel record. The result was simply astounding. A fuel saving of 18 per cent. is declared to have been effected, which aggregated $1,284,000 in one year. The Atchison, Topeka & Santa Fe Railway has nearly 1,700 locomotives, and the sum saved does not reach very high per engine; but it counts of the greatest importance in aiding the company to carry on new enterprises or in helping to raise the pay of deserving employees.

The saving was effected by the revived zeal and care of the enginemen, and by the change in the methods of coal measurement that convinced those using the coal that waste would be resented and care put to their credit. The people who have for years been promoting cheap methods of handling coal at railway supply stations and brought into popularity practices that dumped valuable coal as recklessly as if it were worthless earth ought to reflect upon what careful, intelligent handling has done.

Railway officials who are striving without ceasing to reduce operating expenses without injuring efficiency are respectfully urged to read the remarks made by Mr. C. F. Ludington as reported on page 4 of this paper.

To Interfere with Locomotive Boilers.

The Railway Business Association, although little more than a year old, has become a powerful factor in defending railway interests, and the indications are that it is going to act as an effective buffer in protecting railways from the collisions and shocks of malicious legislation. At a banquet held by the Railway Business Association on Nov. 10 last, some of the most influential statesmen in the country expressed their views in relation to railroads and the public and the trend of their opinions was, that railroad companies have suffered grievously from vicious legislation and that altogether too much industry is displayed by legislators entertaining idiotic anti-railroad sentiments.

While the subject is still fresh we wish to direct the attention of fair people in general and of the Railway Business Association in particular, to a bill introduced last year by Mr. Burkett from Nebraska for the ostensible purpose of promoting safety of railroad employees and travelers upon railroads by compelling railroad companies to equip their locomotives with safe and suitable boilers and appurtenances thereto; which include steam pressure gauge, safety valve, gauge cocks or try cocks, a water glass with certain details specified. The boiler must withstand a hydraulic test, in the ratio of one hundred and fifty pounds to the square inch to one hundred pounds per square inch of the working steam pressure; boiler and appurtenances must be well made of good material, that the openings for the water and steam respectively, and all pipes and tubes exposed to heat are of proper dimensions and free from obstructions; that the spaces between and around the flues are sufficient; that the boiler flues, safety valves, fusible plugs, low water indicator, feed water apparatus, gauge cocks, steam gauge, water and steam pipes, low water gauges, means of moving mud and sediment from boiler, and all other machinery and appurtenances thereof are of such construction, shape, condition, arrangement and material that the same may be safely employed without peril of life and limb.

With a few absurd exceptions, the foregoing particulars describe 99 per cent. of the locomotive boilers used today by railroad companies and they are decidedly better cared for than other boilers; yet the author of the measure makes it imperative that the owners of the boilers shall have them and their appurtenances thoroughly examined and tested every three months by experts employed by the Secretary of Commerce and Labor. That seems to be the real purpose of the bill besides giving this new fangled Congressman some notoriety—to bring into existence an army of reputed experts to perform work that has been done thoroughly and satisfactorily by mechanics who have acquired unquestioned skill by many years of experience in making, repairing and testing locomotive boilers.

According to reports published in the *Locomotive* by the Hartford Steam Boiler and Inspection Company, there were in the months of April, May, June, July and August of last year 159 accidents that were classed as boiler explosions. Of these 4 were in mines, 8 to tugs and water craft, 9 to locomotives, 11 to saw mills, 15 to traction and agricultural boilers, 52 at power plants and 60 at heating and miscellaneous plants. There are about 60,000 locomotive boilers in the United States, more than any other form of boiler. The small number of explosions to locomotive boilers is convincing testimony in favor of the great care such boilers receive from the men responsible for their safety.

In 1868 the American Railway Master Mechanics' Association was organized for the purpose of the "Advancement of knowledge concerning the principles, construction, repair and service of the rolling stock of railroads, by discussions in common, the exchange of information, investigation and reports of the experience of its members." Almost the first investigations this association of the best informed practical mechanics in the country were connected with were locomotive boilers; investigations that included every subject that vast experience and scientific information could suggest to identify weak forms of unreliable material and to recommend for use forms and practices that had proved themselves thoroughly reliable. From such searching ordeal the locomotive boiler of today has taken its form; and the practices of testing and examining that contribute to safety in operation have arisen out of the fountain of experience possessed by the Railway Master Mechanics of the United States. Yet a bovine member of Congress, whose greatest engineering experience has never strayed far from his festive mules, rushes in like others of his kind to overturn practices that wisdom has established and that safety to life and limb have declared satisfactory.

We commend the case to the careful attention of the Railway Business Association and to other sensible citizens having influence in our halls of law making.

Selecting Firemen.

Many schemes have been proposed for the selection of firemen, most of them being based on a desire to give educated young men the opportunity to become wielders of the scoop if they so desire. The genteel young man thus given the opportunity to become locomotive fireman has never met the requirements so well as the youth whose conspicuous personality comprises bone and muscle. Most old locomotive engineers have had experience with mother's darlings ambitious to become locomotive engineers by passing through the rank of fireman for a very short period, and the experience has been of a character to promote profanity. Selecting firemen, which has been periodically discussed by the Master Mechanics Association, came up again at last convention as a topical discussion, and Mr. D. B. McBain, of the New York Central Lines, said:

"The question, 'Is previous railroad experience of advantage to locomotive firemen,' is one that we believe worthy of debate as there are many angles from which the matter ought to be viewed. Ordinarily, there are very few applications from the ranks of the shopmen, the trainmen, the switchmen or the clerical force, for positions as firemen, and it has been our personal experience that in most cases where applications are received from these sources, that the applicants have not been successful for one reason or another, and turn to the locomotive service as a last resort.

"From the ranks of the sectionmen, the bridge gangs, the car repair gangs and the freight-house gangs, there are many very desirable applicants. These men, as a whole, are used to rough, heavy work at low wages, and they appreciate fully the advantages afforded by the locomotive service in the matter of better working conditions and increased remuneration.

"While it has been our experience that not all of these men make good, as locomotive men, the exceptions are, perhaps, less in proportion to number than of any other class of men hired, and some of the very best engineers in the service at the present time are men who began on the track, the repair yard, the bridge gang or the freight-house gang. In such cases, by reason of the fact that they, in most instances, do appreciate that the locomotive service is more desirable in all respects than the jobs they left, it would seem their previous experience was advantageous to themselves and the company alike.

"Viewing the matter from a standpoint of the practical railroad experience of such men, they, of course, cannot be classed with applicants who have had previous experience as trainmen or switchmen, especially when firemen are needed to keep the road open.

"To sum up: First—Should it be the good fortune of a road to get men who have fired elsewhere and been laid off on account of reduction in force, the experience they have had, ought to be of some value to the employing company, and they have, as a rule, the advantage of being young men, which is a desirable feature. Second—If intelligent young men could be induced to enter the track, bridge, car-repair and freight-house gangs, with a prospect of advancement to the locomotive service, if they can qualify, it would seem that the scheme ought to work out advantageously to the railroad companies. Third—In our opinion, the next best material from which to choose firemen, is from the farm. The farmer's son, after he is broken in, is usually appreciative of his position and will develop into a good, reliable locomotive fireman. Much can be accomplished toward improving efficiency among locomotive firemen by having good men as firemen's instructors, who shall have no other duties to perform, and who can apply their whole mental and physical energy toward instruction."

Boiler Lagging in Europe.

According to a recent report of the International Railway Congress, locomotive boiler lagging is being tried with more or less satisfaction by various railroads on the continent. The idea up to somewhat recently seems to have been that "the best lagging is no lagging." A layer of air surrounding the boiler has been relied upon as the protection against loss of heat. The efficacy of air as a non-conductor is too well known to require explanation. The common house refrigerator is built on this principle, and the thermos bottle has only gone one step further and has replaced air by vacuum. Many continental locomotives are "covered" by a layer of air about 1⅜ ins. thick, confined between the boiler and thin sheets supported on a light frame.

Asbestos lagging has been in use on several railways, notably the Northern of France, which has applied it to two of its latest compounds. Cork, slag-wool and silicate-cotton laggings have been tried, but none of these appear to have become popular. It may be said of asbestos lagging that perhaps it has made the most headway of any, but that is not saying very much. Asbestos, and indeed, all the laggings mentioned, are not in themselves very efficient non-conductors. Solid asbestos can be made very hot and asbestos-wool is used in many fireplaces in houses where gas is used. Under the action of a gas flame fed from what is practically a Bunsen burner, this fluffy wool asbestos becomes very hot and may also become incandescent.

The secret of asbestos when it is used to cover a locomotive boiler is that it is made so as to contain an immense number of minute air spaces. Asbestos itself is not injuriously acted upon by heat. The fact that the material in a porous state can be readily put on a locomotive boiler, and the fact that it is a tangible substance and therefore more easily applied than a layer of air, gives this form of boiler covering an advantage which is recognized in this country. After all, it is to the non-conducting property of the contained air that makes this form of covering valuable.

The Southern of France is making trial of lagging composed of magnesium carbonate, and the saving in fuel, through thus checking surface heat losses is said to be from 2 to 3 per cent. The Paris-Lyons & Mediterranean officials are now experimenting with various kinds of boiler lagging, but have not yet arrived at any positive conclusion on the subject. The Italian State Railway is using several kinds of asbestos, and the Belgian State railways, as a rule, use a form of asbestos matting covered with thin sheet iron. The back part of the firebox is lagged with wool which has been coated with silica paint, the outside being covered with thin sheet iron.

In this connection it may be mentioned that many locomotives in the Northern States of America and in Canada have some lagging left off in the cab where the whole back head is covered, for the purpose of supplying heat for the crew in winter time. The ordinary uncovered back head, however, is usually relied upon to radiate sufficient heat to keep the men warm. On some locomotives the whole portion of the boiler in the cab is lagged and covered with Russia iron, and a source of heat is supplied by a steam coil on the engineer's side and on the fireman's side. This has the advantage of keeping the cab comparatively cool in summer.

The matter of boiler cooling has received some attention in Europe in connection with the question of lagging. It is held by some of the Continental authorities that the use of boiler lagging retards the operation of washing out, especially where cold water is used. Boilers with lagging cool more slowly than those without it, and as much as three hours has been stated as the difference in time between the two. Washing out has in some cases been postponed for lack of time to allow a lagged boiler to cool sufficiently to use cold water, and the use of cold water to wash out warm boilers has an injurious effect on flues. It is possible that on the engines which our Continental friends regard as "lagged with air" there may be more or less leaks and a "circulation" of the air, which, while advantageous in cooling a boiler for washing out purposes, might not be a very effective non-conducting covering in road service.

Adjusting the Reach-Rod.

More importance should be attached to the exact adjustment of the reach-rod than is generally done. The usual practice is to adjust the reach rod so that there will be a larger amount of clearance on the top of the link block than there is on the bottom. This, of course, applies to the shifting link only, which, in the course of time, as the amount of lost motion in the joints increases, is gradually and slightly lowered in position. In the first place care should be taken to observe the effect produced by the heating and expanding of the boiler when the locomotive is in service, as compared with the position of the link block at the extreme ends when the engine is perfectly cool as is usually the case when the reach rod and the valve gearing, generally, is originally adjusted. If the quadrant is attached to the boiler a considerable variation occurs. The reach rod remaining cool under all conditions, the expanding of the boiler has the same effect as shortening the reach-rod, thereby affecting the position of the link block and incidentally the opening and closing of the valves.

As we have repeatedly urged, it is always advisable to examine the valve gearing after a short period of service and while the boiler is in a heated condition. It will be a matter of surprise to observe the changes that have already occurred. The most noticeable change will likely be in the point of cut-off, and it is good practice to find the cut-off points with the lever at the extreme ends of the quadrant. The points where the valve closes can readily be found by the valve tram, and, taking one side of the locomotive at a time, it is well to test both the forward and backward motions. In a piston stroke of 28 ins. the extreme point of steam admission may be 25 ins., but it will generally be found that there is a considerable variation observable when the forward and backward points are compared.

Assuming that the average distance should be 24½ ins., it is a simple matter of moving the reverse lever backward or forward so as to bring the valve to the closing point when the cross-head is at that distance, and note the amount which the reach-rod will have to be lengthened or shortened to produce the desired effect. It is also of value to repeat the experiment at the point where the supply of steam is cut off while the locomotive is engaged at its usual working capacity. This is generally with the reverse lever at some point towards the center of the quadrant. As a rule, however, it will be found that if the cut-off point is nearly correct at the full end of the stroke it will be found to retain the same, if not a greater degree of exactness when the stroke of the valve is shortened.

While the reach-rod is thus being readjusted, it would take but little time to observe the valve openings or points of steam admission. Sometimes it will be found that a slight change in the length of the eccentric rods may be necessary to meet the changes incidental to a variation in the length of the reach-rod. If the original adjustment of the valve gearing has been carefully accomplished the eccentrics should not require to be disturbed for many months, but the change in the reach-rod seems to be inevitable and that within a very short period. Every thing that tends to the maintenance of the perfect adjustment of the valve gearing of the modern locomotive, tends to increased efficiency and to economy in fuel, so that there is more than may at first appear in the proper and continued adjustment of the reach-rod.

The Westinghouse Controlled Turbine.

The use of steam turbines as applied to the propulsion of ships has been extended very greatly during the last ten years, but economy in the use of steam has not characterized that form of prime mover. Realizing this radical defect in connection with the operation of steam turbines in marine use, about six years ago, Hon. George Westinghouse requested Rear-Admiral George W. Melville and Mr. John H. Macalpine, consulting engineer, to thoroughly investigate the status of the steam turbine for the propulsion of ships and the probabilities of its becoming the ultimate successor of the highly developed reciprocating engine.

These accomplished engineers proceeded to investigate, to experiment and to invent, with the result that they have worked out an epoch making invention.

A most serious defect of the steam turbine engine now used for the propulsion of ships is that the speed of the engine is too great for the propeller. The invention which Mr. Westinghouse and other prominent engineers desired to see effected was something that would maintain the high speed of the turbine while driving the propeller at a low speed.

Messrs. Melville and Macalpine, following the suggestion of Mr. Westinghouse, proceeded to investigate, to experiment and to invent, with the result of solving the stupendous problem by means of a peculiar form of reduction gear, which makes possible any reasonable speed ratio between the turbine shaft and the propeller shaft.

Mr. Westinghouse, describing the new invention, writes:

The teeth of the gears are helical, that is to say, they do not run straight across the face of the wheel parallel to the axis, as in the case of ordinary spur gears, but they are cut in the form of a steel spiral, like an exaggerated screw thread. This construction allows the teeth to roll into contact without shock or jar. If there were only a single gear on each shaft this helical form of tooth would cause an objectionable end thrust. As the gears must be very wide to transmit the enormous powers required in marine service, two gears, each of half the required width, are placed on each shaft, with the spirals of the teeth running in opposite directions. In this way the end thrust due to the obliquity of the teeth is completely balanced. With a pair of wide-faced gears with straight teeth, it is hardly possible to cut the teeth with such accuracy and to align the shafts so perfectly as to get uniform contact throughout the entire length. Even if it were possible to secure the requisite degree of accuracy at the outset, it could not be permanently maintained on account of the natural wear of the bearings. In general, the conditions are such that a rigidly confined set of gears, such as are common for moderate speeds and powers, is altogether inadmissible.

In the design which has proved its sufficiency under severe and exhaustive tests, the smaller gear or pinion is mounted in what the inventors call a "floating frame." The frame which carries the bearings for the pinion is a heavy steel casting supported only at a single point midway between the bearings. This support is flexible, so that the frame is free to oscillate in a vertical plane passing through the axis of the pinion, but is held securely against motion in any direction. Furthermore, the pinion is free to move endwise in its bearings. Any tendency of the teeth to bear harder at one end of the gear than the other would tend to unbalance the respective end thrusts due to the right and left hand spirals of the teeth; but as the pinion cannot present any resistance to unbalanced end thrust, it constantly adjusts itself in the direction of its axis to the position corresponding to equilibrium between the opposing forces. This means that the tooth contact pressures are always automatically equalized.

If there are any minute irregularities in the spacing of the teeth, which would tend to make the contact harder at one point than another in any part of the revolution, this tendency is defeated by the floating frame, the position of which about its central support or fulcrum is controlled solely by the pressure of the teeth of the pinion against the teeth of the large gear. Naturally the floating frame always yields under the slightest tendency of an unbalanced contact pressure in such a way as to transfer the smallest increment of unbalancing pressure to another section of the gear that in the absence of the floating frame would be less inclined to take its full share of the stress. In short, the gears are self adjusting to relieve and equalize all abnormal strains, and are consequently independent of the small inaccuracies that are impossible to eliminate in the best commercial manufacturing operations.

Wage Earners' Mite Denied.

The measures before Congress that receive the greatest attention from politicians are seldom those calculated to have the greatest influence for good or for evil upon the majority of the people. The frugal and provident tendency of the American people, especially of the wage-earning classes, is seriously impaired by the widespread suspicion of ordinary banks being unsafe, a sentiment that has been nurtured by many cruel failures to return the savings of depositors.

Those who are familiar with the security of savings given by postal savings banks in other countries, are heartily in favor of similar banks being established in the United States. President Taft has urged Congress to establish postal savings banks without delay. The grabbing, grasping tendency of our over-fattened money powers will oppose giving the people postal savings banks until the concession is exacted by menacing demands for what is a real wage earner's mite.

Book Notices

LABOR AND THE RAILROADS, BY JAMES O. FAGAN. Published by the Houghton, Mifflin Company, Boston. 164 pages, cloth. Price $1.00.

The author of "The Confession of a Railroad Signalman," has succeeded in producing material for another very readable book. It is to be regretted however that a writer possessed of fair ability should apparently be so limited in point of personal experience with the subject he discusses. He evidently arrogates to himself a position and place as the spokesman of the railroad men. He complains that the railroad worker has never expressed his opinion on the industrial situation. This is a gross error. There is perhaps no class of men, outside of professional literary men, who have given better expression of opinions in regard to matters affecting their own welfare than railroad men have done and are now doing. The annual conventions, the monthly meetings, the numerous publications all bear testimony to the vast and varied expression of opinion on every conceivable subject affecting the interests of railroad men. The result has been beneficial to the general public and to the railroad men themselves.

THE MECHANICAL WORLD ELECTRICAL POCKET BOOK FOR 1910. Published by Emmott and Company, Manchester, England.

This book contains a vast collection of electrical engineering notes, rules, tables and data that are indispensable to electric workers. There is much new and valuable matter added this year, especially on the subjects of motor converters, carrying capacity of cables and electricity meters. The book costs 25 cents in cloth and 50 cents in leather binding. It contains 200 pages of closely printed matter besides a diary for every day in the year. It can be had directly from the publishers.

LOCOMOTIVE DICTIONARY, second edition, compiled by Geo. L. Fowler, for the A. R. M. M. A. Published by the *Railroad Gazette*, 1909. Price, $5.00.

This work, now in its second or 1909 edition, has been compiled by Mr. Geo. L. Fowler, M. E., for the American Railway Master Mechanics' Association, under the supervision of a committee of this association composed of Mr. J. F. Deems, general superintendent of motive power of the New York Central Lines, Mr. A. W. Gibbs, general superintendent of motive power of the Pennsylvania Railroad, and Mr. A. F. Mitchell, formerly superintendent of motive power of the Lehigh Valley Railroad. The book is of standard railroad size, that is, the pages are of the same dimensions as our paper. The book is bound in leather and well printed. It contains 540 pages and 5,260 illustrations. The dictionary is an illustrated vocabulary of terms which designate American railway locomotives, their parts, attachments and details of construction, with definitions and also illustrations of typical British practice.

LOCOMOTIVE BREAKDOWNS EMERGENCIES AND THEIR REMEDIES. By Geo. L. Fowler, M. E. Enlarged and revised up to date by Wm. W. Wood. Sixth edition, fully illustrated. Published by the Norman W. Henley Publishing Co., New York. 300 pages, flexible cloth. Price $1.00.

This popular and handy text-book on breakdowns and emergencies that may occur to a locomotive in service has come to be recognized as among the best books on the subject, and it is gratifying to observe that it is being kept up to date in the essential requisites of furnishing information in regard to the best methods that are in vogue at the present time in the matter of dealing speedily and effectually with emergencies when they arise. Mr. Fowler's excellent work as an expert in locomotive construction and repair is too well known to need any comment. His work has been ably supplemented by Mr. Wood, and the added or expanded chapters on the Air Brake, the Walschaerts Valve Gear and the Electric Headlight enhance the value of the work, which is sure of a cordial reception among railway men.

THE VALVE SETTER'S GUIDE. A Treatise on the Construction and Adjustment of the Stephenson, Walschaerts, Baker-Pilliod and Joy Valve Gearings. By James Kennedy. Published by the Angus Sinclair Co., New York. Numerous illustrations. Cloth. Price, 50 cents.

Our readers need hardly be reminded that Mr. Kennedy has been for a number of years an Assistant Editor of RAILWAY AND LOCOMOTIVE ENGINEERING, and in this capacity he has had many opportunities of showing his rare ability as a writer, as well as his thorough knowledge of the mechanical appliances used on railways. A series of articles from his pen on the subject of valve gearings has attracted wide attention and met the approval of many of the leading experts. These articles are now collected and revised and presented in such form and at such a moderate price that the book cannot fail to meet with a popular reception among railway men.

The most valuable result of education is the ability to make yourself do the thing you ought to do, when it ought to be done, whether you like to do it or not.—*Hurley*.

Electric Locomotive for Pennsylvania Tunnels at New York

The first of the initial order for twenty-four electric locomotives which are to be used for handling the Pennsylvania Railroad trains into New York, has now been delivered and is in operation on the electrified tracks of the Long Island Railroad. This locomotive incorporates many novel features in electric locomotive design, and is the result of several years' co-operative development between the Pennsylvania Railroad Company and the Westinghouse Electric and Manufacturing Company of Pittsburgh. It is distinctively a high powered machine, built for fast speed operation.

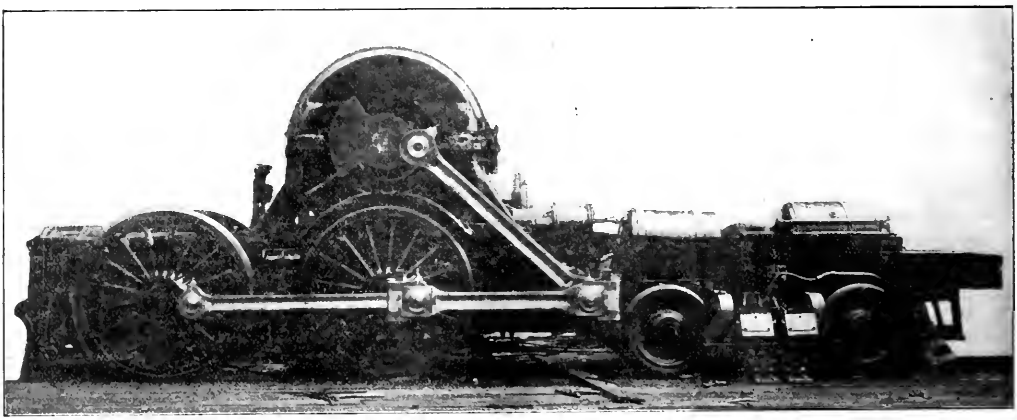
In wheel arrangement, weight distribution, trucks, and the general character of the running gear, it is the practical equivalent of two American or 4-4-0 type locomotives coupled permanently back to back. The motors are mounted upon the frame and side connected through jack shafts to the driving wheels by a system of cranks and parallel connecting rods, similar to steam practice. The connecting rods are in reality rotating links between rotating elements, and are thus perfectly counterbalanced for all speeds. The employment of this form of transmission permits the mounting of the motors upon the frame, and secures their spring support. Like an ordinary steam locomotive, the center of gravity is at approximately the same height above the rails, as that which has been found desirable in the best high speed steam practice. The same freedom of motion in the wheels and axles that is characteristic of the present steam locomotive is secured by this type of electric machine. In these locomotives the variable pressure of the piston of the steam locomotive is replaced by the constant torque of the motor and constant rotating effort of the drive-wheels of the motor, and the pull upon the draw-bar is rendered uniform. It might appear to a casual observer that by this arrangement of driving a return has been made to steam locomotive practice as regards counterbalancing, but upon examination it will be seen that this is not the case. There are no unbalanced reciprocating weights; all weights are revolving ones and are directly counterbalanced, so that as far as pounding upon the track is concerned, the effect is probably the same as though the whole were driven without pins or rods.

The starting requirements of this locomotive are usually severe. It will be called upon to start a train of 550 tons trailing load upon the tunnel grades under the river which are approximately 2 per cent. A guaranteed tractive effort of 60,000 lbs. has therefore been provided. The normal speed with load upon a level track, is 60 miles an hour, but the locomotive is capable of speed much in excess of this. Th total weight of the locomotive is 332,100 lbs., of which 208,-000 lbs. is carried by the drivers. At maximum capacity, this locomotive can develop 4,000 h. p.

The locomotive is an articulated machine, and each half carries its own motor and has four driving wheels each 68 ins. in diameter and one four-wheel swing bolster swivel truck with 36-in. wheels. Each section has its own cab made of sheet steel extending the length of the frame, communication between the two cabs being provided through a standard Pullman vestibule. The rigid wheel base of each half is 7 ft. 2 ins., and the total wheel base of each half is 23 ft. 1 in., that of the whole locomotive being 55 ft. 11 ins. The total length of the locomotive inside of knuckles is 64 ft. 11 ins. The running gear and mechanical parts of this locomotive were built by the Pennsylvania Railroad at their Juniata shops in Altoona. The air brake equipment was made by the Westinghouse Air Brake Company, and the electrical equipment was built and the apparatus assembled by the Westinghouse Electric and Manufacturing Company at their East Pittsburgh works.

The locomotive frames are of cast steel of large cross section and massive construction. In their design an unusually large factor of safety has been employed. The side frames are of sufficient strength to allow the engine to be raised by jacks applied at fixed points. There are five heavy cross ties from side of frame to side frame consisting of bumper, articulation and jackshaft girders, body bolsters and drive wheel cross tie. The jackshaft girder is of inverted U-section and arranged to give rigid support to the jackshaft bearing brasses. It also carries upon facings the driver brake cylinder. The brake lever fulcrums are integral with the girder. The cross tie between driving wheels is of diagonal design, especially fitted for stiffening the bottom members, and also providing a base for the front driver brake hanger pin. This tie fits between the upper and lower members of the side frames and assists in rigidly supporting the heel of the motor frame. The articulation girder is unusually rigid diagonally in the horizontal plane and is designed to accommodate the articulation gear details.

The axles, jackshafts and motor shafts are of special carbon steel, oil-tempered and annealed. They are of large diameter, finished all over and each has an axial hole throughout. The motor shaft cranks are forged with integral counterbalances, accurately placed in quartering positions and pressfitted and keyed to the shaft. The jackshaft cranks are forged



CLOSE VIEW OF CHASSIS OF ONE UNIT OF P. R. R. TUNNEL LOCOMOTIVE.

integrally with the shaft in quartering position. Their counter-balances are keyed in position. As with the driving wheels, the counter-balances of motor shafts and jackshafts are offset from direct opposition to the cranks in order to complete the balance. All connecting rods are of special carbon steel, oil-tempered and annealed.

Inasmuch as under the action of the brake shoes the wear of the axle and the take-up of the wedges in the pedestal tend to decrease the distance between the axle and the jackshaft, the main rod is adjustable at each end, so fitted that all take-up shortens the rod and furnishes compensation. The type of adjustable head is that employed on Pennsylvania Railroad Class E 3 locomotives. All the other rods are fitted with solid bushed ends. The articulation ends are fitted with permanent couplings of long twin draw bars and with Westinghouse friction draft gears, so designed that the leading half serves as a leading truck and the other half as a trailer in whichever direction the locomotive may be moving. The coupling gear is so designed as to oppose any possible "nosing" tendency or buckling action of the halves.

The cab of each half is an independent structure, complete in itself, so built that it may be lifted bodily from the running gear with floor and all auxiliary apparatus and set upon any convenient flat surface or trestle support without damage, leaving the motor and running gear accessible for any desired overhauling and permitting attention to be given at the same time to the machinery in the cab. The location of the cabs in assembling is determined by dowels fitting in corresponding holes in the running gear. They are held in place by a number of bolts sufficient for security, but the locomotives would have to go beyond their centers of stability before the cabs would leave their seats. The cabs are amply lighted by electric lamps. Bulkheads and doors are so arranged that the motor and air compressor compartments, containing nearly all of the auxiliary apparatus, may remain lighted at all times with no intrusion of light in the controller compartment to affect the vision of the motorman. Provision is to be made for heating the cabs by steam furnished from electric steam boilers within the cabs.

The motive power of this type of locomotive is delivered from two interpole motors on direct current at 600 volts. The design of these motors are governed by the necessity of commutating the heavy draughts of power required to accelerate the heavy trains on the tunnel grades. For this purpose the design not only affords great electrical stability but renders it possible to use the economical flexible and efficient field control. Each motor will develop 2,000 h. p. on a current of 2,000 amperes at 600 volts. The weight of each motor complete without crank is 42,000 lbs.

The motors of these locomotives have ten main poles and ten interpoles, with heavy strap field windings. The main field is split in two halves, both being used together in slow speed operation. One of these sections is shunted in control. For relief of the driving mechanism from excessive strains in the event of short-circuit in the powerful motors an adjustable friction clutch of novel design and tested efficiency in action is provided between the armature spider and the motor shaft. Each half unit is supplied with two pairs of third rail shoes suitably connected and fused. One pair of shoes is mounted on a hard wood beam on each side of the swivel or four wheeled truck. The control of these powerful motors is of Westinghouse shunted field control, and by utilization of the unit switch system the motors may be grouped in series or in multiple.

The bridging system is used for passing from series to multiple connections. This prevents the jerk so often noticeable by passengers when this change is made.

A master controller with latches, handle and suitable operating points is placed in each end of the locomotive. This handle resembles the throttle handle of a steam locomotive.

ELECTRIC LOCOMOTIVE FOR THE PENNSYLVANIA TUNNEL SERVICE

Applied Science Department

Setting Stationary Engine Slide Valve.

The valve rod connections being properly adjusted, place the crank on the dead center and move the eccentric around on the axle, in the direction in which the engine is intended to run, until the valve begins to open at the same end at which the piston is then placed, or would be if it was attached to the crosshead. Then fasten the eccentric on the axle. It is usually held by one or two set screws. Next turn the engine, in the direction intended to be run, until the crank pin is on the opposite center, and if the opening of the valve at the other port is the equal to the opening of the first, it proves that the valve is correctly set. The lead or opening, need not exceed one thirty-second of an inch for engines of less than twenty horse power, but may be increased in the case of larger engines.

In determining the proper length of the valve rod, the eccentric may be left loose on the axle and after being connected to the valve rod the eccentric may be readily moved around on the axle and the extreme points of the travel of the valve marked on the steam chest or valve face. If the points of travel are at equal distances from the ports the length of the valve rod is correct. If the distances are unequal, the valve rod should be lengthened or shortened, as the case may require, half the amount of the variation. The experiment of turning the eccentric around on the axle should be repeated and care should be taken that the valve rod is exactly the required length.

A good method of finding the dead centers of stationary engines is by using a surface gauge which may be set conveniently on the bed-plate of the engine and the pointer adjusted to the center of the shaft. The engine can then be turned until the center of the crank corresponds to the height of the pointer. In the absence of a surface gauge, a bent rod of iron, pointed, or a thin board or other convenient device adapted for pointing to the center of the shaft, may be used. Where the bed-plate of the engine cannot be utilized the dead centers can readily be found by markings on the crosshead and rim of the wheel when near the center and moving the engine slowly and carefully, catching with a tram or compass the same mark on the crosshead after it has passed the center. The crosshead need not be moved more than a quarter of an inch backward and forward. Meanwhile the rim of the wheel will have moved a considerable distance and a point exactly between the two markings on the rim of the wheel will be the dead center. This operation was more fully described in our article on the adjustment of the Stephenson shifting link gear.

A direct acting engine, so called because of the eccentric acting on the valve rod without the intervention of a rocker, requires that the eccentric should be set ahead of the crank, the exact amount depending upon the lap of the valve and the amount of lead or opening allowed at the beginning of the stroke. In the case of an engine equipped with a rocker, which is an indirect acting engine, the eccentric follows the crank pin at a corresponding distance.

It need hardly be reiterated that the exact relation of the eccentric to the crank, as well as the correct adjustment and careful maintenance of all the parts of the valve gearing is of the utmost importance in all kinds of steam engines. The exact location of the valve at the end of the piston strokes should be occasionally ascertained with a view to make corrections if necessary. In all changes it is well to note carefully that the valve moves evenly and freely on the valve seat. The tendency to twist the valve rod in blacksmithing operations is very great, and a hasty or careless adjustment of any part of the valve gearing, and especially of the valve rod, is almost certain to be fraught with the most pernicious consequences.

The tendency among engineers to meddle with the valve motion is happily passing away. A growth in technical education has hushed the cry for more lead. One would think that common sense would suggest to any intelligent mechanic the fact that a large quantity of steam admitted into the end of the cylinder toward which the piston was moving could not be other than a hindrance to the piston, but so rooted was this mistaken idea in the minds of many enginemen that the exploded fallacy still lingers in the minds of some.

It could not be expected in this brief article to describe the endless variety of forms in which the valve gearing of stationary engines appear. As we have previously stated, a knowledge of the elementary principles that govern the relation of the valve and piston of all reciprocating engines will naturally lead the intelligent mechanic or engineer to a ready understanding of any kind of valve motion that may come to his attention. The introduction of what are known as inside admission piston valves on many locomotives as well as on stationary engines does not present any new problem to those already familiar with the operations of the older sliding valve. The location of the eccentric on the axle may readily be found by experiment. In the case of an inside admission valve with a rocker operating between the valve rod and eccentric rod, the location of the eccentric on the axle is identical with that of a direct acting engine, equipped with an outside admission valve. In brief, with the proper adjustment of the valve rod, as has been already stated, and with the crank pin in either center, the mechanism may be moved until the valve begins to open at the proper port, and it will be found that the succeeding operations that may be necessary are merely in the direction of making the adjustment of the gearing as near an approach to perfection as is possible in a complex and rapidly moving engine exerting forces of variable magnitude.

The Metric or Decimal System.

The following simple table gives all that there is in the metric or decimal system of weights and measures:

MONEY.

10 mills make a cent.
10 cents make a dime.
10 dimes make a dollar.
10 dollars make an eagle.

LENGTH.

10 millimeters make a centimeter.
10 centimeters make a decimeter.
10 decimeters make a meter = 39.368 ins.
10 meters make a decameter.
10 decameters make a hectometer.
10 hectometers make a kilometer.
10 kilometers make a myriameter.

WEIGHT.

10 milligrammes make a centigramme.
10 centigrammes make a decigramme.
10 decigrammes make a gramme = 15.433 grains troy.
10 grammes make a decagramme.
10 decagrammes make a hectogramme.
10 hectogrammes make a kilogramme.
10 kilogrammes make a myriagramme.

CAPACITY.

10 millimeters make a centiliter.
10 centiliters make a deciliter.
10 deciliters make a liter = 2.113 pints.
10 liters make a decaliter.

10 decaliters make a hectoliter.

The square and cubic measures are nothing more than the squares and cubes of the measures of length. (Thus, a square and a cubic millimeter are the square and the cube, of which one side is a millimeter in length.) The are and stere are other names for the square decameter and the cubic meter.

Celebrated Steam Engines.

XXV. Seth Boyden.

In the city of Newark, N. J., in the center of a fine park, there is a colossal statue of a great mechanic named Seth Boyden. The statue shows the large head and broad shoulders of an intellectual and physical giant. The body and limbs are draped in a blacksmith's apron. This pose and garb seems peculiarly fitting in a city of workshops, and there is a native dignity about the figure that surpasses anything that could be folded in a frock coat or disguised in the trailing drapery of a Roman toga. Boyden deserved to be set up in bronze. He was one of the most useful men that ever lived in New Jersey. He came to Newark in 1815, from Foxborough, Mass. He was then twenty-seven years of age. He had never learned any trade being brought up on a farm, yet he seemed to be able to do everything to which he set his hand. He was watchmaker, telescope maker and manufacturer of electrical apparatus. He made magazine rifles and air guns. He was a miniature painter and microscope maker. He was an engraver on steel. In addition to this he was an agriculturist and botanist. New Jersey strawberries are named after him for by some secret alchemy of nature he doubled their size in a few years.

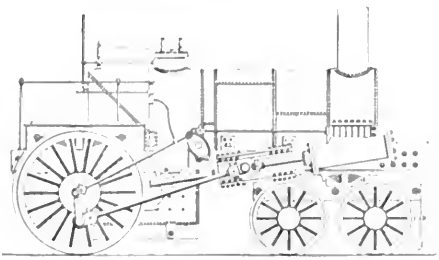
In addition to these wonders he was the first photographer in America. He improved Daguerre's invention and by refining the chemicals in use he reduced the time of sittings from five minutes to less than a minute. He was of much service to Professor Morse in perfecting the electric telegraph. On July 4, 1826, he discovered the process of making malleable cast iron which has since grown to such amazing proportions. This invention was of considerable profit to Mr Boyden, as he sold out the business he had built up to a Boston firm for twenty-five thousand dollars. This was in 1838.

Previous to this he had set about experimenting to discover a process of making glazed leather as it was first called, now known as patent leather. He originated this great business, and Newark has still a prominence in the manufacture of this article and commands the markets of the world on account of its fine product. Mr Boyden was also the first to utilize the zinc ores of the State, and after much experimenting he discovered an economical process of producing spelter from the ore. Coincident with this discovery, he was the first in America to perfect a process for manufacturing Russia sheet iron, and factories for the production of this article were quickly established.

Mr. Boyden produced many new tools among which may be mentioned a machine for making wrought iron nails, a machine for making files, a tack making machine, a machine for splitting leather. The latter was especially valuable as it furnished the means of doubling the quantity of leather from certain kinds of hides.

SETH BOYDEN.

In 1837 he entered upon the manufacturing of steam engines. The Morris and Essex Railroad being near completion at that time, he proceeded to build locomotives to operate the road. His first locomotive named the "Orange" weighed about seven tons. The cylinders were $8\frac{1}{4}$ x 26 ins. This locomotive had a peculiar valve motion actuated like the Walschaerts valve gear by a simple return crank, operating in the valve rod through an elliptical disk which effected reversing similar to the hooks that engaged the upper and lower pin of the rocker arm in the early Baldwin engines. Boyden's adaptation of the hook was peculiarly his own, and was the forerunner in a crude shape of the shifting link that came into use in the next decade. Next year Mr. Boyden built another locomotive named the "Essex." Both locomotives were well adapted to the work in hand at that time and was looked upon as powerful engines in these early days. He also built a locomotive for the Cardenas Railroad in Cuba, and went with it to that island in 1841, and opened the first railroad there.



SETH BOYDEN'S "ORANGE." BUILT IN 18

In 1845 he invented what was known as the cut-off motion, which he described in his application for a patent, as "connecting the governors of steam engines to a cut-off valve, so that the steam is let into the cylinder at full pressure and shut off by the aid of a governor at any point the variation of labor may require, leaving the steam to finish its own work by expanding, until the piston reaches its returning point." He always claimed this as his most important invention. His success as a locomotive builder did not deter him from making other experiments. He latterly invented some complex machines used in forming hats and other articles of wear.

In brief, he never ceased at working out something—making, inventing, creating, combining, discovering. He was a craftsman in the highest sense. With little or no education it seemed as if the accumulated wisdom of the ages came to him, and he began where others left off, and his cunning hands fashioned whatever came to his creative mind. He was indeed a marvellous man, an American mechanic of the highest type, almost without a paralled in history.

Questions Answered

SPEED OF MACHINES.

1. R. S., McKees Rocks, Pa., writes: I observed in some of your descriptions of machine shops that the velocity of lathes and other tools was increasing. Is there any fixed rule in regard to the speed at which the turning, planing and milling of steel, wrought iron, cast iron, and brass should be done?—A. There have been a number of rules but with the marked improvement in tool steel, the leading machine shops are constantly getting away from the rules. Under average conditions steel, wrought iron and cast iron are turned and planed at not less than twenty feet a minute and milled at twice this speed. Brass, which is much easier to cut, may be turned at sixty feet a minute and milled at a velocity of ninety feet a minute. A little experience soon determines the speed at which work may be safely and properly done. The depth of cut, the rate of feed and the degree of finish are all matters that affect the speed at which the work may be moved towards the tool, and there can be no fixed rule in regard to these matters. It is a very noticeable feature that the speed of machinery varies in different shops. Modern equip-

ment, improved tool steel and finely trained mechanics all contribute to the degree of rapidity and perfection with which work is accomplished.

SIZE OF WHEELS.

2. V. P., South Bethlehem, Pa., asks: How is it that a locomotive with small drivers can start and pull a heavier train than one with large drivers?—A. Because the distance from the center of the crank pin to the center of the axle is greater in comparison to the distance from the center of the axle to the rail in a small wheel than it is in a large one. It must be remembered, however, that what is gained in strength is lost in speed. Furthermore, the size of the driving wheel alone does not determine the strength or pulling capacity of a locomotive. The steam pressure is an important factor. The adhesive quality of a locomotive is also of importance. If the wheels slip the limit of adhesion has been reached. There must be sufficient weight to hold the wheels to the rails. The diameter of the cylinder and the stroke of the piston must also be considered. Everything being equal on two locomotives except the size of the driving wheels, the one with the smaller will start and haul the heaviest load, but the other will have speed.

THE NUMBER OF A FROG.

3. W. H. E., Haswell, Col., writes: Please give me a rule for measuring a switch frog to find the number of it. That is, if you had a frog in a switch that you thought was a No. 7 frog, but wanted to be positive, how would you go about measuring it to ascertain the number?—A. Take your rule, or for that matter a lead pencil or a short piece of stick, and place it between the inner sides of the divergent rails back of the point; mark or chalk the place where the rule or pencil exactly fits and then measure the number of rule or pencil lengths from the chalk mark to the point and if you find your rule or pencil can be laid down seven times in the distance it is a No. 7 frog. If the rule or pencil length will only go five times it is a No. 5 frog. The angle of divergence is usually laid off as one in so many, as one in three or one in four, etc., so you can find the frog number this way.

APPLYING BRASS TO OLD PISTON.

4. L. C. B., Covington, Ky., writes: To save solid piston heads after they are worn so as not to fill the cylinders, I desire to pour a brass ring around the head in order to hold it up, similar to the low-pressure piston head on compound engines. Can you inform me how to accomplish it?—A. You had better turn off some of the outside of the head so as to leave the shallow bottom of the packing ring grooves and from them turn out a dovetail groove between them. Pour your metal full on top and sides so as to have enough to finish properly. You would require a good man to do the melting and pouring so as to ensure a good job. The best way and probably the cheapest in the long run would be to get new pistons. You could perhaps more easily shrink on a wrought iron ring. To do this turn off as before, leaving the shallow bottoms of the packing ring grooves and turn off the metal between the grooves. Make your ring to suit this one shallow groove and shrink the ring in place, the two shoulders at the sides of the groove would help to hold the ring in place. The ring should have metal enough to allow for proper finishing for packing grooves and on sides.

ELEVATION OF RAIL ON CURVES.

5. W. H. E., Haswell, Col., writes: Please give me a rule for finding the number of inches elevation to give the outer rail on a curve of a given degree, taking into consideration the speed of trains. For instance, you have a curve of 8 degs. with trains running over it at speeds varying from 15 to 60 miles an hour. What rule would you follow to ascertain the number of inches elevation to give the outer rail?—A. Different railways may have different rules. Trautwine's formula states that the elevation in inches is equal to the velocity of the train in feet per second multiplied by the gauge of the road in inches, and this product divided by the radius of the curve in feet multiplied by 32.2. The elevation should be calculated for the maximum speed. In this connection see article on "Elevation on Railroad Curves," in the June, 1906, issue of RAILWAY AND LOCOMOTIVE ENGINEERING, page 250.

DIFFERENT SIZED WHEELS.

6. Young Boswell, Oakdale, Tenn., writes: On the same axle are fastened three wheels. The end wheels are 5 ft. in diameter, while the small one is only 1 ft in diameter. The middle wheel is on an elevated track, and the three have an equal pressure downward. Explain why the smaller wheel goes the same distance in one revolution of the axle as the larger wheels go.—A. The 5-ft. wheels have a circumference of about 15.708 ft. and the 1-ft. wheel has a circumference of about 3.1416 ft. When the set of wheels is rolled along the track the axle is carried forward 15.708 ft. and the small wheel is carried forward that much; it does not roll that distance. One of its revolutions only amounts to 3.1416 ft. The small wheel therefore slips a distance equivalent to 12.5664 ft. Each wheel makes one revolution, it is true, but wheels of unequal diameter have unequal circumferences, and a rolling wheel cannot progress in one revolution a greater distance than its own circumference unless it slips. All a rolling wheel can do is to measure its own circumference out on the track each revolution.

WHEELS, COUNTERBALANCE, AND VALVES.

7. C. R. Sunnyvale, Cal., asks: (1) What is the largest diameter of driving wheels of Atlantic and Pacific type engines?—A. Passenger driving wheels for these engines usually have diameters varying from 72, 79, or 80 ins. and even 84 ins. diameter.

(2) How are the weights for counterbalancing determined? If the wheel was lifted from the rail when in position would the counterbalance go to the bottom?—A. The counterbalance is lighter than the sum of the crosshead main rod, side rods, etc. See RAILWAY AND LOCOMOTIVE for May, 1902, page 222, and you will learn how the counterbalancing is done.

(3) Looking at some engines starting with passenger trains, I noticed the valve stem moved with a jerk, as if a powerful spring operated the valve. How was it?—A. There is, of course, no spring used to move the valve. The jerking you speak of may have been caused by want of lubrication or valve not well balanced You would get a good idea of the general construction and how a locomotive works by getting hold of a book like "Locomotive Engine Running and Management," by Angus Sinclair.

ETCHING ON STEEL.

8. E. R., Sorel, Quebec, Canada, writes: Will you please publish in your magazine a composition for etching on hard steel. I have tried six different ones that were taken from a contemporary of yours, and put up by different druggists and have always failed.—A. You should coat the steel with a thin film of wax and scribe on the wax, cutting through the film what you want to etch, such as a date (1) a weak solution of nitric acid, or (2) four parts iodine re-sublimed; ten parts potash, and 80 parts of water, or (3) four ounces of acetic acid, one ounce alcohol, one ounce nitric acid.

The engineering publications of Manchester, England, are boasting about a new brand of high speed steel made in that city by a peculiar process. The steel can be made either water-hardened or by air-blast hardened, although the former process is now used. It is stated that a recent test of a tool made of the steel showed that it could be hardened seventeen times in succession, in cold water, without indicating signs of cracking.

He who at the end of the day has gained nothing but his income has lost a day.—*Herald.*

Air Brake Department

Conducted by G. W. Kiehm

Care of H6 Equipment.

The recommended practice of the Air Brake Association deals with care of equipment, and there is no doubt but that those recommendations will eventually be adopted by all railroads whose officials are interested in air brake maintenance. As stated before, those recommendations are not particularly fitted to any local conditions alone, nor are they the opinions of one man. They should be studied by every repairman who wishes to do his work in an economical and satisfactory manner.

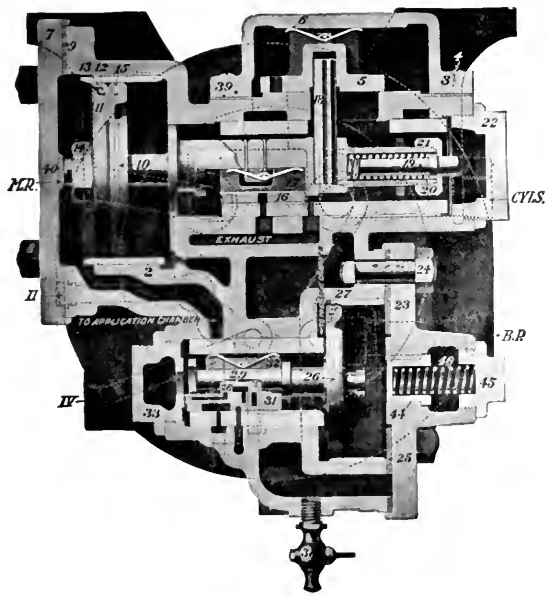
Theories and individual opinions are very often correct, and statements are often assumed as self evident, but for reliable and accurate information it is best to be guided by the results of demonstrations or tests. The matter of equipping a locomotive with air brakes is of some importance, and so is the question of deciding the kind of equipment to be used, and when one of two locomotives of the same class, having the same equipment, the same cost of repairs, permits the same train of cars to run several hundred feet farther in making a stop than the other engine does, it is an evidence of very poor maintenance and may cost the company a good deal of money. The following suggestions concerning the maintenance of air brakes of the H6 type are based upon practical experience and on observation of general conditions, and it is hoped that they will call forth some criticism or additional information concerning the care of the H6 equipment.

In the first place, the air pump, especially the large capacity pump, will usually last as long as the engine, that is, when the pump is overhauled and put in first class condition at the time the engine is in the back shop, the pump will run and give good service until the engine is again stopped, assuming that the pump is given a reasonable amount of care and attention in the meantime.

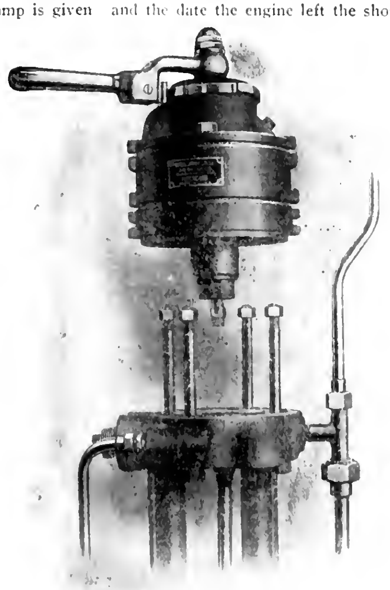
Those in charge of the daily trip inspection should see that the pump is not allowed to pound, groan or run hot, and in case any serious defect develops, another pump should be substituted, as the engine house is a very poor place in which to attempt heavy repairs to air pumps.

At the time the engine is in the back shop, all parts of the brake equipment should be thoroughly overhauled and tested, in fact, they should be put in as good condition as when they were new, and it will save much annoyance and additional expense in engine house repairs, to say nothing of time lost in delays to engines. When one speaks of all parts of the equipment one means air gauges and brake cylinders as well as the pump, governor, brake valves, feed valve, reducing valve, check valve, distributing valve, and signal valve and whistle.

After the engine leaves the back shop, the various valves should be given a periodical cleaning and test and the first test should occur three months after the engine is in service, the date on which the brake has received attention should be stamped on a tag or marked on a card and be kept in a suitable place in the cab, and the date the engine left the shop and the following periods of cleaning can then be noted without the inconvenience of referring to records.



NO. 6 DISTRIBUTING VALVE.



H6 BRAKE VALVE, OFF PIPE BRACKET.

After being in service three months and at a time when the boiler is being washed or when the engine is receiving ordinary engine house repairs, the governor tops, siamese fitting, feed valve, reducing valve, check valve and safety valve should be removed and replaced by parts that are clean and in good condition and that have been tested, and both brake valves and the equalizing valve of the distributing valve should be cleaned.

Three months later, or six months after the engine has left the shop, both brake valves and the distributing valve should be removed, the air gauges should be removed and tested, the driver brake cylinders should be given a small quantity of oil, and if in a horizontal position the piston should be given half a turn in the cylinder. If in a vertical position with one side near the firebox or cylinder saddles, the piston should be given half a turn. The tender brake piston should be drawn and it and the cylinder cleaned and the leather lubricated, and, as before, the governor tops, siamese fitting, feed valve, reducing valve and check valve should be removed, and at this time the distributing valve and signal valve should also be removed. Three months later, or nine months after the engine is in service, the first named method of cleaning is again in order, and when the engine is again in the shop the pump, brake cylinders, and all valves will again receive an overhauling.

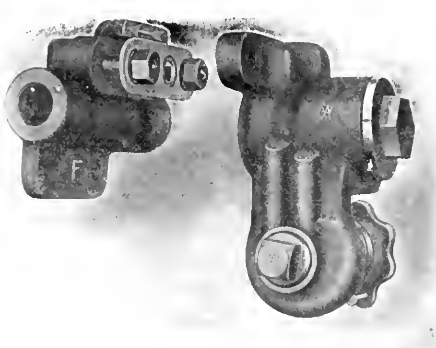
In giving the reasons for suggesting the foregoing methods, it has already been stated that the pump should not require any repairs until the engine is shopped and the steam body of the governor will not require any attention, and under ordinary conditions removing the regulating portions every three months is not too often. The object in removing the brake valves and distributing valve every six months is to allow their parts to be cleaned with lye or some other suitable liquid, and it is assumed that the governor tops, feed valves and reducing valves are subjected to a lye bath every time they are removed and before any repairs are made. In fact, the object in removing and replacing any valves is so that sufficient time will be had in which to properly clean and test them, or in which to make repairs if it is found necessary.

The reason for mentioning the air gauges but once in six months is because of the fact that during the daily trip inspection there are three hands on three separate gauges indicating the brake pipe pressure carried, and in release position the red hand must equal this, and it is practically testing the test gauge, and they can be relied upon to be accurate if all hands show the same pressure.

The reason for suggesting that the tender brake cylinder be cleaned every six months is because there is likely to be cold weather during one of those intervals, and if the freight car cylinder requires attention every twelve months the tender brake piston surely makes more than double the number of strokes that the freight car piston does in the same length of time, and is likely to collect much more dirt.

NO. 6 DISTRIBUTING VALVE, OFF RESERVOIR.

In suggesting a small quantity of oil for the driver brake cylinders it is recognized that the average grade of engine oil, after being in the cylinder a considerable length of time, has a tendency to rot the packing leather, but owing to the location of most driver brake cylinders, the heat will usually burn the packing leather if it becomes dry, so that oiling the leathers is at least choosing the lesser of two evils. Removing the reducing valve and check valve every three months may appear to be rather frequent, but it will be found that at the end of this time the lubrication will be pretty well worn off, and lubrication will prevent excessive wear of the piston, supply valve and supply valve seat, and there is no doubt removing it every three months will save considerable time in the long run, to say nothing of the saving in material for repairs.



B6 FEED VALVE, REMOVED FROM BRACKET.

For the same reason the equalizing valve of the distributing valve should be lubricated at the end of three months' service, and it would take but a few moments additional time to remove the application cylinder cover and lubricate the bushing and packing leather; to remove the entire valve at the end of six months will give an opportunity to properly clean and test the valve. While we know that distributing valves have been in service from eighteen months to two years without any attention or without giving any trouble, it is no indication that it would occur on any locomotive or in any class of service, as the amount of oil and dirt that enters the air cylinder of the pump very often determines the interval of time that should elapse between removals for cleaning and testing.

Removing the safety valve every three months is suggested as a matter of precaution, even if nothing is ever found wrong with it; if a very bad leak exists at the piston valve seat, proper brake cylinder pressure can not be obtained during automatic service application, and the leak will not show when the equalizing valve is in service lap position, and furthermore, after cleaning or examination the safety valve can be adjusted in a much more convenient and accurate way on a shop test rack.

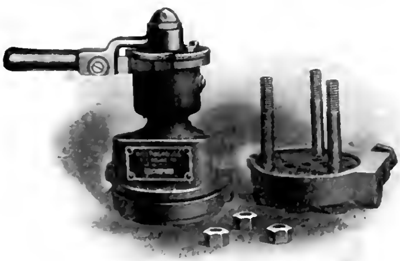
If the signal valve is located in the cab, it will require attention every three months, possibly oftener; but if properly located, under the roof just outside of the cab, with the whistle pipe running through and the whistle itself on the inside, it will not require attention within six months, possibly not even then, but this cleaning and inspection, if done regularly, will surely reduce to the minimum, if not entirely avoid, the detentions and annoyance caused by defects developing while the engine is out on the road.

If an ounce of prevention is ever worth a pound of cure, it is in the care of the modern air brake equipment, and the foregoing may appear to some repairmen to be unnecessary, too frequent, or that if followed out there would be no time left for any other work, but if the repairman is doing this there will be very little of anything else to do, and it would no doubt be more satisfactory to the master mechanic and the road foreman of engines if his time was spent in this manner instead of tearing apparatus apart to ascertain the cause of some disorder that has given trouble during the previous trip; and if all the equipment is always in good condition when the engine leaves the engine house, it is difficult to imagine anything that would be liable to happen while out on the road, or what work the engineer could report at the end of the trip outside of an occasional air pump packing or tightening a pipe joint. When the brake equipment on a locomotive is neglected until it begins to cause trouble, the work reports usually show it, and following up those reports faithfully and intelligently requires time. For instance, if the engineer should report that the brake worked in the emergency at some point along the road when the service application was attempted.

Some repairmen could climb up in the cab, try the brake several times, see nothing wrong, and tell the foreman that the brake is all right on the engine and that nothing was found wrong, and it may be all right on the next trip or on the next two trips, but the writer has never been able to satisfy himself upon this point without making an examination of the brake after a report of this kind.

If the engine is equipped with the high-speed brake and is in passenger service and such a report is written, the following examination should be made in every case: The quick action triple valve on the tender should be removed and tested and particular attention paid to frictional resistance of the piston and the action of the graduating spring. If nothing is found wrong, the brake valve is next taken apart, the equalizing piston examined and known to be working freely, the preliminary exhaust port gauged, and if nothing as yet has been found wrong, the equalizing reservoir must be known to be free of water even if it is necessary to remove it from the engine to find out whether or not it contained water. The pipe connections to the reservoir should be broken and the gaskets examined, and also the restricted opening through the Tee, and if nothing is found up to this time it would indicate the source of the trouble. The feed valve must be removed, cleaned and tested, or rather replaced by one that is known to be in good condition. Before the feed valve is bolted to the reversing cock, the ports through the cock should be blown out with pressure by moving the valve handle to release and to running positions, and finally, after the broken pipe joints are connected and tested, the brake must be tested, and the work may then be considered as finished.

This was done by the writer and is, of course, a case where the brake was reported as having worked in quick action once or twice. If the brake could be found working in quick action or could be induced, by any manipulation of the brake lever handle, to go into quick action while the handle had not passed the service position, the defective part was gone to directly and no particular attention was given to the rest of the equipment.



S6 INDEPENDENT BRAKE VALVE, OFF PIPE BRACKET.

If the engine is equipped with the H6 quick action distributing valve it would have to be given the same attention as the quick action triple valve, after a report of this kind, and the brake valve, equalizing reservoir and feed valve the same attention as the older equipment would receive.

While the same thing should be done in case the disorder is reported on a freight engine, it must be admitted that the entire examination is not always gone through with as faithfully as it would be on passenger engines.

Another report that will take up some of the repairman's time is "brakes sticking." Many repairmen have had so much experience with the brake that they can pump up the pressure, apply the brake a few times and release it a few times with the valve handle in running position and then conclude that the sticking brakes were not due to any disorder on the engine. We beg to differ with these repairmen on this point and think it is a very good practice, after such a report has been made, to test the triple piston packing rings for leakage. If a distributing valve gives trouble, make an examination of the equalizing valve and main piston, and no matter what kind of an equipment is used, before deciding that the locomotive brake does not cause any "sticking" and that it is due to brake pipe leakage on the train, the main reservoir should be drained, the air gauge tested, and the flow of air from the angle cock on the rear of the tender noted when the handle is in release and when in running position and, after the feed valve shows that it will raise brake pipe pressure promptly and maintain it, it is safer to conclude that leakage on the train is entirely responsible for the "brakes sticking."

This is mentioned for the purpose of showing that it requires time to follow up engine house reports carefully, and a great deal of this wasted time can be saved by periodical cleaning and testing, and while not wishing to make any criticism, it is just to the engineer to admit that too often his complaint is met with the reply, "The air man says the brake is all right, and he ought to know."

Air Brake Tests.

Airbrake tests have recently been in progress on the Lake Shore & Michigan Southern, under the direction of Mr. R. B. Kendig, the mechanical engineer of the road. These tests are to be made on the Pennsylvania. They have been made under the observation of experts of the Westinghouse Air Brake Co. and representatives of other railroads.

The results obtained are to be set forth in a report to the Master Car Builders' Association by the committee on airbrake and train signal equipment. The report will become public at the June convention.

The purpose of the tests is to determine the efficiency of passenger airbrake equipment, used on heavy cars run at high speed, and with a high percentage of braking power. The Lake Shore has a special test track 15 miles long, and on this it is possible to do experimental work without interfering with regular traffic. The Pennsylvania have a similar track at Toledo.

In making the tests a train of 10 heavy passenger coaches is used, the platforms being loaded with pig iron to secure added weight equivalent to that of buffet and dining cars. Each car is equipped with an indicator connected with the brake cylinder, a car record being thus obtained of the pressure on the cylinder at each stop. Brake application is made automatically when the speed of the train has attained approximately 80 miles an hour.

Electrical Department

From Coal Pile to Third Rail—I.

By Wm. B. Kouwenhoven.

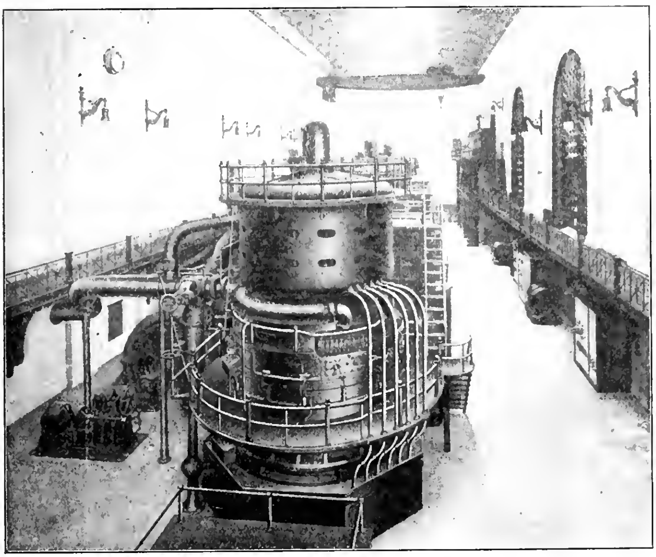
The Central Station.

This is the first of a series of articles describing the power equipment of a large railway system using electricity as the motive power for moving its passengers and freight. The intention is to follow the energy that exists in the coal, before it is burned under the boilers, through its various stages and transformations until it is finally delivered to the electric locomotive on the road.

On a railroad drawing its trains by steam locomotives, the motive power, or the steam, is generated at the point where it is to be used. The steam locomotive consists of two main parts, a boiler in which the steam is generated, and a steam engine in which it is used.

An electric locomotive supplied with power from a central station may be considered as a steam locomotive from which the boiler has been removed and placed at some convenient central point along the road. The generators in the central station, the wires for carrying the power, the substations, and the third rail, form simply a link which connects the locomotive, out on the road, with its steam boiler in the central station many miles away. This link may be compared to the pipe on the steam locomotive which joins the boiler to the cylinders.

By concentrating the boilers in one central plant economy in coal consumption is the result, but the reduction in cost of operating expenses is not sufficient to pay a fair return on the large investment required for the electrification of a road. It is therefore necessary to look for other reasons for making the change. A comparison of performance of an electric locomotive with that of a steam locomotive is interesting and the reader is referred to pages 255 and 256 of the 1908 volume of Railway and Locomotive Engineering for a comparison of a motor car with a small steam engine such as is used on elevated structures. The electric locomotive, because of its higher rate of acceleration and the greater speed obtainable, is ahead of its steam rival in the handling of high speed passenger service, and to even a greater degree in the handling of freight. Thus it is clear that the use of electricity as a motive power for handling the traffic, increases the carrying capacity of a road.



6,500 H. P. CURTIS TURBINE WITH ALTERNATING CURRENT GENERATOR ON TOP.

THE CENTRAL POWER STATION.

The location of the central power station is usually chosen with reference to its nearness to the center of distribution of the road and its proximity to a navigable body of water or a railroad. As a rule the best location for the station is near a navigable stream or bay, as coal may then be delivered very cheaply in barges, and there is also plenty of water available for condensing purposes. The building is made of fireproof material, and with a view to future extension as the demands of the traffic increase. It is much more difficult to add to the equipment of an already overcrowded power house than it is to purchase an additional steam locomotive.

LAYOUT OF THE BUILDINGS.

The building is divided into two main parts, a boiler room and an engine room, which are separated from each other. The best arrangement is to place the boiler room alongside of the engine room, but when this is not possible it is made a continuation of the latter.

The boilers are mounted in pairs and each pair is spoken of as a battery. Space is allowed between the batteries for workmen to pass in order that inspection and repairs may be carried on without crowding. The batteries of boilers are arranged in rows facing each other with the firing floor between. At the rear of the batteries a main flue leads to the stack. Each battery is connected to this flue. The boiler feed pumps, a fire pump, and pumps for general service are located either at one end of the boiler room or in a separate room.

In almost all stations chimneys are used to provide the draft for the furnaces, and in case the chimney should not be capable of accomplishing this, some form of mechanical draft is installed. A few plants depend wholly upon mechanical means to provide a draft for their furnaces.

On the main floor of the engine room the engines with their generators are located. The engines and generators are always direct connected. Ample space is allowed between the units and a powerful crane is provided for raising and moving the heavy parts of the machine when repairs are necessary. The condensers, with their necessary equipment of auxiliaries, are generally located in a room beneath the engine room. The switch board, offices and other station apparatus are often placed on galleries running around the engine room.

COAL SUPPLY.

The coal burned is not lump coal such as is commonly used on steam locomotives, but is usually of the pea or buckwheat size. It is brought to the station, either by barges or in cars. From these it is carried by a conveyor to a second conveyor which distributes it to several large bins which are situated above the boiler room. The storage capacity of these bins should be at least enough to store the coal necessary to run the station for one week, and if possible a larger capacity is desirable. From the bins the coal is fed down by coal chutes to the boiler room floor. In some central stations mechanical stokers are employed for firing the furnaces thus doing away with all but a few firemen. In most of the best stations efforts are made to have the men fire properly and to maintain the correct depth of coal on the grates. Every good locomotive fireman knows the importance of properly taking care of his fire and of maintaining the proper depth of coal, in order that the maximum amount of steam per pound of coal burned, may be obtained. The ashes are dumped into the basement under the boiler room, wet down and carted away.

BOILERS AND STEAM PIPING.

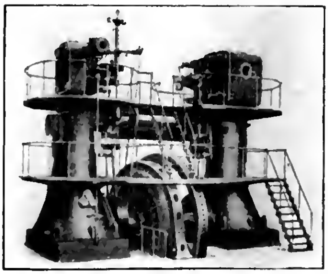
Locomotive boilers are of the fire tube type while those of the central station are of the water tube type. The chief advantage possessed by the water tube boiler is the fact that there is less danger of an explosion, and that in case of an explosion one tube is usually all that bursts and then there is less danger of serious damage because of the small amount of water which the boiler contains. The steam pressure usually employed in modern plants varies from 120 to 175 lbs. per square inch.

The Babcock and Wilcox boilers are those most generally found in central stations. The tubes in these boilers are inclined at a slight angle from the horizontal, and a drum is placed at the top in which the dry steam collects. In some stations vertical boilers are used, the Sterling being perhaps the most common type. Duplicate feed pumps are used to feed the boilers with water. The injector which is universally used on locomotives for this purpose is rarely met with in central stations. The water is not fed cold to the boilers, but is passed through a feed water heater before reaching them.

There are two systems of steam piping employed in central stations, one, called the ring system, where the boiler room is a continuation of the engine room, and the other, using a straight steam range or header, where the boiler room is built alongside of the engine room. Duplicate systems of steam piping are rarely installed, dependence being placed entirely on one set of heavy steam piping carefully installed. Valves are arranged in the pipe line so that any section of piping or boiler may be cut out for repairs if necessary. The piping is covered with a substantial lagging in order that the condensation of steam may be reduced to a minimum. In some stations the steam from the boilers is passed through a set of coils, located in the flue, called an economizer, before going to the engines. This gives the steam a certain degree of superheat. In some plants separately fired superheaters are employed for this purpose.

ENGINES AND CONDENSERS.

The engines employed are either reciprocating or turbine engines. The reciprocating engines are usually of the compound condensing type, and they may be horizontal or vertical or a combination of the two. The turbine occupies much less floor space than any of the reciprocating types of engines of equal sizes and has been used exclusively in all the large plants that have been erected within the last few years. This is due to their great economy of steam consumption and to the higher overload capacity that they are capable of developing. The Parsons turbine and the Curtis turbine are the two types generally found. The Parsons is a horizontal turbine and the Curtis a vertical one.



2,500 H. P. COMPOUND VERTICLE ENGINE GENERATOR BETWEEN HIGH AND LOW-PRESSURE CYLINDER.

Condensers most often met with in power stations are of the surface type. The exhaust steam from the engines and turbines flows into the condenser which consists of a large number of small brass tubes around which cold water is kept circulating. The steam is condensed to water and is pumped out of the condenser by vacuum pumps. The vacuum created in the condenser makes it possible to run the steam down to a pressure below that of the atmosphere and results in a great saving of steam. From the condenser the steam is returned by pumps to the hot well, from which it is returned to the boilers. Thus the same water is used over and over again, and only enough fresh water is added to supply the amount that is lost.

THE WATER SUPPLY AND OILING SYSTEM.

As stated above the same water is used over and over again, and the only fresh water added is that which is required to make up the losses and this is usually taken from the city mains or from wells on the premises. The cooling water from circulating through the condensers is taken from the nearest body of water, it sometimes becomes necessary to create an artifical pond for this purpose. The oiling system is usually worked by gravity. The oil is stored in tanks placed in one of the upper galleries in the engine room. From these tanks it flows to the different machines and when it has passed through the bearings of the machines it drains into a receptacle, where it is carefully filtered and returned to the storage tanks by the pumps.

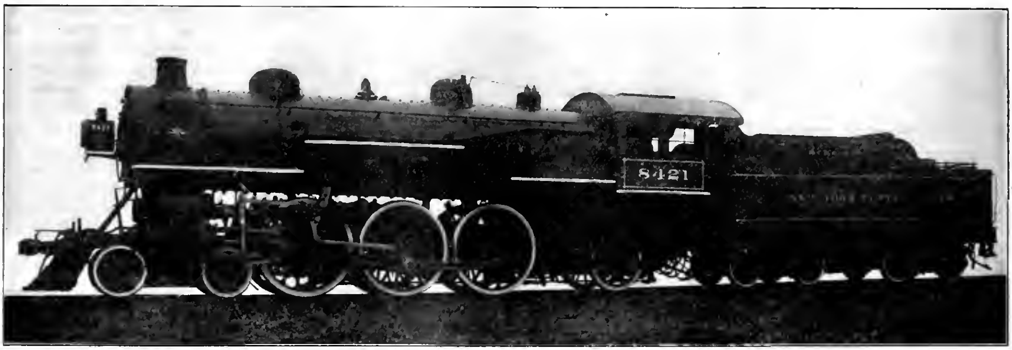
GENERATORS.

The electric current is generated by alternating current generators which are directly connected to the engines driving them. Almost all of the large alternators are built with the armature stationary and the field coils are revolved inside of the armature. This simplifies the construction of the machine. The frequency at which the current is generated is 25 cycles in almost all plants. Small direct current generators are also placed on the engine floor, to supply direct current to the fields of the alternators. These small generators are called excitors and they are usually engine driven although in some stations they are driven by motors.

Now let us follow the energy that exists in the coal from when it enters the furnace until it comes out of the generator terminals in the form of electricity. When coal is burned on the grate its carbon combines with the oxygen of the air and the energy that this combination produces passes off from the fire in the form of heat contained in hot gases. The heat from these gases which are made to pass up and around the boiler tubes is transmitted through the iron tubes to the water within, changing it into steam. Less than 25 per cent. of this heat from the coal is given to the steam, the remaining portion goes up the stack. The steam passes through the economizer in the flues and absorbs still more heat from the hot gases. The heat energy of the steam is changed to mechanical energy which is the energy of motion, by allowing the steam to expand in the cylinders of the engines or among the vanes of the turbine. This mechanical energy is changed, by the motion of the bundles of wires on the armature of the generator as they are cut by the magnetism from the rotating field. This particular motion under these circumstances changes the mechanical motion into electrical energy, in the form of an alternating current which comes out at the terminals of the generator, as a series of pulsations or waves which rise to the maximum and fall to the minimum 50 times a second.

Simple 4-6-2 for the Michigan Central Railroad

The Montreal works of the American Locomotive Company have recently completed six heavy Pacific type locomotives for the Canada Southern division of the Michigan Central Railroad. These are practically duplicates in design of a previous order of the same number built in 1907 at the Schenectady works of these builders, and represent the latest development of the Pacific type locomotive on the Michigan Central. This development has been along the lines of increased boiler capacity for sustained high speed rather than greater starting power, so that while the tractive power of these latest engines is the same as that of the first engines of this type built for this road in 1904, they have the largest amount of heating surface of any Pacific type locomotive so far constructed by the American Locomotive Company.



SIMPLE 4-6-2 LOCOMOTIVE FOR THE MICHIGAN CENTRAL RAILROAD.

E. D. Bronner, Superintendent of Motive Power. American Locomotive Company, Builders.

In working order they have a total weight of 240,000 lbs., of which 149,500 lbs. is carried on the driving wheels. The theoretical maximum tractive power is 28,500 lbs. This gives an ample factor of adhesion of 5.24, which would indicate that the full tractive power of the engine would be available in starting without danger of slipping the driving wheels. The cylinders are 22 ins. in diameter by 26 ins. stroke, and are fitted with ¾-in. bushings. They are equipped with 12-in. piston valves, having inside admission and operated by the Walschaerts valve gear. The driving wheels are 75 ins. in diameter.

The arrangement of the valve gear is similar to that employed in other instances by this company, in the application of this style of gearing to locomotives of the Pacific type. In this arrangement the link is supported between the sides of a cast steel longitudinal beam which is supported between the guide yoke and a special cross-tie placed between the first and second pair of driving wheels. The reverse shaft is carried in bearings bolted to this cross-tie and the forward-extending arm of the reverse shaft is directly connected to the radius bar by means of a slip block.

The frames consist of a main frame of cast steel 5 ins. wide with single integral forward section and a slab section 2½ ins. wide spliced to the rear of the main frame, for the trailing truck.

The rear frame fits into a recess machined in the main frame, and keys are provided at the top and bottom, thus reducing the shear on the bolts connecting the two and making a very strong and rigid splice. Outside the rear frame is a supplementary frame 1¼ ins. wide which is connected to the former by means of cast steel spacing castings. A thorough and substantial system of frame bracing has been employed throughout.

The boiler is of the straight top type and the barrel measures 72 1/16 ins. in diameter outside, at the first ring. It contains 394 tubes 2 ins. in diameter, and 21 ft. long. The total heating surface of the boiler is 4,548 sq. ft., of which the tubes contribute 4,314 sq. ft., and the fire-box and arch tubes make up the remainder. With this amount of heating surface, the B. D. factor (the tractive power multiplied by the diameter of the driving wheels divided by the total heating surface), is 470, which is the lowest figure for any engine of this type made by the American Locomotive Co., and would indicate that these engines will have sufficient steam making capacity to meet the requirements of the severest service.

The fire-box is 108⅛ ins. long and 75¼ ins. wide and provides a grate area of 56.2 sq. ft. Tate flexible stay bolts are liberally used in the fire-box throughout the breakage zones, there being 337 in all. In some of the engines of this order the side rods and driving axles are made of vanadium steel.

The tender is equipped with a water bottom tank having a capacity of 7,000 gallons and space for 12 tons of coal. The tender frame is built of steel, the center and side sills being constructed of 13-in. channels, weighing 37 lbs. per foot. The tender trucks are of the arch bar type with simplex bolsters. Some of the principle dimensions are given below.

Wheel Base—Driving, 13 ft.; total engine, 33 ft. 7½ ins.; total engine and tender, 65 ft. 8½ ins.

Boiler—Type, straight top.

Firebox—Type, wide; length, 108⅛ ins.; width, 75¼ ins.

Tubes—Number, 394; diameter, 2 ins.; length, 21 ft.

Heating Surface—Tubes, 4,315; firebox, 208; arch tubes, 26; total, 4,549; grate area, 56.5 sq. ft.; steam pressure, 200 lbs.; fuel, bituminous coal.

Weight in Working Order—Leading, 45,000 lbs.; driving, 149,500 lbs.; trailing, 45,500 lbs.; total engine, 240,000 lbs.

Axles—Driving journals, 10 x 12 ins.; engine truck journals, 6 x 12 ins.; trailing truck journals, 8 x 14 ins.; tender truck journals, 5½ x 10 ins.

Boiler—Thickness ring, 1st, 23/32 in.; 2d, ¾ in.; 3d, ¾ in.; throat, ¾ in.; dome, ½ in.; front tube, 9/16 in.; roof, ½ in.; side, ½ in.; back head, ½ in.

Firebox—depth, front, 83½ ins.; back, 68¾ ins.; thickness, crown, ⅜ in.; tube, ½ in.; side, ⅜ in.; back, ⅜ in.; water space, front, 4½ ins.; side, 4½ ins.; back, 4½ ins.

Seams—Horizontal, butt, sextuple riveted; circumferential lap, double riveted.

Tube, Detroit seamless steel

Crank Pin—size main, 7 x 6½ ins.; main side, 7½ x 4¾ ins. front, 5 x 4½ ins.; back, 5 x 4½ ins.

Engine Truck—Type, four-wheel, with swing bolster.

Trailing Truck—Type, radial, with outside journals.

Fire Brick—Supported on arch tubes.

Injectors—Hancock, type G; size, 6,000.

Piston—Horizontal, thickness, 6½ ins.

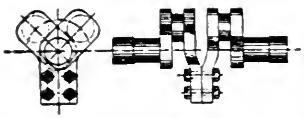
Smoke stack, Diameter at choke, 20 ins.; top, above rail, 14 ft. 8 9/16 ins.

Valves—Type, piston: admission, inside; travel, 5½ ins.; steam lap, 1⅛ ins.; exhaust clearance, ⅛ in.; lead in full gear, ¼ in. constant.

Tender—Weight empty, 67,720 lbs.; wheel base, 21 ft.

Crank-Axles Made in Parts.

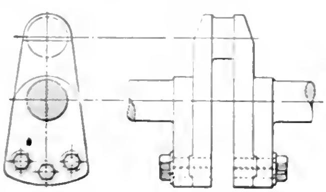
A new form of crank-axle has recently been patented by Wm. H. A. Ivatt, chief mechanical engineer of the Great Northern Railway of England. The axle is made in two pieces, each one a solid forging, and they are bolted together through projecting crank ends. These pieces are practically tonged and grooved so as to secure greater rigidity and this method also provides a counter-balance for the cranks. The crank-axle being in two pieces facilitates the making, and secures



IVATT'S CRANK AXLE.

a certain amount of flexibility as far as end thrusts are concerned, which cannot be had to the same extent where a shaft joins the inside arms of the cranks. The cranks are set at an angle of 90 degs., while the bolted portion occupies the middle position. Several of these cranks have been put in service on some of the Great Northern goods engines and are said to have proved themselves very satisfactory. The Joy valve motion has been used on these axles.

Another built-up, balanced crank axle has been designed and patented by Mr. Ivatt. The shaft is really in three pieces, and each crank is a separate piece, thus making five parts in the crank axle. Each crank has projecting ends which are fitted to similar extensions at the ends of the parts forming the shaft. These extensions of shaft



BUILT-UP CRANK.

and crank serve as counter weights for the crank. All the bolting is done through the extensions, and a tongue and groove joint is used as well as the bolts.

Odd Announcement.

The English practice of aspirating words beginning with vowels sometimes produces funny effects. A railroad supply man, of English birth, noted for adherence to his childhood pronunciation, was presiding at an entertainment. The first song to be sung by a professional was "The Owl." On rising to announce it, the chairman was informed that the singer had not arrived, a fact that he duly notified to the audience.

A little later the missing baritone made his appearance and was observed by the worthy chairman, who rose with evident pleasure, and innocently announced with marked confidence:

"Mr. 'Ampton will now favor us with the longed-for "Howl"

Pretending to Understand.

One time when the writer was engaged taking indicator diagrams from a locomotive, he handed one of them to a master mechanic for inspection. Holding the card upside down, the man looked earnestly at the diagram and exclaimed: "That's a blank fine card. You do not find many engines to make a card like that." That was a case of pretending to give judgment on a thing that he did not understand. On this subject, here is good advice given by Mr. W. E. Symons, in an address at Purdue University. He said:

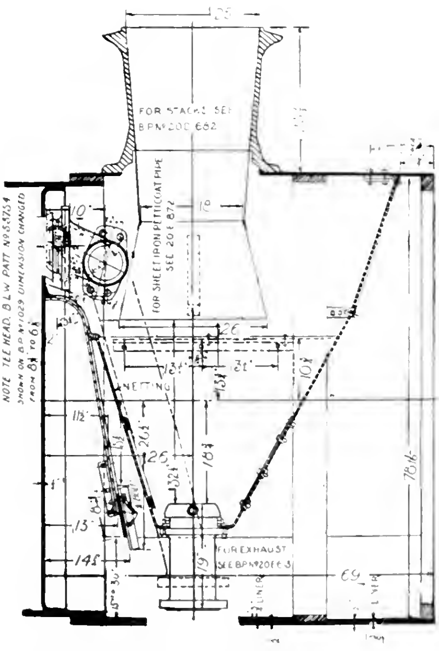
"Frequent problems or instructions are presented to the practical man for execution, in language or by formula which he does not understand, although he may know thoroughly well how the operation should be performed: a sense of wounded pride or humiliation prevents him asking for information, and sometimes a feeling of superiority prevents the theoretic man from either placing the problem in easier terms to be understood or going in person and making such explanations as would be helpful to both. This together with many other similar circumstances, all tend to prevent that bond of union or good fellowship between the practical and theoretic man which should exist, and which is essential to a high standard of ability or efficiency in men of either class."

Smokebox Arrangement.

The Central of Georgia Railroad is using a front end arrangement somewhat different from that recommended by the M. M. Association. It was designed by Mr. F. F. Gaines, superintendent of motive power of the road.

The draft plate is placed back of the exhaust pipe and the diaphragm is perforated all over by a series of round holes so that the smoke and hot gases pass through as well as under the draft plate. The principal draft is of course under the diaphragm in the usual way, and this is always sufficient to keep the smokebox as clean as is required.

The netting is outside the diaphragm, so that gases and cinders which have passed through and under the perforated diaphragm have still to pass the netting. This arrangement enables a larger quantity of netting to be used. In fact, the netting is shaped very much like a hopper, with the exhaust nozzle placed at the lowest point. The perforated diaphragm and the amount of netting used gives the smokebox gases the freest possible exit while most successfully restricting the danger of spark throwing. The free exit provided for the smokebox gases permits of the use of a larger nozzle than if the exhaust was compelled to pull the gases



FRONT END USED ON CENTRAL OF GEORGIA.

round the lower end of the diaphragm and force them out of the stack. The success of the plan is attested by the fact that some consolidation engines with cylinders 22 x 30 ins. are run with 5⅞ and 6 in. nozzles.

The Central of Georgia smokebox is made in two pieces with a riveted ring between them. This has been done as the front part of the smokebox usually wears away more rapidly than the regular type. The worn out portion can be quickly and easily renewed. This extension piece is, roughly speaking, about a third of the depth of the smokebox. The stack is 25½ ins. above the top of the smokebox, but extends down to within 10 ins. of the center line of the box.

The Ton-Mile-Per-Hour.

By Geo. S. Hodgins.

The ton-mile-per-hour came up in the report of the automatic stoker committee of the Master Mechanics' Association last June, and it was referred to in the discussion relative to coal economy in the Traveling Engineers' Association which met last year in Denver, so that it is safe to say that the ton-mile-per-hour is coming to the front as the unit by which a rational comparison of the performance of various engines may be fairly and accurately made.

The advantage of using the ton-mile-per-hour becomes apparent if we briefly consider the parallel performance of two engines which haul the same train daily over a division. This is perhaps the simlest case that can be taken, but it serves to illustrate the principle involved. The train, we will suppose, is passenger, and weighs 500 tons and the distance run is 120 miles. This trip is made normally in 3 hours. That is at the rate of 40 miles an hour. We will suppose for sake of even figures that 4 tons of coal is burned to do this work.

At the end of the trip engine A has made 60,000 ton-miles, occupied 3 hours and used 4 tons of coal. Engine B, next day hauls the same train of 500 tons the same distance, but the locomotive engineer in charge is called upon to make up 20 minutes, and he burns more coal in doing it. He has to his credit at the end of the run, 60,000 ton-miles made on 4½ tons of coal and he appears to have done the same work. He looks like the more expensive man, and he is the more expensive man as far as the actual quantity of coal burned is concerned. The only difference is that engineer B, acting on the expressed wish of his company made up 20 minutes, and while they approved of his action, they set him down on the performance sheet as the more expensive man on coal, and they said nothing about the time made up.

An analysis of the performanee of A and B on the ton-mile-per-hour basis reveals a very important fact. It is that although B burned more coal than A, he is not a more expensive man but is just as economical as A.

An example may help to make this clear. Horse power is made up of three factors, weight in pounds, distance in feet and time in minutes. It is 33,000 foot-pounds per minute. In order to find how much coal has been used per h. p. it is only necessary to divide the total coal by the number of h. p. Thus, if 5 h. p. be derived from the burning of 15 lbs.; 1 h. p. will be obtained from 3 lbs. of coal. Six h. p. would at the same rate use up 18 lbs. of coal and yet be no more costly as far as coal is concerned per h. p. than the 5 h. p., but it is more costly as far as coal is concerned, for one has to buy 15 lbs. in one case and 18 lbs. in the other.

The ton-mile-per-hour is made up of three similar factors, viz.: weight in tons, miles of distance and time in hours. In this case A made 60,000 ton-miles and burned coal at the rate of .13 lbs. per ton-mile. B did the same thing at the rate of .15 lbs. of coal. That is the same ton-mileage at a higher rate and a higher total consumption, for one used up 4 tons and the other 4½ tons. The latter cost more money because it was the greater amount, but the point to consider is how was it used.

When the ton-miles-per-hour are taken, A making 20,000, and B 22,500, and each divided into the total coal used, we get the cost in coal, so to speak, of the ton-mile-per-hour, or the rate at which ton-mile-per-hour eats up the coal. In each case it is exactly the same, viz.: 4 lbs. The matter is analogous to the parable of the talents where he that had received 10 talents and by trading judiciously had secured other 10 talents is commended, but is not praised above the man who having received 5 talents had likewise gained 5 more. Condemnation was for the man who havng received one talent did nothing with it.

If the total ton-miles of each engine which is: 60,000 be divided into the total coal consumed which is 4 tons and 4½ tons, respectively, A is found to have burned his supply at the rate of .13 lbs. per ton-mile and B at the rate of .15 lbs. per ton mile. B appears to be the more expensive man. Just here a curious point comes in, and that is that the ton-miles-per-hour, divided into the amount burned in one hour, gives the same rate of consumption, viz.: .13 lbs. and .15 lbs., respectively. But that is practically the same as dividing the total ton-miles into the total coal. It is equivalent to taking a proportional fraction of each and what is true of the whole is true of the parts

The whole value of the ton-mile-per-hour lies in the fact that from it we can get the rate at which the ton-mile-per-hour eats up coal. In A's case he made 20,000 ton-miles-per-hour and he burned a total of 4 tons, or 8,000 lbs The rate at which he burned the 8,000 lbs was .4 lbs. for each ton-mile-per-hour which he made. That was the rate at which the ton-miles-per-hour which he made consumed coal. In B's case he made 22,500 ton-miles-per-hour and he burned 9,000 lbs., and the rate at which his ton-mile-per-hour consumed coal was .4 lbs. Therefore the rate of coal consumption for each ton-mile-per-hour for each man was exactly equal. This is as if one man had made 5 h. p. on 15 lbs. of coal and the other had made 6 h. p. on 18 lbs., both would be equal on the rate of coal consumption, although the man who had done the more work would naturally have consumed the greater quantity of coal.

A preformance sheet got out on this basis would give B something to show for his extra coal consumption, and would be an indirect acknowledgment by the company that he had done more work in making up the time they required him to make up.

An engine hauling a heavy freight train, and another hauling a light one burn different amounts of coal, and the larger ton-mileage of the heavier train apparently offsets the greater amount of coal burned, and roughly speaking, it balances the lighter fuel consumption of the lighter train, but it is not strictly accurate and this becomes clear when trains of equal weights are hauled at different speeds. To correctly get at the ton-miles-per-hour of freight trains, the total time standing in all sidings ought to be deducted from the time the train is actually in motion, and if an arbitrary coal consumption is allowed for each hour of standing time, the problem as solved by the ton-mile-per-hour system has some important advantages.

The writer when engaged in railway work, was the first to propose the ton-mile-per-hour system of coal accounting. In an article which appeared in the June, 1897, issue of this paper, page 439, he discussed this question under the head of "Fuel Economy and Wind." He there used the car-mile-per-hour in passenger train service as that was the prevailing unit at that time. Later, in an article entitled "The Ton-Mile-Per-Hour," which appeared in our May, 1899, issue, page 207, he took up the ton-mile-per-hour pure and simple.

The ton-mile-per-hour is a rational and logical method of fuel accounting for the reason that is provides an equation between work done and coal consumed. Pulling a given train of 40 miles an hour requires less power than pulling the same train at 45 miles an hour. With a ton-mile-per-hour system, the coal burned varies with the work done. A performance sheet made out on this basis would be fair and equitable, for it could be made to show in a column by itself the number of hours per month that any engine was standing in the siding or waiting for train. Side track coal consumption would be an item by itself and the regular appearance of such a total would have a beneficial effect on the efforts of the operating department to get trains quickly over the road, and the actual work hauling the train would show for itself at so much coal per ton-mile-per-hour. A fire deteriorates when engine is kept standing in the siding. This and the amount of coal burned in lighting up an engine should not be charged against engine performance.

Items of Personal Interest

Mr. G. W. Daves has been appointed signal engineer of the Eastern Division of the Chicago & Alton at Chicago, Ill.

Mr. E. H. Diehl has been appointed traveling engineer of the middle division of the Pennsylvania Railroad.

Mr. M. H. Haig has been appointed engineer of the Atchison, Topeka & Santa Fe, with office at Topeka, Kan.

Mr. T. H. Yorke has been appointed master mechanic of the Chicago Great Western, with office at Des Moines, Ia.

Mr. H. M. Levinson has been appointed a roadmaster of the International & Great Northern, with offices at San Antonio, Texas.

Mr. H. A. Keswick has been appointed locomotive foreman of the Canadian Pacific at Field, B. C., vice Mr. F. D. Warner, transferred.

Mr. F. Stamelen has been appointed acting locomotive foreman of the Canadian Pacific at Winnipeg, vice Mr. F. Webster, on leave.

Mr. George S. McKee, formerly superintendent of motive power and car equipment of the Mobile & Ohio, with office at Mobile, Ala., has resigned.

Mr. H. G. Locke has been appointed travelling passenger agent of the Chicago Great Western, with office at No. 208 Old South Building, Boston, Mass.

Mr. Michael Hassett has been appointed master mechanic of the New York Central at East Buffalo, vice Mr. F. M. Steel, transferred to Rochester.

Mr. N. M. Maine, general master mechanic of the Chicago, Milwaukee & Puget Sound at Deer Lodge, Mont., has been transferred to Tacoma, Wash.

Mr. W. J. Bennett, formerly assistant superintendent of motive power of the Chicago, Indianapolis & Louisville, with office at Lafayette, Ind., has resigned.

Mr. W. O. Birnett has been appointed road foreman of engines on St. Lawrence Division of New York Central, with headquarters at Watertown, N. Y.

Mr. Byron E. Woodcock has been appointed chief engineer of the East Broad Top Railroad & Coal Co., with office at Orbisonia, Pa., succeeding Mr. A. E. Bachert.

Mr. Geo. H. Gray has been appointed trainmaster and traveling engineer of the

It does not require a great memory for railway veterans and other people of observing habits to remember a bright, ruddy-faced youth who was chief clerk for the general manager of the Missouri Pacific Railway and a favorite with all callers because he had a kind word and cheerful smile for every visitor. That was Charles Melville Hays, who last month was elected president of the Grand Trunk Railway. The British capitalists who rule the fortunes of the Grand Trunk are a most discriminating lot of people, with keen vision for their own interests, which goes to prove that Mr. Hays must have developed extraordinary ability as a manager to be advanced to the position of president. Because he was the most effi-

CHARLES M. HAYS

cient youth in sight, the passenger department clerk became the general manager's assistant. It was not a case of courting a neighbor's wife, but of courting a neighbor's assistant, that moved the general manager of the Wabash to act so that Mr. Hays was allured to that road as assistant general manager. That was merely one of the steps in the ladder which led him by others to the position of vice president and general manager. His services then became decidedly in demand, so he went with tentative steps to various roads, the Grand Trunk having held him for five years as general manager. The Southern Pacific took him away from Canada for about one year, then he returned, and there he has received the highest honors the owners of a great railway can bestow. We have no information of the race from which Mr. Hays sprung; but his face shows almost a family likeness to judges, literati and other eminent persons whose intellectual eminence in days gone by gave to Edinburgh the name of the Modern Athens.

South Park division of the Colorado & Southern Railway, with headquarters at Como, Colo.

Mr. E. J. McMahn, general foreman of the Illinois division of the Iron Mountain at Dupo, has resigned to become master mechanic on the Raton Mountain division of the Santa Fe.

Mr. C. M. Stansbury, formerly master mechanic of the Boca & Loyalton at Loyalton, Cal., has been appointed master mechanic of the Western Pacific, with office at Elko, Nev.

Mr. Michael W. Hassett has been appointed master mechanic of the New York Central & Hudson River Railroad, with office at East Buffalo, N. Y., vice F. M. Steele, transferred.

Mr. T. Mahar has been appointed master mechanic, Harlem and Putnam divisions of the New York Central Lines, vice Mr. H. B. Whipple, master mechanic Harlem Division, resigned.

Mr. George G. Mason has been appointed road foreman of engines on the Salt Lake Division of the San Pedro, Los Angeles & Salt Lake Railway, with headquarters at Milford, Utah.

Mr. G. E. Johnson, master mechanic of the Chicago, Burlington & Quincy at Wymore, Neb., has been appointed general master mechanic on the same road, with office at Lincoln, Neb.

Mr. J. J. Thomas, Jr., has been appointed superintendent of motive power and car equipment of the Mobile & Ohio Railway, with office at Mobile, Ala., vice Mr. G. S. McKee, resigned.

Mr. G. W. Vanderslice has been appointed superintendent of the Western Division of the Chicago Great Western, with headquarters at Clarion, Iowa, vice Mr. A. E. Harvey, transferred.

Mr. F. H. Probert, heretofore locomotive engineer, has been appointed roundhouse foreman of the Intercolonial Railway at St. John, N. B., vice Mr. D. A. Sinclair, retired from the service.

Mr. C. J. Shaughnessy has been appointed traveling engineer on the Southern division of the Colorado & Southern Railway, with headquarters at Trinidad, vice Mr. A. E. Roesch transferred.

Mr. Thomas L. Carrew has been appointed road foreman of engines for the Saginaw, Mackinaw and Grand Rapids divisions of the Michigan Central Railroad, with headquarters at Bay City, Mich.

Mr. W. R. Armstrong has been appointed superintendent of the Montana Division of the Oregon Short Line Railroad, with headquarters at Pocatello, Idaho, vice Mr. G. H. Olmstead, deceased.

Mr. A. H. Barnes, acting supervisor of signals of the Northern Pacific, in charge of maintenance of signal apparatus on lines west of Paradise, Mont., at Tacoma, Wash., has been appointed superintendent of signals.

Mr. J. H. Race has been appointed master mechanic of the Oregon Short Line, with office at Pocatello, Idaho. He will have charge of the Pocatello shops, including the roundhouse and car department forces.

Mr. F. S. Anthony, master mechanic of the International & Great Northern at Palestine, Tex., has been appointed superintendent of machinery of the same road, with office at Palestine, succeeding Mr. J. F. Enright.

Mr. D. F. Clark has been appointed roundhouse foreman in charge of the mechanical department on the Salt Lake & Ogden Railroad at Salt Lake City. The position of master mechanic has been abolished.

Mr. Benjamin Johnson, formerly superintendent of motive power of the Mexican Central, has been appointed superintendent of motive power of the United Railways of Havana, with office at Havana, Cuba.

Mr. Frank L. Matthews has been appointed district passenger agent of the Chicago Great Western Railroad, with headquarters at 7 West Ninth street, Kansas City, Mo., vice Mr. George W. Lincoln, resigned.

Mr. A. E. Roesch has been appointed traveling engineer on Northern and Wyoming divisions of the Colorado & Southern Railway, with headquarters at Denver, Col., vice Mr. G. H. Gray assigned to other duties.

Mr. J. C. Reed, heretofore acting locomotive foreman at Kamloops, B. C., on the Canadian Pacific, during the absence of Mr. A. E. Bennets on leave, has been appointed shop foreman at that point, Mr. Bennets having returned.

Mr. R. F. Kilpatrick, assistant superintendent of motive power and car department of the Denver & Rio Grande at Denver, Col., has been appointed master mechanic of the Western Pacific, with office at Stockton, Cal.

Mr. J. F. Enright, superintendent of machinery of the International & Great Northern at Palestine, Tex., has been appointed superintendent of motive power and car department of the Denver & Rio Grande, with office at Denver, Colo.

Mr. W. R. Hastings, superintendent of signal construction on the Chicago, Rock Island & Pacific, has been appointed general signal inspector, and the office of interlocking engineer has been abolished. His headquarters are in Chicago, Ill.

At the recent meeting of the directors of the Big Four Railroad, the pension system drawn up for New York Central lines was adopted. Mr. R. N. Harry was appointed local treasurer of the company in Cincinnati.

Mr. C. M. Bailey, road foreman of the McCook Division of the Chicago, Burlington & Quincy at McCook, Neb., has been appointed master mechanic of the Wymore Division, with office at Wymore, Neb., succeeding Mr. G. E. Johnson.

Mr. Francis B. Freeman, engineer of construction of the New York Central & Hudson River Railroad at New York, has been appointed chief engineer of the Boston & Albany, with office at Boston, Mass., vice Mr. Everett E. Stone, resigned.

Mr. Welling G. Sickel, having disposed of his interest in the United & Globe Rubber Mfg. Companies, has become associated with the Hewitt Rubber Company of New York. He will hereafter represent this company's various interests.

A division superintendent of the Chicago & North-Western Railway has had flanged wheels applied to an automobile and uses it as an inspection car. President Hughett of the same road has several automobiles but he does not have them run upon the track.

At the annual meeting of the Angus Sinclair Co. Mr. Harry A. Kenney was elected secretary, in place of Mr. James R. Paterson, resigned. Mr. Kenney entered the employ of the company six years ago and has risen through the force of efficiency to his present position.

Mr. Richard H. Lanham, who, for the past five years has been traveling engineer of the Iron Mountain & Southern Railway, has been promoted to the position of master mechanic, with headquarters at Helena, Ark. His jurisdiction extends over three hundred miles of territory and he has fifty engines under his care.

Mr. J. W. Small, superintendent of motive power of the Southern Pacific of Mexico and of the Sonora Railway at Empalme, Sonora, Mex., having resigned, that office is now abolished. Reports previously sent to the superintendent of motive power now go to Mr. R. H. Ingram, assistant general manager, at Empalme.

Mr. James W. Stuart, formerly assistant general storekeeper for the Burlington system, has been appointed general storekeeper of the entire C., B. & Q. system, succeeding Mr. T. A. Fay. Mr. Stuart has been connected with the stores department of the Burlington for twenty years. His headquarters are at Aurora, Ill.

Prof. H. H. Stock, in charge of the mining engineering department at the University of Illinois, has been appointed by Governor Deneen a member of the State Mining Commission, which has been constituted to collect data, prepare matter which may become the subject of desirable legislation with reference to the mining industry, and to make recommendations along these lines to the Governor before the next regular session of the State Legislature.

Mr. W. C. Webster, manager of the Westinghouse Electric & Manufacturing Company's New York office, has resigned his position with the company. Mr. Webster's experience with the Westinghouse interests has been quite varied and extensive for the past twelve years. His first position was in the sales department at East Pittsburgh. He later became assistant vice-president with headquarters in New York, and for the last few years has been the New York manager. Mr. Webster has made no plans for the future as yet.

Mr. Charles Robbins, who has for many years been connected with the Westinghouse Electric & Mfg. Company in the industrial and power sales department in connection with the sale of industrial motors, has recently been appointed manager of this department. Mr. Robbins has been with the company since 1899 in the manufacturing department, the New York district office sales department and for the past three years in the industrial and power sales department at East Pittsburgh. His headquarters will continue to be at East Pittsburgh.

Mr. Samuel A. Chase, who for the past few years has been with the Westinghouse Electric & Mfg. Company in their New York sales office as a special detail and supply salesman, has recently resigned in order to accept a position with the White Investing Company. Previous to Mr. Chase's employment with the Westinghouse Electric & Mfg. Company, he was a salesman for the Western Electric Company, where he was highly successful. He is now in charge of the

Chicago office of the White Investing Company.

At the recent Christmas entertainment of the New York Railroad Club, Mr. J. F. Deems, general superintendent of motive power of the New York Central Lines, who has been president of the club for the past year, was presented with a beautifully formed silver pitcher as a token of the esteem in which he is held by the members of the club and as an evidence of the appreciation of his work for the club as president. The presentation was made on behalf of the club by Mr. H. S. Hayward, first vice-president, and Mr. Deems expressed his thanks in a few well chosen words.

Dr. Ernst J. Berg, of Schenectady, N. Y., has been appointed professor of electrical engineering in charge of the department, at the University of Illinois, an appointment which secures leadership of the highest quality for one of the more important departments of the college of engineering. Dr. Berg was born in Sweden in January, 1871. He graduated from the Royal Polytechnical Institute, Stockholm, in mechanical engineering in 1892, and he came to the United States in 1893. For the past 17 years he has been associate with the General Electric Company, which company he now leaves for the work of the university.

Mr G. Brewer Griffin has recently been appointed manager and is now actively directing the sales policy of the detail and supply sales department of the Westinghouse Electric & Mfg. Co., by which department transformers, meters, fans, heating appliances, switches, switchboards, railway line material, etc., are sold. Mr Griffin has been assistant manager of this sales department for the past six years, having previously been connected with the sale of detail apparatus in the Boston office. He has altogether been in the employ of this concern for seven years. Previous to his connection with the Westinghouse company, Mr. Griffin was connected with the Manhattan General Construction Company.

Mr. S. L. Nicholson has recently been appointed general sales manager of the Westinghouse Electric & Mfg. Co., and has direct charge over the sales policies of the entire company. Mr. Nicholson has been with the company for eleven years in different capacities, such as salesman, district department manager, and for the past five years he has been industrial and power sales manager. Before coming to the Westinghouse company he was with the C. & C. Electric Company. He is perhaps best known to motor manufacturers as the organizer and president of the American Association of Motor Manufacturers, an organization which has done much in the two years of its existence to improve the art of manufacturing motors.

From track laborer to president of one of the leading railroads on this continent represents the progress made by Daniel Willard in thirty years. Mr. Willard is now vice-president of the Burlington system, and by the time this paper reaches our readers he will be president of the Baltimore & Ohio Railroad. His upward career has been steady as the growth of the locomotive engine with which his life work has been much associated. Like Mr. Brown, president of the New York Central System, and several other railroad presidents, Mr. Willard began his railroad career by working on the track. That was in Vermont, his native State, which has nurtured many eminent railroad men. The steps by which he reached the top were by that of fireman, engineer, brakeman, conductor, roundhouse foreman, trainmaster, assistant superintendent, assistant general manager, general manager, vice-president. That involved service on six or seven different railroads, where he always proved himself an efficient and popular official. He has the faculty of inspiring in a high degree the personal regard and confidence of those under his charge. A firm and just official, he possesses the mysterious attributes that create popularity. When the writer first called on Mr Willard on his entering the position of general manager of the Erie system, he grasped the editor cordially by the hand, saying: "I owe much of my success to your writings. I carried your book in my pocket for years, and it inspired me to work my way upwards."

Obituary.

John Caldwell, treasurer of the Westinghouse Air Brake Company, was last month stricken with heart disease and died in his office before a physician could reach him. Mr. Caldwell was one of the trusted lieutenants of George Westinghouse with whom he had been associated since the inception of the Westinghouse Air Brake Company. Mr. Caldwell was well known in financial circles and was a connoisseur in art, being also one of the trustees of the Carnegie Institute from its foundation. He was born in the north of Ireland about 70 years ago, his father being a Presbyterian minister. Mr Caldwell early developed the sturdy character that later brought him to the fore as one of the builders of the greatest manufacturing city in the world. He came to Pittsburgh as a lad of 12, and his first employment was as a clerk in a grocery store. For several years he followed mercantile pursuits, and upon the organization of the Air Brake Company in 1869 he became its bookkeeper, a position he retained for 10 years.

He was then elected treasurer, a position he held for the rest of his life. He was beloved of his associates, many of whom like himself had given the greater part of their lives to this great industry, and were members of the Air Brake Veteran's Association. In financial circles his judgment and advice was frequently sought. He was a factor in banking circles for many years. He was with the old Merchant and Manufacturers' Bank which was absorbed with the Iron City Bank by the Bank of Pittsburgh, N. A., of which he was made a director and vice-president. The latter position he held at the time of his death. When the Westinghouse Electric & Manufacturing Company, was organized Mr. Caldwell was made its treasurer. He retained the position until the organization was put on a smooth running basis, when he resigned in 1892 to give his entire time to the Air Brake Company. At the outbreak of the civil war he was enlisted as a private in Company E, of the Sixty-first Pennsylvania Volunteers, and was mustered out as a second lieutenant at the close of the war. He was wounded at the battle of Spottsylvania.

JOHN CALDWELL.

Outside of his business affiliations, Mr. Caldwell had a wide reputation as an art connoisseur and collector of rare books. His collection at his Edgewood home is said to be among the most valuable in existence. He was particularly fond of etchings, and his collection of Whistler's is said to be unequaled. His books have been gathered from all parts of the world and are reputed to be priceless. At his death Mr. Caldwell was chairman of the fine arts committee of the Carnegie Institute trustees and also of the finance committee.

J. J. Ellis, who was for many years master mechanic of the Chicago, St. Paul, Minneapolis & Omaha, died in England on Dec. 14. He had gone to visit the scenes of his childhood after long absence and reached there in time to fill his last resting-place.

Robert Morris Van Arsdale, proprietor of the *American Engineer and Railroad Journal*, died suddenly on Nov. 23 last. Only a brief notice of it was possible in our December issue. He was born in Titusville, Mercer County, N. J., on July 1, 1848. Mr. Van Arsdale was connected with trade journalism from his twenty-fifth year. In 1875 he joined the staff of the *Railroad Gazette* as an advertising solicitor. He remained in this position for about six years and on Jan. 1, 1880, purchased the *National Car Builder*, which was then being published in New York by Vose, Dinsmore & Co. and James Gillet was retained as the editor. In January, 1896, Mr. Van Arsdale purchased the *American Engineer and Railroad Journal* from the late M. N. Forney, who remained as the editor for one year. Mr. Van Arsdale merged his two papers. His success in his chosen field was largely due to his extensive acquaintance and numerous friendships.

Peter H. Peck, for many years master mechanic of the Chicago & Western Indiana Railroad, died on Nov. 29, as the result of an accident. The day before was his 65th birthday and he was crossing the tracks of the Rock Island in Chicago, he stepped out of the way of a passenger train only to be struck by a freight train which he had not noticed.

Mr. Peck left railroad service last year and lately became interested with the Belt Line Coal Co., in Chicago. He had been treasurer of the Western Railway Club for eighteen years, and was president of the American Railway Master Mechanics' Association in 1904 and 1905. Mr. Peck entered railway service in 1865, since which time he has been, consecutively, locomotive fireman Des Moines Valley Railway, locomotive engineer on several roads, division master mechanic Hannibal & St. Joseph, master mechanic Chicago & Western Indiana and Belt Railway.

The Lehigh Valley Railroad officials have recently granted a concession to the trainmen on that road which will be much appreciated. Heretofore, the trainman's regular day consisted of twelve hours, before any overtime was computed. The working day for trainmen has now been reduced to ten hours. This new arrangement will probably work well in two directions. It will please the train men and dispatchers will no doubt endeavor not to have much overtime. Ten hours on the road is a day's work.

Progressive Safety.

The National Association of Railroad Commissioners held their annual convention at Washington, D. C., in November last. An interesting part of the proceedings was the reading of a paper on "Progressive Safety in Railroad Operating," by Mr. A. H. Smith, vice-president of the New York Central Railroad.

Mr. Smith briefly outlined the origin and growth of railways, showing the increase of mileage from 1830 onward, then he described in detail the methods that resulted in progressive safety. The first movement in this line was the Westinghouse air brake which appeared in 1869, to be followed four years later by the Westinghouse automatic brake.

For years there had been agitation in favor of uniform car couplers to aid in preventing the numerous accidents that happened in coupling cars. The first improvement that resulted from this movement was a rule adopted by the Master Car Builders' Association establishing a uniform height of drawbar which had an excellent effect. Various tests had been made of automatic car couplers which were unsatisfactory at first. Then attention was directed to the dead block which brought about some increase in safety. In 1880 the Massachusetts Legislature instructed the Railroad Commissioners to investigate and report on means for preventing accidents in car coupling. This stirred up the Master Car Builders' Association to renewed action. After several seasons of discussion, tests and investigation the executive committee in 1887 reported in favor of the Janney type of coupler, and the report was adopted the following year.

Agitating and legislating against defective railway appliances were now recognized as duties of public spirited American bodies and individuals. The questions that soon came up for settlement were improved means of signalling, interlocking, train dispatching, locomotive and car construction and many others of which Mr. Smith gives particulars.

We regret that the space at our disposal prevents us from publishing his entire paper. Those interested should apply for a copy to Mr. A. H. Smith, Grand Central Station, New York.

The Chicago Metal Bearing Company, of Chicago, are the makers of locomotive and car journal bearings, manganese bronze castings and many other kinds suitable for automobiles, electric work, mill work, hydraulic bronzes, anti-acid bronzes and solders. This company makes graphose bronze bearings specially for locomotive work. The bearings are suitable for heavy loads and high speeds. The company will send you a folder with full information if you signify your desire for one. They also extend an invitation to you to visit them at their works or city office any time you are in their city. The address is 45 and Centre Avenue, Chicago.

All Steel Official Car.

What is probably the first all-steel car ever built for use on an American railroad has been completed at the Altoona car shops of the Pennsylvania for the exclusive use of the executive officers. Not one piece of wood was used in the car, which embodies the very latest practice in steel car construction. It is to be equipped with all conveniences, such as typewriters, telephone, desks, maps and statistics, for carrying on the business of the company, the object being to enable those by whom it will be used to conduct their work while traveling from place to place. In this way much time that otherwise would be lost is utilized.

Nearly seven years ago, the late A. J. Cassatt, foreseeing the inevitable substitution of steel for wood in the construction of passenger cars, directed that the design of steel cars be undertaken. The first of these was built at Altoona for the Interborough Rapid Transit Co. of New York. This was followed by the construction of the first all-metal car for the Pennsylvania which was turned out of the Altoona car shops in June, 1906. This design was followed by those of the present steel coaches, combination passenger and baggage, baggage, postal and dining cars, it having been decided that all new passenger equipment for the Pennsylvania should be of steel construction.

Conflict of Opinion.

An election of members of Parliament will be held in Great Britain soon. There is often violent difference of opinion manifested at these elections.

During the last election a man walking along a quiet street was startled to see a house-door suddenly opened and a man fall bumping down to the sidewalk. Picking him up, the pedestrian asked what was the matter. "That's my club in there," said the human projectile. "It's a political club; there are nine Jones men and I'm for Smith. They threw me out. But don't worry. I'm going in and clean 'em all out. You stand here and count 'em." In he went and sure enough, in a minute the door burst open, and a figure cleared the steps without touching. "One!" said the spectator, holding up a finger. "Hold on!" cried the prostrate one. "Don't begin to count yet. This is only me again!"

Getting results from advertising is like harvesting. The crop is in proportion to the machinery and ability to reap when the harvest is ripest. Many a man condemns advertising when the real fault was with his lack of proper organization to reap the benefit of advertising. —*The Houghton Line.*

The Torque of a Motor.

We have sometimes referred to the tractive power of a locomotive as equivalent to the weight the engine could haul up out of a well if a rope from the tender coupler extended back to a frictionless pulley and down the well with the weight at the end of the rope, and in our October issue we dealt with tractive effort and horse-power of locomotives. When dealing with electric motors one of the elements which determines its ability to do work is called its Torque. This word comes from the Latin, and means "to twist."

The measurement of the torque of a motor is, in one sense, an arbitrary or fixed standard, and may be illustrated in this way: Suppose a drum exactly two feet in diameter to be keyed on the armiture shaft of a motor, and on this drum a cable or rope is wound, and that its free end hangs down a well, the torque of the motor is the weight it can pull up. The essential point about this view of the torque is that it is always calculated for a drum 2 ft. diameter or 1 ft. radius. That size is arbitrary and fixed, very much as the 85 per cent. boiler pressure is the arbitrary ratio selected by the Master Mechanics' Association for finding the mean effective pressure in the cylinders of a locomotive.

If torque is always calculated as the pull on a rope wound on a 2-ft. pulley, it is obvious that if instead of a pulley of this size we had a wheel 4 ft. diameter the torque of the motor would exert less force at the circumference of such a wheel than it did on the 2-ft. drum. If the torque of the motor was 500 lbs., the force between wheel and rail with 4-ft. wheel, would only be 250 lbs. The larger the wheel the less the force produced by any given torque. This is practically the same with a locomotive, the larger the driving wheel the less the tractive effort, where the other factors remain the same

The ability to do work introduces the element of time, and if our motor with 2-ft. drum has a torque of 500 lbs. and is revolved at the rate of a little over 105 revolutions a minute, the weight will be pulled up out of the well at the rate of 660 ft. a minute. Thus the weight of 500 lbs. will be raised 660 ft. a minute and 330,000 foot-pounds of work will be done, that is 10 horse-power. With the 4-ft. wheel treated as a pulley and supposed to haul up the weight, the same number of revolutions a minute will pull a weight of 250 lbs. up close to 1,320 ft. in one minute, and that will give the same number of foot-pounds of work and the same horse-power.

If, however, the motor with 500-lbs torque mounted on 4-ft. wheels is run twice as fast, that is, just over 210 revolutions a minute, we find that the lighter weight of 250 lbs. comes up at the rate of 2,640 ft. a minute, and that gives 660,000 foot-pounds of work or 20 horse-power. When we come to consider power, which is the rate at which work is done, we find that with a given torque, power is proportional to speed, and conversely with given speed, power is proportional to torque. Torque is the strain on a rope wound on a drum 2 ft. diameter. Work is the product of this strain, in pounds, by the distance through which it acts, and power is the number of foot-pounds multiplied by the time it is in operation. Time so used is usually expressed in minutes. One horse-power is an arbitrary unit in which 33,000 lbs. are moved through one foot of space in one minute of time. Any exact equivalent of this is also a horse power, such as 275 lbs., raised 1 ft. in half a minute.

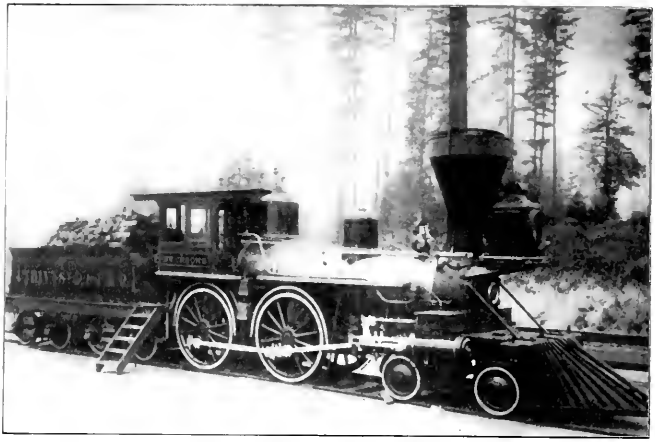
Gaskets and Glass Cutters.

Catalogue Number Nine has a very attractive cover, but that is not all by any means. The reason the cover is attractive is that on the outside there is, we were going to say, a very lifelike reproduction, but realistic is the better word, to express the representation in color of the new Chapman case-hardened corrugated copper flange gasket which bears the trade mark "Springtite." This gasket is intended for superheated steam, high pressure and low pressure steam joints. In the catalogue you will find an interesting bit of reading about the case-hardening of copper and all about the gasket. It's worth reading anyway and the Franklin Manufacturing Company, of Franklin, Pa., are ready to send you a copy of the pamphlet if you drop them a card to say you want one. All sorts of gaskets are listed and prices given. On page 19 you come to locomotive gaskets and composition metallic gaskets, and the prices are given.

If you are interested in circular glass cutters for headlight glasses, or other purposes, the Chapman double, and the Chapman single glass cutter is worth knowing about. The device is simplicity itself and was invented by a practical railroad mechanical engineer who had to inspect steam gauges as well as do other things. Steam gauge glasses are as easily cut as headlight glasses. The base or pivot pillar stands secured on a sheet of glass by vacuum and a graduated radial arm carries the diamond holder. This holder can be moved out or in on the radical arm. To cut a gauge glass a smaller radial arm with a second diamond is applied to the long radical arm and turned by a knurled thumb nut. Ask the Franklin people to send you catalogue No. 9 and you can read about some good things.

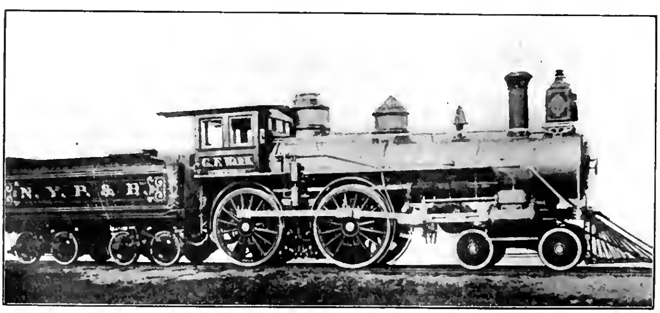
The Days of Long Ago.

Our illustration of at least one wood-burning engine brings back years that some of our readers are not old enough to have known. The trim looking 4-4-0 called the "Wm. Crooks" was used on the first division of the St. Paul and Pacific. It was built by the New Jersey Locomotive and Machine Works at Paterson, N. J., in 1861. The weight on the drivers is 55,400 lbs. The driving wheels are 61 ins. in diameter. Cylinders 12 x 22 ins. The engine is now owned by the Great Northern.



THE FAMOUS "WM. CROOKS" OF 1861.

Our other illustration is made from a photograph of the engine " G. F. Ward," built by Mason, in 1880, at Providence, for the New York, Providence & Boston. This engine is, of course, modern enough to burn coal but has the dome and sand-box moldings and the brass trimmed straight smoke stack of former days.



MASON ENGINE, "G. F. WARD," ON THE N. Y., P. & B.

The third illustration may not inappropriately be called the "Winning of the West." It shows a scene in the early days of the Union Pacific where an attack of Indians has brought the traveling contingent of U. S. soldiers into action along with the trainmen, track layers and others. This kind of desultory Indian warfare was of frequent occurrence in pioneer railroad days in the Wset.

The Pennsylvania lines West of Pittsburgh announce the following as the number of locomotives being built on the 1910 programme, as Naval experts would say: 30 passenger engines and 13 shifting engines at their Juniata Shops at Altoona, Pa.; 50 freight engines at the Baldwin Locomotive Works; 5 freight and 27 shifting engines by the American Locomotive Company. This makes a total of 125 locomotives.

The demand for asbestos has grown so steadily that it is becoming scarce and deposits of the mineral are considered as valuable as gold mines. Canada leads the world in asbestos output, the production in thirty years having been valued at $30,000,000. A new source of asbestos supply has recently been found in Rajputana Afganistan, and a company has been formed to exploit the mineral. The Johns-Manville Company are among the largest importers of asbestos in this country.

Advice to Shop Foremen.

A remarkably interesting address was delivered by Mr. Robert Quayle, superintendent of Motion Power of the Chicago & North-Western, at the opening of the General Foremen's Convention. Among the good things said was: "If I were a shop foreman I would like to belong to your association. I would like to be in big company. If I were a master mechanic, I would like to belong to the Railway Master Mechanics' Association, where I would meet the superintendents of motive power, the general master mechanics and others of that class. The shop foremen hold the same relation to the general foremen that the master mechanic hold to the superintendents of motive power and so on. But, if I were a foreman I should belong to this association. I would want to know what you know for that would help me in my business.

"In your efforts to succeed get with the biggest men in your line of business. Don't be going around making associates of fellows who know less than you know. Get with the men who know more than you do and try to measure up to where they are and go beyond them if you can. Do not feel that you have only to be shop foremen or shop men. Work to rise higher through commanding ability, increased skill and superior knowledge."

"Wherever you are engaged, your individual units, or the units of work that you are going to perform, will be expressed in the confidence that you can create in the men who are working for you; in the amount of work that the other fellow is going to do for you and with you, and the amount of enthusiasm that the man at the head of the department gets into his life, and the amount of energy he gets in, is going to measure the amount of energy the other fellow is going to put in. If the superintendent of motive power goes through the shop with his hands in his pockets every other man catches the same spirit."

Everlasting.

The Everlasting Valve is made by McLaughlin & Mains, of Jackson, Mich. It is specially designed for blow-off service. The valve is composed of a top and bottom bonnet, a disc and a lever and post. The orifice through the valve is opened and closed by the movement of what may be called a partition between the bonnets. In a certain sense it resembles a gate valve in which the gate is rapidly moved by a lever applied to what is called the operating post. The two bonnets are set together upon an approved high pressure gasket with machine bolts, giving quick access to the inside, should it ever become necessary to renew the disc or reface the seat. When repairs do become necessary, a monkey wrench and a file are the only tools needed. This feature is made possible by the simplicity of the whole apparatus.

The operating post is set tight upon a ground joint and held there by a stiff bronze spring, thus doing away with a stuffing box entirely, and making it perfectly tight as long as the valve lasts. It need never be touched, as it constantly tends to grind itself to a true seat at each operation. The inlet orifice is tapered just above the seat. This increases the velocity of the blast at this point and insures its delivery into the discharge pipe without detriment to the seat as would be be the case were this precaution not taken. It also has the effect of syphoning the valve clean at each operation. The clearance spaces within the valve have been made ample to avoid the possibility

WINNING THE WEST. U. P. TRACK LAYERS AND SOLDIERS REPELLING INDIANS.

of clogging, and its makers assure us that numerous tests prove that the valve will work as well discharging mud or putty as it will with pure water. Write to the manufacturers for illustrated circular if you are interested, and they will be pleased to send you a copy.

Pintsch Gas for Transport.

Recent experimental research made by the Pintsch Compressing Co. has brought out the fact that dry Pintsch gas, such as is obtained by the regular Pintsch process, is suitable for transportation under a pressure of 100 atmospheres or over. For this purpose Pintsch gas, from which all liquid hydrocarbons have been removed while under the pressure of 14 atmospheres is used, and the dry gas is compressed directly into steel flasks at high pressure. Under this high pressure a partial condensation of the gas takes place, which, however, disappears as soon as the pressure is reduced, the gas presenting again its original dryness, and other characteristics with but an inappreciable loss in candle power. A steel flask of 3.75 cu. ft. capacity and weighing about 330 lbs., will, when charged to a pressure of 100 atmospheres, yield about 500 cu. ft. of gas at atmospheric pressure.

From this it is seen that the gas under these high pressures deviates considerably from Boyle's Law, in accordance with which the flask would be expected to yield but 375 cu. ft. of gas at atmospheric pressure. The deviation from Boyle's Law at a pressure of 100 atmospheres amounts to about 33 per cent., the flask containing a correspondingly larger quantity of gas. This departure combined with the fact that small seamless flasks can be constructed of extremely high tensile strength steel, renders it possible to reduce the weight of the transport holder, for a given quantity of gas carried by over 50 per cent. of that of the former weight of transport holders used. The space or volume occupied by the high pressure holders, is, at the same time, nearly ten times less than that of the holders used in transporting gas at a pressure of 14 atmospheres.

The true value of the high pressure transportation becomes most apparent in cases where no compressing facilities are available at the point of distribution, to transfer the gas from the transport holder to railroad cars; where in other words, filling can only be accomplished by equalizing the pressure. In such cases, only about 30 per cent. of the gas carried in transport holders at a pressure of 14 atmospheres is available for filling, and the remainder of the gas returns to the supply station unused.

In the case of high pressure transportation, however, fully 90 per cent. of the gas transported becomes available for filling, and under these circumstances the reduction in weight of the transport holders for a given quantity of gas supplied to cars, is about six times less, and the volume about 30 times less than that of the transport holders used by the former method. There exists a distinct difference between high pressure Pintsch gas and the so-called Blau gas. The former is a dry gas, possessing all the well-known characteristics of regular Pintsch gas, great care being taken in the process of manufacture to remove from the gas all liquid hydrocarbons. The same liquid hydrocarbons are retained in the Blau gas, and others added, to exert a solving influence upon the remaining dry constituents of the gas, and thus effect a reduction in volume. The presence of these hydrocarbon liquids are the cause of difficulties experienced in connection with Blau gas, due to accumulation of liquid in the regulating devices at the point of consumption, and due to freezing up in cold weather. Inquiries concerning this interesting subject may be addressed to the Safety Car Heating and Lighting Co. of New York. This high pressure Pintsch gas is available for use in the buoys used in harbor lighting.

Hudson Bay Railway.

As previously reported in our columns the prospects of a rapid construction of the Hudson Bay Railway seems assured. It will form part of the Canadian Northern Railway. The only point remaining to be settled is the exact location of the terminus on Hudson Bay. Churchill seems to be the best natural harbor on the west coast of Hudson Bay, but Port Nelson is capable of affording much larger accommodation for shipping, and at that point the water never freezes over. The entrance to the latter harbor would require considerable dredging. The proposed railway has brought the Nelson River into prominence as one of the great rivers of the world. It is not improbable that coincident with the opening of the proposed railway, a ship way will also be opened between Winnipeg and Liverpool by way of the Nelson River. The advantages to the Western States, as well as to the Canadian Provinces, would be incalculable.

Tube Expander and Driving Block.

Some very useful articles have recently been catalogued by W. H. Nichol & Co., of Wilkes-Barre, Pa., among them is Nicholson's patent tube expander. It can be operated by power or by hand and it is self-feeding and requires no driving. It is also self-releasing. This is done by simply reversing the rotation of the arbor. It has six rollers, thus giving it a large bearing in the tubes. It is made from the best tool steel throughout and hardened. The makers claim that one man can expand a 4 in. tube by hand.

Another very useful little shop appliance is the Nicholson driving block. This consists of a sort of triangular pillar, if one may so call it, when one side of the triangle is not there. The plan of the driving block is practically the letter V, and it stands up a convenient height for hammering and has a broad foot at the bottom and a wide coping on top. The inside of the V is cut into a series of grooves so that an iron shelf covered with lather can be placed in the V at any required height. The block is used for driving a mandrel out of a piece of work and is a great deal more handy than an old gear wheel or a casting with a hole in it. Write to the Nicholson people and ask for an illustrated circular. The illustrations alone tell the story of how these things are used.

A Philosophic Barber.

President Taft tells this experience with a barber during a visit to England years ago: "The barber who was cutting my hair said to me: 'You 'ave a large 'ead, sir; it is a good thing to 'ave a large 'ead, for a large 'ead means a large brain, and a large brain is the most useful thing a man can 'ave, as it nourishes the roots of the 'air.'"

Railway officials who are interested in securing castings for rolling stock that do not break under the most severe stresses, ought to be well informed concerning vanadium steel. We have published much information about this steel, but the full story of its strength and toughness will stand rereading. Those interested should send to the American Vanadium Company, Frick Building, Pittsburgh, Pa., for the company's catalogue concerning vanadium. Tell them we advised you to send for the catalogue and you are sure to receive one. If you turn to page 273 of the June, 1909, issue of RAILWAY AND LOCOMOTIVE ENGINEERING you will find something of interest concerning the properties of vanadium steel.

A catalogue dealing with railroad shop and yard cranes has recently been issued by the Whiting Foundry Equipment Co., of Harvey, Ill., a copy of which may be had on direct application. This publication gives a general outline of the purpose for which cranes are used in railroad yards and shops. The illustrations are reproduced from photographs of actual installations, and cover the entire railroad field. From the handling of complete locomotives and parts thereof to the transfer of freight, very heavy loads are encountered and this company have originated many special designs, including gantry cranes for wheeling locomotives, traveling cranes running on circular track in roundhouses and service cranes, which include portable self-supporting jib cranes for auxiliary service. The company also manufactures transfer tables and railroad turntables of all capacities. The equipment of complete foundry plants for production of car wheels, gray iron castings, steel and malleable castings to meet railroad requirements is a specialty of this company. The latter equipment is described in a booklet entitled, "A Modern Foundry," which will be sent to any one by the Whiting Co. upon request.

Dudley's Process for Rail Makers.

Dr. P. H. Dudley has been designated as consulting engineer for all the New York Central Lines with respect to everything that relates to the use of iron and steel. He is recognized as one of the leading experts of the country on the question of steel rails. Dr. Dudley will soon be provided with a completely equipped chemical and physical laboratory.

Owing to the pressure upon the rail mills of the country to keep pace with the demand for rails, railroads will have to wait a long time for deliveries of steel rails which they could use at this time, if they had them. The same is true of structural material.

It is believed that many tons of rails will soon be produced by a process perfected by Dr. Dudley in which he has no pecuniary interest. The process is free to all the mills without discrimination. Rails so made, it is thought, will minimize and may eliminate breakages.

Safety valve capacity is a subject as interesting as it is important, and the whole matter has been very concisely presented in the form of a treatise which is printed in the first few pages of the Consolidated Safety Valve Company's catalogue. A series of safety valve tests were conducted not long ago by this company for the purpose of finding the actual relieving capacities of safety valves in pounds of steam per hour. The results of these tests were embodied in an illustrated paper read before the American Society of Mechanical Engineers, by Mr. Philip G. Darling. This paper now forms a part of the catalogue, and it is well worth careful perusal. The catalogue illustrates all the many and various forms of locomotive and stationary boiler pop valves made by this concern. Water relief valves are also listed, house-heating valves are also included and prices are given. The book which will be given away for the asking is worth having, not only by those who require to use the catalogue part, but by any intelligent man who is sufficiently interested as to wish to know something about safety valves. The book is called Consolidated Pop Safety Valves, the address of the company is 85 Liberty street, New York, N. Y., and a postcard request secures you a copy.

Some Ideas of James J. Hill.

A good authority on the efficiency of railroad men says that James J. Hill has the best force of employees on his Great Northern Railroad that is to be found in the country. Other roads exert every effort to draw employees from Hill's lines to theirs, because they know that Hill's men are real railroaders and know their business. Mr. Hill is reputed to be some versed in railroading himself, having learned the business from the ground up to the top.

Being the most successful railroader in the world does not appear to have exhausted the energies of Mr. Hill, for he has been devoting much effort to throwing light upon various questions of National importance, more especially those relating to ignorant farming. The following are extracts from a speech Mr. Hill made at Omaha:

OLD B. & O. ENGINE, 1891.

"The whole subject of our food supply and its relation to population, industry, growth, institutions and everything that concerns our future is appropriate for this occasion. The true statement of the broad general fact which it is most desirable that everyone should understand, is that this country cannot feed the population which it must necessarily have within comparatively few years if it does not change its agricultural methods. The emphasis is all on that conditional clause.

"We cannot support our coming population upon the crop yield per acre that now satisfies us. We have to transform a growing decline in value and productivity of our soil under continued cultivation into a rapid increase in both. If the crisis can be seen moving upon us now, and if it took Great Britain half a century to raise her wheat yield from about fifteen bushels to thirty-two bushels per acre, we have no time to lose.

"Our public lands are mainly exhausted. A few more years will see the last of them. And lest they should not be squandered quickly enough, we not only offer them to everybody under conditions that invite and reward fraud, but when the government finds itself burdened with a particularly choice and valuable tract of farm land it holds a lottery and distributes it among Tom, Dick and Harry, no matter whether farmers or speculators, after they have been collected from distant parts of the country by appealing to the passion for gambling.

"The country, unless there shall be a change, is approaching a time when it must import wheat to meet home needs. Other food products also lag behind the constant new demand. There is but one course before the nation. That is to increase the productiveness of the farm so that the earth's gifts may year by year equal or exceed the people's requirements. It is the more necessary because the great bulk of our foreign trade is made up of these commodities."

The New Era metallic packing may be briefly described by saying it is a collection of many irregular particles like small pieces of some whitish metal. It is in fact a "pliable compound mass of metallic lubricants." This lot of particles may be put into any kind of stuffing box and the gland screwed up so as to press the particles together on the rod. The particles are not elastic, so that there is no pressure on the rod. The metallic particles are irregular in shape and are soft and plastic so that no scratching of the rod can take place. The packing particles squeeze together and so insures a steam tight fit. It is suitable for any kind of work where packing is required and is efficient in water, oil, gas or steam. Renewal can be made without taking out the old packing. All that is necessary is to slack back the gland, pour in the new lot of particles, close up the gland and old and new coalesce under pressure. There is thus no waste to this form of packing. The New Era Manufacturing Company, of Kalamazoo, Mich., are not only willing but anxious to send a sample free to anyone who wishes to make a trial of their product. When the packing is in place it does not need to be oiled as it is self-lubricating and takes care of itself and the rod it is in contact with. Write for sample and circular if you are interested.

A rather interesting though unintentional test of the tungsten filament used in incandescent lamps in train lighting took place not long ago. A collision between a passenger train and a light engine resulted in comparatively few injuries to the passengers, due to the fact that the strong frames of the passenger cars resisted crushing. One coach was derailed and the steel side plate dented in about 18 inches. In the lighting equipment of this car were nine General Electric tungsten lamps. After the wreck all the lamps were taken out and tested. The tungsten lamps were found to be in good condition. This indirectly shows the strength and durability of the tungsten filament when specially adapted for train lighting service.

Ties for New Line.

A recent press dispatch from the Pacific Coast says: The San Diego & Arizona Railroad will soon be very much a reality between San Diego and Tia Junction and operations will be extended eight miles over the border line into Mexico. Altogether 100,000 ties have so far been ordered. Of this number 53,090 already have been received and 19,000 will arrive shortly from Mendocino County. These ties are of redwood and the best quality produced. Forty-six cars have been ordered. One engine and ten cars, previously ordered, will soon be completed.

Catalogue 11, issued by the National Tube Company of Pittsburgh, Pa., may properly be styled the high water mark of catalogues. There are 470 pages of extra thick superfine paper, gilt edged, bound in flexible morocco, and almost every page illuminated with the finest half-tone illustrations. The frontispiece is a tinted chromo photograph of the Kewanee Works of the company at Pittsburgh, Pa. The works are a miniature Pittsburgh in themselves. The buildings cover many acres. All who are interested in wrought iron pipe for steam, gas, water and air, cast malleable iron and brass fittings, brass and iron body valves and cocks, radiators and coils, drive well points, and well supplies, should have a copy of this superb publication. Apply at the general offices of the company, Frick Building, Pittsburgh, Pa.

In renewing his subscription to RAILWAY LOCOMOTIVE ENGINEERING, a Western reader writes: "I think you're a good one and one that every engineer should subscribe to. It was the means of getting us a five per cent. increase on a certain class of engine that is used now and of collecting a year's back time."

The American Specialty Company of Chicago have recently been appointed sole export agents for the line of portable electric drilling machines manufactured by the Van Dorn Electric & Mfg. Co. of Cleveland, Ohio. The American Specialty Company also have the agency for these tools in the Chicago and Central Western districts.

Various methods have been devised for protecting the occupants of the cab from the effects of flying glass, steam and scalding water when a gauge glass breaks. One of the most recent is what has been called the "Ironclad" water glass protector. It is, however, a circular shield of wired glass open at the back so that it may be easily put on or taken off. One can see the water level through the protector and in the event of the gauge glass breaking the wired glass protector, even if shattered, hangs together and gives the fireman or engineer a chance to shut off the gauge. The protector is made of good quality of tempered plate glass in which is cast woven soft steel wire. The protector has the effect of preventing draughts of cold air from reaching the gauge glass, and in the event of something striking the gauge the protector gets it first. Write to the Sargent-Hollings head Company, 1616 Fisher Building, Chicago, for their illustrated folder.

The Delaware, Lackawanna & Western Railway Company are organizing schools for the education of their workshop apprentices on lines similar to the schools at various shops of the Erie Railroad. President Truesdale is encouraging the enterprise and has directed Mr. T. S. Lloyd, superintendent of motive power, to work out the details.

The Mumford Molding Machine Company has been organized, and will sell the foundry molding machines heretofore sold by The E. H. Mumford Company, of Philadelphia. These well-known molding machines will be manufactured by The Q. M. S. Co. for the new company, at Plainfield, N. J., and the Mumford Molding Machine Company will have their sales office at 30 Church street, New York, with funds ample for the proper handling of their business. Mr. W. D. Sargent is president, and Mr. E. H. Mumford vice-president and general manager of the new company.

The construction of the Pennsylvania Railroad tunnels from Bergen Hill, N. J., to Long Island City was practically completed early in December, when the final section of concrete was placed in the fourth and last of the tunnels under the East River to Sunnyside Yard in Long Island City. The only construction work remaining to be

KILLARA STATION, AUSTRALIA.

done has to do with some minor features in the Long Island City shafts. These will be completed in a very short time. With all of the construction work on the tunnels finished, it will be possible to go ahead rapidly with the electrification, signal installation, lighting and track laying.

Schools Run by Railroads.

A novel system of special education for the children of Cape Colony is in operation, and the success of the schools is marked, says the *Educational Review*.

Whenever railway employees in isolated places can guarantee an average attendance of ten children or more not otherwise provided for by the railway schools the railway department and the education department, acting conjointly and each furnishing half the expense, provide suitable premises and a certified teacher at a salary of $390 to $487 a year and quarters.

Children of railway employees are carried to and from these schools free of charge and are charged slightly lower fees than in the regular government public schools; they must also provide their own books and stationery. No objection is raised to the attendance of the children of farmers who also may be living beyond the convenience of any government public school.

An officer of the railway known as the education officer acts as manager of all the railway schools, and where there are a sufficient number of parents they form local committees to assist him in managing the affairs of the school. He is always more or less guided by the opinions of the station masters or head officers of the railway. The schools are inspected regularly by the inspector of the education department.

Statistics of these railway schools for 1908 show that there are forty-one schools on the railways, with a total enrollment of 2,135 pupils. Many of these children would have no educational advantages if it were not for the railway schools established especially for them. The expense to the Cape Government railways for these schools was $28,367 for the year 1907.

Air brake repairers. Don't it make you hot to put in a new air brake leather, and after testing it find out it has crimped, then have to throw the leather away and begin the job all over again? Well, there is no crimping with a Vim leather air-brake cup packing, proclaims E. F. Houghton & Co., Philadelphia. They make the Vim, and ought to know.

The sub-committee of the American Railway Engineering and Maintenance of Way Association appointed to gather statistics on the life of metal and composite railroad ties have recently reported that the steel tie (Buhrer patent) is very satisfactory. Approximately 1,200,000 ties of this type are in use and so far they have withstood the most severe service when properly installed.

It is stated that the steel tie gives a more solid track than the wooden tie gives, due to the rigid fastening of the rail to the tie. The committee believes that no wholly concrete tie has yet been produced which is able to withstand heavy high-speed traffic without crumbling, cracking or breaking. Very satisfactory service has been obtained with concrete-steel ties in a number of instances, mostly in cases where the traffic was of moderate speed and not too fast.

The L. S. Starrett Company, of Athol, Mass., publishes an elegant 32-page supplement to Catalogue No. 18, recently issued. There are a number of new tools described and illustrated in the supplement, particularly several new bevel protractors which will be received with much favor by the best mechanics. A fine feature of these protractors is the fact that the turret is graduated to read both ways from 0 to 180 degs. The readings include, at a glance, not only the angle required but the supplement of the angle. A number of planer and shaper gauges, and taper and thickness gauges, and other small tools, all showing improvements, are added. Write to the company for copy of their catalogue and supplement. You will likely find something there which will interest you.

The new double track of the Canadian Pacific Railway between Winnipeg and Fort William has been completed. The president recently stated that the company is continuing the work of extension in the West and East alike. In the past three years, 1,500 miles of new track have been built, and in the past six years more than $40,000,000 have been spent on equipment. The new double track cost 25 per cent. more than had been anticipated, but it is as good a road as can be built.

The Stevens Engineering Society, which is affiliated with the American Society of Mechanical Engineers, has a very interesting series of lectures for the remaining months of the college term at the Stevens Institute of Technology. The first of the series for the 1910 is on "Engineering Efficiency," with H. G. Stott as the lecturer. Mr. Stott is superintendent of motive power of the Interborough in New York. The lectures are delivered in the Stevens Institute every Tuseday, beginning at 4:30 p. m. The last lecture will be on Tuesday, May 10, 1910. The programme of lectures may be had by addressing the secretary, Mr. Ralph S. Upson, at the Stevens Institute of Technology, Hoboken, N. J.

Many Uses for Electricity.

By way of educating the people in regard to electricity in its numerous applications to domestic and general power purposes, a municipal electric plant manager tells of the following things which one kilowatt-hour of electricity will do:

Saw 300 ft. of timber (deal).
Clean 5,000 knives.
Keep your feet warm for 5 hours.
Clean 75 pairs of boots.
Clip 5 horses.
Run an electric clock for 10 years.
Iron 30 silk hats.
Light 3,000 cigars.
Knead 8 sacks of flour into dough.
Fill and cork 250 dozen pint bottles.
Run an electric piano for 10 hours.
Lift 3½ tons 75½ ft. in 4 minutes.
Cook 15 chops in 15 minutes.
Give you 3 light Turkish baths.
Keep you warm in bed for 32 hours.
Keep your breakfast warm for 5 hours.
Run your sewing machine for 21 hours.
Keep four domestic irons in use for an hour.

Boil 9 kettles, each holding 2 pints of water.

Run a small ventilating fan for 21 hours.

Run a large ventilating fan for six hours.

Carry your dinner upstairs every day for a week.

Warm your shaving water every morning for a month.

Run a plate-polishing machine for 21 hours.

Supply all the air required by an ordinary church organ for one service.

Pump 100 gallons of water or other liquid to a height of 25 ft.

Warm all the beds in the house, by a warming-pan, for a fortnight.

Give you a fire in your bedroom for an hour while you are dressing or undressing.

Carry you 30 times from the bottom of the house to the top, 80 feet each journey.

To our readers who have not studied the elements of electricity we explain that a Watt is 1/746 of a horse power. A Kilowatt is 1,000 Watts and is therefore 1.34 horse power. Those who desire to persue this interesting subject, are referred to an article on the subject published in RAILWAY AND LOCOMOTIVE ENGINEERING for April, 1907, page 171 and entitled "What is a Watt?"

The fifth edition of a finely illustrated descriptive catalogue on the subject of the Foster patent superheater has been issued by the Power Specialty Company of New York. The advantages of superheating have been recognized for many years, but it is only recently that a reliable apparatus has been perfected that may be fitted to stationary boilers not designed for high pressure or which may have been in use for some time. The Foster superheater has many advantages, particularly in its ready adaptation to any kind of boiler. Send for a copy of the 1910 catalogue to the company's offices, 111 Broadway, New York City.

Facts Concerning Platinum.

The principal supply of the metal platinum comes from Russia, but that precious metal has been found in limited quantities in different parts of America. Its extraordinarily refractory properties have brought platinum largely into use for electric purposes, but cheaper substitutes have been lessening the demand for platinum.

This has brought depression in the platinum mining industry in Russia, the platinum miners having applied to the government asking that the industry be upheld until it is definitely decided whether the mining of platinum is to be made a monopoly of the Russian government. The platinum miners have petitioned the government for temporary assistance; that is, to permit the Russian Imperial Bank to grant loans on platinum ore containing 83 per cent. of pure platinum, at the valuation of 16,000 rubles per pood ($8,240 per 36 pounds), with interest at the rate of 5 per cent. per annum.

The Chicago Pneumatic Tool Company have just issued an illustrated circular descriptive of the Franklin High Speed Air Compressor, type G H. The product of this company is of the best and their latest type of air compressor possesses several new features that are being fully appreciated. Improvements are also to be observed in their Little Giant drills which are already in use in 15,000 machine shops. Their riveting and chipping hammers keep pace in point of popularity with their drills. Send for descriptive circular to their offices at Chicago or New York.

The Regular Alarm.

"Have you any alarm clocks?" inquired the customer of a State street jeweler recently. "Yes, ma'am," said the man behind the counter. "About what price do you wish to pay for one?" "The price is no object if I can get the kind I am after. What I want is one that will rouse the girl without waking the whole family." "I don't know of any such alarm clock as that, ma'am," said the man. "We keep just the ordinary kind—the kind that will wake the whole family without disturbing the girl."

We are informed that the Hicks Locomotive and Car Works of Chicago, Ill., have recently received an order from the Gilmore & Pittsburgh Railroad for one hundred 80,000 lbs. capacity new box cars.

The general dimensions of these cars are: length over end sills, 40 ft. $10\frac{7}{8}$ ins.; width over side sills, 9 ft. $1\frac{1}{4}$ in.; height top of rail to top of running board, car light, 14 ft. $0\frac{1}{4}$ in.; width over eaves, 9 ft. $5\frac{3}{8}$ ins.; bolster centers, 31 ft.; truck wheel base, 5 ft. 4 ins.; total wheel base, 30 ft. 4 ins.; height top of rail to center line of coupler, car light, 2 ft. $10\frac{1}{2}$ ins.

Run, Repair or Transfer.

What is wanted is a rule embodied in the M. C. B. Code requiring roads to take a loaded car, and "run, repair or transfer." This is the gist of the remarks made by Wm. W. Baird, shop engineer of the C., B. & Q. at Plattsmouth, Neb., at a recent meeting of the Western Railway Club. Mr. Baird says it is no uncommon thing to see important trains held for hours to get through cars from connections, only to find that one-half of the cars were refused by the car inspector, and why? Because a roof board was broken, or a corner knocked off a piece of sheathing, or a wheel had a flat spot that was just the limit.

Mr. Baird considered that a good deal of the unnecessary rejection of cars is caused by one inspector endeavoring to "get even" with a car inspector of another road who had on a previous occasion delayed the movement of paying freight on a technicality, and bad incidentally inconvenienced the first inspector. Who is responsible for this state of affairs? he asks, and answers by saying: Simply the M. C. B. rules in saying if such and such a defect exists on a car it "may" be rejected.

SIGNALLED TRACK ON THE B. & O.

As we read the M. C. B. code, Rule 2 says, "Cars offered in interchange must be accepted if in safe and serviceable condition, the receiving road to be the judge in cases not provided for in rules 3 to 56, inclusive." While some uncertainty may exist about what is safe and serviceable, as the receiving road is the judge, this difficulty entirely disappears wherever there is a competent and conscientious joint car inspector.

The delivery of a car implies a switching movement from the delivering to the receiving road, and the act of rejection implies a return of the car by a second switching movement, and the redelivery of the car implies a third switching movement. The joint car inspector obviates two of these switching movements, as he gives a defect card, where necessary, to the receiving road and that road does the repairs then and there.

The wholesome spirit contained in the words "run, repair or transfer" is, we think, also contained in the words of rule 2 which was modified from the old original form "may be rejected." The M. C. B. code was revised last June and the word "should" in the preface is now changed to "must," so that the paragraph reads that railroads "are responsible for damage to cars by unfair usage, derailment or accident, and for improper repairs made by them, and they must make proper repairs at their own expense or issue defect card covering all such damage or improper repairs."

The Baltimore & Ohio Railroad have recently placed orders for 3,400 steel hopper coal cars; 1,000 steel underframe box cars have also been ordered. These orders call for the expenditure of four and a half million dollars. The cars complete the relatively recent addition of 10,000 new cars of the largest capacity to the coal and general freight equipment of the B. & O. Delivery on former orders began early in November, with these orders following as rapidly as possible. Every effort is being made to meet the increasing coal shipment and requirements.

There has been a tendency in this country to give graduates of technical schools privileges on railways and in industrial establishments that no apprentice enjoys. In Germany, which is by many regarded as the original nursery of the technically educated operative, the school graduate is given no pay for the first year that he works in a factory or workshop.

A Scotch lady invited an elder in the Free Church to dinner and a remarkably tough piece of veal was placed on the table. After some frantic endeavors to cut it, in which the elder's plate landed on his knees, the lady said: "Ye aye said there wis something to be thankfu' for in everything. I jalouse ye wad be at a loss to fin' something to be thankfu' for in that veal?" "Not at a'," he responded, cheerfully, stopping to breathe; "I wis just thinking hoo gratefu' we should be that we met it when it was young."

The Q. M. S. Co. (Quincy, Manchester, Sargent) have moved their Western office from 1775 Old Colony Building to 738 First National Bank Building, Chicago. Their interests in the West will hereafter be taken care of by Mr. John C. Hoof.

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances

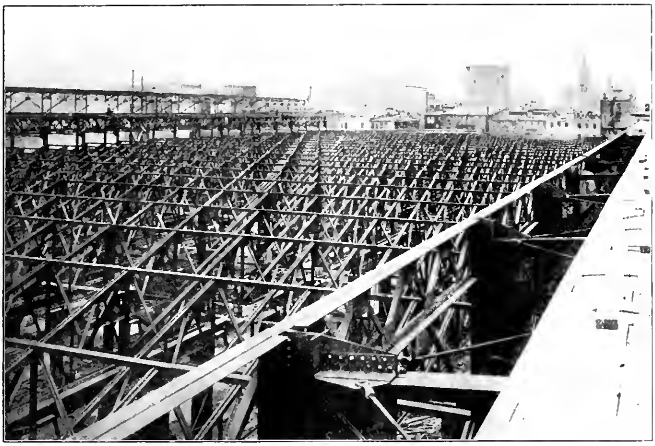
Vol. XXIII. 114 Liberty Street, New York, February, 1910. No. 2

D., L. & W. Shops at Scranton.

GENERAL VIEW, BEFORE COMPLETION, OF THE D., L. & W. SHOPS AT SCRANTON, PA.

Those who have had opportunities of marking the improvements in the motive power and rolling stock of the Delaware, Lackawanna and Western Railroad during the last twenty or thirty years cannot fail to be struck with the high degree of efficiency to which the mechanical appliances have arrived. It was hardly to be expected that during the period of business depression through which the country has been passing that much further outlay would have been made in the way of still larger improvements. But no sooner were the extensive repair shops of the company completed at Kingsland, N. J., than the accomplished staff of constructing engineers were engaged on the plans of still greater works at Scranton, Pa. The work of building these shops has been rushed with a degree of rapidity that is surprising. Much of the heavier machinery is already installed, and before many months the shops will be in full running order. It is very gratifying to learn that so perfect have been the plans of Mr. G. J. Ray, the chief engineer of construction, and Mr. S. S. Riegel, the chief mechanical engineer, that not a single hitch has as yet occurred in the vast and multiplex details of the great undertaking. Much credit is also due to the fine staff of assistant engineers. All seem to have a thorough grasp of the work, and all are earnest and enthusiastic in the success of the enterprise.

Mr. T. J. McDermott, of the engineering staff, was deputized to conduct us through the vast wilderness of steel, granite, concrete and brick. He seemed to know every stone and girder of the mighty fabric. The works are situated east of the old shops that were great in their day, but now dwindled into comparative insignificance. The new works occupy the site of the rolling mills and blast furnaces of last century and stretch the entire length of what was the limits of the city not many years ago. A thousand workmen were busy on the towering walls and far-stretching roofs, and the rattle of a hundred hammers told the story of riveting together a structure that will likely stand for centuries.



VIEW ALONG THE ROOF MEMBERS, D., L. & W. SHOPS AT SCRANTON, PA.

THE MACHINE SHOP.

The erecting and machine shop is the largest of the several buildings. It is 600 ft. in length and 350 ft. in width, and is divided into five bays. On the two outer bays nearest the side walls there are two travelling cranes traversing the entire length of the building, one crane capable of carrying 120 tons and the other 20 tons. In the two adjoining bays there are lighter cranes each of 15 tons capacity, while the central bay is served by four lighter traveling cranes suitable for loads of 1 ton and under. The outer and intermediate bays are 62 ft. in width, leaving the central bay a clear width of 100 ft. The height of the building is over 60 ft. There is one gallery running along the north end of the building, the floor of which is 25 ft. above ground. It extends over 60 ft. from the outer wall and is itself an extensive shop and will be fitted with light machinery adapted for the construction of steel or wooden cabs of locomotives. The lighter cranes of the central bay traverse this department.

On the main floor of the machine shop there are 35 pits finished in concrete and equipped with compressed air, electric and steam attachments. Between the pits there are auxiliary pits into which the material stripped from the locomotives will be deposited and suitable coverings for these pits may be readily opened and closed, leaving the floor entirely clear for the workmen. The rails extend under the heavy cranes so that trucks and wheels and other large material can be speedily brought within reach of all of the cranes. The transfer table traverses the entire east side of the building. It is electrically driven and will accommodate any locomotive and tender whose wheel base is not over 70 ft.

An admirable feature in the classification of tools in the machine shop will be an arrangement whereby the machines necessary for certain pieces of work all adjoin each other so that with a series of compressed air hoists and running tackle the various parts of the locomotive are completed and ready for assembling, each series of operations being accomplished within a limited space unobstructed by any other kind of work. The completed arrangements provide ample accommodations for the general repair of 30 locomotives and the construction or rebuilding of 5 new, or nearly new, locomotives. Nearly all the machines will be driven by separate electric motors, the exception being in the case of some of the groups of smaller machines where light shaftings will transmit sufficient power from one motor to drive several machines.

THE BLACKSMITH SHOP.

The blacksmith shop is situated east of the machine shop, from which it is separated by the transfer table. Its construction is similar to the machine shop, although much smaller, being only 300 ft. in length by 125 ft. in width. The same general plan of special grouping of tools that is used in the machine shop is also in evidence in this department. The section devoted to frame work is necessarily the most commodious. Here are two of the largest steam hammers, one 80 ton and the other 60 ton capacity. The four open fires adjacent to these hammers are equipped with jib cranes, two cranes being available for use at each fire. A row of furnaces runs along the entire length of the shop, and these will all be gas burners, the gas being furnished from an adjacent building on the company's property. The spring and tool furnaces occupy an extensive area and the bolt department, when in full operation, is expected to forge 40,000 bolts a day.

THE FOUNDRY.

An extensive system of material sheds stretching over 1,200 ft. in length by 40 ft. in width separate the machine shop and blacksmith shop from the foundry. This building, which embraces the foundry and pattern shop and casting platforms, is 750 ft. in length by 120 ft. in width. The foundry is furnished with two cupolas, one of which is 7 ft. in diameter and the other 5 ft. When working full capacity the output will approach 50 tons per day. The casting platform has the appearance of a very large machine shop. It is equipped with a series of jib cranes and traversed by numerous tracks intersected by turning tables. In the foundry the same thorough classification of appliances adopted in the machine shop is in evidence. On one side of the building are being arranged the molding machines for smaller castings, the section for brake shoes alone covering an area larger than many complete foundries.

THE BOILER SHOP.

Retracing our steps through the extensive material bins, we observe the boiler steel rack, a building 90 ft. by 30 ft. This building, of course, is adjacent to the boiler shop, which runs the entire width of the machine shop, being 350 ft. by 120 ft. The boiler shop is, properly speaking, part of the machine shop, and is equipped with a 30-ton traveling crane. Quite a number of the larger boiler shop tools are already in place. A boiler shell riveter is being set in position, and with the traveling crane traversing the entire length of the shop a boiler can readily be removed from any part of the shop and suspended in the well-like opening which has a width of 15 ft. and a depth of over 20 ft.

BUILDING MATERIAL.

As will be observed from the accompanying illustrations, the buildings are of structural steel upon which reinforced concrete is set in solid blocks. The view of the roof of the locomotive shop gives a good idea of the vastness as well as the substantial character of the structure. As will be noted the roof is considerably raised along the sides of the shop. This is where the heavier traveling cranes are located, and as there is only one main entrance it will be necessary to lift the locomotives from place to place over those already undergoing repair or in course of construction. This operation is already in vogue in quite a number of the larger shops in America, and is a marked improvement over the older method of slowly moving the ponderous locomotives from place to place. The approaches to the main entrances as well as much of the substructure and retaining walls are of rough hewn granite.

THE SUBWAYS.

A novel feature in the construction of works is the connection of the various shops by a series of subways. The uneven nature of the ground, and the fact that the locality is partly traversed by public avenues renders such a scheme necessary. At first sight it might appear that it would have been an easier operation to construct a system of bridges but it is quickly observed that the underground plan of communication has many advantages. From the storage building and casting platform and far-stretching bins the various materials are lowered in elevators to the subways and transferred rapidly to their separate destinations. There will literally be no surface traffic throughout the works. Locomotives passing through the upper air while the parts are being assembled from a system of underground tunnels beneath leave the skilled mechanics and their machines in undisputed possession of the field. Some of the subways are flanked by wide cellars, floored and roofed with concrete, and larger than ordinary shops themselves. These may serve as auxiliary storerooms. These vast receptacles would be a good place for scrap to accumulate in, but there are scrap bins nearly 400 ft. in length by 40 ft. in width where the scrap will be sifted and classified and labeled and stored and stacked and sent off to seek its fortune in the fiery furnaces of the future.

As we leave the wide wilderness of woven steel and grey granite, the glittering lamps of Lackawanna avenue are bursting into myriad blossoms of electric fire. The illumination is wonderful. Scranton is lighting up. When the new shops are opened we will go back to look at them, and Scranton will have good reason to extend her illumination and feel proud of the mighty hive of industry that is springing into being and becoming part of the expanding city.

Shandy Maguire Moralizes Among the Tombs.

In his letter to the *Locomotive Engineers' Journal* concerning his visit to Europe last summer, among other things, he says:

Next morning, May 25, we were out at the sight-seeing again, with what eyes we had left. We saw Hyde Park and the Albert monument, which is a colossal work of art and a noble tribute from "The most womanly queen and the most queenly woman" who ever honored a human throne, to her departed husband. We were taken through Rotten Row, Kensington Museum and the Royal Academy, and the next stop was at Westminster Abbey, which my pen balks at, as I cannot convey the slightest interest in the wonderful place. I walked over and under dead kings, queens, princesses, dukes, lords and earls, in my plebeian way, and not one of the haughty sleepers was disturbed by my presence. I "did" the Poet's Corner and paid my regards to Longfellow, who was there on a bust; looking down at the Brownings, Tennyson, Irving, Sheridan, Campbell, Chaucer, Dickens and scores of others. I remained amongst them a short time, paying tribute to the immortals, and then I sauntered round till I came to Seibert the Saxon, the first king crowned therein, and after a silent salutation to his Majesty and a thank God for surviving him I went to the tomb of Edward the Confessor, not that I had any acquaintance with him, dead or alive, but I wanted to see the coronation chair which all kings were crowned in from Seibert the Saxon to the present reigning monarch, Edward VII. I found it! It is about 15 ft. from the tomb of Edward the Confessor. As I was disappointed in not getting a chance to drop into it for a while, it being protected from all such meanderers as I am by a railing, I looked intently at it, contemplating everything connected with it and satisfied that as a work of art it would not attract much notice for, if I had a saw and a few pieces of pine boards, I could scallop out as grand a looking one in short order; but oh! its mighty history! Beneath it and attached to it is "The Stone of Destiny," stolen from Scone by Edward I. in 1296. It is a member of the old families you can see, for in the sixth century it was in Scone, Scotland, where Scottish monarchs were crowned as they sat on it. I don't know what virtue it is noted for, but had I gotten a chance I'd have chipped off a sliver of it to carry in my pocket as a talisman, to see if it would ward off some of the ills that my flesh is heir to. I got out of the Abbey, having entertained myself to the limit of my endurance in the most wonderful place man can find on earth of its kind. As I was leaving, I would have sent up a prayer to the Throne of Grace for the Lord to grant the sleeper peace and rest, but that the place was silent and none of them seemed to move, and my prayer would have been superfluous.

SIDE VIEW OF THE SCRANTON SHOPS, D., L. & W.

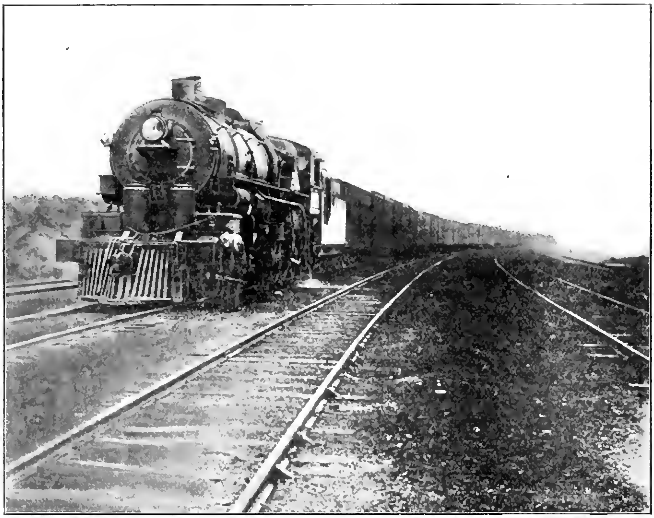
My First Blizzard in the Wild Western Winter

By Angus Sinclair

A person lost in the pathless forest or cast without landmarks in a far reaching desert draws my sympathies more than any victim of misfortune except, perhaps, that of people in a boat on the ocean without compass or other means of guidance.

I have always felt that a man sent out to run a locomotive over a strange road was in a condition similar to the cases mentioned, and I hoped that it might never be my lot to go through the experience. It was though.

I had enjoyed considerable experience on double track lines with all sorts of engines and had figured as engineer of the plug for two years, but I did not feel by any means at home on a strange single track road, when the "plug" was purchased by a large company and I was ordered to report at the mechanical headquarters.



MODERN POWER IN THE WEST, READY FOR THE START.

AN EMBARRASSING SITUATION.

The road was rushing business and was short of engineers when I hired. The master mechanic gave me a note to the roundhouse foreman, saying he might send me out. I supposed this meant that I would be sent round for a week to learn the road; but the foreman handed me a time card and mileage-book, and said they would soon teach me the road. At ten o'clock that night I was called to take a train of twenty loaded stock cars over the Southeastern division. To start out with a heavy train at night, with a strange engine on a single-track road, is a trying position, but the difficulties of the case are increased a hundred-fold when the journey has to be made over a strange road whose train rules and orders an engineer happens to be entirely unacquainted with.

FEELING MY WAY OVER A STRANGE ROAD.

However, I determined to do my best, so I looked the engine over carefully—it was a Baldwin in fair order—oiled every cup, bearing and box, and while waiting for the order to start studied over the meeting points. After getting the train going, I kept plenty of water in the boiler, and held the train running at as nearly uniform speed as the case would admit. The road was undulating. When I got running down a hill where steam was not needed I watched for the creek bridge that generally indicated the bottom of the grade, and was the signal to give her the steam. By the help of the fireman and head brakeman I found the water tanks and the trip was made without any mishap.

SNOW WAS FALLING.

I had been running on this road about two months, when on getting out of bed one morning, I found a heavy coating of snow on the ground. Snow had been falling the greater part of the night. There had been no snow of any consequence where my previous railroading had been done, and I felt very much like laying off now, for the boys often spoke about the rough times they had snow-bucking. However, on reflection, I concluded to go out, for I guessed I could do what any other man had done.

I was boarded to go out in the morning with a freight train over a Southwestern division, that had a bad character for snow. When I went to my engine the fireman advised me to get a heavy overcoat and arctic overshoes. These articles seemed to me superfluous in the comfortable cab of a locomotive, so I started without them. I had never been in a northwestern blizzard.

Although considerable snow had fallen, the weather was mild and pleasant when we started out and there was no difficulty in taking a full train along, for frequent trains had kept the track clear. The division I was bound over followed the main line for twenty miles, then struck to the southwest through a country that was thinly settled. We had met with several delays on the main line, and it was about mid-day when we reached the junction. We were glad to get away from the main line, for we knew that on the branch we would be free from the delays incident to meeting numerous trains on a single track.

THE SNOW IN MOTION.

About the time we got rightly going on the branch, the wind began gradually to rise and the temperature to fall—not slowly by any means, but surely enough. At first the light breath of wind seemed to toy with the soft feathery particles on the surface of the snow. The downy flakes clinging to exposed tufts of prairie grass and reposing on the leaves of scrub oak, would rise on the breeze and be wafted quietly to more sheltered resting places. As the speed of the wind increased, the clumps of light timber passed began to look like fallen dust clouds; then the surface of the prairie snow got in motion. There was nothing tumultuous or fear-inspirng about it. It merely looked as if the whole surface of the earth was a stream of snow dust flowing southward.

COLD STIFFENS OIL BOXES.

There was still no obstruction of a serious nature on the track, but at the first water station, where there was some delay with a meeting train, I found that the cold had frozen the axle boxes of my train so badly that I had difficulty in getting away with half of the train. The knowing ones about said a blizzard was coming, and that the sooner we got to the end of the division the better. The train despatcher gave us orders to push through with whatever train we could safely take. By the time darkness began to close down upon us we had got within thirty miles of the terminus, and was pushing on for all the engine was worth.

A REAL BLIZZARD.

But the character of the storm had changed. The wind had continued to rise, and the river of snow dust gradually ascended till the surface was away beyond sight, and the whole world seemed to be a cloud of driving snow above, below, in every direction nothing was to be seen but blinding snow dust.

I had nothing with which to clear off the snowdrifts except a slated pilot and brushes in front of the engine truck. The snow was now becoming troublesome, and the drifts in the cuttings were getting ominously near the rails. As I pushed my head out of the window to get a glimpse ahead, while passing through one cutting, the snowbank had crept so close that it rubbed off my cap, and would have taken off my head, too, had the snow been hard enough.

STRUGGLING AGAINST STALLING.

It was all I could do to get the train through that cutting, and I stuck outright two miles further on. The place where I stalled was about an eighth of a mile up an ascent, that succeeded a down grade over a mile long. It was a frightfully bad place to lay up, for a train was supposed to be following us and it was impossible for a flagman to remain out, and it was equally difficult for a man to walk back to the past station through such a storm as was raging.

Fortunately I was able to back out of the snowbank, and by making a tremendous run down the grade forced my way through the snow that would have stalled the engine running at a lower velocity. By the time I got through this obstruction, another cause of disquietude began to haunt me. The toilsome journey from the last water tank had drawn heavily on the water in my tender, and it was getting low. Stoppage in another drifted cutting would make us face the necessity of dumping the fire. This emergency did not overtake us, but we were subjected to tribulations equally severe.

SHORT OF WATER.

A few miles ahead was a water station, and here we had resolved to ask for orders to remain until morning. Visions of lying comfortably in the side track, with the warm way-car as a shelter, began to be very attractive, for I was beginning to suffer horribly with the cold. The piercing wind was blowing on my side, and it whistled in through crevices at the sides of the cab and running board, and eddied through the back boards in chilling gusts. My thin shoes were no protection to my suffering feet, and my thin, nice-fitting overcoat, that I had so often worn with pride, seemed now to mock my suffering, and permit my life's blood to freeze in my veins.

When we got to the water station, we found the supply spout of the water tank frozen solid, and not a drop of water would run out. We toiled for long with bars and hot pokers to make an opening through the ice; we burned all the waste and kerosene we could find, impinging the flame on the pipe, but it was labor lost.

DUMPED THE FIRE.

Meanwhile our tender was empty. Seeing that water could not be obtained, the proposal was made to replenish the tender with melted snow. Melted snow can be used to fill a tender, but not the light, unpacked snow that we had to deal with on this night. We tried it, however, but merely succeeded in adding to our discomfort and fatigue. Next operation was to dump the fire of the engine, and to make provision against any pipe, tube or valve getting destroyed by water freezing within it. As the steam began to go down, I opened the cylinder cocks and blew steam through the cylinders. The feeding pipes belonging to the pump and injector were kept warm as long as any steam remained in the boiler. When the gauge index got back to zero, I opened the blow off cock and permitted the water to run out of the boiler.

HUMAN SUFFERING.

All this work was not done without considerable suffering, but a harder job remained to be done which I regarded as my bounden duty to perform. The feed pipes had to be uncoupled and the pump-joints loosened. While the fireman attended to the couplings, I crept under the engine with wrenches to loosen the nuts that bound the pump chamber joints. The wrenches would not fit the nuts, so I had to get hammer and chisel to wrestle over the job. Then was the time I properly appreciated what a blizzard meant as the searching winds penetrated my vitals. I remembered trying to steady the lantern on the feed-pipe so that I could see the nut I was trying to loosen, and it seemed that the nut and the lantern got mixed up in some curious way, and got chasing each other round the driving wheel. I became amused with the fun and sat watching it oblivious of the howling wind and my frozen couch. Next that I remember I was lying in the way-car, and the trainmen were rubbing my limbs with rags and pieces of waste.

RECOVERED.

One of the brakemen known as Long John, who had been in the army, forced off my shoes and began beating the soles of my feet with a flag staff which soon sent me dancing. Then he touched up my arms and leg till I got fighting mad and began to return his heroic treatment. In a few moments the exercise of the fight and the warm way car had me in a boiling sweat which banished the last traces of the chilling I had received. No evil effect resulted from my trying experience.

Natural Gas.

The records of early investigators and missionaries show that natural gas has been known to exist in natural springs in western New York, western Pennsylvania, central West Virginia, northeastern Kentucky and southeastern Ohio for at least 250 years. In 1775 General Washington visited a burning natural gas spring on the northeast bank of the Great Kanawaha River in West Virginia, a few miles east of the present city of Charleston. He was so impressed by the phenomenon that he pre-empted an acre of land surrounding the spring and dedicated it to the public forever.

The earliest economic use of natural gas in this country was probably made in lighting the village of Fredonia, Chautauqua County, New York, in 1821. The existence and utilization of this gas at Fredonia became widely known, both in this country and abroad, and excited the liveliest interest among scientific men. So little suspected, however, was the presence of the enormous volume of gas since developed that, when it was further explored, it was pronounced "unparalleled on the face of the globe," and Humbolt is quoted as declaring it the eighth wonder of the world.

Its introduction into commercial use was slow, but after its value was fully demonstrated there was a rush of capital, and a large amount of money was invested in gas territory, gas wells, and pipe lines. Then followed a period of reckless consumption and appalling waste. Many of the original fields were rapidly depleted of their high pressure. Not until it was fully realized that a large proportion of the natural supply had been consumed and dissipated by the extravagant methods in use were improved means adopted for holding back the gas in the original rock reservoirs. This was done by shutting off the wells, by cutting off all blow off standpipes and escapes, by improving the joints of the pipe lines, and by the more economical consumption of the gas.

This economy came rather late, but enough of the original supply remains stored principally in the deep and prolific sands of northern and southwestern Pennsylvania and western West Virginia, to furnish this ideal household fuel for many years to come. What may be done by deeper drilling and improved methods to prolong its use indefinitely is yet unknown.

The Hicks Locomotive and Car Works have recently closed a contract with the Clinchfield & Ohio Railway for twelve 70 ft. coaches. These vehicles are to have steel underframes and six wheel trucks.

Baldwin 4-4-2 for the Idaho & Washington Northern

The Baldwin Locomotive Works have recently completed for the Idaho & Washington Northern Railroad an Atlantic type locomotive which uses moderately superheated steam at a comparatively low pressure. This engine is in passenger service on a line having 16-deg. curves and grades of 1 per cent. The safety valves are set at 160 lbs., and with 22x28-in. cylinders and 73-in. drivers, the tractive force exerted is 25,250 lbs.

The boiler is of the extended wagon-top type, with three rings in the barrel. The second ring is tapered. The longitudinal seams on the first two rings have double welt strips and four rows of rivets, while the seam on the third or dome ring is placed on the top centre line, and is welded throughout its length on either side of the dome opening. A liner is placed inside the barrel, under the dome base. The firebox is wide, with a sloping throat and back head and vertical side water legs. The mud ring is supported on a buckle plate at each end. The crown staying is radial, and one T-bar, hung on expansion links, is placed at the front end, to better provide for expansion and contraction.

The superheater is of the smokebox type as developed by the builders. The deflecting plate is cylindrical in form, with a conical extension at the rear. It is centrally placed in a horizontal position, between the right and left hand sections of the superheater. The space enclosed by the deflecting plate can be entered at the front end only and is in direct communication with the stack by means of a downward extension of the latter. The hot gases are thus compelled to traverse the entire length of the smokebox, during which time they circulate among the superheater tubes. The exhaust pipe is extended upward to the deflecting plate and has a single nozzle. The stack is straight, and is 16 ins. in diameter.

The cylinder castings are double bolted to the smokebox and to each other, and are built with heavy walls. The steam distribution is controlled by balanced slide valves, driven by Walschaerts gear. The links are placed outside the leading drivers, and are supported on longitudinal bearers. These are bolted in front to the guide yoke, and at the back to a crosstie, which latter also supports the reverse shaft bearings. An interesting detail is the connection between the combining lever and valve stem. The upper end of the combining lever is pinned to a long crosshead, sliding in suitable brackets. The front bracket is bolted to the top guide bar, while the rear bracket is cast in one piece with the steel guide bearer. The valve rod is attached to a lug cast on the crosshead. The valves have an outside lap of 1 in. and an inside clearance of ⅛ in. They are set with a travel of 6½ ins. and a constant lead of ¼ in.

The frames are of cast steel, 4½ ins. wide, with double front rails of forged iron. Each main frame is cast in one piece with its rear section. The trailing wheels have outside journals, and are held in a radial truck frame, which, however, is clamped to the engine frames, so that no radial motion is allowed. Both the front and back engine truck wheels are steel-tired, with cast iron spoke centers. The cast steel details, in addition to those previously mentioned, include driving wheel centers and boxes, crosshead bodies, spring saddles, steam chests and caps, foot plate, and equalizing beams. All the wheels under the engine and tender are braked, and the Le Chatelier water brake is also applied for use on heavy grades.

The tender frame is built of 12-in. steel channels, and carries a water-bottom tank of 7,000 gallons capacity. The trucks are of the arch-bar type, with steel bolsters and rolled steel wheels. These wheels, as well as those of the engine trucks, were supplied by the Standard Steel Works Co., of Philadelphia. This locomotive has ample boiler capacity, and should prove successful in express passenger service. The design presents a neat and symmetrical appearance. Some of the principal dimensions are as follows:

Boiler—Type, wagon top; material, steel; diameter, 68 ins.; thickness of sheets, 11/16 ins. and ¾ ins.; working pressure, 160 lbs.; fuel, soft coal; staying, radial.

Firebox—Material, steel; length, 108⅛ ins.; width, 66¾ ins.; depth, front, 73½ ins.; back, 67 ins.; thickness of sheets, sides, 5/16 ins.; back, 5/16 ins.; crown, ⅜ ins.; tube, ½ ins.

Water Space—Front, 4½ ins.; sides, 4 ins.; back, 4 ins.

Tubes—Material, iron; wire gauge, No. 12; number, 358; diameter, 2 ins.; length, 16 ft.

Heating Surface—Firebox, 180 sq. ft.; tubes, 2,983 sq. ft.; total, 3,163 sq. ft. Engine equipped with Baldwin Smokebox Superheater—superheater surface, 367 sq. ft.; grate area, 40.8 sq. ft.

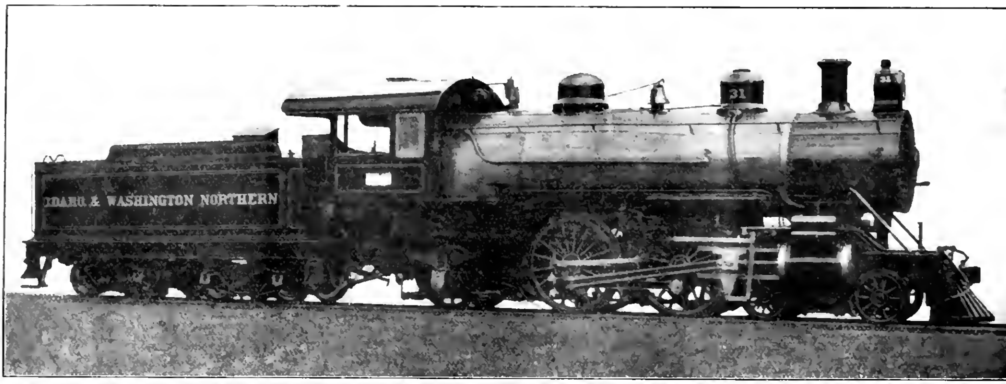
Driving Wheels—Diameter, outside, 73 ins.; journals, main, 9½ x 12 ins.; others, 9 x 12 ins.

Engine Truck Wheels—Diameter, front, 36 ins.; journals, 6 x 10 ins.; diameter, back, 48 ins. journals, 8 x 14 ins.

Wheel Base—Driving, 7 ft.; rigid, 15 ft. 6 ins.; total engine, 27 ft.; total engine and tender, 57 ft. 7¼ ins.

Weight—On driving wheels, 101,600 lbs.; on truck, front, 50,300 lbs.; on truck, back, 45,000 lbs.; total engine, 196,900 lbs.; total engine and tender, about 335,000 lbs.;

Tender—Wheels, diameter, 36 ins.; journals, 5½ x 10 ins.; tank capacity, 7,000 gals.; fuel capacity, 12 tons; service, passenger.



SIMPLE 4-4-2 FOR THE IDAHO & WASHINGTON NORTHERN RAILROAD.

P. T. O'Neill, General Foreman. Baldwin Locomotive Works, Builders.

Give Workmen Safe Banks.

There is no measure of legislation which wage earners are so much interested in as the establishing of postal savings banks in which a saving person of low degree may feel that the savings are absolutely safe. Thrifty workmen send millions of money abroad annually for deposit in banks that enjoy government security.

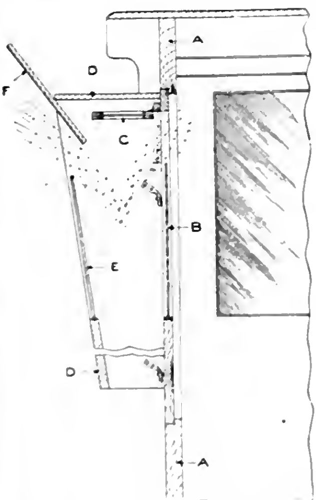
General Correspondence

Storm Guard For Engine Cab.

Editor:

I send you, for publication if you see fit, a sketch and description of storm guard, or protector, which I have invented and patented in the United States and Canada. It is intended for use on locomotive cabs and cupolas of conductors' cars on rear of freight trains, and also for other purposes.

The exacting conditions under which locomotive engineers of the present day perform their duties requires that they have a clear view ahead at all times, if schedule time is to be maintained, and all danger and other signals are to be correctly determined. At times it is impossible for human eyes to see ahead on account of weather and other conditions that prevent a clear view. With front windows of locomotive cabs equipped with the storm guard, or protector, it provides



SECTION OF QUICK'S STORM PROTECTOR

protection for the eyes from wind, rain, snow, hail, sleet, insects or other objects in the air which would cause injury to the eyes or obscure the view ahead. It also prevents the reflection of light inside of cab or cupola interfering with view ahead. Dirt and grime, darkening the windows of locomotives or motors that run through subways and tunnels is absent when such locomotives or motors are equipped with this guard or protector.

The advantages of seeing ahead under unfavorable conditions, without looking through glass are many. Condensation of moisture cannot take place on inside of guard or protector, as in all cases the man is not looking through glass. The danger of looking out of side windows of locomotive cabs, trying to get a partial view ahead, has been demonstrated repeatedly by the death or injury of the engineer.

The illustration shows a locomotive engineer sitting in the engine cab, with windows closed, protected from wind and storm, looking directly ahead, with a clear view against the storm, ready to meet any emergency that may arise, and being in a position to make schedule time just as safely in the storm as in clear weather, without taking chances of any kind.

Referring to the drawing, A represents a section of locomotive cab. B is the front window sash of cab, with top portion of glass cut away. C is a small window attached by hinges to top of sash B. D is the guard, or protector, removably attached to cab A or sash B. E is a windbreak, preferably made of glass or some transparent pane. F is a deflector set at a suitable angle.

The guard, or protector, D is removably attached to sash B when sash B opens outwardly, and swings open or shut with sash B. When B opens inwardly, the guard, or protector, is hinged to cab A, and, with suitable fastenings, swings independently of sash B. Sash C is opened and closed with suitable attachments. When in the closed position, it overlaps top of glass in sash B, which allows external air to rush upwardly across the inner surface of glass in sash C. By this means condensation on the inner side of glass in sash C is avoided and prevented from interfering with clear view through this glass when guard, or protector, is removed. In service, wind, rain, snow, hail, dirt or objects of any kind in the air strike the deflector and are thrown downward between windbreak and bottom portion of glass in sash B and out of the bottom of guard, or protector, which is open. The guard, or protector, has closed sides and top; the bottom is open. There is no draft into cab after suitable speed is attained. Instead of this, there is a light draft out of the cab, through opening in top of sash B. While standing, or while attaining suitable speed, or when going through snowdrifts, sash C should be closed. When suitable speed is attained, or when not in snowdrifts, sash C should be open.

I used this storm guard, or protector on the engine I ran during the last two winters and never knew what real comfort in a storm meant until I began its use. Should you see merit enough in my invention to have this appear in the columns of RAILWAY AND LOCOMOTIVE ENGINEERING, I shall be pleased. I will be

FRONT VIEW OF STORM PROTECTOR.

happy to give further particulars to any who write to me. T. J. QUIRK,

Dunkirk, N. Y. Loco. Engineer.

Old Timers.

Editor:

One of the most interesting features of your excellent publication is the reproduction of cuts of old time locomotives, the locomotives of those days being picturesque, if not effective, in strong contrast to the vast and ugly machines of the present day. But sometimes it grieves me to say you fall into slight error, as in the case of your preceding number, in regard to the "Old Colony" and "Narragansett" built for the O. C. R. R.

And in your January number, page 38, you have an excellent illustration of the "G. F. Ward," which was not built by William Mason, and was never nearer Taunton than the turn out switch of the Providence station. It was built by the Rhode Island Locomotive Works, from the designs of the late Augustus Durgin, and ran the Shore Line Express between Providence and New London for a long time. I myself constructed the whistle for her, at the request of Charlie Vars, who was the engineer, and who wanted something which would sound as a locomotive whistle should sound, and as it did sound. I have not heard of Charlie for several years. I hope he is still running. But if not, he must be where all good and faithful engineers finally bring up, a better place, no doubt, for the men who run the engines than that for the men who ran the engineers—a climate for the former not as high as that for the latter.

GEO. H. LLOYD.

Boston, Mass.

[Our correspondents who sent us the information concerning the "Old Colony" and the "G. F. Ward" will, no doubt, be glad to know the facts as stated by Mr. Lloyd. It is only by those who have personal knowledge of these old-time engines, coming forward with their information that a correct history can be built up.—EDITOR].

Early Days on the P. R. R.

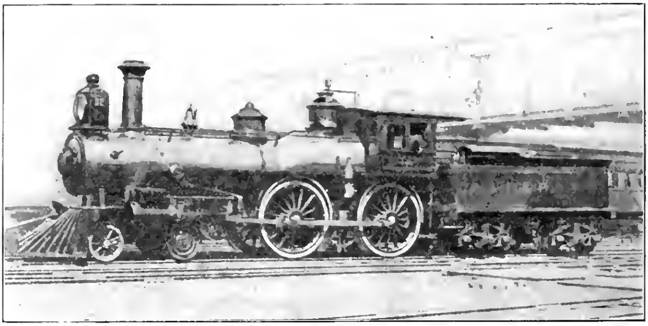
Editor:

I was much interested in an article signed by Hugh G. Boutell which appeared in the December number of your publication, entitled "Old Engines on the P. R. R." I spent a portion of my boyhood and young manhood on the main line of the P. R. R. between New York and Philadelphia and, like Mr. Boutell, I have always taken a lively interest in the locomotives of that system. It is the old engines which now appeal to me especially, as in later years, the P. R. R. engines have lost many of the earmarks which were distinctive. I send you herewith, a photograph taken in 1883 of a Pennsylvania "Class K" in front of the old Jersey City train shed, ready for her run to Philadelphia, which shows the "Pennsy" stack, wheel covers, which contain the sand-boxes, and short front. Later, however, these engines were all equipped with extension smoke-boxes. They were very fast and powerful engines for their time, were hard coal burners, good steamers and very easy riding.

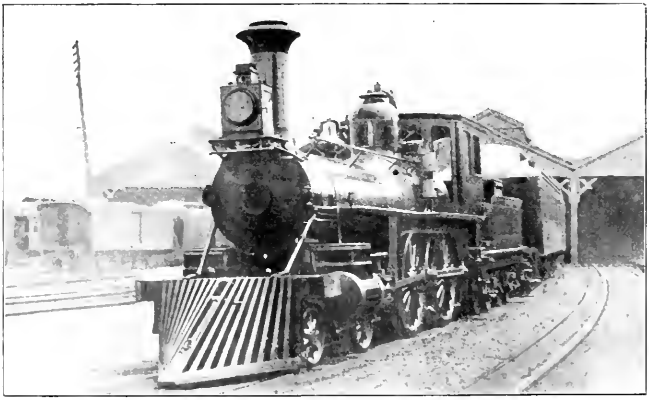
Some time in the early part of 1880, one of these engines, No. 10, made a record run with her train from Philadelphia to Jersey City, making a mile, near Metuchen, N. J., at the rate of 72 miles per hour, which I believe was claimed to be the fastest mile ever made by a railway train up to that time. John A. Covert, who later was engine foreman at Jersey City, was the engineer. I have not the statistics of this run, relying wholly on memory for the facts, so if any of your readers can furnish further information, I would be pleased to hear from them through the columns of RAILWAY AND LOCOMOTIVE ENGINEERING. I also send you a photograph of engine No. 32 of the New York Central, taken about 1885 in the yards of the Grand Central Station, New York. She is one of the "old timers" and probably some of your New York Central readers may be interested to see a picture of an old friend, as, at one time, the New York Central owned a large number of these locomotives. These pictures are old and faded but I sincerely trust you may be able to make use of them. Kindly return them when they have answered your purpose as I value them highly.

C. R. MACKEY.

St. Augustine, Fla.



OLD NO. 32 ON THE NEW YORK CENTRAL.



OLD TIMER ON P. R. R. SAND BOXES IN THE WHEEL COVERS.

A Fireman's Views.

Editor:

The proceedings of the Traveling Engineers' Association as given in your most valuable paper interest me greatly as much is said regarding fuel economy and other of our duties. It may be that the opinion of one who has ate the dust, dodged the call boy and made whole continents of black smoke may prove interesting to some of those whose papers interested me.

From the stories of our old engineers, those who have seen the locomotive grow from a little single driver pigmy to the giant Mallet compound, the cars from 10-ton "wagons" to 50-ton "battleships" and rails from 30-lb. ribbons to 100-lb. bands—these men say, the lot of the present-day fireman is a paradise to that which they went through. To my mind the difference may be compared much as these locomotives, cars and rails are. Polishing brass is of course one of the lost arts, but the coal space in the tanks has trebled.

Indeed, a whole engine of the by-gone days would find very comfortable winter-quarters in the tender of a modern "hog." So while we are not compelled to bury ourselves in the snow jacking up the drivers in order to work the pumps, we do have to keep every muscle and every organ in perfect condition to meet the requirement of passing 10 or 12 tons of coal over a deck vibrating at 60 miles per hour in the short space of from 3 to 6 hours on passenger, or 30 tons in from 10 to 16 hours on freight.

The amount of work, of course, varies with the man and his method. The "bank" fireman methodically blackens his fire until he uses about one-half the grate surface designed for the engine. The "hook-and-puddle" fireman, otherwise known as the "Wabasher," throws in about 30 scoops to a fire and then levels it with the hook. Of course, this mode is very beneficial—to the glove factories. The one who fires light and often, while he can't count quite so many telegraph poles between his fires, somehow or other, gets in fresher and with coal further up on the coal boards than the others. However, the laurels should go to the fellow who uses his brains, who suits his firing to the engine, to the grade and to the train, who grabs the precious lumps as the few poor lonely things try to escape by rattling off the gangway. This man does not have that prevailing style of tanks, cab-lights, headlights, etc., which always run over when they are full.

There are more things to be considered though than the saving of coal and supplies. The poor fellow who spoils a hook and new pair of "Hansen's" every trip may see around more of the curves on his side than the other fellows ever knew were there, and the one who spills oil from the headlight to the back drawbar may know more about the location of fixed signals than the engineer. Thus it is hard to distinguish the value of different firemen, although it can be estimated to some extent by observation and from records. Nearly four years behind the scoop, however, has convinced me that 90 per cent. of the boys make an honest effort to succeed, and with a little more encouragement and friendly instruction, they would.

Whole books might be written about our faults, but the volume could as easily be filled by the faults of our superiors. It is a well known fact that pay day is the most unhealthy time of the month, as the sick list is invariably long and thick, but don't that help to square up for that awful cold we got last winter when the road foreman made us work on an engine with a cab so full of steam from leaky gauge cocks, etc., that the fire-door had to be opened to find the way inside? Yes, it's so; we couldn't be found that last stormy night; but remember the night the engine dispatcher ran that guy with the good cigars around us to give him a light section? As will be seen there is a good bit of give and take connected with the fireman's life which, of course, looks bad, but may be a little more consideration of his annoyances would at least make the seamy side appear smoother.

Some estimate of a man's value may be obtained from the way in which he spends his leisure. Good reading and respectable companions are very commendable signs. "Tied to his wife's apron string" is an epithet which not always dooms a man to oblivion. Because a man goes to church, it is not a sign that he is trying to atone for past and present railroad sins.

Of course, that brilliant "smoky," who has worn a special notch in the hotel bar, is a wise head. Cinders fairly roll from him and with the advent of each drink information drops from him as the shell from a newly born chick; the only discrepancy in his exceedingly bright career being the dislike borne for him by the engineers in general, and their efforts to keep him from firing for them. But "there is so much bad in the best of us and so much good in the worst of us that it behooves none of us to talk about the rest of us."

Where courtesy and good fellowship between an officer and his employees exist, there you will find a model set of workmen. A cheery "Good morning," maybe, a short chat as the official passes his men has the same effect as a beautiful sunrise. Requests instead of demands work like a charm. At investigations and even when giving discipline this same courtesy stimulates in the hearts of all. An innate admiration and respect for their chief which can be created by no other method. This is a policy which ought to be a rule. By it the friction caused by so-called "superiority" would be greatly reduced and in the end it would become as much a dividend payer as the superheater, Walschaerts or the Baker-Pilliod valve gears and other like improvements.

I was much surprised to learn of the efficiency cards on the Lake Shore so nicely explained by our road foreman, Mr. C. E. Rush. I rather like this idea, although in many cases it is unfair both to the men and to the company. The card may show correctly the number of ton-miles-per-hour, but while Bill Jones goes over the road in seven hours with the lever on the center and the valves working square, Jack Dropherdown makes it in eight hours with the lever on the quarter and the exhaust sounding like a three legged jackass on cobble stones. Again there is a larger difference in engines, and the quality of coal ranges from first class real estate to flinty lumps which repel all attacks. Of course, when firemen are pooled, as we are, it would seem that the bitter and the sweet fill about equally, and it does to some extent, but not enough to give each man a fair show.

Taking all into consideration, though, these cards are a good thing, they should be posted every month instead of every year. Who wants to be the worst fireman on the road? The very thought of comparison urges one to greater effort. The weak ones are uncovered and it becomes definitely known who needs the most instruction. This is a very necessary cog in the big wheel. On these cards some of the good actions ought to appear, as well as the bad. If a man goes without a meal to keep a train on time, tell of it, if he does unusually well on a trip, make that known, if he keeps a leaky engine hot all trip long, tell of that. In other words make his good actions count with his bad ones. Give him a good fair chance.

The greatest help to a present day fireman is the Railroad Club houses. The description of those on the Southern Pacific in your last magazine almost influences me to go there after a job. The excellency of this club house plan is well known. Good billiard and pool tables, good books especially and maybe a model room, and the good fellowship which hovers over any such club, creates enough diversion and employment in the leisure hours to keep the boys away from the saloon and its influences. Contentment basks in the warm rays of good treatment and a clean wholesome bed in the nucleus of health and energy. The Railroad Club under proper management cannot help but produce a class of railroad boys better morally, physically and financially than their predecessors.

It will be thus apparent that, as stated in the article in your December number, the only profit accruing from these clubs is the increased efficiency of the men.

As a last argument I wish to bring out the importance of making such arrangements that, if possible, the men may be home as much as possible when off duty. Keep a man away from his home and family unnecessarily and he is likely to become a poor and discontented workman. Cause him to change his location with every phase of the moon and the effect is the same.

I am hopeful, and let me say in conclusion, I see in the near future the realization of my dreams. The world is growing better, the minds of its citizens broader and we railroaders are no exception. Both officers and men are looking more to each other's comforts and needs than ever before. Fairer treatment is in store for us and hand in hand with it goes the better effort which it necessarily brings. Improvement on both sides is still much in evidence, but the gaps are closing up and the time is not far distant when the railroad man will have a good job.

LAKE SHORE FIREMAN.

American Tourists on the G. I. P.

Editor:

A large party of tourists, with representatives from nearly every State in the Union, intent on seeing the sights of the world left New York on the S. S. *Cleveland* on Oct. 14 last, and after calling at several ports, including Egypt and arrived in Bombay harbor on Nov. 14. They numbered nearly 700 and of these a considerable number were naturally anxious to inspect the wonders of India and feast their eyes on the beautiful Taj Mahal at Agra.

To afford facilities the management of the Great Indian Peninsula Railway arranged a grand "day" trip from Bombay to Agra and back (nearly 1,700 miles), running two complete hotel trains at express speed. These trains were composed exclusively of vestibuled sleeping cars and restaurant. The natives of India are largely vegetarians and have little sympathy with the creature wants of Europeans or Americans, it is therefore necessary to carry practically all the provisions required by Western travelers on the trains, hence nearly 20 tons of meat, vegetables, bread, mineral water and ice accompanied each train on this excursion. There were 8 cooks, 22 waiters and 10 attendants besides the train crew and conductor on each special train. The running time allowed in each direction was about 32 hours, giving the tourists two complete nights rest in the train and on the down and up journey, and 12 hours of daylight at Agra.

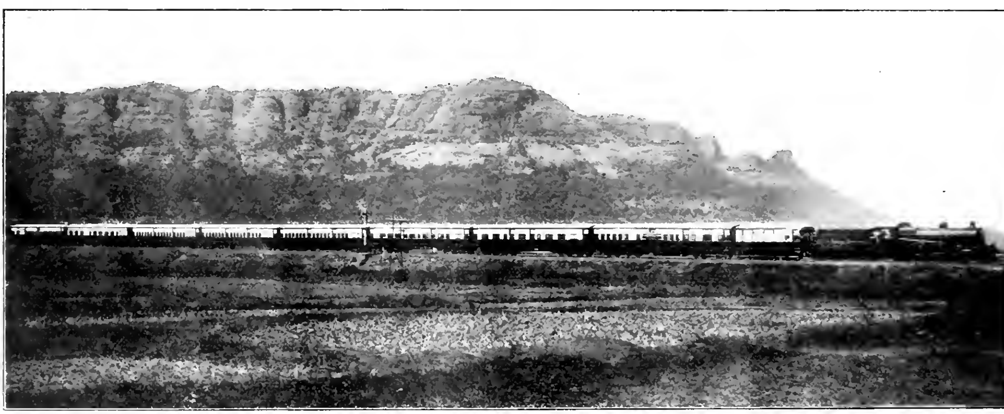
On return of these trains to Bombay another special excursion was arranged for an "Across India" tour, the cars being laid up at all the big cities called at to afford boarding accommodation for the visitors. The cars left Bombay on the eighteenth of November and proceeded via Agra, Delhi, Thanas and through Benares to Calcutta which city was reached on the twenty-fifth.

As the great bulk of the Indian passenger traffic is third class (some 300 millions per annum) it was necessary to make some temporary arrangements for the transport of so many additional first class passengers; further the want of accommodation for meals necessitated the use of vestibuled trains. One train was composed of compartment "sleepers" taken or withdrawn from ordinary services, but the other was composed of cars usually running as locals but built to form hospital (Red Cross) cars to meet the military requirements of the Government of India. These are large open cars 62 ft. long by 10 ft. wide and those selected were temporarily transformed into "sleepers" after the Pulman style with a center aisle. Each car had 24 berths and two toilet rooms with electric light and fans. All were vestibuled together with standard connections 3 ft. wide and a telephone service was installed to the restaurant. This last mentioned car was capable of seating 40, and to assist in the cooking and service an additional kitchen car was attached to bring up the rear of the train.

THE G. I. P. "TEDDY BEAR."

For the "Across India" train where the number of passengers exceeded 120 (3 sittings) an additional restaurant was put on. As a compliment to the visitors two of the locomotives used on the Bombay division were renamed "President Taft" and "Roosevelt," and as a mascot a "Teddy Bear" sat complacently on the bumper of each engine used to haul the trains over the long stretches of India soil. Great satisfaction was expressed voluntarily by the tourists at the considerate arrangements of the Great Indian Peninsula Railway authorities.

W. J. BELL.



SPECIAL HOTEL TRAIN ON THE G. I. P., RUN FOR AMERICAN TOURISTS.

Railway Signals.

Editor

The many good articles on the railway signal to be found in the columns of your valued publication lack in criticism. Honest criticism does not injure that which has merit; on the contrary it tends to improve.

With the object of improving, I shall, in this communication unsparingly criticise that, which, in my opinion, is wrong and unnecessary and advocate changes that I think would tend to better the signal system, trusting thereby to promote interest and discussion and eventually, improved conditions.

As bad weather conditions determine the value of all signals, it seems to me to be a waste of time and money to endeavor to design and place signals that can be seen a mile or more. A dense fog, heavy rain or snow storms will reduce the distance this signal can be seen to a few feet. On the other hand, a signal so designed and located that it can be easily seen and correctly read in bad weather conditions, will, without doubt, answer in clear weather.

Among the most important considerations is, of course, location. On roads three or more tracks wide, overhead bridges have become necessary, with the result that signals are too high. This compels the engine crew to give too much of their attention to the observance of overhead signals and to neglect other important duties. This is particularly the case when on high speed trains on a stretch of track protected by automatic signals less than a mile apart, when running on the inside tracks; or in open country, when familiar landmarks cannot be seen or dependable marks made. Under abovenamed conditions there is nothing left to do but look upwards almost continually, and in doing this, the gauges and track do not receive the attention they should. The air pump may stop or the injector break, and not be noticed as soon as it should be. It might be desirable to cut the engine back or drop a notch according to grade, consult the watch, etc. It is hardly safe to do either. A flagman on the track would be likely to be overlooked unless he made an unusual noise. Why? Simply because no man can look intently upwards and, at the same time, see what is on the track. In addition to this, a signal can, at times, be passed without being seen, when running in a dense fog. It can also easily be misinterpreted. At best, a glimpse is all that can be had, and all those who have had experience running an engine know that a light looks very small in the fog, if it cannot be seen until just at the moment when passing under it. This leaves a very narrow margin of safety; so much so, that it has often occurred to my mind that if the higher officials, the Interstate Commerce Commission, or even the traveling public knew the exact conditions, traffic would be stopped until a change could be made. This statement, I will admit, is radical and refers to the worst condition only, but it is true and can be proved by practical demonstrations. What is worse than all, is that conditions under which engineers must perform their duties are becoming more difficult daily, owing to the rapid increase in the number of signals and the increase in the size of the locomotives. The latter has more bearing on this subject than is apparent at first sight and can be best explained by stating that the design of the cab is such that the man running the engine cannot see all he should and too little attention is paid to comfort and convenience.

It occurs to me that every man running an engine and every experienced fireman looking forward to promotion should avail himself of the opportunity to express their views through the columns of your paper. The subject is not only of paramount interest to them, but is also of vital interest to the companies they work for. Any change for the better that can be made at the present time, means a saving in the future, and added safety and more satisfactory service.

G. I. P. 4-4-2, WHICH HAULED AMERICAN TOURIST TRAIN. TEDDY BEAR IN FRONT OF SMOKE BOX.

To remedy the above shortcomings I would suggest the lowering of all signals, a reduction in the number of signals and a design of the cab of the engine that would enable the crew to see all that is necessary through the cab door while running forward, and protect the engineer as much as possible against rain and storm and place him in a position of ease.

Design, color and meaning come next to location. Experience has demonstrated the superiority of the semaphore arm. Usually the home signal is of the square end pattern, and the distant signal is the fish tail type. On some roads these signals are painted to correspond with the color shown by the lamp when in stop (or caution) position, respectively. This is by far the best way, as it gives a color as well as form meaning, and tends to simplicity. To paint semaphore arms with a light color so that they may be seen from a greater distance, is sheer nonsense. It does not help in bad weather and is not needed in clear weather. The above design answers the purpose very nicely as long as the home signals are all of the absolute form, not to be passed unless proceed indication has been displayed or an order or clearance card has been issued. But where interlocking plants are located on stretches of track protected by automatic signals, where the home signal requires a stop and then permits a train to proceed carefully to the next home signal and the home signal of both interlocking and automatic bridges are the same, it tends to confusion and the best are at times liable to err. To place a small character or an extra signal on bridges to guard against mistakes, is only a half way measure, increasing the number of indications to be observed, which are already too numerous, without giving full protection. Better by far change the form, making one entirely different from the others.

The meaning of signals should be limited and all signals of the same type should in all cases mean exactly the same. This will increase in importance as the use of the signal increases. It is not far off when all important lines will be signalled from terminal to terminal and the permissive block will be abolished. A home signal should mean either stop or proceed, according to indication. As few in number as possible should be placed on a mast. A home signal fixed in stop position to denote any peculiar condition is unnecessary and should be removed. A distant signal should mean either proceed at full speed, at reduced speed, or stop at home signal. Two blades of the two position type would suffice at most interlocking plants. The top arm when in clear position to indicate full speed, whether for one or more routes. The lower arm to govern routes where it is desired to pass through the interlocking plant at reduced speed and still proceed, it being immaterial whether for one or more routes. Both arms to be in caution position when desired to stop the train at the home signal or permit it to pass through the interlocking plant at a very low rate of speed. The two or three indications should be all that is necessary to display for the conditions to be governed and if the electric, pneu-

MILITARY HOSPITAL CAR TEMPORARILY CONVERTED INTO A MODERN SLEEPER.

matic, or semi-automatic signal is in use, is perfectly safe and reliable. The latter condition would require an additional home signal indication. The two first named conditions would not need an additional home signal indication, and home signals could be obscured unless desired to stop a train that had passed a clear distant signal, when a very prominent or extraordinary signal to stop should be displayed, or given by sound, or if, under ordinary conditions a train is stopped and a home signal indication becomes necessary. But when everything is clear and a train has the right to proceed a distant signal indicating the speed is all that is necessary and all that should be used. This signal alone is depended upon to stop the train before passing the home signal; why, then, should it require from one to two more indications to proceed? In my opinion not enough use is made of the facilities a properly placed and designed distant signal affords.

First, it should be placed a sufficient distance from the home signal to insure a safe stopping of trains. It should be semi-automatic in order to cause it to go to caution position, as soon as the train has passed a given point close to it, and remain in this position until train has passed the home signal and signal man has again moved lever to clear it after having first given all routes and signals controlling this signal.

This would make it safe and reliable. It certainly would relieve the engine crew of considerable strain and unnecessary work and worry if this system was adopted. Another device that

ON THE GUATEMALA RAILROAD.

is greatly needed is some form of signal that will give warning when close to a signal when vision is restricted. This would be a time saving device, as too much time is lost at the present time hunting signals after caution signal has been passed. It would also decrease the liability of passing any signal unobserved.

Bad combinations also exist that could and should be changed. At terminals where one signal gives the right to move to the next, regardless of direction and switches and signals are numerous, some indication should be given of route to be taken. This would enable the engineer to make the proper calculations and move his train more promptly and with greater safety.

Another bad combination is to give a clear distant signal indication for a caution block indication. Either have the distant signal correspond with the home or stop the train. Most roads place a low speed restriction upon running on caution blocks. A train may be running on a clear block where a speed of from 30 to 60 miles an hour is permitted and receive a clear distant signal indication and a caution home signal indication. If home block indication cannot be seen until close to it an engineman may find himself running 40 or more miles an hour on track when a speed of 10 miles an hour or less is permissible. Most roads, however, do not permit passenger trains to accept a caution home signal indication without an order from the superintendent. Freight trains usually do not have this protection.

Some of the rules governing the use of signals could also be amended. If a strict observance of the rules is really desired, they should be plain and based on common sense. For instance, a rule, requiring a train to run on a caution block under perfect control so that it can be stopped within range of vision is wrong. No man can conform to this rule when his vision does not extend beyond the classification lamps (often the case), and haul a train of 3,000,000 or more pounds.

To do this successfully would mean to either stop and wait until fog cleared or flag ahead. Another rule requires, when running on an automatic signal block, looking for broken rails. A broken rail 99 times out of a 100 could not be seen from the cab. Rules of this kind are foolish and cause contempt for rules which they deserve. The engineer should not be placed in a position where he must assume responsibility for all accidents, whether within his power to prevent or not.

Conditions on a modern railway system have brought about a change unobserved by many. It has lessened the work and responsibility of some and increased that of others. Take a road, that runs on the signal system, such as the Pennsylvania, where a train of inferior class has a right to proceed on a signal displayed for a track assigned to traffic in the direction in which they are moving regardless of overdue superior class trains. What does it mean? Just this. The work and responsibility formerly assumed by the conductor is now assumed by the train dispatcher and signalman or operator. Consequently the latter is of far more importance than formerly. He also does a great deal of the flagman's work by protecting following trains by means of properly displaying signals and routing trains. This man has grave responsibilities to assume. He should be a cool, well-schooled railroad man with good pay and good working conditions.

Where traffic is dense and the track is protected by signals, flagging is a farce. Consequently, absolute blocks are necessary.

BRIDGES NEAR AUGA CALIENTE, GUATEMALA RAILROAD.

As to color for night indications: I believe white, green and red to be the best. Yellow it seems to me in the fog would be nothing but a dirty white, a hard light to see and more or less unreliable. But why not dispense with colored lights entirely. The World Signal Company, of Phillipsburg, Pa., have on the market today an illuminated background signal. This enables the position of the blade to be plainly seen at night as well as in daytime and is certainly superior to the present different colored night indications. This signal can be placed much lower on the overhead bridges than the present form of signal permits. It is a larger object to catch the eye. The light shines on the background and does not reflect its rays in the cab windows. It would do away with a large number of lights, and permit the engine crew to more readily observe the signals other than fixed signals, that might be given, a difficult task under present conditions on account of greater brilliancy of the fixed signal lamps. It would also dispense with signal failures on account of lamps not burning. It also promotes safety, as position of arm is the safest indication and the least liable to failure. It being much larger than a lamp it reduces the liability of passing it unobserved.

Div. 325.

Wilkinsburg.

Good Work by Apprentices.

Editor:

Enclosed you will find a picture of Pennsylvania engine No. 5166, that has just had a general overhauling at the P. B. & W. shops at Wilmington, Del. When this engine was taken into the shop she was what we call E.2.A. with the slide valve motion, and they changed her to what we call E.3.D. with the Walschaerts valve motion.

The work was done by eight apprentice boys with the assistance of their worthy foreman, Mr. L. P. B. Faust and his assistant, Mr. J. F. Feeney. The boys names are, reading from the left, H. E. Kalambacker, F. J. Thompson, (Foreman) L. P. B. Faust, (Assistant) J. F. Feeney, F. W. Lewis, C. V. Marshall, R. Pyle, T. Lajman, W. W. Rice and W. Appleton. This engine is a great credit to these boys, for after she had a trial, she was put into through service, and has not lost a trip. I hope you can find a place in the February issue for this picture and contents.

P. R. R. NO. 5166, AND GROUP OF APPRENTICES.

F. W. Lewis,
Locomotive Inspector,
P. B. & W. Shops.

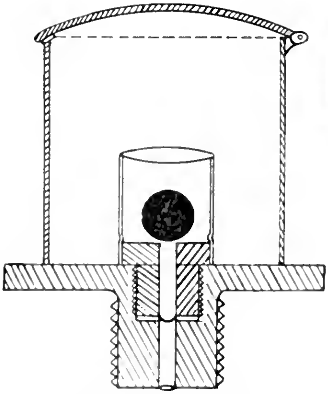
Wilmington, Del.

Self-Closing Oil Cup for Guides.

Editor:

It is a well known fact that the consumption of oil on a railway is a serious item. It is necessary that it should be closely watched in order to avoid waste as much as possible. I have noticed engines arrive at the roundhouse with oil dropping on the guide bars, owing to the needle not being closed down. The oil that remains in the cup drops on the guide and then to the floor and is wasted. I do not say the closing of the needle is omitted wilfully, but it does take place. The engineer may possibly have his attention directed to some important work or have to make out his report, and he thus omits to close the needle in the cup.

It will be seen by the enclosed sketch how the cup may be made to close itself. It is not necessary to make a new cup. Remove the needle in your old cup, bore a hole 1/2 in deep in the bottom for 5/8 in. screw. Take a piece of brass and turn one end down and screw 5/8 in.; bore a 3/16 in. hole through for oil to feed. Bore out the top (3/4 in. diam.) 1 in. deep; put 6 small holes round the bottom so oil can flow on the center. Place 1/2 in. ball inside, bore the bottom with a slight curve, and you will find that the ball will seat over the center of the 3/16 in. hole and prevent any leak of oil when the engine is at rest. As soon as the engine moves, the vibration of the machine causes the ball to move or roll about and oil drops through to the guide. By using this device the waste of oil on guide bars is reduced to a minimum.



SELF-CLOSING OIL CUP.

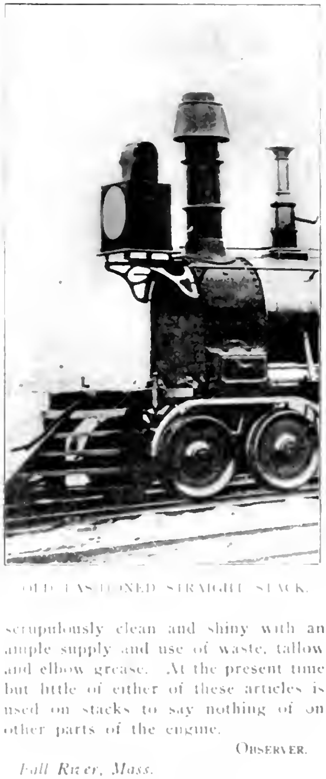
A. J. Varlow.

Fort William, Ont.

Old Timer with Straight Stack.

Editor:

We hear straight stacks spoken of as a "recent invention." It is not such. In the late 50's and early 60's stacks as shown in accompanying picture were used on the Old Colony. The "dicky" on the top was larger than the stack and open at the bottom, the theory being that air passing between the stack and "dicky" would have a tendency to give the smoke an upward motion to the relief of passengers. In connection with these stacks the Bullock spark catching device was used, the sparks falling into a sheet iron box midway between the frames and just in rear of the truck wheels. These stacks gave way to the "diamond stack," in 1865. The stack was painted black. The "dicky" and bands around the stack were a bright red and were kept scrupulously clean and shiny with an ample supply and use of waste, tallow and elbow grease. At the present time but little of either of these articles is used on stacks to say nothing of on other parts of the engine.



OLD FASHIONED STRAIGHT STACK.

Observer.

Fall River, Mass.

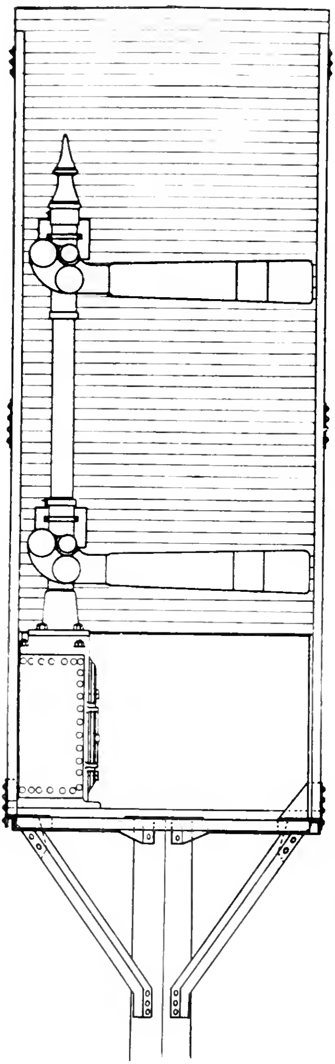
Predictions.

It is amusing to read the discussions in technical meetings long gone and the predictions concerning lines of progress. At the master mechanics' convention in 1883 a paper on Locomotives was read by Mr. F. W. Dean, a rising mechanical engineer.

Mr. Dean showed himself deeply enamored of the European style of locomotive, advocating the use of slab frames, plain, straight, domeless boilers, solid pistons and other novelties. He predicted that Joy's valve motion was destined to supersede the link motion.

The World System of Railway Signals.

In viewing a work of art such as a painting by some great master, the ordinary spectator, as a rule, is principally interested in what is shown in the foreground. In the brief description which



WORLD SIGNAL, FRONT VIEW.

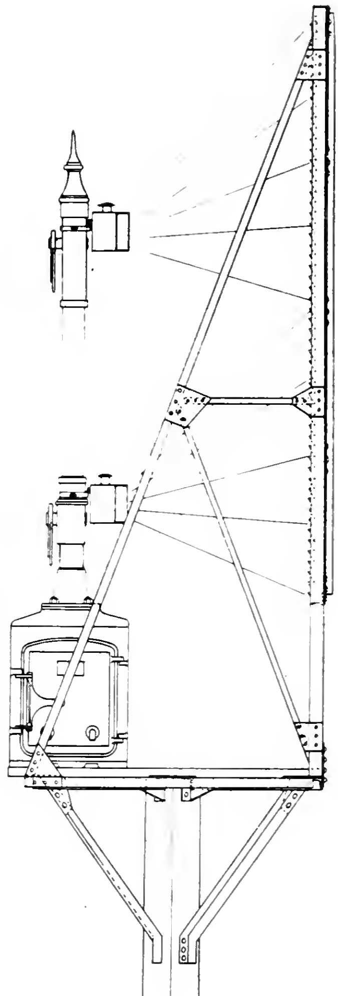
follows, of what may be called a work of art in railway signaling, it is the background upon which the interest of the reader must be concentrated. We have had so many letters from locomotive engineers, traveling engineers and others, in commendation of the system brought out by the World Signal Company of Philipsburg that we have pleasure this month in presenting to our readers an illustrated description of the very ingenious method of illuminating the background of this signal.

In the first place the World Signal system dispenses with colored lights, and as it depends upon the observation of the position of the signal arm either day or night, it is quite effective for men who are color weak or even color blind. In fact this system entirely does away with the necessity for the spectacle and the semaphore lens, but the heavy spectacle can be replaced, if desired, by a weight sufficient to bring the arm to the horizontal position in case of track circuit derangement or other form of failure. It also lends itself readily to the upper quadrant system.

As will be seen from our illustrations the background is placed several feet back of the semaphore arm. This allows room enough for a man to stand on the signal platform between the signal and the background, and in this way he is able to adjust the one or clean the other as occasion may require. The background is made of a series of horizontally placed metallic strips, usualy galvanized iron, painted white and coated with a flexible enamel paint. The background is therefore white; and the adhearance of snow and ice to its surface would in no way interfere with the usefulness of the background.

It is, as we have said, made up of metallic strips horizontally arranged and carried on a suitably braced frame, and on closer examination it will be found to have several interesting and useful features. In the first place the background which looks solid when viewed from a locomotive cab, has each of its parallel metallic strips inclined at an angle to the vertical. The angle at which the strips are set in such that light reflected from each strip would fall generally toward the track, and roughly speaking the whole background would appear brightest when viewed from below by an engineer on an approaching train. The angle at which the strips are placed has a tendency to cause any dirt or grime to settle on the back of the strips and thus always preserve the illuminated surfaces clean and bright. The open or Venetian blind effect produced by this arrangement of metallic slats is such as to greatly reduce the wind pressure upon the whole surface, with consequent economy in weight and in the supporting members.

Not only is the make up of the background itself very ingenious, but the method of its illumination has been worked out with an eye to practical details which has rendered the result produced most effective. The background is illuminated by means of a light which is more than half enclosed in a reflector. The direct light from the lamp, of course, falls upon the background and renders it bright, but the reflected light is handled in such a way that a somewhat brighter area of illumination is



WORLD SIGNAL, SIDE VIEW.

secured on that part of the background over which the moving end of the signal arm sweeps out its arc.

The reflector consists of a series of facets, one might almost liken them to the flat surfaces on a cut glass tumbler, but they are not necessarily of equal area and each facet stands at such an angle to the adjacent facets as has been found necessary to distribute the beams of reflected light where they will do most good. A glance at our engraving, Fig. 1, will show the parts of the background

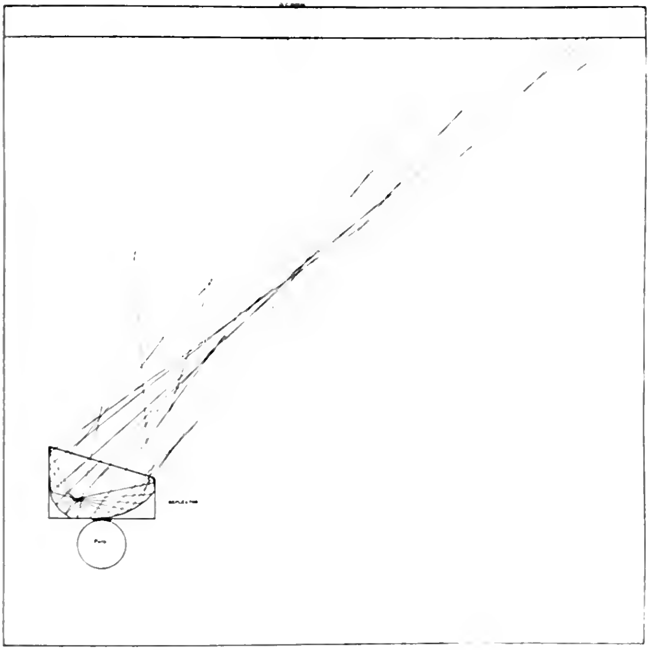


FIG. 1. PLAN OF REFLECTOR, SHOWING DIRECTION LIGHT RAYS.

which receive light from each of the facets of the reflector. We have here the entire surface of the background illuminated by the direct rays of the lamp, and this light falling on it is augmented by that from the numerous facets of the reflector, and, furthermore, the arrangement and angle of certain of the facets is such as to reinforce the light on that part of the background where the maximum motion, or consequently where the greatest evidence of position by the semaphore arm is shown.

The background with its white surface effectively marks out and conspicuously reveals the semaphore arm during the day. No natural or artificial surroundings can, by blur of color or similarity of form, detract from the stark staring individuality and meaning of the signal as it stands out in plain view. At night the very darkness surrounding, enhances the effectiveness of the carefully illuminated background, and like a shield charged with the heraldic ensignia of an ancient warrior, it attracts the eye singly and alone, without ambiguity of meaning, direct, definite and clear.

Among the advantages which this system of signaling possesses may be mentioned the fact that color is not depended on in any way, the day and night indications are identical. The system may be used on automatic or interlocking installations with equal facility, the whitening effect of snow and the cleaning action of rain tend to increase its effectiveness. There are no corrugated spectacle glasses to collect darkening snow or obscuring grime. During the two-fold round of the clock which makes the 24-hour railroad day, the signal with the white background has but one definite message to give unchanged as to form, and always in evidence, clear and beyond peradventure.

Engineer's Professional Services.

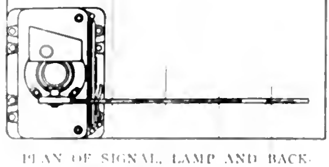
A minister of the gospel is the only professional man whose advice can be safely asked without the danger of receiving a stiff bill for "professional services." The mechanical engineer has just as good right to claim pay for advice rendered as has a lawyer or medical doctor, but nearly all persons interested in any mechanical question or device feel perfectly at liberty to consult a mechanical engineer without expecting to pay anything. This is particularly the case in respect to railway matters. We are compelled frequently to decline to answer questions sent in concerning inventions, because we consider that investigating the merits of inventions belongs [illegible] engineers who are trying to make a living in the business.

A good story was told of W. A. Sweet, a well known engineer of Syracuse, N. Y. Casually meeting a prominent lawyer one day, a long conversation followed, during the course of which Mr. Sweet happened to ask the Judge what he thought of some questions people were interested in, without meaning to ask for legal advice. Soon afterward Mr. Sweet received a bill from the Judge "for legal advice one thousand dollars," which was promptly paid without protest.

Time passed, and one day the Judge, who was heavily interested in salt manufacture, needed professional advice about some machinery which was not operating properly, so he asked Mr. Sweet to examine the machines and tell him what was wrong. Mr. Sweet looked them over for two or three hours and indicated what in his opinion was the cause of the trouble. When he went home he promptly sent to the Judge a bill, "for mechanical advice, fifteen hundred dollars." That charge was promptly paid, and the astute lawyer confessed that the law was sometimes beaten by mechanics.

The Popuar Locomotive.

All classes of railway men, from the president to the newest brakeman, are interested in the locomotive, and all of them like to talk knowingly about its design, construction and operation. Considering the difficulty of mastering the intricacies of this engine, its peculiarities are discussed very intelligently by men whose training has been of the most elementary character. The locomotive stands out a prominent figure



PLAN OF SIGNAL, LAMP AND BACKGROUND.

in railway operations, and the intelligence of high and low may be gauged by what they know about it. Operating officials can nearly always be induced to talk with a visitor when the subject of locomotives is introduced.

Railway Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances.

Published Monthly by

ANGUS SINCLAIR CO.

114 Liberty Street, New York.

Telephone, 984 Cortlandt.

Cable Address, "Loceng," N. Y. Glasgow, "Locoauto."

Business Department:
ANGUS SINCLAIR, D.E., Prest. and Treas.
JAMES KENNEDY, Vice-Prest. and Gen. Mgr.
HARRY A. KENNEY, Secretary.

Editorial Department:
ANGUS SINCLAIR, D.E., Editor.
GEORGE S. HODGINS, Managing Editor.
JAMES KENNEDY, Associate Editor.

Advertising Department:
JAS. R. PATERSON, Manager, Chicago.

Boston Representative:
S. I. CARPENTER, 170 Summer St., Boston, Mass.

London Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., 3 Amen Corner, Paternoster Row, London, E. C.

Glasgow Representative:
A. F. SINCLAIR, 49 Jamaica Street, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid in the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribe in a club, state the name of the agent.

Please give prompt notice when your paper fails to reach you regularly.

Entered at the Post Office, New York, as Second-class Mail Matter.

Attempts to Keep Steam Cylinders Hot.

Very early in the world's experience with the steam engine observing people saw that serious heat losses resulted from condensation of steam before it performed the work of actuating the piston or while it was performing that operation. The owners of mines, that had been rendered worthless through being flooded by water that animal power failed to pump out, did not grudge the expense of coal used to keep pumping engines at work, that being the first paying operations to which the primitive steam engines were applied. But when the steam engine came into service for driving mills and for other purposes, demand for economy soon arose and one of the first attempts in the line of economy was to keep the steam in vapor form until its work was done.

James Watt's famous invention of a separate condenser for the steam engine was devised for the purpose of preventing cylinder condensation, but it proved only partially effective. Another move of the same inventor for the prevention of loss by the steam turning prematurely into water was applying steam jackets to the cylinders. That invention had its advocates and its detractors, but it continues to be used on some engines today.

The high speed high pressure engines peculiarly American did not suffer so grievously from cylinder condensation as the ponderous slow moving engines so often found driving machinery in Europe, but the losses were heavy enough to enlist many inventors into the army of ingenious engineers striving to devise remedies. The locomotive, which is the most popular representative of high pressure, high speed engines suffered badly from cylinder condensation owing to the exposed position of steam chest and cylinders. It is no exaggeration to say that twenty-five per cent. of the steam generated in the boiler returns to water in the cool steam chests and cylinders without doing work. Many attempts to keep the cylinders hot were tried before the modern superheater appeared and some of the work done deserves commendation.

About 1876 George Richardson, inventor of the pop safety valve, and Frank F. Hemenway, for years afterwards editor of the *American Machinist*, carried on a series of experiments with heated jackets for locomotive cylinders. They ran a current of hot gases from the smoke box around the cylinders, obtaining a high degree of heat ranging from 400 to 600 degs. Fahr. That was considerably better than a steam jacket, and it ought not only to have arrested the steam condensation within the cylinders, but should have provided heat for slightly superheating the working steam. But a curious feature about the experiment was that the experimenters could determine no saving of steam or of heat. They could not make the engine do its work with less coal when the heater was in action than it used under ordinary conditions, so the attempt to save steam by heating the cylinders was abandoned. The writer has always felt that some unseen defect existed that neutralized the experiments.

M. Anatole Mallet, of France, whose name has become so familiar to Americans through his double ended locomotive made a great many experiments with the steam jacketing of compound locomotives and maintained as did other European locomotive engineers that the steam jackets promoted the efficiency of compound engines. The employment of superheaters has now, however, eliminated the troublesome steam jacket which very often, when defectively drained, became a condenser instead of a heater. While accepting the superheater as an effective preventor of condensation we should like very much to witness another attempt to keep the cylinders hot by means of gases passed from the smoke box.

Coal by Volume and Weight.

Coal purchased by railway companies is very often bought by weight, but it is usually measured out to engines by volume. There is supposed to be a definite relation existing between coal by weight and volume. That is, a cubic foot of coal is said to weigh a definite amount. As a matter of fact in actual daily life on a railway one finds that the relation varies. It may be much or it may be little, but there is always a certain discrepancy. Railway companies generally purchase what is called "run of mine" and they frequently use two or more kinds of coal at a locomotive station, so that the difference between weight and volume exists in a certain degree.

Coal may be bought by very carefully determined weights at the point of delivery. That is, the tare weight of the car may be determined each time a car is unloaded, and the tare weight which is painted on the car may be ignored in the interest of greater accuracy. This method, good as it undoubtedly is, does not eliminate two sources of error. One is that coal may have mixed with it a certain amount of snow in winter time and some coal may be lost between the point of delivery to the railway and the point where the car is unloaded. These sources of loss come ultimately on the mechanical department, for the weight purchased and paid for, is the weight assumed to be delivered to the locomotives. The variation between coal by weight and coal by volume may not be very great for any one engine. It is the cumulative effects which make up a discrepancy like the agent's fifty-ton error to which Mr. C. F. Luddington referred, in our January issue. These are the days when the matter of accurate coal accounting is being looked into. There are weighing hoppers on the market, the use of which would entirely eliminate this source of error.

We would like to hear from locomotive engineers on this subject of coal accounting. Many of them have suffered by reason of inaccurate methods and they may have suggestions to offer which would be not only interesting but valuable.

Elementary Industrial Education.

The discussion of mechanical and industrial education generally is receiving more than its natural share of attention from people assuming to themselves the duty of guiding public opinion. We have always advocated the promotion of education among those who need it most, the classes who gain their living by manual labor; but of late the advantages to this class of acquiring knowledge that has no relation to their business has been so much dilated upon that those most interested are becoming tired of being bored by would-be friends. They make believe that knowledge relating to the laws of friction is necessary to enable a youth to acquire the art of pushing a file straight and that the laws of hydrostatics would help a boiler maker to drive rivets properly.

In one of his books on firing, Angus Sinclair gives a good illustration of the relation between skill and knowledge. He says: "It is not essential that a man should know something about the science of combustion to become a first class fireman; but a knowledge of the science will often enable him to overcome difficulties and take a direct road to secure the best results in firing." Firing requires a combination of skill and knowledge; filing and riveting involve manipulative skill alone.

There is a growing demand for elementary industrial education in the public schools. In a speculative way, at least, the popular idea of an industrial education is that of one to be obtained at schools which aim to properly regulate the education of both mind and muscle. Undoubtedly the ideal industrial education, the one most likely to benefit its possessor, combines with practice a good deal of the knowledge of the practice and researches of others.

It is probably equally true that to be the most effective, the practice and what is usually called the theory should be blended rather than be come at separately by a sort of cramming process, first with one and then with the other. By the latter process the full advantage of neither are obtained, because one of the most important considerations is that that knowledge gained in one direction shall, in passing, show the needs of the other.

The technical or industrial school can without difficulty attend to the theoretical part by furnishing so far as known correct instruction, but there is no less need—rather there is much greater need—that the practical part shall be correct, and just here is where any system of industrial education in schools is quite likely to be wrong.

In other words, the practical part of the education of such schools may not unreasonably be supposed to be defective in one of its most important elements, viz: *lack of purpose*, or the setting up of incomplete purposes.

In the trades to which such an education leads up materials are worked to a purpose and those who work them, whether in the capacity of proprietors or workmen, do so in direct competition with others similarly engaged; hence the practical part of an industrial education should embrace working to a definite end, which is materially more than completing a task. Physicians tell us that needed exercise fails in its purpose when aimlessly pursued. So to a great extent will any system that aims to impart practical instruction through doing something for the mere sake of doing it.

There is not much room for the man who does even well, in a week, what another does in a day, and industrial education to be of substantial value must at the *same time* it teaches how to do a thing teach *how* to do it so as to *pay*. Unless it does this it is established on a wrong basis and creates impressions and forms habits never likely to be got rid of. While this may not be impossible in industrial schools, it is undoubtedly the most difficult problem connected with their successful working.

One of the advantages, so far, that those have who contrive to educate—in the commonly accepted sense of the term—themselves while pursuing their regular work, is that the practical part of their education has the element of completeness, and is blended in the most satisfactory way with the theoretical.

Education, under these circumstances, may not be so easy of accomplishment, but it never need lack in the way of comparative utility.

An intelligent mechanic related recently an experience which seems so exactly to the point of working with a definite purpose as to be worth preserving. Being desirous of learning mechanical drawing with special reference to his business—that of a foundry foreman—he applied to a professional teacher, from whom he received instruction for about two years. At the end of that time he knew, as he expressed it, just as much about making any practical use of his knowledge of drawing lines as he did in the beginning. Despairing of accomplishing anything, he discontinued his lessons, but fortunately happened to mention his lack of success to an acquaintance, who volunteered to assist him. His instructions were to make any sort of a rough sketch of some mould being made in the foundry—some thing he had some distinct reason for making a drawing of—which should be sufficient by the aid of his memory to fix the dimensions. This he did, and by repeating it was, in a few weeks, and with a very slight assistance from his friend, he was able to do all he had ever expected, and what two years' hard study had left him as much in the dark about as ever.

Old War Locomotive Engineers May Receive Pensions.

About twenty years ago, when LOCOMOTIVE ENGINEERING was young and there were many Civil War veterans about, whose hair was free from the white frost of time, we frequently published reminiscences of war time experiences from locomotive engineers who had taken active part in the fray. From these stories we received the impression that an engineer engaged in train moving in the theater of war operations passed through greater dangers than the men operating rifles. We are now glad to learn that there is some prospect of the nation treating the war locomotive engineers with some consideration.

A bill has been introduced in Congress enacting that all persons employed by the Quartermaster-General of the Army as locomotive engineers, under contract or otherwise, during the late war of the rebellion, or who were employed as locomotive engineers during such period by authority which is recognized by the War Department, and who rendered actual service as locomotive engineers for a period of ninety days or more and who were honorably relieved from such service, shall be held and considered to have been in the military service of, and to have formed a part of the military establishment of, the United States during the period each person so served, and that the Secretary of War be, and he is hereby, authorized and directed to enter upon the proper records of the War Department the names of all persons who are shown by the records of the office of the Quartermaster-General of the Army to have served as locomotive engineers for the period hereinbefore specified and to have been honorably relieved of such service. The purpose of that enactment is to make war locomotive engineers eligible to be placed upon the Government pension roll.

Cause of Railway Accidents.

The real, fundamental cause of railway accidents is to be found in the human element. This is the view of Mr. F. P. Roesch, master mechanic of the El Paso & Southwestern, as expressed at the annual meeting of the Railway Surgeons. Mr. Roesch said that in former years it was not uncommon to hear the statement that in proportion to the number of men engaged there were more fatalities on American railways than in any one battle in the Civil War. At the present time railroads afford greater safety to the passengers carried by them, than by any other means of transportation.

In support of this, Mr. Roesch pointed out that the Pennsylvania, the Burlington, the Santa Fe and the Chicago & North Western ran their passenger trains for the year ending June 30, 1909, without a single fatality to passengers. In 1908 the New York City street cars killed 444 persons and injured 30,000. With regard to steam railroads very few accidents can be set down to defective equipment. Railroads are still striving to further improve conditions by constantly adopting, at enormous outlay and expense, any new equipment or appliances which have stood the test and are proved to be efficient safety devices.

When one comes down to the only phase of railroad operation that so far has been beyond absolute control, the element of human fallibility stands out as the primary cause of accidents in ninety-nine cases out of every hundred. The whole matter, therefore, in Mr. Roesch's opinion, resolves itself into a campaign of education. Everyone connected with railroad work must be taught that he is a valuable cog in the railway machine, and that any failure on his part may jeopardize the lives of hundreds.

Mr. Roesch is emphatic in what he says of how to deal with the man who is habitually careless. RAILWAY AND LOCOMOTIVE ENGINEERING has always held that on a railroad the only rational system of operation is where everyone plays the game according to the rules, and in that game the chancetaker has no legitimate place. On this subject Mr. Roesch says: "The chancetaker, regardless of position, must be weeded out, and if he cannot be brought to a realization of his responsibility in any other manner, then statutory laws should be enacted and enforced, treating the proven chancetaker through whose carelessness, indifference or neglect others have been subject to injury, as a convicted criminal, as much so as one who commits a felonious assault.

"When men can be taught to realize that indifference to the safety of others may in the course of events some time place his own life or that of a member of his family in danger, a longer step will have been taken toward increased safety than all the mechanical appliances that can possibly be adopted."

The Choice of a Calling.

We are constantly in receipt of letters from young men asking advice on the subject of what, in our opinion, is the most likely department in railroad operation offering opportunities of advancement to earnest workers. We wish that we were able to point out the clear path to each individual seeker after light, but the task is an impossible one. It largely depends on the individual. Those whose youth has been spent without some experience in manual labor would find firing a locomotive to be a laborious occupation requiring more than ordinary physical strength and activity. Those who have reached manhood without any experience in machine shops would also find much difficulty in getting an opportunity of entering on an apprenticeship in any of the mechanical branches, and still more difficulty in securing sufficient compensation to meet living expenses while learning the particular trade they had chosen.

A large number of the youths of all countries spend some years in ineffectual beginnings at occupations. The knowledge they gain in this way is not altogether wasted, but it is better if the mind of the young lad can be directed toward some particular branch or department of human endeavor. Nature never errs. Her followers are wise. Lightly built lads who may be good at penmanship and clever at mathematics should not waste their time in sighing for the opportunity to move throttle levers. They should learn stenography, and to that add the correct use of words, and they will find a wide and growing field in several departments of railroad work.

For several years railroading, like many other occupations, has been overcrowded, but the future is full of promise. This is especially true of the expanding opportunities of the West and Southwest. New roads are being projected and will be shortly opened there with a degree of rapidity unparalleled in the history of the world. There is now and will continue to be a call for young men in these golden fields of opportunity. The strong, the accomplished, the self-reliant will be welcomed. The feeble, the unskilled and the unwilling will better stay at home.

In this connection we would urge with all the unction that we possess, that coincident with the physical equipment indispensable to the making of a successful railroad man, a careful study of the best books, a regular perusal of the best periodicals are absolutely essential to that fullness of information in regard to the complex mechanism and methods encountered in railroad operation, which the railroad man must acquire if he ever hopes to be other than an humble drudge.

If we had space to recount the thousands of testimonials that have come to us unasked proclaiming the belief that our publications have conduced to more promotions in the railroad service than all other similar causes put together, it would seem as first sight incredible; and we might be accused of egotism. As it is, we prefer to state modestly that what we have already done falls short of what we would wish to do. We cannot do better than to urge the young railroad man to follow in the footsteps of those who are older and perhaps wiser, to peruse our pages and study our books, and verily he will have his reward.

Test of Technical Training.

"I would have a first-class manual training school attached to every high school, college and university, and I would make attendance compulsory," so spoke Mr. W. C. Brown, president of the New York Central, to the students of Cornell on Founder's Day. Mr. Brown does not take a very rosy view of the future and fears that unless the important subject of technical education is adequately dealt with, this country will suffer severely from inability to cope with more progressive nations.

We pointed out in our December issue page 526, that the German method of technical education is the most advanced of any today. In Germany technical training is the goal toward which all lower forms of instruction are urged to strive. The lower grades in the various schools of that country face toward the ultimate technical instruction which the pupil must receive before he graduates. Mr. Brown, speaking of the German system, says:

"If we could accept Germany's system of technical training, her research and thoroughness and combine them with our inventions the combination would dominate the world. Without these fundamental qualities it is only a question of time when this country must surrender its place as a leader among the great manufacturing nations of the world. The failure to increase the production of nation's farms by increasing the number of bushels an acre is steadily and rapidly increasing the cost of living, and manufacturers, merchants and employers of labor of every class are scanning the future with an anxious eye, for the end does not seem in sight.

"The only possible solution, the only possible salvation for the country, is the immediate and most thorough awakening of our people to an appreciation for the overshadowing importance of the condition, followed by a systematic campaign of education."

Mr. Brown shares the opinions of Mr. James J. Hill, chairman of the Great Northern, as to one of the reasons why the cost of living has gone up in this country. The yield in bushels per cultivated acre is below what the land can be made to produce. In other words, these two railroad magnates regard the agricultural output of the United States as practically on half time.

The New York Central president was not content with merely pointing out what he considered the fault of our system; he outlined the remedy, but he went a step further and proposed to practically apply his method, confident as to results. He said the New York Central intended to buy two or three abandoned farms in New York State and get practically trained Cornell men to manage them. As soon as these farms have been brought up to what they should be, the company will sell them and buy others. This, he explained, was not philanthrophy and not simply a money making scheme. It was just plain common sense and would practically be a demonstration, in terms of material output, the value of technical training. Mr. Brown has the courage of his convictions. There has not often been made as clear and definite a proposal to test the value of trained men and the result will be watched with interest.

Machine Shop Economy.

An observable feature in railway machine shops is the close attention that is being given to economical details. This is especially noticeable in the lubrication of high speed machinery which requires a large supply of oil. It is of importance that the oil should not be allowed to run to waste after it has performed its work of lubrication, as it has lost comparatively little of its lubricating qualities and only requires to be carefully cleared of impurities to be used over and over again. In some of the larger shops what is known as a centrifugal separator is coming rapidly into use. This machine consists of a drum mounted on a vertical spindle, and may be rotated at a high speed. The oil that has served as a lubricant for shafting, or screw-cutting or other work may be readily conveyed to this machine, and the drum when set in motion has the effect of separating the oil from the grosser metallic or other particles with which it may be mixed, the oil flying outwards owing to the centrifigal force of the revolving drum, and the drum being surrounded by a casing, the oil strikes this casing and falls into a receptacle beneath, while the heavier, solid substances remain in the hollow shaped disk enclosed in the drum.

It seemed to us that this perfecting of the details of machine shop economy is carried to a finer degree of excellence in some of the Eastern shops than it is in America generally. This may partly arise from the fact that many of these shops have been longer in existence and have advanced in what may be called the lesser details. We noticed recently on the Boston and Maine railroad a systematic method of collecting oily waste in iron buckets of substantial construction, the buckets being furnished with legs and close fitting lids. The danger from fire is certainly lessened by not leaving loose and oily waste lying promiscuously around the shop. In the iron buckets if by any means the waste should ignite the combustion would necessarily be slow and readily detected. The accumulated waste mixed with saw dust and crude oil is very serviceable in lighting locomotive fires. These little economies may seem as trifling details, but in the aggregate they amount to a great deal when practised year after year.

Side-Rod Stresses.

Railway men are well aware that there is less breakage in the parallel rods of locomotive engines than formerly. This is gratifying to observe in spite of the cumulative stresses induced by increased tractive effort and higher steam pressure. The improved form of the parallel rod has much to do with this. A straight parallel bar, with a channel cut in each side of it, so that it is in cross section a double-flanged girder in miniature has the element of rigidity in a marked degree and far surpasses in every essential requsite the old rectangular rod of last century.

The stresses which a side rod has to endure are greater than are generally imagined. In a four-coupled engine, the adhesion being the same on all wheels, and the distance from the center of the coupling rod pins from the wheel center being the same as that of the main crank pin center from the center of the axle, the stress on the coupling rod will be equal to one half the pressure of the steam on the piston, the other half being met by the driving wheel in front. The pressure on a 20-in. piston at 180 lbs. per square inch amounts to 28 tons. A bar in tension with a sectional area of five inches would be sufficient to meet this pressure, but in the constant and ever-varying pressures exerted on a side rod embracing direct push and pull and all the various angles at which struts and braces may be set, the rod must be stiff enough to resist the tendency to bend. In addition to this the centrifugal stress is the most serious of all. At high velocities the circle described by the coupling rods being usually over two ft. in diameter, a velocity of 30 ft. per second is often exceeded in the motion of the rod. If we calculate the weight of the rod as approaching 300 lbs. the tendency to fly away from the crank pins would exceed four tons, and twice in each revolution of the rod will be in the same condition as a girder eight ft. in length, carrying a distributed load of four tons. This transverse stress has a constantly repeated tendency to break the rod.

It must also be borne in mind that there is an added stress in the compelling of all of the coupled wheels to revolve at the same speed, which they would not do if left uncoupled. This arises from several causes. They wear unequally. They slip irregularly. They are rarely equally loaded. In curving the conical formation of the rims induce varying velocities. The rods deprive the wheels of their individuality, and if we add to these cumulative causes of bending and fracture the fact that the crystallization of all metals is hastened by vibratory effects of rapid motion and variation in stress, some idea will be gained of the exacting nature of side-rod stresses.

The Air Brake Magazine, published at Meadville, Pa., appears in fine form and already extends to 80 pages. The publishers are peculiarly fortunate in beginning the publication with an excellent staff of editorial writers, all of them experts on the subject to which the magazine is devoted. The well known air brake authority Mr. F. F. Dukesmith is Editor in Chief. The subjects are discussed with marked ability.

Book Notices

Illustrated Technical Dictionary. By August Boshart, Vol. V and Vol. VI. Published by the McGraw-Hill Book Company, New York.

Two additional volumes of this important work are just issued and amply meet the expectation of the engineering world in regard to this modern cyclopedia of engineering. Each of these volumes contain nearly 900 pages and are illumined with about 2,000 illustrations. The book has already an international reputation, and is the first work of its kind giving the meanings and explanatory notes in six different languages. These are English, German, French, Russian, Italian and Spanish. Vol. V treats of Railway Construction and Operation and may be sold separately at $4.00. Vol. VI treats of Railway Rolling Stock and is sold at $3.00. It need hardly be stated that Mr. Boshart, the able compiler, has been assisted by a large number of the leading engineers of America and Europe. The method of classification and illustration is that adopted by the celebrated engineering writer, Mr. Alfred Schlomann, and these books are altogether an important and invaluable addition to the engineering literature of the twentieth century.

Practical Engineer's Pocket Book and Diary for 1910. Published by the Technical Publishing Co., London, England. Price, 50 cents.

The popularity of this diary is such that an ever increasing demand is manifested year by year for copies all over the world. It would be difficult indeed to think of an engineering subject which is not fully treated in its pages. Much new matter is added to the present volume, especially in the growing department of electricity. It is handsomely bound and, finished with strong india rubber clasp, is admirably suited for the pocket of the working engineer.

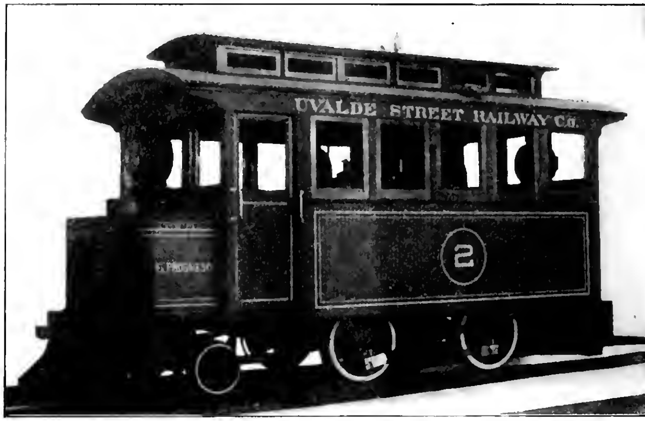
Report of the Proceedings of the Seventeenth Annual Convention of the International Railroad Blacksmiths' Association. Edited by A. L. Woodworth, Lima, Ohio.

The annual conventions of this Association are increasing in importance each year, and it is very gratifying to observe the wide range of subjects discussed, and the excellent degree of clearness with which the subjects are treated. The book is illustrated with a large number of folding plates and other drawings, and should meet with much popular favor among railroad blacksmiths generally, and among those having charge of blacksmithing operations particularly. Copies may be had from the Editor. Price, $1.50.

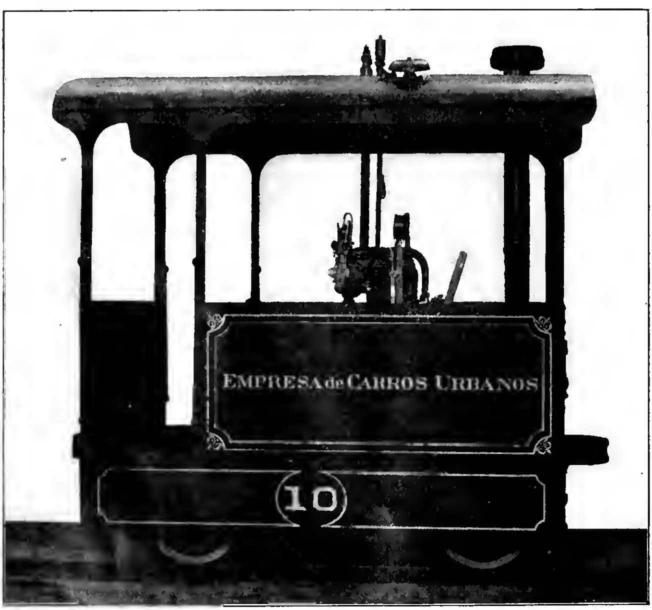
Steam Motors for Street Service.

Electricity has pretty nearly monopolized the street railway field, but not entirely if we may judge from two examples of steam motors recently turned out by the H. K. Porter Company of Pittsburg, Pa. One of these is a small motor, "Empresa de Carros Urbanos." The gauge of this road is the standard 56½ ins., and the weight of the machine is 6,200 lbs. The cylinders are 4½ x 8 ins.; driving wheels, with chilled tread, 18 ins. diameter; boiler pressure, 160 lbs.; tractive force, 1,220 lbs.; boiler, 18 ins. diameter; number of tubes, 22; diameter of tubes 1½ in.; length of tubes, 2 ft. 9 ins.; length of firebox, 16 ins.; width of firebox at top, 13½ ins.; width of firebox at bottom, 20 ins.; heating surface of tubes, 23 sq. ft.; heating surface of firebox, 8.88 sq. ft.; total heating surface, 31.88 sq. ft. The water tank is placed at the rear, and holds 60 gallons. Coke fuel, capacity 100 lbs. Six of this class of motor were recently exported to Guayaquil.

The other example is of a larger street railway motor, built for the Uvalde Street Railway Company of Texas. The gauge of the track is standard. The cylinders are 8 x 14 ins.; diameter of driving wheels, 30 ins.; weight of running order, 28,500 lbs.; weight on drivers, 20,000 lbs.; boiler pressure, 165 lbs.; tractive force, 4,174 lbs.; straight type boiler, diameter 32 ins.; number of tubes, 67; diameter of tubes, 1¾ in.; length of tubes, 4 ft. 9 ins.; length of firebox, 37 ins.; width of firebox at top and bottom, 26¾ ins.; heating surface of tubes, 143.2 sq. ft.; heating surface of firebox, 32.5 sq. ft.; total heating surface, 175.5 sq. ft.; water capacity, 300 gallons; coal capacity, 300 lbs.



STEAM MOTOR FOR STREET SERVICE, WITH PILOT AND HEADLAMP. H. K. PORTER CO.



H. K. PORTER CO. STEAM MOTOR FOR STREET RAILWAY SERVICE.

Railway or Railroad?

The structure consisting of rails on which cars are run is to most Americans a "railroad," but the practice of calling it a "railway" is growing, though slowly. That the word railway used almost universally in foreign English speaking countries is gaining favor among Americans, may be inferred from the number of technical and social organizations that have railway in their names. For many years "railway" publications have been much more common than those bearing the railroad device, and now we notice that our ancient friend the *Railroad Age Gazette* has changed railroad for railway.

The preference for railroad or railway is a matter of taste, but our own bias favors "railway." It is the shortest word, the most enphonious, the most easily articulated and at the same time quite as expressive as its rival. We could, however, content ourselves with either if some power would banish one of the names from use so that uniformity might prevail. We lose too much time in our writing moments turning up railroad directories to find out whether the authorized name of a company is railroad or railway.

The Valve-Setter's Guide.

The unexpected rush of orders for copies of James Kennedy's new book, "The Valve-Setter's Guide," is such that we have not been able to fill all of the orders as promptly as we would have wished. We are now in a position to meet the demand quickly, as the binders are supplying us with finished copies at a speed calculated to meet any emergency. The book is generally conceded to contain more matter in less bulk than any other work ever published on valve gearings. It is altogether the best and most substantially bound book that we have ever published at the price. Fifty cents per copy.

It is a good and safe rule to sojourn in every place as if you meant to spend your life there, never omitting an opportunity of doing a kindness, or speaking a true word, or making a friend.—*Ruskin.*

Applied Science Department

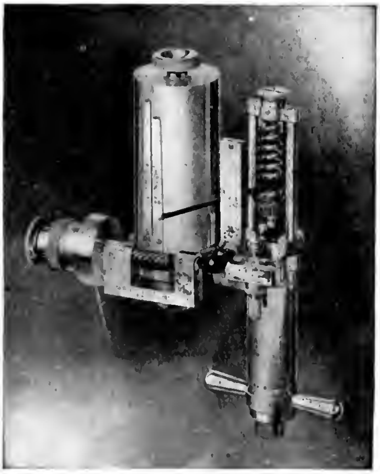
The Steam Indicator.

Among the many inventions of James Watt was the steam indicator, an instrument by which the action of the steam in the cylinder is accurately recorded on a piece of paper, the record being called an indicator diagram. It will be readily understood that it is of the utmost importance in the use of steam in the steam engine to know exactly the amount of pressure exerted on the face of the piston during the entire length of the stroke. Without the use of the indicator this cannot be correctly done.

As is shown in the accompanying illustration the indicator consists of a small cylinder upon which a spiral spring of known strength is coiled. A finely fitted piston is located in the bottom of the cylinder. Connections are made with the cylinder of the engine to be tested. This is usually done by having holes tapped into the engine cylinder near the extreme ends so that the movement of the piston in the engine cylinder cannot stop or interfere with the supply of steam to the indicator. The small pipes leading from the cylinder are attached to the indicator by a three-way cock. When steam is admitted into the cylinder of the indicator, the piston rises in the cylinder, the coils of the spring being closed in proportion to the amount of pressure on the piston. The piston rod passes up through the top of the indicator cylinder, and its extremity is connected with a swivel jointed connecting rod which engages a lever having mechanism for operating a pencil at its extreme end. It will thus be readily understood that as the steam pressure varies in the engine cylinder, the pressure being highest at the time that the valve is fully opened, the piston then rising to its fullest height in the indicator cylinder, and consequently when the supply of steam is shut off from the engine cylinder there will be a corresponding lowering of the piston in the indicator cylinder. The variations of steam pressure in the engine cylinder will thus be indicated by the rising and falling of the piston in the indicator cylinder, with a corresponding movement of the lever with pencil attachment already alluded to. It will be noted in the illustration that the distance between the piston rod connection where it is attached to the lever and the point of the lever to which the pencil is attached is about six times the distance that the piston connection is from the fulcrum. The movement of the pencil will therefore be six times that of the indicator piston.

It should be noted at this time that the indicator piston and rod and connections are usually made as light as possible, the piston rods in some of the best indicators being of hollow steel. The lightness of material has the effect of avoiding the accumulating force of momentum which is common to all heavy masses when in motion, the real value of the steam indicator being in its ready resiliency, corresponding to the ever-varying pressure. The movement of the spring must be a constant and unerring ratio to the force applied within the engine cylinder, otherwise it would be misleading in the record of its movements.

Coming to the point where the lever ends with pencil attachment it will be noted that there is another cylindrical attachment also furnished with a coiled spring. This cylinder or drum is adapted to admit of a piece of paper being rolled around its outer surface, and the coiled spring which the drum encloses is so arranged that the drum may be turned when sufficient force is applied to its periphery and the action of the coiled spring is such that the drum is pulled back to its original position when the moving force ceases. When the indicator is in operation the drum receives a circular motion from a cord, which is operated by the crosshead of the engine, and the attachments are so arranged that the drum will begin to move round just as the piston of the engine begins its stroke. The circular motion of the drum continues till the piston reaches the end of its stroke, when the cord ceasing to pull further the coiled spring impels the drum back to its original position.



INDICATOR WITH EXPOSED SPRING.

The coincident motion of the piston in the indicator cylinder with that of the drum upon which the paper is attached and on which the pencil is printing is such that the pencil will describe a diagram which represents the amount of pressure inside the cylinder of the engine at every point of its stroke. The motion for the paper drum is commonly and conveniently taken from the crosshead. There is no plan universally applicable, a common method long in use being to attach a reducing lever to the crosshead which is pivoted to a temporarily arranged plank or block of wood secured to the running board of the locomotive or in the case of a stationary engine the lever may be pivoted to a scantling braced from the top of the engine bed to the ceiling—any kind of arrangement that will present a suitable surface at the proper height. The careful adjustment of the cord that conveys the motion from the reducing lever to the drum is necessary, but the location of the point is not difficult, as it will be easily calculated by comparing the length of the stroke of the engine piston in inches with the length of diagram that is possible to be described.

Recent improvements have added greatly to the facility with which the indicator diagrams may be taken. The best form of indicator is now equipped with a reducing wheel which dispenses with the intermediary attachments on the crosshead, leading directly from the reducing wheel to the crosshead, the reduction of speed between the reducing wheel and drum being occasioned by the use of a spiral moving in gearing attached to the drum. Other improvements add to the accuracy of the instrument, a feature being the arrangement of the coiled spring in an open casing, thereby avoiding the heating effect caused by enclosing the spring in the cylinder to which the steam is admitted.

Our illustration shows a Tabor indicator made by the Ashcroft Manufacturing Co., page 105 of their catalogue.

A beautiful form is better than a beautiful face; a beautiful behavior is better than a beautiful form; it gives a higher pleasure than statues or pictures; it is the finest of the fine arts.—*Emerson.*

Celebrated Steam Engineers.

XXVI. John Fitch

The application of the steam engine to navigation has occupied the attention of many eminent engineers. We have already presented brief biographical sketches of some of these gifted men. More are yet to come. The question of priority has created much unnecessary discussion. After the perfecting of the steam engine by James Watt had been accomplished, it was only natural to expect that with the expansion of industries, and the call of necessity for more commodious and rapid transportation, the new and mighty machine would be applied to other purposes some of which were unthought of in Watt's time. Hence the locomotive, the steam hammer, the rock drill, the injector, the steam crane, and other devices.

In justice to John Fitch, one of the earliest and ablest American engineers, it must be admitted that his experiments in steam navigation antedate Watt's engine. He was born at Windsor, Conn., in 1743. He was totally ignorant of the fact that certain successful attempts at moving engines by the pressure of the atmosphere, superinduced by a vacuum created by the condensation of steam, had been already accomplished. In 1785 he produced his first engine. It was applied to a steamboat with paddle wheels. The entire mechanism was of brass with the exception of the paddle wheels which were of wood. So convincing was the success of his experiments that early in 1786, the State of New Jersey passed a law, giving Fitch, for fourteen years, the sole and exclusive right of navigating all kinds of boats which might be moved by the force of fire and steam in all the waters of the State. In the same year he made experiments on a skiff with a steam engine of three-inch cylinder, which moved a spirally arranged set of paddles, the endless chain, and several other modes, none of which were quite satisfactory.

New York and Pennsylvania both followed the example of New Jersey, and later, Virginia and Delaware, and in 1787 Fitch produced a larger boat, the engine of which was equipped with a twelve-inch cylinder. This craft was launched on the Delaware at Philadelphia, on August 22, 1787, and the inventor received the congratulations of the members of the National Convention then in session. Mr. Fitch continued his improvements on the steamboat, and in 1790 his steamboat made repeated trips between Philadelphia and Burlington, making the distance of twenty miles in three hours. During the summer of 1790 the steamboat traversed over 3,000 miles on the Delaware carrying passengers as far as Trenton, making three trips each week.

It is to be regretted that Fitch's repeated ventures were not as financially successful as might have been wished, and he carried his inventions to France and latterly to England. He came back to America, working his way as a common sailor. Among his last experiments was a steamboat he constructed out of a ship's yawl. This he launched on a pond in New York City, on the ground near where the Tombs prison now stands. The boat was driven by a screw propeller, and was acknowledged by the best engineering authorities to be a marked success in every way, and Fitch's failure to maintain and expand the real value of his remarkable inventions was the lack of capital, which, as may readily be imagined was an insurmountable difficulty at a time when the country had hardly begun to be opened up, and very few men had acquired any surplus wealth. It was by selling his own lands in Kentucky, which he had acquired as a surveying engineer, that he was enabled to demonstrate to the world the practicability of steam navigation. Fitch died in 1798. A rough stone without an inscription marks his grave at Bardstown. On the east wall at the north entrance to the capitol building at Hartford there is a bronze tablet commemorative of this fine engineer and inventor. The merits of his invention are undisputed, but it seems that he came ahead of his time, and he only succeeded in paving the way where others followed to fame and fortune.

Imperfections of Puddled Iron.

Defining the broad distinctive character of wrought or bar iron and cast homogeneous iron or steel in his autobiography, the late Sir Henry Bessemer remarks that a merchant bar produced by a number of puddle bars being welded and rolled into one appears to the eye, and is supposed, to have all its separate parts united so as to form an indivisible mass. But he points out that this is not so. "I have never seen," he says, "a bar of wrought iron produced by puddling that, in two or three minutes, by a very simple treatment, I could not separate more or less perfectly into its component bars, which are in reality never thoroughly united, although they adhere more or less soundly." Referring to the far-famed Lowmoor and other Yorkshire irons, Bessemer remarks that it may be supposed that these are exempt from this defect, the simple fact, on the contrary, being that "best-best" iron has been piled more times than common iron, and the result of working it at a temperature that will not continue the welding process only divides it into more numerous filaments than a bar of common iron. He recounts how the head of a great Yorkshire firm, famed among bar iron makers, who called at his works, scouted the idea of disintegration of any bar-iron made by his firm by simply working it at a temperature below welding heat, but on one of his bars being hammered he was utterly astonished at it dividing for about a foot of its length into a mass of fibres "forming a veritable birch-broom." Sir Henry Bessemer also mentions that a bar of Bessemer mild steel, similar to the two bars of 1 in. square iron referred to above, were heated at the same temperature under the same hammer; but it simply became extended into a flat undivided surface, without a crack or rift in the material. He comments that these examples of forging below a welding heat serve to show the imperfection inevitable to all puddled or welded iron; while the steel example also shows the continuity of parts resulting from the Bessemer steel or homogeneous iron being formed into an ingot while the metal is in a fluid state, hence producing an undivided and indivisible mass, however much it may be hammered, hot or cold.

Questions Answered

FORGING FINE SWORDS.

9. A. B. Y., Morristown, N. J., writes: As you discuss all questions of an engineering character, I make free to ask if such swords as Damascus blades have ever been forged by modern blacksmiths?—A. Modern blacksmiths can do as good forging and tempering as ever was done, and modern metallurgists have produced steel of a fineness that the ancients never equalled.

BURNING TOO MUCH COAL.

10. R. H. F., Chicago, writes: I wish to obtain your advice or that of your practical readers about an engine that is burning too much coal. The engine, a Rogers, with cylinders 18 x 24 ins., had a broken frame which was replaced by a frame from another engine, but now she burns 95 lbs. of coal to the mile on a certain grade which used to be got up on 49 lbs. to the mile. She now burns holes in the fire, whereas formerly the fire was burned evenly. A bush was formerly used in the nozzle making it 5 ins. diameter, but that was removed and now the nozzle is 5¾ ins. diameter, yet she devours the coal. What would you advise?—A. This is a very puzzling case. We should first advise that you experiment with the draft appliances in the front end until the fire burns level. We have known a few rare

cases where nozzles were made so large that they decreased compression, thereby wasting steam. In the line of experiment the reduced size of nozzle might be tried. We wish to have our readers express their views on this question.

---

11. A. J. B., Batesville, Ark., writes: Please give me the temperature of steam for different pressures. I have seen a table somewhere but have lost it.—A. The table you require is generally to be found in some engineer's pocketbook, such as Kent's. The table is called the "Properties of Saturated Steam." The temperature of steam at atmospheric pressure is 212 degs. F., at 80 lbs. pressure it is 323.9 degs., at 100 lbs. it is 337.8 degs. F., at 150 lbs. it is 365 degs. F., and at 200 lbs. 387.7 degs. F. All the other pressures and temperatures may be found in the table. What we have quoted here are the pressures as shown on a steam gauge. The absolute pressure is 14.7 lbs. below, each as 14.7 lbs. is the pressure of the atmosphere at the sea level.

HAULAGE CAPACITY.

12. C. L., Yonkers, N. Y., writes: One of the trainmen on the Ulster & Delaware informed me that while three of their engines coupled together could haul a train of thirteen passenger cars up the grade, yet not one of these three could singly pull four of the same cars up. What is the explanation of this?—A. We do not think you were correctly informed on this matter. There is nothing to make an engine become more powerful simply by being used in conjunction with others. There is, of course in nearly all cases of grade climbing, a margin of power, that is, an engine is not usually taxed to the very last ounce. It can pull the train up, and perhaps a trifle more—not another car perhaps, but a trifle more. It might so happen that the margin of power in the case of these three engines amounted to the haulage of one car. In any case it is not likely that each of these engines exactly equalled the others in haulage capacity, and weather conditions may have been different on the occasion when one engine and the three were used, and engineers handle their engines differently.

TO REMEDY CLOUDED GLASS.

13. Fireman, Washington, D. C., writes: There is some leakage of steam from the stuffing boxes and other parts of the engine that earns my livelihood, and the windows are often badly obscured. Can you tell me of a remedy?—A. Put a thin coating of glycerine upon both sides of the window glass. That will prevent the misty moisture from adhering to the glass. When dust collects on the glycerine coating, all you have to do is to clean the glass and put on a new coating of the glycerine.

TENDENCY OF CURVED TUBES TO STRAIGHTEN.

14. Novice, Wilmington, Del., writes: I have noticed that the tubes used in gauges to indicate pressure by their tendency to straighten out are of elliptical section. Would a round tube not act as well? If it would do as well it would be stronger than in the elliptical or rectangular form.—A. A round tube would have no tendency to straighten out. It has been tested repeatedly.

PRESSURE OF STEAM IN PIPES.

15. J. M. K., McKeesport, Pa., asks: Does the pressure of steam remain the same at the extreme end of a long pipe, say 40 ft., as it does near the boiler?—A. If the pipe is placed horizontally the pressure will be the same at all points. If the pipe is placed vertically the pressure will be slightly greatest at the bottom owing to the weight of the column of steam in the pipe.

MUD RING CORNERS AND GRATES.

16. M. M., Chicago, writes: Why could not the mud ring be made with a long radius at the corners of the firebox, say 12 ins., and have a drop grate at back end of firebox the same as the front?—A. The round corners of the size alluded to would take away considerable heating surface and decrease the grate area without any apparent gain. An extra drop grate would save a little work, but would require extra shafting and connections and would not be much used. There are already as many attachments on the shaking grates as can well be taken care of.

The term "coefficient of friction" is an expression which indicates the proportion which resistance to sliding bears to the force which presses the surfaces together. There is little friction when this amounts to only one-twentieth; it is moderate when it is one-tenth, and it is very high when it is a quarter or twenty-five per cent. of the force which presses the surfaces together.

Following are the number of long tons of different weight steel rails, required to lay one mile of track: 30 pound, 47 tons; 40 pound, 63 tons; 50 pound, 79 tons; 60 pound, 94 tons; 65 pound, 102 tons; 70 pound, 110 tons; 75 pound, 118 tons; 80 pound, 126 tons; 90 pound, 141 tons; 100, 175 tons.

Patents and Their Cost.

Last year the United States Patent Office issued 33,514 patents, reissued 168 patents, and registered 6,029 trade-marks, labels, and prints. During that time 22,328 patents expired. The expenses of the office for the year were $1,712,303 and the receipts $1,896,848. Last year's balance, together with that of former years, leaves to the credit of the office in the United States Treasury, $6,890,720. Special attention is now being given to the classification of the 915,000 United States' patents, to the 2,000,000 foreign patents, and to the 85,000 volumes in the library. When this work is accomplished it is expected that the expense of examining applications will be reduced by one-third, and that the character of the work will be improved.

The present method of operating the Patent Office imposes an unnecessary tax upon inventors for which there is no excuse. With all the surplus income derived from patentees the office is entirely inadequate for the business and its inconvenience has been the subject of complaint for years but Congress has always turned a deaf ear to complaints.

In the course of its progress through the office, up to the issue and mailing of a patent, an application passes through the hands of fifty-two persons. An applicant pays $15 to have his claim examined, and in case he is granted a patent an additional fee of $20 is required. Attorneys charge from $25 up, according to the work demanded by the cases, and as the applications number about 40,000 yearly it will be seen that there is a good deal of money to be divided among the patent lawyers whose signs cover the faces of the buildings in the vicinity of the Patent Office. An inventor is not required to employ an attorney, but probably ninety-nine out of a hundred do. In simple cases, where there is no interference with prior claims, an inventor can almost as well deal direct with the government, but in most cases the knowledge of the lawyer is valuable. He can study other inventions in the same line, and knows how to make the claim of his client broad enough to cover all that is new and valuable, and not so broad as to be rejected.

Change of Tune.

When Frank S. Gannon was on the Southern Railroad he had a particularly efficient car porter named Enoch Strong. Enoch was something of a dude but coal black and chronically merry.

Enoch got married one day and after a time Mr. Gannon noticed that his porter had lost much of his vivacity.

"What's the matter with you Enoch, doesn't married life agree with you?"

"Yer see Mas Gannon," replied Enoch, "Yer see befo' we was married, when I wen' to see Chloe, who is a yaller girl, she would shout 'Come right in honey and plant me down on de lounge.'"

"Now when she hear me open de gate, she shout, 'clean off dem shoes befo' you open de dore, you black nigger'"

Air Brake Department

Conducted by G. W. Kiehm

K Triple Valve Tests.

In the September, 1909, issue attention was called to the fact that a reliable record of the performance of type K triple valves was obtained during a series of demonstrations on the Southern Pacific Railway.

The actual value of this type of triple valve must be determined by a comparison with the older type H valve, and the quick service, uniform release and uniform rechange type of triple valve is now so well known that a review of the train brake operating conditions which necessitated the use of this type of triple valve can now be omitted, but we have placed a few of the principal results of those tests in a tabulated form from which the advantage of the use of those triple valves can be readily noted.

The train which was used in conducting the tests was composed of 80 oil cars having over 3,700 ft. of brake pipe and hose connections, cars fitted with 10-in. brake cylinders and with both K and H triple valves in a manner that either type could be used by simply cutting the other out, thus a test of one type could be immediately followed by a test of the other, thereby obtaining the same conditions of rail, weather, etc., during a comparative demonstration, or, both types could be mixed or used at the same time, that is, type K triples could be operated among H triples to show the beneficial effect of K valves when used among H valves.

The advantage of the quick-service feature becomes apparent in the following table which shows the time required for different brake pipe reductions to travel through the brake pipe of the 80-car train.

The 1st, 25th, 50th and 80th cars had pressure recorders attached to their brake cylinders during this test and they were electrically connected to the brake valve on the locomotive, thus this time in movement is accurately recorded.

The letter H means type H triple valves, K and H means one-half H and one-half K triples. K means type K triple valves alone.

The time in seconds for the reduction to travel to the different numbered cars is measured from the movement of the brake valve handle.

While the table represents the time required to move the brake pistons, the time required for the brake to do work, that is, to get the pistons out 6 ins. (10 or 12 lbs. cylinder pressure) is somewhat longer, but the K triple valves maintained about the same ratio, doing the work in one-half the time required by H triple valves.

The principal object of the quick service is a desire to apply the brakes on the rear end of a long train and get them to do work before the slack can run in or before the brakes are applied heavily on the front end.

TABLE 1.

Type of Triple.	25th Car.	50th Car.	80th Car.
5-LB. REDUCTION.			
H	8.5 seconds.	.... seconds.	.... seconds.
K and H	6.0 "	13.3 "	21.2 "
K	3.3 "	8.7 "	13.0 "
10-LB. REDUCTION.			
H	4.6 seconds	16.4 seconds.	27.7 seconds.
K and H	5.9 "	12.8 "	15.5 "
K	3.4 "	9.2 "	13.0 "
15-LB. REDUCTION.			
H	5.6 seconds.	17.0 seconds.	30.2 seconds.
K and H	4.0 "	11.7 "	17.0 "
K	3.3 "	8.8 "	12.8 "
25-LB. REDUCTION.			
H	5.5 seconds.	18.8 seconds.	29.0 seconds.
K and H	4.7 "	11.5 "	15.0 "
K	3.0 "	5.3 "	8.0 "

TABLE 2.

Triple valve.	1st car.	25th car	50th car.	80th car.
5-LB. REDUCTION.				
H	8.0 seconds.	... seconds.	.... seconds.	.... seconds.
K and H	6.0 "	30.0 "	47.0 "	51.0 "
K	3.8 "	16.0 "	28.0 "	29.8 "
10-LB. REDUCTION.				
H	8.7 seconds	30.0 seconds.	34.0 seconds	49.0 seconds
K and H	4.5 "	20.0 "	24.0 "	27.0 "
K	3.6 "	12.7 "	18.7 "	21.5 "
15-LB. REDUCTION.				
H	9.0 seconds.	27.5 seconds.	35.0 seconds.	45.0 seconds.
K and H	5.0 "	16.0 "	21.2 "	30.0 "
K	5.4 "	12.8 "	14.5 "	21.5 "
25-LB. REDUCTION				
H	9.0 seconds.	27.5 seconds.	35.0 seconds.	44.5 seconds.
K and H	6.8 "	14.2 "	24.4 "	25.5 "
K	2.7 "	12.3 "	16.0 "	10.0 "

The second table shows time in seconds from the movement of the valve handle until the brake is doing work.

The running demonstrations will show the value of each type of triple valve in actual service, some of the stops with the 80-car train are as follows: Brake pipe pressure 80 lbs., average piston travel 6.78 ins. track level.

In the Table No. 3, ft. is distance in feet of the stop and M. P. H. is speed in miles per hour.

In the table it will be noticed that when K triple valves were used a 5-lb. reduction stopped the train from a speed of 30 miles per hour in 1,700 ft., while with H triple valves a stop from 30 miles per hour was made in 1,725 ft. by a 20-lb. reduction, to replace the volume of air required by each type of triple valve in stopping the train the number of strokes of the cross-compound pump were counted.

It required 474 single strokes of the compressor to restore the air pressure used by H triples in stopping the train and 122 single strokes to replace the air used by K triple valves in stopping the train.

The chief consideration here is not the money value of compressed air or the saving in wear and tear on the compressor, but rather the matter of controlling trains on grades with the least possible reduction from the stored volume.

The chief object in printing Tables 1 and 2 is to show the time required for the brake pipe reductions to travel through or to accomplish anything in long trains, rather than to dwell upon the superiority of this type of triple valve which at this time is very well known and appreciated.

These tables form a very useful record of what might be called the speed of application.

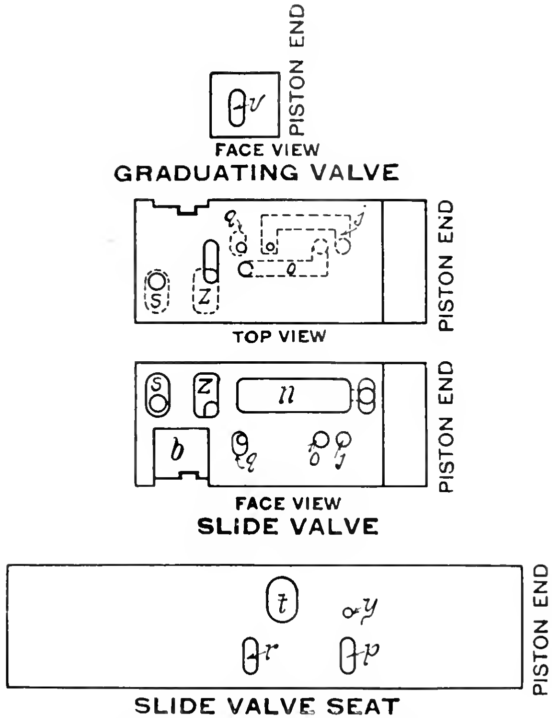
Air Brake Study.

Air brake instruction is not always given the consideration it deserves, some railroad officials seem to think that their engineers and trainmen know enough about the air brake to get along, and that an air brake instructor is an unnecessary expense. In other cases officials are not satisfied with such conditions and insist upon instruction and examination, and even in such cases instruction is of very little consequence if there are no students, but if the engineers or trainmen on any division of a railroad are interested in air brake matters and desire to keep in touch with new features of the equipment, the air brake instructor is invaluable.

The most valuable instructor is not always the man with the most fluent speech, and the most profitable instruction is not always delivered in the instruction car, for when the student meets the instructor along the line of the road or privately he feels free to ask questions concerning matters he is not entirely familiar with and in this manner the student often receives information that he will retain, while the volume of information given in the course of a number of lectures is often quickly forgotten.

To be able to impart to others the knowledge that comes from a study of the air brake requires patience, perseverance, tact and a quickness of thought, it is a faculty natural, rather than acquired. If a study of the air brake was taken up by everyone who has to deal with it on a railroad and every man became an expert, there would still be work for the air brake instructor, for if every human being on the face of the earth were suddenly brought to a full realization of the object of his creation and would depart from his evil ways, there would still be occasion for teaching, for we forget and are replaced by another generation, and if every man on the railroad was a student there is no assurance that those following us would be students.

Instead of ideal conditions existing, it is seldom that an engineer or trainman is found who makes a constant study of the air brake and becomes so familiar with it that he can be depended upon to get the best possible results at all times and under all conditions, regardless of the equipment used, and when one is found it is quite likely that he is also familiar with other parts of the locomotive and knows exactly what to do in cases of emergency; thus others hear of him, go to him for advice, ask for his opinions, and his superior officers hear of him and discover the fact that he would be a more valuable man elsewhere.



SLIDE VALVE, SEAT AND GRADUATING VALVE.

Everything written on the subject of air brakes is not intended as instruction or explanation; very much is written in a manner calculated to develop thought and study, and is intended for those who already know the construction and operation of the brake, and very often the student begins in the middle instead of the beginning, that is, he attempts to learn the defects the brake is liable to develop before he learns the operation and construction thoroughly.

In contemplating a study of the air brake it should be remembered that it will simplify matters considerably and shorten the distance to the object to be attained, if the subject is taken up by stages, that is, if each part is first subjected to the question "Why is it used?" then "What it does," and "How it does it," leaving the defects the part is liable to develop for a later consideration.

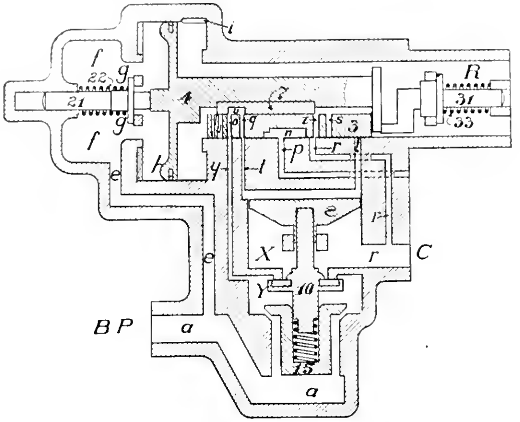
Applying those questions to the brake valve as an illustration, first, why is it used. In order to answer the question it would be necessary to go into the history of the brake to a certain extent and explain the use of the three-way cock in connection with the straight air brake and the automatic brake, and the necessity for accurate and graduated reductions of brake pipe pressure will show the reasons for its use.

TABLE 3

Triple valve	15 M. P. H.	20 M. P. H.	25 M. P. H.	30 M. P. H.
5 LB. REDUCTION				
H	1,500 ft.	2,275 ft.	3,200 ft.	1,138 ft.
K and H	[illegible] "	970 "	1,350 "	1,915 "
K	575 "	875 "	1,238 "	1,700 "
10 LB. REDUCTION				
H	560 ft.	800 ft.	1,310 ft.	1,800 ft.
K and H	500 "	735 "	[illegible] "	1,275 "
K	400 "	595 "	825 "	1,000 "
20 LB. REDUCTION				
H	615 ft.	910 ft.	1,310 ft.	1,725 ft.
K and H.......	490 "	730 "	990 "	1,260 "
K	370 "	580 "	815 "	1,060 "

What it does, is to control the flow of air from the main reservoir to the brake pipe and from the brake pipe to the atmosphere.

How it does it must be explained by the flow of air through the brake valves in its five different positions, and after



K. TRIPLE VALVE QUICK SERVICE POSITION.

this is thoroughly understood there will be plenty of time to learn the defects of the brake valve or the disorders occurring from neglect, and their cause and effect will be more readily understood than they would be were the instructor's remarks merely memorized.

Applying the three questions to "brake pipe pressure" first is its use, which is to operate the triple valves in the train: what it does is to establish a communication between the triple valves and the brake valves; how it does it (operate the triple valves) is by being reduced below or increased above the pressure in the auxiliary reservoir by means of the brake valve and the main reservoir pressure.

Those questions, if applied to any part of the apparatus and in the right spirit, are calculated to develop a line of thought that cannot fail to be of assistance to the student, although applying it to the later apparatus may at first glance appear a little more defficult. What the H-6 brake valve does in addition to controlling the flow of air from the main reservoir to the brake pipe and from the brake pipe to the atmosphere is to control a flow of air from the main reservoir to the pump governor and to the atmosphere, and a flow of air to and from the distributing valve and from the equalizing reservoir to the atmosphere.

How the brake valve does this work will be told in describing the flow of air through the valve in the six different positions of the rotary valve or of the brake valve handle. In release position there is a flow of air from the main reservoir directly into the brake pipe and equalizing reservoir, from the main reservoir to the excess pressure top of the pump governor, and from the feed-valve pipe through the warning port to the atmosphere. In running position the flow to the governor is unchanged, the direct flow from the main reservoir to the brake pipe is cut off and instead the brake pipe and equalizing reservoir are fed from the feed-valve pipe, and if the brake has been applied previously, and assuming that the equalizing valve of the distributing valve is in release position, there is a flow from the distributing valve to the atmosphere by the way of both brake valves.

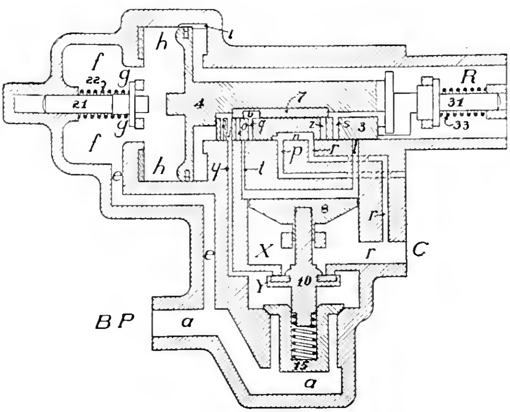
In holding position the flow to the governor continues, the supply to the brake pipe from the feed-valve pipe continues and the position of the rotary valve prevents the escape of any air from the application cylinder of the distributing valve through the release pipe.

On lap position of all ports closed, main reservoir pressure is separated from the brake pipe and the brake pipe pressure is separated from the equalizing reservoir by the movement of the rotary valve, the dividing line between brake pipe and equalizing reservoir pressure being the equalizing piston packing ring, the flow of air to the governor is also cut off.

Service position leaves the relative position of the ports unchanged and merely creates an opening for the escape of equalizing reservoir pressure, the equalizing feature being identical to that of the older types of brake valves. In the emergency position air flows from the brake pipe to the atmosphere, from the feed-valve pipe to the distributing valve, and from the equalizing reservoir to the atmosphere. If those questions are applied and the construction and operation of the brake is first thoroughly understood, the disorders resulting from wear and neglect will be quickly observed and the cause and reason thereof will be readily ascertained.

To Keep Workmen.

When business is brisk in machine shops the question always arises, What can best be done to retain good workmen? The ready answer is, pay them well, but when all shops are giving good pay that does not apply to a particular shop. Good tools and convenient appliances have excellent influence in keeping a shop popular. They have also the power of increasing the output of the shop. When machine shops are equipped with worn-out tools and inferior machinery generally, poor product is the result and the place gets to have the character of being an undesirable place to be connected with.



K. TRIPLE VALVE RELEASE POSITION.

Electrical Department

New York Subway Control.

By W. B. Kouwenhoven

The theory and operation of the New York Subway Electrical Equipment was very briefly described on page 103 of the 1908 volume of this paper. We will now consider the duties of the motorman in operating the equipment and in remedying troubles that may arise on the road. The equipment may be considered as consisting of four parts; a motor or main control and a master control, forming the two principal parts; a switch panel and two motors comprising the remaining parts.

The motor or main control carries the current from the third rail shoe to the motors. It makes the various connections for starting and accelerating the train, producing the step by step application of power

The contactors are in a dustproof box underneath the car. A contactor is simply a heavy switch operated by an electromagnet, which is capable of handling the heavy motor currents. The rheostats are also to be found underneath the car. They consist of 18 cast iron grids which are mounted in an iron frame from which they are insulated. Their purpose is to reduce the third rail current to a proper value during the acceleration of the train. The reverser is placed in a dustproof box underneath the car It is simply a switch which is operated by two electromagnets so arranged that only one of them can be energized at a time The reverser makes the connections for the forward and backward running of the train

The main switch is a quick break knife-switch placed on the switch panel. This switch carries all the current that comes from the third rail and passes through the contactors to the motors. It should be opened only in case of emergency or trouble The circuit breaker is enclosed and is located beneath the car. It is closed by means of a circuit breaker setting switch in the cab. The circuit breaker is supposed to open and protect the motors in case of a short circuit or heavy overload. The main fuse consists of a copper ribbon It requires a current to blow the fuse, that is slightly greater than that required to open the circuit breaker. The fuse is intended to blow only when the circuit breaker fails to act An inclosed fuse is also provided at each third rail shoe as an additional protection. In case of a severe short circuit in which both the main fuse and the circuit breaker should fail to act, then the motorman must open the main switch.

The motor control is confined to each motor car. The master control, on the other hand, continues throughout the entire length of the train. Its purpose is to operate the motor controls located on the motor cars that make up the train. A cab is provided at either end of each motor car and the entire train may be operated as a unit from any one of these cabs by means of the master control. The master control apparatus consists of two master controllers, a 10-point cut out switch, train line, 2 connection boxes, coupler sockets, jumpers, a control rheostat, fuse and master controller switch.

A master controller is placed in each cab of the motor car. It consists of a movable handle which winds up a coil spring, which in turn rotates a contact cylinder. The contact cylinder carries contacts which engage with stationary fingers, and operates the contactors in their correct order as it revolves. The speed with which the cylinder moves ahead is controlled by what is known as a control governor. A 10-point switch called a cut out switch is located on the panel. It has two sets of contacts, 10 of which are connected to the train and 10 are connected to the operating electromagnets of the contactors. In the off position there is no connection between the two sets of fingers, but in the on position metal strips connect them together.

The train line consists of ten insulated wires, each being covered with a different colored insulating braid in order that it may be readily distinguished from its fellows. At either end of each car the train line is ended up in what is known as a controller coupler socket. The train line is connected to the circuits of the master controllers at what are known as connection boxes The connection boxes contain ten studs or clamps, insulated from each other. Here the wires from the master controllers are connected and clamped by means of the studs to the wires of the train line Wires having the same colored braid are always connected to each other except at one box on each car where the reverse wires are crossed in order that the direction of travel of the train may correspond to the position of the reverse handle of either controller Cables consisting of ten insulated wires each and called train line jumpers or simply jumpers are used to connect the train line between cars Each jumper socket has ten metal pockets into which the ten plugs of the coupler socket fit. These jumpers serve to make the train line continuous throughout the train. In addition to the train line jumpers there are provided jumpers that are known as bus jumpers. These consist of seven wires, one large and six small. The large wires connect with the third rail shoes on the train together and serve at all times to provide current throughout the train for light, heat, and power, when crossing switches or gaps in the third rail. The large wire is protected from carrying excessive currents by fuses, called bus fuses. The other six wires are connected to the circuit breaker setting switch and to several small contacts in the master controller. Bus connecting boxes are also provided which have only seven studs.

The control circuit rheostat provides a small current for operating the master control circuits and for energizing the train line and the electromagnets of the contactors. The rheostat consists of twelve tubes wound with a high resistance wire, and mounted in an iron frame. A fuse is used to protect the circuits of the master control apparatus from damage due to short circuits or other trouble that may arise.

A master control switch and a circuit breaker setting switch are located in each cab. The master controller switch has a removable handle, and turns on or off the current for the master controller. There should be only one of these handles on a train and that one should be in the possession of the motorman. The circuit breaker on the train cannot be opened unless every master controller switch is open. The circuit breaker setting switch is only used for closing or setting the circuit breakers, as it is called.

The switch panel is in the back of the motorman's cab and besides the main switch and ten point cut out switch it carries the switches for the air compressor, for light, and heat and the platform transfer switches All of these switches are provided with fuses and they are all of the quick break type. There are two motors which are mounted upon one of the trucks of each motor car. They are geared to the wheels and are series direct current, 660 volt railway motors.

It must be remembered that the New York subway motor cars are equipped with the button on the controller handle. This is a safety device and the reader is referred for a description of this to page

69 and 70 of the 1908 volume of RAILWAY AND LOCOMOTIVE ENGINEERING. This button must always be held down except when the reverse handle on the controller is in the mid position. Releasing the button permits it to rise, opening all the contactors and opening a pilot valve in the air brake pipe. This cuts off the current and applies the emergency brakes. A sealed cut out valve is placed in each cab, to cut off the air from the pilot valve. In case of a leaky pilot valve, the motorman should break the seal and close the cut out valve, and he should make a report of the trouble at the end of his run.

When a subway train has been made up and all the jumpers placed in position and the air hose coupled, the motorman's first duty is to go through the train and close all airbrake switches and see that all the main switch and 10-point cut out switches were closed. After the reservoirs and the air line have become charged, he must test his brakes. If everything works satisfactorily the motorman inserts the removable handle into the master controller switch in his cab and closes it. Then he moves the circuit breaker setting switch handle to the right and after holding it there for about two seconds, releases it. This closes all the circuit breakers on the train.

Now he is ready to start the train. He grasps the master controller handle, presses down the button, and throws the reverser handle to the forward position. Then he moves the controller handle around to its full speed position. This winds up the coiled spring that connects the handle with the contact cylinder, causing the cylinder to move until its contacts make connection with the first set of fingers. Current now passes from the third rail shoe up through the control rheostat through the contacts and fingers on the master controller in the cab, through the connection box and into the train line. From the train line the current passes through the reversers, setting them in the proper direction. Then the current flows through certain contactor electromagnets back to the master controller to the track, or ground as it is called. The current closes a set of contactors on each car and the action is simultaneous for the entire train, originating from the cab in which the motorman sits at the head of his train. On every motor car, current now passes from the third rail through the main switch located on the panel, through the circuit breaker and main fuse to the contactors. From the contactors the current passes through one-half of the rheostats, through motor number one back to another set of contactors, through the remaining resistances to motor number two, to the ground. The train starts, the motors being in series with all the rheostats in circuit.

The contact cylinder does not continue to follow the handle because it is held locked by the control governor. As the speed of the train increases the governor releases the cylinder and permits it to go to the next point, cutting out a rheostat and increasing the power supplied to the train. This continues until the master controller through its control governor has automatically cut out all of the rheostats and brought the motors to their full speed parallel running position. To shut off the power the motorman swings the controller handle to the off position and after coasting for a short time applies the air brakes, bringing the train to a gradual stop at the station.

Now let us consider what the motorman must do in case the train refuses to start after he has complied with his instructions. The train may fail to start owing to the electric power being cut off from the third rail. The motorman should close the light switches located on the switch panel and should observe whether trains that are in sight have power. If the incandescent lamps fail to light it indicates that there is no current in the third rail and the motorman must wait until the power is turned on again. If there is current in the third rail then the trouble must lie in the train and it may be caused by a failure in either the master control or the motor control part of the equipment or both.

The motorman should first investigate the master control part of the equipment, and should ascertain whether there is power in the master controller or not. He should move the controller handle to the first point and then open his master control switch. If he sees the flash of a spark or arc, as it is called, on opening the switch it indicates that power reaches the master controller. If he does not observe any spark he should insert a new master controller fuse. If, then, the train fails to start, one or more of the following things may have happened to the master control equipment; the new fuse may be imperfect, a bad contact in the controller, the fingers and contacts in the master controller jammed or stuck, a grounded train line, or a loose train line jumper. The motorman should first insert a new fuse and if this fails he knows that the trouble lies elsewhere. Next he should investigate the master controller itself. He should remove the cover and see if the contacts and fingers near the top of the control cylinder makes good connections. The satisfactory operation of the control depends upon these contacts, and if they are poor he should endeavor to adjust them, first being sure to open the master controller switch and cut off the current. If the fingers are bent in so as to jam against the contacts on the cylinder then he should endeavor to bend them back, so that the cylinder rotates freely. In case he is unable to repair the master controller, he should operate the one from another cab. If he is unable to find any trouble either with the fuse or with the master controller he should then look for a ground in the train line. To do this he must pull the jumper plugs and test each car separately, opening the 10-point cut out switch on the panel. He should cut out the car affected and proceed. If the motorman thinks that a train line jumper is loose then he should immediately go through the train making sure that they are all inserted properly in their respective coupler sockets.

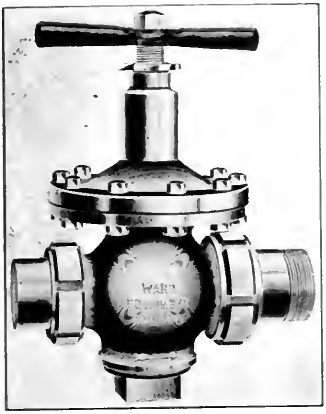
If he can find no trouble with the master control then he must turn his attention to the main or motor control part of the equipment. Trouble in the motor control may be due to the opening of the circuit breakers, blowing of a main or inclosed fuse, trouble with the air brake equipment or to the blowing of a bus fuse.

The motorman should first close the circuit breaker setting switch, and if they fail to reset it is probably due to the contactors on one of the cars being stuck up. He should test each car and open the cut out switch on the one affected. If the circuit breakers reset satisfactorily then he should next investigate the fuses. If on opening the box containing the inclosed fuse he should find a gray powder, it indicates that the fuse has blown. This fuse only blows when there is a short circuit on a car and should not be replaced by the motorman, but the car should be cut out by opening the 10-point switch and the trouble reported when he reaches the end of his run. If the fuses and circuit breaker are all right perhaps the trouble is with the air brake equipment, and a triple valve may be stuck. If the motorman finds an imperfect triple valve, he should cut out the valve and open the auxiliary reservoir cock to release the brakes, and then proceed with his train. If he can find no trouble with the brakes, circuit breaker, or fuse, perhaps the first car is on a cross-over and none of its shoes are touching the third rail. In this case the bus line fuse must have blown, thereby preventing his car from receiving power. He should go back to the first car having power and operate the train from a cab in that car until the cross-over is passed, when he should return to his cab at the head of the train.

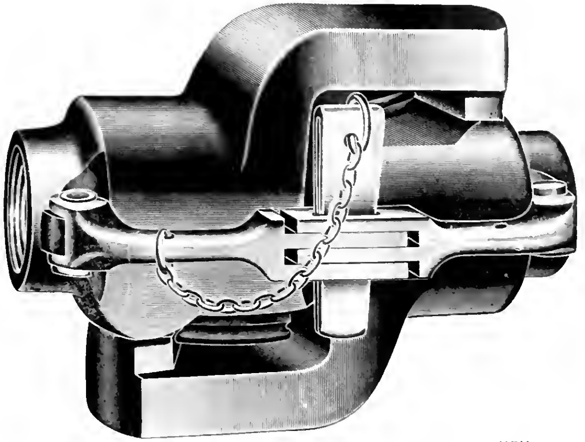
In some cases the train will accelerate very slowly or else too rapidly; or it may fail to accelerate at all after reaching the first point on the controller. This is caused by a failure of the control governor to act and to remedy this the motorman should cut out the automatic feature of the equipment. To do this he presses down the button turns it to the right which holds it there, then he should open the case and pull down a catch located inside near the top. This locks the control cylinder and handle together. Now he may notch up his controller handle step by step, as an engineer would run his engine.

An Enemy of Leaks.

A school boy was once asked to name some of the characteristics of steam, and he said that steam was always trying to escape, but most of the time it only leaked. The boy was fairly correct, but as a matter of fact steam never leaks, though it escapes. If you want to be particularly correct about the matter, it is the joint or the coupling not the steam that does the leaking. One of the objects of the makers of steam couplers is to prevent leaks.



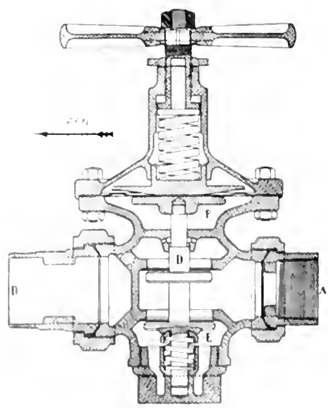
WARD REDUCING VALVE.



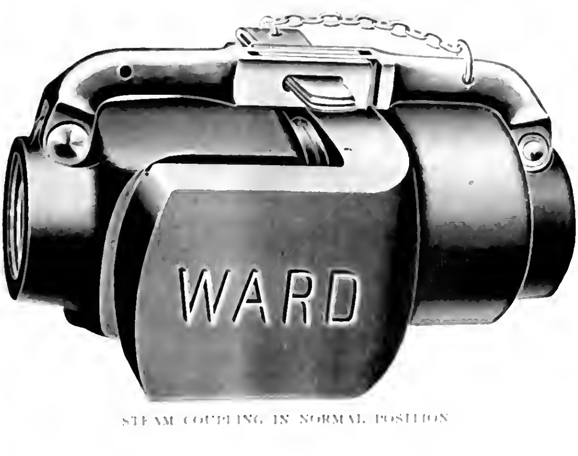
WARD STEAM COUPLING, SHOWING LOCK AND TAPER KEY.

An ordinary steam coupler between engine and tender, or between tender and first car where steam of high pressure is conveyed to a dynamo, has to stand a great deal of hard usage and is not only subject to wear, to the gradual compression and hardening of the gasket, but to the chance of being uncoupled by the swing and sway of the vehicles when at high speed. In order to overcome these difficulties it has been customary to apply some form of lock to the steam coupler body. One of the best we have seen is the lock designed by the Ward Equipment Company, of New York. A very marked feature of this lock is that it takes up the lost motion due to wear. The lock as seen in our illustrations is a neat little malleable iron arm pivoted to the coupler at one end and stretching out a couple of fingers to interlock with the finger of the arm on the other steam coupler. Where the fingers interlock, a taper key is driven through all four and the couplers can always be drawn up tight together without reference to wear. The taper key or cotter, if you like to call it that, is itself interesting. It is made of spring steel doubled over and tapered along the sides. The free points naturally spring open so that when the key is in place the taper sides draw the fingers of the lock tight, but the springiness of the key itself keeps it in place so that it cannot work or jar out. A neat little chain secures the key to one of the lock arms. The whole arrangement of key, arms and fingers may fairly be called a handy little device, as one tap of the car inspector's hammer releases the lock.

While we are on the subject of this kind of engine equipment, we may say the Ward reducing valve possesses several features of interest. Steam enters through a $1\frac{1}{2}$-in. pipe and leaves by a 2-in. pipe. A diaphragm under spring pressure governs the double disk balance valve, in the usual way. In order to prevent injury to the diaphragm the bottom of the lower disk valve carries a spring cap or oscillating washer, marked E in our line cut, and this acts as a stop in case the compression spring above the diaphragm should be unduly tightened down. The bearings of the spindle are all ample and the whole valve is substantially and well made, its adjustment easy and its action prompt and efficient. The Ward Equipment Co. have recently issued a finely illustrated catalogue, which they will be happy to send to those who apply for it.



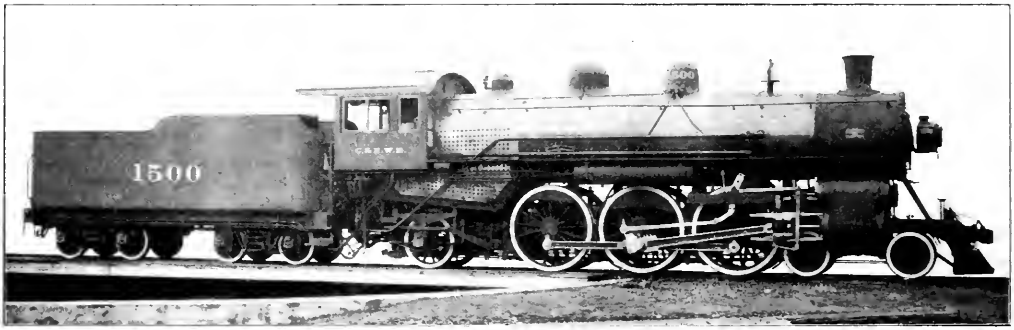
SECTION OF REDUCING VALVE.



STEAM COUPLING IN NORMAL POSITION.

Simple 4-6-2 and 2-8-0 for the Chicago & North-Western

The American Locomotive Company have recently completed an order of 25 Pacific and 40 Consolidation type locomotives for the Chicago & North-Western Railway. Particular interest attaches to these engines in that they represent the introduction of a much heavier class of power for both freight and passenger service than has hitherto been used on this road. Although, in general, each of the classes of engines here illustrated represents a simple, straightforward design of its particular type, both present a number of features which are worthy of special notice.



PACIFIC TYPE ENGINE FOR THE CHICAGO & NORTH-WESTERN.

Robert Quayle, Superintendent of Motive Power and Machinery. American Locomotive Company, Builders.

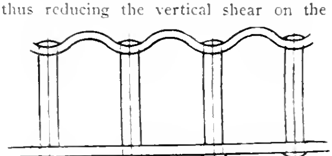
PACIFIC TYPE LOCOMOTIVES.

In working order these engines have a total weight of 245,000 lbs., 151,000 of which are carried on the driving wheels. The cylinders are 23 by 28 ins., and boiler pressure of 190 lbs. is employed, which is lower than usual practice in engines of this size using saturated steam. With driving wheels 75 ins. in diameter, the theoretical maximum tractive power is 31,900 lbs. This gives a factor of 4.73, which would indicate that the full tractive power of the engine will be available in starting without danger of slipping the driving wheels.

The design is characterized by a large boiler capacity and shows an ample steam making power to meet the requirements of the severe service for which the engines are intended. The boiler is of the extended wagon top type and the barrel measures 70 5/16 ins. in diameter outside at the first ring. It contains 396 tubes 2 ins. in diameter and 20 ft. long, so spaced as to give 3/4-in. bridges. The total heating surface of the boiler is 4,366 sq. ft., of which 4,130 sq. ft. is in the tubes and the remainder is contributed by the fire box and fire brick arch-tubes. Practically the only unusual features in boiler construction lie in the use of the O'Connor fire door flange and the Cour-Castle corrugated side sheets in the fire box. Both of these forms of construction have been in use on the Chicago & North-Western Railway for several years, and have given very satisfactory results. The fire box is 108 1/8 ins. long and 70 1/4 ins. wide and provides a grate area of 53 sq. ft.

The cylinders are fitted with 3/4-in. bushings and are equipped with 14-in. piston valves having inside admission and actuated by Walschaerts valve gear. The arrangement of this valve gear follows the builder's latest practice in the application of the Walschaerts gear to 4-6-2 locomotives. The reverse shaft is located ahead of the link and its backward extending arm is connected to the radius bar by means of a link. With this arrangement the link block is in the upper part of the link when the gear is in forward motion, and the eccentric crank consequently leads the main crank pin instead of following it.

The frames, which are of cast steel, consist of a main frame 5 1/2 ins. wide with a single front rail cast integral with it and a separate slab section 2 1/2 ins. wide at the rear for the trailing truck. The slab section is fitted into a recess machined in the back end of the main frame, thus reducing the vertical shear on the bolts connecting the two and making a very strong and rigid splice. A very thorough and substantial system of frame bracing has been employed.



CORRUGATED SIDE SHEETS, C. & N.-W.

The trailing truck is of the builders' latest design outside bearing radial truck. This arrangement eliminates the use of the outside supplementary frames required with their older design of this type of trailing truck, thereby simplifying the construction and effecting a considerable reduction in weight.

Some of the ratios involved in this design are as follows:

Weight on drivers ÷ tractive power = 4.73.
Weight on drivers ÷ total weight (per cent.) = 61.6.
Total weight ÷ tractive power = 7.68.
Tractive power x diameter driving wheels ÷ heating surface = 548.
Heating surface ÷ grate area = 82.4.
Firebox heating surface ÷ total heating surface (per cent.) = 4.79.
Volume of cylinders, cu. ft., = 13.28.
Grate area ÷ volume cylinders = 3.99.

Some of the principal dimensions are given below:

Wheel Base.—Driving, 13 ft. 6 ins.; total, 34 ft. 7 ins.; total engine and tender, 66 ft. 10 1/2 ins.

Weight of engine and tender 390,100 lbs.; heating surface tubes, 4,130 sq. ft.; heating surface, firebox, 209 sq. ft.; heating surface, arch tubes, 27 sq. ft.; heating surface, total, 4,366 sq. ft.

Axles.—Driving journals, main, 10 1/2 x 12 ins.; others, 9 1/2 x 12 ins.; engine truck journals, diameter, 6 ins.; length, 12 ins.; trailing truck journals, diameter, 8 ins.; length, 14 ins.; tender truck journals, diameter, 5 1/2 ins.; length, 10 ins.

Boiler.—Type, extended wagon top; O. D. first ring, 70 5/16 ins.; fuel, bituminous coal.

Firebox.—Thickness of crown, 3/8 in.; tube, 1/2 in.; sides, 3/8 in.; back, 3/8 in.; water space, front, 4 1/2 ins.; sides, 4 1/2 ins.; back, 4 1/2 ins.

Crown Staying.—Radial

Brake Driver.—Pump, 9 1/2 ins., Westinghouse; 2 reservoirs, 18 1/2 x 102.

Tender.—Frame, 13 ins., steel channels; tank, style "U" shape, level top; capacity, 7,500 gallons; capacity fuel, 13 tons.

Valves.—Type, piston, travel, 6 ins.; steam lap, 1 1/16 ins.; ex. clearance, 3/16 in.; setting, 1/4 in.; lead constant.

Wheels.—Driving, diameter outside tire, 75 ins.; engine truck, diameter 37 1/4 ins.; trailing truck, diameter, 49 ins.; tender truck, diameter, 37 1/4 ins.

CONSOLIDATION TYPE LOCOMOTIVES.

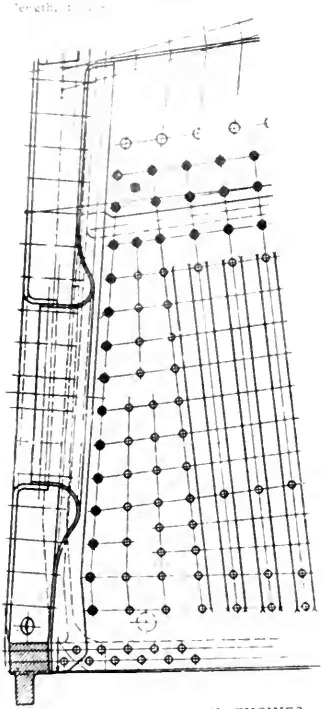
In working order, the Consolidation engines have a total weight of 232,000 lbs., of which 205,000 lbs., or 88.3 per cent. is carried on the driving wheels. One of the most interesting features of the design lies in the use of an unusually low boiler pressure with saturated steam. A boiler pressure of 170 lbs. is employed and the cylinders are 25 by 32 ins., and are fitted with 3/4-in. bushings. These are the largest cylinders so far applied by the American Locomotive Company to a single expansion engine. The cylinders are very carefully and thoroughly lagged in order to reduce as far as possible the cylinder condensation, which would otherwise be excessive in cylinders of this size using saturated steam at short cut offs due to the cooling effect of the large area of the cylinder walls.

This feature of the design is a striking example of the present tendency to resort to lower boiler pressures in order to prevent the boiler troubles caused by the high steam pressures of current practice. Steam is distributed to the cylinders by means of 14-in. piston valves, having inside admission and operated by a simple design of the Walschaerts valve gear. The frames are of cast steel 5 ins. wide with single integral front rail. Especial care has been taken to provide a strong system of frame bracing.

The boiler is of the straight top radial stayed type and the barrel is built up of two courses, the outside diameter of the first course being 81½ ins. The tubes, of which there are 443, are 2 ins. in diameter and 15 ft. 2 ins. long; and, as in the Pacific type engines, are placed so as to give ¾-in. bridges. The total heating surface of the boiler is 3,713 sq. ft. The fire box is 108⅛ ins. long and 70¼ ins. wide and provides a grate area of 52.7 sq. ft. It is supported at both the front and back ends by buckle plates. The ratios given by the builders are here appended for reference:

Weight on drivers ÷ tractive power = 4.3.
Weight on drivers ÷ total weight (per cent.) = 88.3.
Total weight ÷ tractive power = 4.88.
Tractive power x diameter driving wheels ÷ heating surface = 780.
Heating surfoce ÷ grate area = 70.4.
Firebox heating surface ÷ total heating surface (per cent.) = 5.
Volume of cylinders, cu. ft., = 18.16.

[illegible] diameter [illegible] length [illegible]; tender truck [illegible] diameter, 5½ ins.; length [illegible]



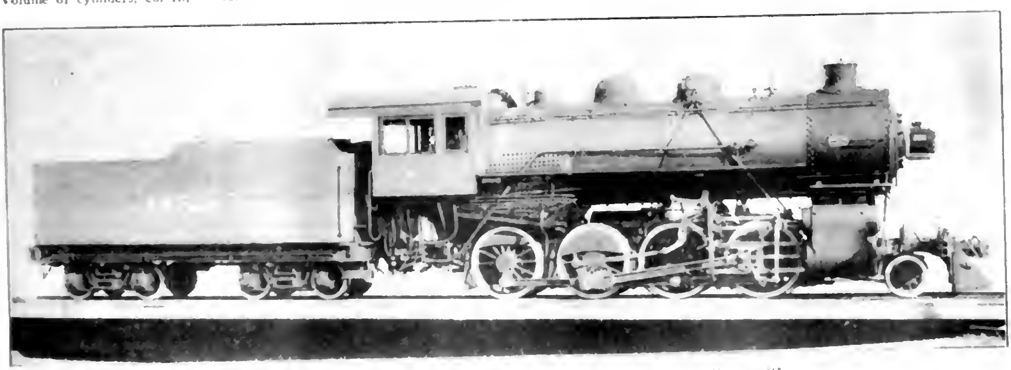
FIRE DOOR ON C. & N. W. ENGINES.

Boiler.—Type, straight top; O. D., first ring, 81½ ins.; fuel, bituminous coal.
Firebox.—Length, 108⅛ ins.; width, 70¼ ins.; thickness of crown, ⅜ in.; tube, ½ in.; sides, ⅜ in.; back, ⅜ in.; water space, front 4½ ins.; sides, 4½ ins.; back, 4½ ins. crown staying, radial.

Recent Railway Accidents.

[illegible] world's press has [illegible] to [illegible] upon the dangers of railway travel in America that a [illegible] showing that serious railway accidents are remarkably rare on this side of the Atlantic is something to make us feel proud. The Bureau of Railway News of Chicago appears to rival the Interstate Commerce Commission in the accuracy of its records of railway accidents and it has recently issued the statement that 34 roads, operating over 153,000 miles of railway, have kept their score clean. Ten other companies, operating 22,000 miles, were so unfortunate as to kill each a single passenger. The clean score of 23,000 miles of British railway seems not very extraordinary when compared with the deaths of only ten passengers upon a mileage exceeding all Europe combined.

The New York *Times* commenting on this statement says: "The railways in the United States which do not kill passengers are longer than all the railways of Europe. This is a literal statement of fact. In the three years 1906-7-8 316 companies, operating 124,050 miles of road, did not kill a single passenger. The passenger mileage of these roads surpassed by a billion the mileage of the roads in England which boasted of a like clean record. In fact, the length of these railways in the United States exceeded that of all the railways in England, France, Germany, Austria, Hungary and Italy combined. The freight trains over railways are a contributory cause of accidents, and the freight ton mileage of the American railways with a score clean of all fatality for three years together exceeds that of the countries of Europe with Japan, Argentina, and [illegible] thrown in."



[illegible] ATION TYPE ENGINE [illegible] THE CHICAGO & NORTHWESTERN.
Robert Quayle, Superintendent [illegible] Power and Machinery. [illegible] Locomotive Company, Builders.

Total heating surface [illegible] cylinders [illegible] 204.
Grate area [illegible] volume of cylinders [illegible]

Principal dimensions are as follows:

Wheel Base.—Driving, 17 ft. [illegible] 36 ft. 5 ins.; total, engine and tender [illegible] ft. 9½ ins.
Weight.—Of engine and tender [illegible] lbs.; heating surface, tubes [illegible] fire box 186 sq. ft., arch tubes [illegible] total, 3,713 sq. ft., grate area, [illegible]
Axles.—Driving journal [illegible] others, 9½ x 12 ins. [illegible]

Pistons [illegible] ins. [illegible]
Engine [illegible]
Tender [illegible] style [illegible] capacity, 7 tons [illegible]
Valves [illegible] steam [illegible] & line, setting [illegible]
Wheels [illegible]
Heating surface [illegible] sq. ft., [illegible] ins. [illegible]

[illegible] reservoir, [illegible] center bearing, [illegible] channels, [illegible]

Your manners will depend very much [illegible] quality of what you frequently [illegible] for the soul is tinged and col[illegible] with the complexion of thought [illegible] Aurelius.

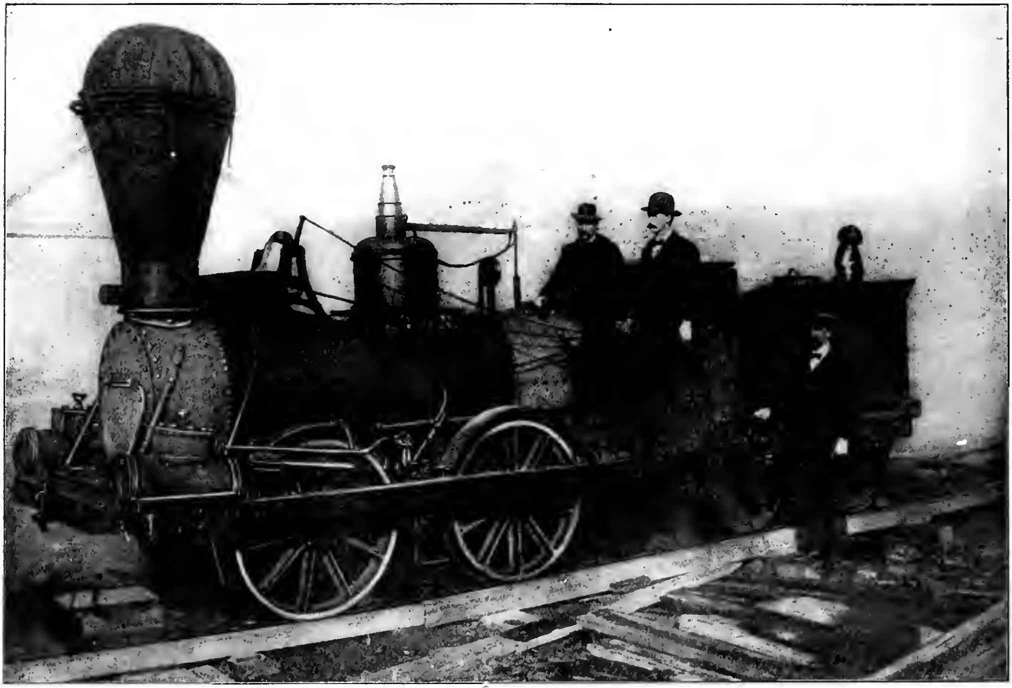
Hinkley & Drury's "Lion."

In these days when railway companies are engaged in rivalry for ownership of the largest locomotive, it seems a relief to examine the outlines of the engine illustrated, which was one of the first built by the famous Hinkley & Drury Company, of Boston, in the early 40s.

According to an article which appeared lately in the Boston *Globe*, this engine was built in 1843 and was sent by water to Machiasport, Me., to be used on the Whitneyville & Machiasport Railroad, a strap rail line, about eight miles long, used for the transportation of lumber. The railroad was abandoned lately and the rolling stock disposed of. The following notes of ancient railroad history are culled from the article referred to by a veteran engineer still alive, Mr. W. R. Bradford:

From start to finish this road was free to anybody who chose to ride upon it and take his own risk, and the accommodating engineer would always slow down, or in case of a lady or an old man, come to a halt, that they might take passage or depart in safety at the "Old Country Road," near Machias. Special trains have been run to convey parties to Machiasport to go on sailing excursions, and political parties to attend lectures at Machias and Machiasport, and, unlike anything of the kind ever known in the whole history of railroading in the United States, they were always free; those who were thus favored not even deeming the services of the engineer and fireman worthy of a "tip." During the fifty years of free riding, few accidents occurred among those who availed themselves of the privilege, though several were killed in various ways while connected in the service of the road. Dana Bullard was the first machinist employed to work on the engines, and to make occasional runs to the "Port." A man by the name of Butler, however, was the first regular engineer. He was followed by Colon Dorman, who ran a short time. Michael Corbett ran several years, and Samuel Paul, machinist, ran occasionally. Corbett was succeeded by Cornelius Sullivan, the present owner of the "Agency" property, who ran twenty-three consecutive years. The others were Albion Dunning, Edwin K. Smith, John R. Sullivan, and, finally, Cornelius Sullivan, Jr., who had a more trying experience and participated in more railroad wrecks than all the others combined.

The "Lion" and "Tiger," which weigh, with tender, about nine tons each, were recently purchased, together with the strap iron and spikes of the road, by Thomas Towle, Portland, Me. Whether these engines will be broken up or preserved as keepsakes is not known; but the people here felt that they were losing old and tried friends, and before they were taken away photographs of them were secured by Albee Bros., of Machias.



HINKLEY AND DRURY ENGINE "LION," BUILT IN 1843.

The Greatest Traveler.

Among the engineers pensioned by the Pennsylvania Railroad Company last year was John Cassell, a locomotive engineer, who entered the service in 1860 and has had continuous service of 49 years. He was assigned to passenger service in 1872 and continued running a passenger engine up to the date of his retirement. Mr. Cassell was a very methodical railroad man and kept a record of all the runs made during these many years. The runs made reach a grand total of 1,794,136 miles. If any other engineer has passed this immense extent of travel we should like to publish the particulars.

Compound engines were used on steamers plying the Mississippi and Missouri about 1850. They were mostly of the two-cylinder type and used a heavy fly wheel. A steamer called the *Hawkeye*, of Memphis, was sunk by her flywheel breaking and by a piece going through the bottom of the vessel.

Items of Personal Interest

Mr. N. McNeil has been appointed foreman of the car department of the Intercolonial at Sydney, succeeding Mr. R. Dunlap.

Mr. C. W. Kinney has been appointed superintendent of transportation of the Lehigh Valley Railroad, vice Mr. R. W. Baxter, resigned.

Mr. J. E. Munro has been appointed assistant air-brake instructor of the Chicago, Rock Island & Pacific, with office at Chicago.

Mr. W. B. Ross has been appointed secretary of the pension board of the Chicago, Rock Island & Pacific, with office at Chicago.

Mr. H. Frawley has been appointed locomotive foreman of the Canadian Pacific at Three Rivers, Quebec, vice Mr. J. Gregoire, deceased.

Mr. J. H. Wilson has been appointed locomotive foreman of the Canadian Pacific at Kenora, Ont., vice Mr. T. F. Patterson, transferred.

Mr. G. B. Minshull has been appointed superintendent of car service of the Lehigh Valley Railroad, with office at South Bethlehem, Pa.

Mr. W. J. Davis, has been appointed general foreman on the Detroit, Toledo & Ironton Railway at Ironton, Ohio, vice Mr. J. H. Hott, resigned.

Mr. C. J. Shea has been appointed superintendent of the Auburn division of the Lehigh Valley Railroad, vice Mr. C. W. Kinney, promoted.

Mr. J. A. Hannigan has been appointed general foreman on the Detroit, Toledo & Ironton Railway at Jackson, Ohio, vice Mr. H. F. Martyr, resigned.

Mr. Benjamin Johnson has been appointed assistant locomotive superintendent of the United Railways of Havana, with office at Havana, Cuba.

Mr. L. Fisher has been appointed master mechanic of the Fourth district, Central division, of the Canadian Pacific, with office at Winnipeg, Man.

Mr. R. Anthony has been appointed acting locomotive foreman of the Canadian Pacific at Moose Jaw, Sask., vice Mr. J. H. Wilson, transferred.

Mr. Edward Wees has been appointed general foreman of the Ann Arbor Railroad at Frankfort, Mich., vice Mr. W. J. Davis, assigned to other duties.

Mr. H. McDonald has been appointed locomotive foreman of the Canadian Pacific at Macleod, Alta., vice Mr. H. Stevenson, assigned to other duties.

In our December, 1909, issue we had the pleasure of recording the re-election of Mr. Lucius Tuttle, to the presidency of the Boston & Maine Railroad. Mr. Tuttle, whose picture adorns this page, entered railway service in 1865 as a ticket clerk on the old Hartford, Providence & Fishkill Railroad. Later he became general ticket agent for the road, and in time he was promoted to be assistant general passenger agent of the New York & New England Railroad. In 1879 he took the position of general passenger and ticket agent and assistant to general manager of the Eastern Railway. 1885 saw him general passanger and ticket agent of the Boston & Lowell. From 1887 to 1889 he was passenger traffic manager on the

LUCIUS TUTTLE

Canadian Pacific Railway. In 1889 to 1890 he was commissioner of the Trunk Line Association passenger department. In May, 1890, he was general manager of the New York, New Haven & Hartford. From February, 1892, to September, 1893, he held the position of vice president of that road, and in October of 1893 he was elected president of the Boston & Maine Railroad and has been successively re-elected to that important office every year since.

Mr. D. B. Sebastian has been appointed acting fuel agent of the Chicago, Rock Island & Pacific, with office at Chicago, vice Mr. Eugene McAuliffe, resigned.

Mr. G. R. West has been appointed general foreman on the Detroit, Toledo & Ironton Railway at Springfield, Ohio, vice J. A. Hannigan, assigned to other duties.

Mr. Thos. McFarland has been appointed traveling engineer on the Chicago, Milwaukee & St. Paul Railway, with headquarters at Ellensburg, Wash.

Mr. C. E. Chambers has been appointed superintendent of motive power of the Central Railroad of New Jersey, with office at Jersey City, N. J.

Mr. W. P. Drumb has been appointed foreman in the mechanical department of the Southern Railway at New Albany, Ind., vice Mr. A. H. Firnhaber resigned.

Mr. C. M. Hoffman has been appointed master machanic of the Denver & Rio Grande, with office at Grand Junction, Colo., vice Mr. F. B. Mahoney, resigned.

Mr. M. A. Craig has been appointed general foreman on the Detroit, Toledo & Ironton Railway at Lima, Ohio, vice Mr. G. B. Sollars, assigned to other duties.

Mr. R. S. Miller has been made master car builder of the New York, Chicago & St. Louis Railroad, his previous title, general foreman of car department, being abolished.

Mr. J. H. Wilson, heretofore locomotive foreman at Moose Jaw, Sask., has been appointed locomotive foreman at Sutherland, Sask., vice Mr. G. Twist, transferred.

Mr. W. Price, heretofore car inspector of the Canadian Pacific at Macleod, Alta., has been appointed car foreman at Swift Current, Sask., vice Mr. J. A. Jenson, transferred.

A pension of $54.00 a month has been granted by the Santa Fe Railroad Company to Mr. Edward Robinson, an old engineer, who had been in the company's service since 1875.

Mr. G. E. Watts, of Atlanta, Ga., well-known among traction men throughout the South, has been appointed Southern representative of the R. D. Nuttall Company of Pittsburgh.

Mr. W. Sealy, heretofore machinist charge hand, Stratford shops of the Grand Trunk, has been appointed erecting shop foreman at that point, vice Mr. A. J. Roberts, resigned.

Mr. E. A. Shipley, formerly locomotive engineer on the Frisco system, has been appointed fuel supervisor on the Chicago, Rock Island & Pacific, with headquarters at Kansas City, Mo.

Mr. J. N. Haines, formerly trainmaster, has been appointed assistant superintendent of the Buffalo division of the Lehigh Valley Railroad, vice Mr. C. J. Shea, promoted.

Mr. L. C. Heilman has been appointed supervisor of signals of the Rock Island at Cedar Rapids, Iowa, having jurisdiction over the Northern district, vice Mr. G. W. Trout, transferred.

Mr. H. C. Stevens, assistant to general storekeeper of the Atchison, Topeka & Santa Fe at Topeka, Kan., has been appointed supervisor of stores of the National Railways of Mexico.

Mr. R. E. Knox has been appointed road foreman of engines on the Los Angeles division of the San Pedro, Los Angeles & Salt Lake Railroad, with headquarters at Los Angeles, Cal.

Mr. H. L. Roth, has been appointed road foreman of engines on the Cincinnati, New Orleans & Texas Pacific Railway with jurisdiction over the first district with office at Danville, Ky.

Mr. G. Twist, heretofore locomotive foreman of the Canadian Pacific at Sutherland, Sask., has been appointed locomotive foreman at Minnedosa, Man., vice Mr. W. F. Lowe, transferred.

Mr. B. T. Jellison has been appointed purchasing agent of the Chesapeake & Ohio, with office at Richmond, Va., reporting to the vice-president and general manager. He succeeds Mr. La Bonto.

Mr. H. E. Byram, formerly assistant to the second vice-president of the Chicago, Burlington & Quincy, has been made chief assistant in the operating department, to Mr. Darius Miller, the first vice-president.

Mr. C. S. White has been appointed motive power inspector of the Pennsylvania Lines west of Pittsburgh, Southwest system, with office at Columbus, Ohio, vice Mr. W. H. Holbrook, transferred.

By a slight misunderstanding the name of our agent was mentioned as the person in charge of the fast work done in C. P. R. engine No. 712 in the Winnipeg shop recently and reported in our December number.

Mr. R. H. Lanham, who has been traveling engineer on the Iron Mountain & Southern Railway, has been promoted to the position of master mechanic on the same road, with headquarters at Helena, Ark.

Mr. H. F. Smith, formerly general foreman of the car shops at West Albany on the New York Central Lines, has been appointed master car builder of the Chicago & Alton, with headquarters at Bloomington, Ill.

Mr. John Hill, master mechanic and master car builder of the Minneapolis & St. Louis Railroad, has been appointed master mechanic of both eastern and western divisions of that road, with office at Minneapolis, Minn.

Mr. H. M. Murchmore, master mechanic of the Frisco at Paris, Tex., has been transferred to Birmingham, Ala., and is succeeded by G. E. McCauley, who has been with the Frisco for 30 years at Springfield, Mo.

Mr. Hiram J. Slifer, general manager of the Chicago Great Western Railroad, has assumed the duties heretofore performed by the superintendent, Mr. O. Cornelison who has resigned. The position of superintendent has been abolished.

Mr. James McDonough, formerly roundhouse foreman at Topeka, Kan., on the Atchison, Topeka & Santa Fe, has been transferred from Topeka to Emporia, Kan., on the same road, with the title of division foreman, at the latter place.

Mr. A. H. Firnhaber, formerly foreman in the mechanical department of the Southern Railway at New Albany, Ind., has recently been appointed master mechanic of the J. L. Smith Construction Company, with headquarters at Kansas City, Mo.

The New Year's greeting sent out by the B. M. Jones Co., of Boston, agents for Taylor iron, took the form of a very handsome penknife. We have found that form of card very popular among the ladies, too popular for our own sense of possession.

Mr. David Van Alstyne, vice-president of the American Locomotive Company in charge of manufacturing, has resigned. Mr. James McNaughton, vice-president in charge of sales, has been put in charge of the manufacturing department as well as that of sales.

Mr. J. W. Bennett has been appointed master mechanic of the Utah lines of the Denver & Rio Grande Railroad, with office at Salt Lake City, vice Mr. A. H. Powell, resigned. The position of assistant superintendent of motive power has been abolished on the D. & R. G.

Mr. O. S. Jackson has been appointed master machanic of the Chicago, Indianapolis & Louisville, with office at Lafayette, Ind., vice Mr. W. J. Bennett, assistant superintendent of motive power, resigned. The position formerly held by Mr. Bennett has been abolished.

Mr. C. H. Ketcham, formerly division superintendent on the D., L. & W., has been appointed superintendent of the Western Pacific Railroad, with headquarters at Sacramento, Cal. Mr. Ketcham's many friends on the Lackawanna and elsewhere wish him every success in his new field of labor.

Mr. J. Snowden Bell has recently removed his office from No. 165 Broadway to the Singer Building which is No. 149 Broadway, New York. Mr. Bell is a patent attorney of long and varied experience and is a contributor to the columns of Railway and Locomotive Engineering.

Mr. Eugene McAuliffe, formerly general fuel agent of the Rock Island Frisco lines at Chicago, has resigned from the Rock Island and has been appointed general fuel agent of the St. Louis & San Francisco, the Chicago & Eastern Illinois and the Evansville & Terre Haute, with office at Chicago, Ill.

Mr. C. M. Byrd has been appointed road foreman of engines of the Atchison, Topeka & Santa Fe Coast Lines, with jurisdiction over the Second district of the Albuquerque division, with office at Winslow, Ariz. He will perform such other duties as may be assigned to him by the master mechanic of the Third district.

Mr. John W. Daly has been promoted from general passenger agent of the Lake Shore to be assistant passenger traffic manager of the New York Central lines in Chicago. He is succeeded by Mr. L. W. Robinson, who will continue also as general passenger agent of the Pittsburgh & Lake Erie, with headquarters in Cleveland, Ohio.

Mr. John D. Conway, formerly chief clerk of the motive power department of the Pittsburgh & Lake Erie, and for 25 years in the company's service, has resigned to become secretary of the Railway Supply Manufacturers' Association. His associates on the P. & L. E. give a dinner in his honor and presented him with a gold watch and chain on the occasion of his retirement.

Mr. E. H. Coapman, manager of the Southern Railway, has been promoted to the position of general manager of that company, with headquarters in Washington, D. C., vice Mr. C. H. Ackert, resigned. Mr. Coapman will have general control and direction of the operating and maintenance departments, and will report to the president. The office of manager has been abolished.

Mr. F. F. Prentiss, recently resigned from the presidency of the Cleveland Twist Drill Company on account of ill health, and Mr. J. D. Cox was elected to that office. Mr. Cox was the founder of this business and has always been the practical man of the concern. He has wide and varied experience and has always kept in very close touch with the manufacturing of twist drills.

Mr. J. E. Osmer has been appointed assistant superintendent of the Hicks Locomotive & Car Works, of Chicago Heights, Ill., in charge of the locomotive works. Mr. Osmer has been master mechanic of the Northwestern Elevated Railroad of Chicago for about six years and previously was connected with the mechanical departments of the Iowa Central, C. & A., and the C. & N. W.

Mr. J. W. Coyle, who was connected with the Best American Calorific Co. until they retired from business, is now with the Rockwell Furnace Co. Mr. Coyle is an experienced railroad man, having formerly been master blacksmith on the Lehigh Valley Railroad at Wilkes-

Barre, and later he was in charge of the drop hammer and machine department at the forge shops of the Philadelphia & Reading, at Reading, Pa.

Mr. William McIntosh, superintendent of motive power of the Central Railroad of New Jersey, has resigned owing to impaired health, and has gone to Arizona to recuperate. Mr. McIntosh is a Canadian by birth, but has done all his railroad work in the United States. Although he did not proclaim it from the housetops, Mr. McIntosh has been a very successful inventor of railway appliances. He was highly popular with the men under his charge, and received on leaving the Central a beautiful gold watch, chain and Masonic emblem from the men in the mechanical department.

The Watson-Stillman Company, of New York, have made several additions to their sales department in order to handle the increasing business in hydaulic tools and turbine pumps. Mr. Edwin Stillman has entered the sales department, and is helping to take care of customers in New York State, while all railroad business in the South is now in charge of Mr. Frank C. Clark. The more direct representation that has become necessary in the Orient will hereafter be in the hands of Mr. F. W. Horn, the well-known machinery importer of Yokohama, Japan.

Mr. Walter D. La Parle has been appointed general sales agent for the Chicago Bearing Metal Co. Mr. La Parle is a native of Chicago and has been engaged in the railway supply business for the past twenty years. He was formerly connected with the Verona Tool Works of Pittsburgh for eleven years, after which he organized the Solid Steel Tool Co., which is now the Western Tool & Forge Co., of Brackenridge, Pa. Mr. La Parle has a very wide acquaintance among railroad officials in both the operating and maintenance branches and brings to his new position a technical and practical knowledge which has been gained by long years of training and experience. Mr. La Parle's offices are in the Old Colony Building, Chicago.

Mr. Darius Miller, first vice-president of the Chicago, Burlington & Quincy Railroad, has been made the head of all departments of that road. This was occasioned by the retirement of Mr. Daniel Williard, who has become president of the B. & O. Mr. Miller began his railroad work as a stenographer in the general freight office of the Michigan Central in 1877. He subsequently became a clerk in the general freight office of the St. Louis, Iron Mountain & Southern. This position he left to become chief clerk to the general manager of the Memphis & Little Rock Railroad. In 1883 he was appointed freight and ticket agent on the same road. In 1899 the St Louis, Arkansas & Texas Railway secured his services as general freight and passenger agent, and a year later he became traffic manager of the same road. This lead to his being secured by the Queen & Crescent Route as traffic manager. Later he became traffic manager of the Missouri, Kansas & Texas and was in due time elected to the position of vice-president. He accepted the second vice-presidency of the Great Northern in 1901. The following year saw him first vice-president of the C., B. & Q., which position he now holds, and he has now become the official head of all departments of the road.

Obituary.

Charles B. Dudley, chief chemist of the Pennsylvania Railroad, died last December after an attack of typhoid pneumonia at his home in Altoona. Dr. Dudley was born in 1842 at Oxford, N. Y. He was educated at the Oxford Academy and also at Yale University where he graduated in 1874 with the degree of Ph.D. He spent the year after graduation as professor of physics in the University of Pennsylvania, and in the following year he was appointed to the position of chemist for the Pennsylvania. Dr. Dudley was widely known for the valuable work he did in the testing of materials used on railways, but outside this he was considered one of the most prominent men of science in the country. He was president of the American Society for Testing Materials, president of the American Chemical Society, a member of the Iron and Steel Institute. He was president of the Bureau of Explosives of the American Railway Association, and chairman of the committee on the safe transportation of explosives. He was honored by the International Association for Testing Materials at a recent meeting in Copenhagen, when he was elected president.

We regretfully record the death of James W. Friend, of Pittsburgh. He died on December 26, 1909, after a lingering illness. He was sixty-four years old. Mr. Friend was a familiar figure in the iron, steel and coal industries and among the banking interests of Pittsburgh, having been vice-president of the Pressed Steel Car Company, the Western Steel Car & Foundry Company, one of the owners of the Clinton Iron & Steel Company, vice-president of the German National Bank of Allegheny, and a director in the Farmers' Deposit National Bank of Pittsburgh.

William Buchanan, one of the veterans in the service of the New York Central, who, for some time, had been on the retired list, died at his home in South Norwalk, Conn., aged 80 years. Mr. Buchanan was a native of Scotland, and on coming to this country entered railway service at the age of seventeen as an apprentice in the shops of the Albany & Schenectady Railroad. In July of 1849 he secured the position of machinist in the Hudson River Railroad, and subsequently became a locomotive engineer, after which he was promoted to be shop foreman, and later on he was made master mechanic on the Southern division. In 1859 he became master mechanic for the whole line and of the Troy & Greenwich Railroad. In 1880 he was made superintendent of motive power of the Hudson River & Harlem division of the N. Y. C. & H. R. In 1890 he was given the position of superintendent of motive power and rolling stock of the New York Central & Hudson River Railroad, the West Shore Railroad, the Rome, Watertown & Ogdensburg Railroad and the Dunkirk, Allegheny Valley & Pittsburgh Railroad. During Mr. Buchanan's time the famous 999 class of engines were brought out by him for service on the Empire State Express, and it is this fact that is probably more widely known to the general public than any other of his long and useful career.

To Promote Industrial Education.

The American Federation of Labor has decided to encourage a teaching of the principles of mechanics in the public schools. John Mitchell, chairman of a committee appointed to push the movement, says:

"National associations for the promotion of industrial education have been started from time to time, but this is the first time the American Federation of Labor has gone into the matter. The committee has gone into the subject exhaustively, and finds that many manufacturers because of the specialization of the different departments of the trades find it difficult to get competent superintendents owing to the difficulty of finding all-around mechanics who have learned everything about any particular trade.

"We will agitate for the teaching of the principles of mechanics in the public schools. The high schools, for instance, teach pupils how to prepare for the professions, but as there are more people in mechanical trades than in the professions they should also, we believe, teach the principles of mechanics.

"A man, for instance, may know that a joint at a certain angle is stronger than at any other angle, without knowing the reason why. Another man will know why that joint is stronger. This man will be more valuable than the first man. Ambition to excel would be stimulated if mechanics had a better opportunity of knowing the principles of mechanics, as well as learning one branch of a trade in a routine way. In the end this would be better for both emloyers and employes

Railroad Character Sketches

Macfarlane as a Napoleon of Finance

By James Kennedy.

Presentations, raffles and benefits seemed to come like evil spirits and seize upon the lean pocket-books of the railway men. Jack Macfarlane was the chief manager of these nefarious visitations. Jack had earned a character for benevolence that marked him out as the proper man to appeal to in the hour of financial need, and whether it was the bare-faced beggar whose children had the measles, and whose pantry and coal-scuttle were empty because, as he said, the doctor and the druggist had taken all his money, or whether it was some invisible widow, Jack made no inquiries as to their previous habits or antecedents. The man with the measly children may have had teeth black with tobacco and his breath sulphurous with alcohol, and the widow might be an invisible thing, like Wordsworth's cuckoo, or Halley's comet, but the tender-hearted railroaders responded nobly.

Some odd cases there were. A carpenter came into the roundhouse at midday and asked Macfarlane if he would call the men together. The visitor had a bundle under his arm. "Certainly—what was it—a new invention?" No; it was an army revolver of the most formidable caliber, a relic of the battle autumn of 1862. It had a history and he would raffle it at twenty-five cents a chance. His wife needed a new set of teeth more than he needed artillery. He was willing to part with a family heirloom rather than see the mother of his children compelled to live on mashed potatoes and buttermilk. Macfarlane testified to the complete toothlessness of the unfortunate woman. The raffle, like all others, occurred at Clark's parlors, and the history of the revolver was so illuminated by stories of feats of broil and battle by the loquacious carpenter, and so strongly endorsed by Macfarlane that a fine set of incisors, molars, and bi-cuspids, sharp and shining as a badger's, were promptly planted on the gums of the half-starved woman. This was not all. Macfarlane, like an experienced financier, had quietly accepted a handful of stock in the shape of free raffle tickets himself, and won the revolver.

A fresh young paymaster, recently appointed, had had the effrontery to keep a finely mounted revolver of light caliber lying conspicuously exposed at the window of the pay car. Jack came along in the crowd next pay day and deposited his heavy artillery on the sill of the window, and took considerable time counting his money. Some high words were exchanged between Jack and the paymaster. For a few minutes they had the car to themselves. The paymaster blanched. No shots were exchanged. Jack came out of the pay car swinging his revolver like an Indian club. The path to Clark's parlors was cleared for him as if by magic. The paymaster's revolver was never seen again. Some said that Jack was half shot, but that was a false report.

Macfarlane's methods were similar to most benevolent institutions. "Think of thyself last," was no part of Jack's gospel. His own expenses came first. When Shaw fell asleep in the cab of a locomotive and tumbled out of a cab door sustaining a severe contusion of the radius and ulna, superinducing inflammation which extended to the biceps and deltoid, Jack's charity list was as promptly in the vicinity of the bruised arm as Billy's medicine box. Billy reduced the swelling, and Jack raised the money. Billy was a surgeon in embryo. Jack was the finished financier. Nobody had the audacity to ask for an examination of his subscription sheets. The signatures were largely hieroglyphic. The figures were as involved as a problem in differential calculus. Shaw was full of gratitude. Billy was full of pride, and on pay-day Macfarlane's pockets were full of silver.

In the presentations to departing officials Jack was at his best. He assumed full charge. He knew where gold-headed walking sticks could be had at his own price. Neither the precious metal upon the head of the stick nor the duties of Jack's fellow committeemen were heavy upon them. The subscriptions included alcoholic beverages to the full, or nearly full, committee, but it did not include the aquafortis test to the shining head of the stick. In many instances the subscribers would not have grudged to have added a pair of shoes to the walking stick, so that the recipient could have kept on walking away as far as possible, but bygones should be bygones when the parting of the ways come.

A boiler maker foreman was leaving and something had to be given to him so that in his new sphere of industrial activity the railroaders could see the reflex of the exalted estimate we had of him. Macfarlane proposed a set of resolutions. Billy drew up the ornate sentences in mellifluous perfection. Shaw made a cylindrical case of burnished brass to hold the document. The presentation at Clark's parlors was an affecting scene. The words were inscribed on a silken banneret and decorated with a spread eagle, crowned by a bare arm in the sinewy hand of which there was a raised hammer seemingly ready to strike the bird of freedom a crushing blow. The boiler maker was so carried away, as it were, that he ordered large quantities of "Clark's Best," with the result that the parting hour was all too short. He ran to catch a train, pocketing the shining case but leaving the resolutions elsewhere Next week Macfarlane and Shaw were stripped to the waist washing themselves. Shaw looked like the tattooed man. On his broad breast were cabalastic characters like Runic inscriptions. Shaw had been wearing the missing resolutions as a chest protector.

Jack got the worst of it when the manager died. The great man, like Solomon, had grown silly as he grew older. He should have been buried quietly, but some parasite suggested that the railway men should erect a monument to his memory. The surviving officials approved of it. It was no light matter. It was coercion and retaliation running riot and Macfarlane was the storm center. It was a low steam pressure on one side and a tremendous back pressure on the other side. Jack nearly stood still, but the strength came to him that comes to men that are compelled to bear troubles that are not of their own making. Jack was a manipulator in finance, but be hated the task of taking bread out of the mouths of hungry men, women and children, and heaping it on the grave of the unworthy. It was his financial Waterloo. He was never quite the same Jack Macfarlane afterwards.

Railway Rate Regulation.

Among the recent recommendations of President Taft on the subject of railway rate regulation, the one which has probably been received with the least opposition is the proposal to create a Court of Commerce, composed of five judges, to which all appeals from the decisions of the Interstate Commerce Commission shall be made.

Another recommendation is the modification of the Sherman law so as to permit railways to enter into reasonable agreements regarding rates. Under the present law the published rate is the legal rate, and the President proposes to have a fine of $250 inflicted on any road which either by mistake or otherwise quotes an incorrect rate

Mr. Taft proposes to give power to the Interstate Commerce Commission to change the classifications, as it now has the power to change rates. The change in classification practically involves change of rate of commodities, and the proposal is simply an enlargement of powers of the commission in this direction

If the President's views prevail the commission will be given power to initiate investigations and to hold hearings on any point which it may consider should be so examined The commission has asked that it be given power in its discretion to postpone indefinitely any proposed advance in rates, pending investigation as to the reasonableness of the advance. In dealing with this request from the commission the President recommends that the commission be empowered, when an advance of rates is filed, to begin investigation at once as to its reasonableness and that if after 60 days the commission has not completed such investigation, the advanced rate or rates shall go into effect and shall be legal.

Willing to Go Higher.

"Yes," said the old man, addressing his visitor, "I am proud of my girls, and should like to see them all comfortably married; and as I've made a little money, they won't go to their husbands penniless. There's Margaret, twenty-five years old, and a real good girl. I shall give her five thousand dollars when she marries. Then comes Bet, who won't see thirty-five again, and she'll have ten thousand dollars; and the man who takes Dora, who is forty, will have fifteen thousand dollars with her."

The young man reflected a moment or so, and then nervously inquired, "You haven't one about fifty, have you?"

Engine Front Finish.

The ordinary treatment of locomotive front ends has a number of unsatisfactory features. Whatever is put on a front end requires frequent renewal. This means not only cost of material, but also cost of labor. Some of the material generally used is volatile, and when the engine is running and the front end becomes hot, offensive fumes come back to the cab. In aggravated cases these fumes may fill the eyes of the engineer, and making it difficult to see the signals. For engine fronts The Joseph Dixon Crucible Company recommend their Graphite Engine Front Finish, which is said to give a service of from six to nine weeks at each application. It provides the engine front with a durable and attractive coating. The value of this finish is due chiefly to the flake graphite which forms its base. As most of us know, flake graphite is unaffected by heat or cold; and it has, in additon, durable polishing properties. The Dixon Company have recently issued a little circular concerning this engine front polish, and all those interested in material of this kind, should write to the Dixon Company for it The home office should be addressed at Jersey City, N. J.

A Proper Understanding.

Possible Boarder—"Ah, that was a ripping dinner, and if that was a fair sample of your meals, I should like to come to term."

Scottish Farmer—"Before we gang any further, was that a fair sample o' yer appetite?"

Great Meeting of N. E. Railroad Club.

The officials of the New England Railroad Club achieved a triumph in the January meeting of the club, for they made it so attractive that several railway presidents were present, the Governor of Massachusetts delivered an address, and a galaxy of the most celebrated business men in the country swelled the large audience.

President Webster of the club was in the chair and introduced Governor Draper, who in a pleasing address made the point that railroads must serve the people with equality. It is as important that the people treat the railroads fairly as that they should be treated fairly.

Mr. W. C. Brown, president of the New York Central Lines, said: "The most portentous cloud discernible upon the political or economic horizon at this time is the steady, relentless increase in the price of everything that goes to make up the cost of living.

"This unusual phenomenon of steadily rising values in the face of a long succession of bountiful crops is one of the most important as well as interesting problems that confronts the political economists today."

Mr. Brown then discussed the relation between the supply of gold and the industrial conditions. He made a vigorous plea in favor of increasing agricultural products, and asserted that we must increase production per acre by more intelligent methods, or we must face the relentless, certain day when we shall not produce food enough to supply our own necessities.

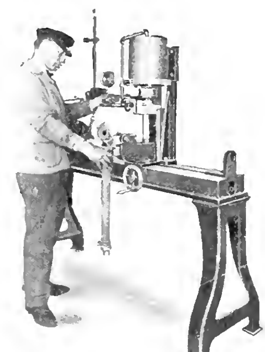
Mr. George A. Post, president of the Railway Business Association, made some most felicitous remarks about the position railway supply men occupied at that meeting, where no apologies were necessary in getting close to railway officials of the highest rank.

Mr. Post excited intense enthusiasm by expressions of admiration for the Governor of Massachusetts and for President Brown, of the New York Central Lines. He explained the purposes of the Railway Business Association as working under the banner inscribed "Conference, Concession and Concentration." "It was, he said, "the necessity for this trinity of action that called our organization into existence. Our method of promoting that end is to help create such amity between the railroads and the public that they will co-operate and each perform its part with wisdom.

"Our message to you in New England is addressed to railway officials on the one hand and to the public and public officials on the other. To our railway friends we say: 'By your efficient operation, your fair dealing with your patrons, your consideration to all men and your spirit of co-operation toward those charged with regulation, let it be seen that you desire the general good will and stand ready to go all reasonable lengths to secure it."

Can Do Four Things.

A good illustration and a few timely words do more to rivet the attention of a busy man than columns of closely printed matter set in minion type. As an example of the effective style of catalogue we may mention that recently got out by the Buker & Carr Manufacturing Company, of Rochester, N. Y. In that catalogue their Twentieth-Century Outfit is well illustrated and briefly explained. The outfit is most useful in a railroad repair shop as it deals with air brake and steam hose in several ways. First it is a bolt cutter and it cuts the clamp bolts as fast as a man can feed them to the jaws. Second it is a hose stripper. It will pull hose from their metal couplings after the bolts are cut at the rate of perhaps a thousand a day. Third it is



Bolt Cutter in Operation

a hose fitter and forces new hose on metal connections with as much ease as it took off old ones. Fourth it is a hose clamper. It applies clamps to new hose after the couplings are in place and it does this in a way which leaves nothing further to be desired. Write to the Buker, Carr Manufacturing Company, Rochester, N. Y., and ask for a copy of the catalogue. It is worth looking over.

The Johns-Manville Co., of New York, have issued an elegant catalogue with post card attachment describing and illustrating how four cars of coal did the work of five. The figures are given in detail showing the saving effected. It is pointed out that most of the so-called steam pipe coverings are merely coverings and not in any sense insulators. The merits of their Asbesto-Sponge Felted Covering are set forth in due form and when this is used on the pipes and Vitribestos Boiler Covering is used on the boiler, the saving is unquestionably great. All interested in fuel saving should send for a copy of this publication.

Long John's Misfortune.

Everybody knows that "Long" John Driscoll is lame, but very few people know how John came to lose his foot. John pulled a construction when the Santa Fe was pushing its track through New Mexico. Lawlessness prevailed in the territory at that time, and railroad men were frequently the victims of thieves and robbers.

John with other railroad men was housed for a time in a hotel in Albuquerque. Everybody went armed. One night John was in bed and he thought he heard a noise in the room. It was a clear moonlight night, and on looking carefully about he thought he saw a hand clasping the rail at the foot of his bed. Quickly slipping his revolver from under the pillow he took aim at the hand and fired. He jumped up with a yell and found he had passed a ball through his own foot.

A Modest Hero.

By Angus Sinclair.

In 1889 it was my good fortune to cross the Atlantic in company of Dr. Williams, of the Baldwin Locomotive Works, and Albert J. Pitkin, of the Schenectady Locomotive Works. We formed a very social trio and I have always remembered the voyage as the most delightful trip I ever enjoyed. Our principal amusement was telling stories and Dr. Williams seemed to excel himself. According to my note book:

"Some men," remarked the Doctor, "think that they can best distinguish themselves, when they become the chief officers of a railroad, by turning off as many of the old hands as possible. A superintendent wants new train dispatchers, new conductors and even new brakemen. A master mechanic has a following behind him, and to give his friends positions he turns out shop foremen, engineers and even firemen. I never found that practice to work well. The men familiar with a road and the ways of doing the work may be depended upon to carry on the business for the interest of the company better than new men. I never saw the follower practice followed, but it resulted in failure, and the men who adopted the policy seldom remained long on one road.

"When I went on the Michigan Southern, as general superintendent, I was told on all hands that I would find the worst set of men to be found on any road in the West, and that my first work ought to be the making of a clean sweep of the trainmen. The thing was repeated to me so often that I got to believe that I was going among a hard, incompetent crowd. I made up my mind to move slowly, but to be on the watch for black sheep.

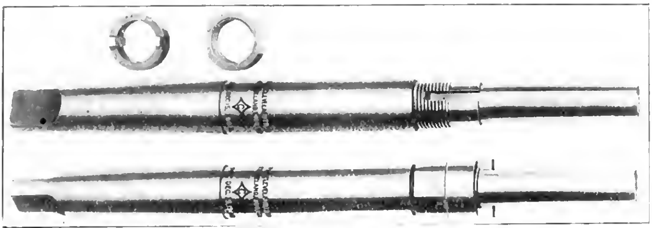
"There was on the road, as passenger engineer, a tall, lank, loose boned Eastern man called James McKinney, who had a gruff, independent way with him that I did not like. In a few weeks I made up my mind that I would start an exodus with McKinney. Time went on and I had no decided cause for sending McKinney about his business when a bad snow storm came on. The main line got blocked near Chicago and I had personally to take a hand in getting the track cleared. A number of snow-blocked trains had got together, and it was a terribly hard job getting the cars moved out. We toiled continuously, day and night, at the work, and the last night the only engine I had that could give help was that run by McKinney. We kept going all night long and worked steadily without a murmur. I had heard something during the night about the heater pipe on McKinney's engine bursting, but no delay was caused by it, although there was a fearful cold wind blowing and the bare prairie gave it full sweep so that the men had full cause for giving in. Well, toward morning we got the line cleared, and when we were all done McKinney asked some of us to help him to get down off the engine. I asked what the matter was, and he replied that his leg got burned when the heater pipe burst, and it was now so stiff that he could not move. We got him down and into a waiting room and when we took his drawers off to examine the wound the skin of his side and leg came off. I was shocked, and asked whatever induced him to keep at work in that condition. In a matter-of-fact way he said that there was no one to take his place, and he could not let the work stop. He was laid up for six weeks, but got around again all right. I always found him just the kind of man that one would expect from the incident. His case was a lesson to me not to judge men rashly. He is now an engineer on the Union Pacific, and I know the company have no better man."

Corubin.

A valuable by-product is obtained in making chromium by the Thermit process. This by-product is known as "Corubin" (registered trade-mark) and has proved to be one of the best abrasive materials obtainable. It is used extensively abroad in the manufacture of high grade emery wheels, emery cloth and for other purposes where a first class abrasive is required. Arrangements have now been completed for supplying the American market with this material and the Goldschmidt Thermit Co., of 90 West street, New York, will be glad to send further particulars to any firms that may be interested in the subject.

New Arbor for Shell Tools.

The Cleveland Twist Drill Company have secured the patents and are about to place on the market a new arbor for shell tools. As is indicated in our illustration the essential difference between this patent arbor and the regular type is that it is equipped with an adjustable collar provided with integral keys which slide in longitudinal keyways in the arbor. The arbor is also threaded for a short distance to receive an adjusting nut which bears on the collar. The collar engages the shell reamer in the usual way.



NEW ARBOR FOR SHELL TOOLS.

Perhaps the chief advantage of the new arbor is the quickness and ease with which it releases the shell tool no matter how tightly it may have become jammed on the arbor. A turn or two of the adjusting nut does the business and there is no necessity for removing the arbor from the spindle, and no need to resort to the vise and hammer methods which often cause damage. Another advantage which this arbor possesses is the fact that the collar can always be set so as to allow the shell tool to fit snugly on the arbor, and yet have the collar keys full engage with the slots.

On a recent Monday morning the pastor of a church in Virginia was the recipient of a basket of strawberries brought to him by a little girl of the parish. "Thank you very much, my dear," said the minister, one of the "unco guid" species. "These berries are as fine as any I've ever seen. I hope, however, that you did not gather them yesterday—the Sabbath." "No, sir," replied the child. "I pulled 'em early this mornin', but they was a-growin' all day yesterday.

Scots Giving.

Thomas Murdoch, a Scots wholesale grocer of Chicago, died on Christmas Day and left between $2,000,000 and $2,500,000 to benevolent purposes. The Cleveland *Leader*, sent to us by Mr. A. H. Carpenter, of the Acme Machinery Company, of Cleveland, O., says concerning Scots benevolence:

"The largest bequests of the year, for public purposes, were made by the will of John Stewart Kennedy, of New York, a banker of great wealth. It is calculated that about one-half of his fortune was given to philanthropic institutions and agencies, to churches, museums, and colleges especially. Mr. Kennedy disposed of $50,000,000 or $60,000,000, altogether, and his kinsfolk and friends were given only about half of that great sum. This munificent giver was born in Scotland, about the time that the Chicago grocer's life began.

"In the last dozen years the largest giver of all Americans or, indeed, of all individuals, the world over, has been Andrew Carnegie. He was born in Scotland, amid the usual grinding conditions of life for poor laborer's boys in a country upon which nature has lavished little to make work light or the struggle for existence easy.

"These men are types of a great class of Scots whose giving shames those who call the Scots avaricious and miserly. They are great workers and great getters of gold. They love wealth and the success which it implies more ardently, perhaps, than some other nationalities, but they are princely givers, when the occasion and the means are theirs. The typical son of Scotland hates waste and sets great store upon thrift, but he is no miser. He wins with a strong hand and gives with one which is as noble as it is careful."

Remembering Faces.

One cannot attend a railway convention or other meeting where many people come together who have met before, without being struck with the difference displayed in recognizing faces. The average person does not possess the gift of naming people they have seen rarely before.

The late P. M. Arthur, chief of the Brotherhood of Locomotive Engineers, possessed an extraordinary gift for remembering faces and could name all the delegates in a large convention. That gift is a strong source of popularity and is much cultivated by politicians.

King Edward of Britain is reported to have an extraordinary memory for faces, and is said to have recognized Americans he met during the visit he made to the United States a quarter of a century after he had met them.

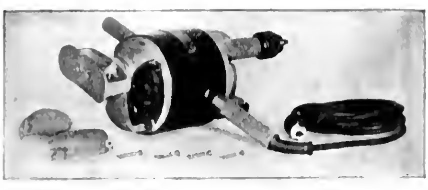
When personal accomplishment among royal potentates are considered, the Khedive of Egypt is the most remarkable of living rulers. He is a splendid linguist, speaking every European language with ease and fluency—German, perhaps, best of all, since he was educated in Vienna. At his receptions in Cairo it is nothing unusual for him to converse alternately in German, French, English, Arabic and Turkish. One of the most striking characteristics of the Khedive is his wonderfully retentive memory. He never forgets a face or a name, and is credited with having admitted, only a short time ago, that tabulated on his mind are the names, occupation, nationalities and circumstances of the many hundreds who have shaken hands with him in the reception room of the Abdin Palace, so that without hesitation he can greet each one by name and in his guest's own language on meeting him again, no matter how long after the first introduction.

Alternating Current Portable Drill.

The practice of taking heavy castings to a stationary drill, and of spending valuable time in adjusting them in order that a few brief moments may be spent in drilling is an example of old time shop practice which is being gradually superseded by the use of new tools. The direct current portable breast drill designed by the General Electric Company has so demonstrated its ability to do the work for which it was designed that they are now manufacturing an alternating current one which possesses all the superior features of their direct current drill and permits the use of this device where alternating current only is available.

The drill possesses the ruggedness of design required to withstand the hard usage incidental to its service, yet its weight has been reduced to 21 lbs. The device may be handled by one person with ease and rapidity. Two gnurled side handles and a breast plate provide ample means for holding it securely in any position.

An indicating control switch for starting and stopping the motor is located conveniently near the right handle so that it can be operated by the right hand without releasing the hold on the right handle. This feature makes control of the apparatus so simple that the workman's whole attention may be given to the operation of the drill. Hand holes are provided which furnish a means of easy access to the commutator and brushes for inspection and repairs if necessary.



PORTABLE DRILL FOR ALTERNATING CURRENT.

The drill is fitted with a Jacob's chuck which will take drills up to and including ⅜ in. in diameter. An idea of the saving of time made possible by its use may be gained from the following approximate data given to us by the makers: It will drill a ⅜ in. hole 1 in. deep in cast iron in 27 seconds; do the same in machine steel in 95 seconds. It will also satisfactorily operate a ¾ in. wood bit.

Compare this with the time required to move heavy castings to a stationary drill, adjust them, drill one hole, adjust again, drill another, etc. A crane is generally required for this work, necessitating the services of several men in addition to the one operating the drill. In many cases the same work could be done in a few minutes by one person with a portable drill.

This alternating current drill is designed for operation on a 110 or 220 volt 60 cycle circuit to which it is connected by screwing the attaching plug into a standard lamp socket. Our illustration shows the alternating current portable drill with cover removed.

Success.

Salesmanship is like athletics.

Success, in a degree, is handed to most of us.

Then success makes a fool of us.

Success makes for popularity, which means invitations.

Invitations to banquets, joy parties, and one more drink.

Successful salesmanship means the cultivating of confidence on the part of the buyer; confidence in the salesman, his house and his goods.

You can make this confidence in but one way, and that way is not through the bottom of a glass or by smutty stories.

The buyer that must have joy parties and night attention gets tired of these in a short time or goes down and out; in either event, he becomes a worthless acquaintance to the salesman who "set 'em up" in former years.

Chances are he will reform and look back on his escapades with shame, and blame the salesman for being the cause, for we are all prone to blame others for our own faults.

One requires a good digestion, a clear eye, a good appearance, quick thought and earnest application in selling, just as one does in boxing, playing billiards, or engaging in any other sport.

Learn to say "no," and you will have acquired the most essential aid in salesmanship training.—*The Houghton Line.*

Erie Lead with U. S. Screw Threads.

To the railway companies more than any other interest is due the fairly rapid introduction of standard screw threads. The United States officials had agreed to use the Sellers system of screw threads in all government structures and they became known as United States Standard Screw Thread. For years the promise was all that the Government departments had done.

When the promised reform was in a moribund state, Mr. Octave Chanute, general manager of the Erie railroad, inspired with life and vigor the movement which it had not previously possessed. He determined to introduce the system of interchangeable screw threads upon Erie car repairs, for it promised to effect great saving of expense. He applied to the Navy department for screw threads and gauges and specimens were received, but they did not agree. By very great persistence he succeeded in prevailing upon Pratt and Whitney to make special tools for the manufacture of the United States screw threads and the most important standard ever introduced by the Master Car Builders' Association was put in a fair way for becoming the uniform screw threads of the world.

Terrible Nervous Strain.

A rather seedy looking man hurried excitedly from the rear coach into the one ahead. "Has any one got any whiskey?" he shrilly inquired. "A lady back there has fainted."

Half a dozen flasks were offered instantly. Seizing one, he looked at it critically, uncorked it, put it to his lips, and took a long, lingering pull.

"Ah!" he exclaimed, with gusto. "I feel better now. Seeing a woman faint always did upset me."—*Cosmopolitan*.

Light Spreading Book.

Peter Gray & Sons, lantern makers, Cambridge, Mass., have been giving away a remarkably convenient memorandum-information book. It is complete as a calendar, contains pages of psychological fragments of wisdom, has blank for identification, tells all about weather indications, on weights and measures, makes a person independent of school memory, as it gives answers to almost every embarrassing question that Young America shoots at its long suffering parents. It's a dandy. Send for one. You may get it or may not, but try. There is a special edition for ladies, too. That goes exclusively to people interested in buying lanterns.

A neat catalogue describing and illustrating Mica Chimneys and Globes is issued by the Storr's Mica Company, Owego, N. Y. The Storr's "Never Break" has become a familiar watchword among railway men, and those who may not be familiar with its appropriateness should send for a catalogue and become instructed in the peculiar fitness of Mica in the use of lamp chimneys. The value of the publication is enhanced by a full description of the best methods of cleaning the chimneys.

Had Patience.

The days of long sermons are not entirely departed from Scottish churches, although the discourse lasting four hours that used to be slept through is now seldom indulged in.

A stranger entered an Auld Licht church in the middle of the sermon and seated himself in the back pew. After a while he began to fidget. Leaning over to the white-haired man at his side, evidently an old member of the congregation, he whispered:

"How long has he been preaching?"

"Thirty or forty years, I think," the old man answered. "I don't know exactly."

"I'll stay, then," decided the stranger. "He must be nearly done."

"The Mallet Articulated Compound Locomotives" is the subject of Bulletin No. 1000, published by the American Locomotive Company. It is an elegant folio of 12 pages printed on toned paper and illuminated with 19 illustrations of the Mallet articulated type of locomotive. The remarkable success of this type of engine in certain kinds of work is finely described in an introductory essay, and the various locomotives illustrated are mechanically described. These Bulletins are issued monthly and may be had on application to the company's office, New York.

Visitors to the Springfield Manufacturing Company's factory at Bridgeport, Conn., find signs of new business activity that have come from a change of management. Mr. Bromdes, who was long the active personage at Bullards, is now president of the Springfield Manufacturing Company and he is making things hum. He is preparing to manufacture several new tools, particulars of which will be given out soon.

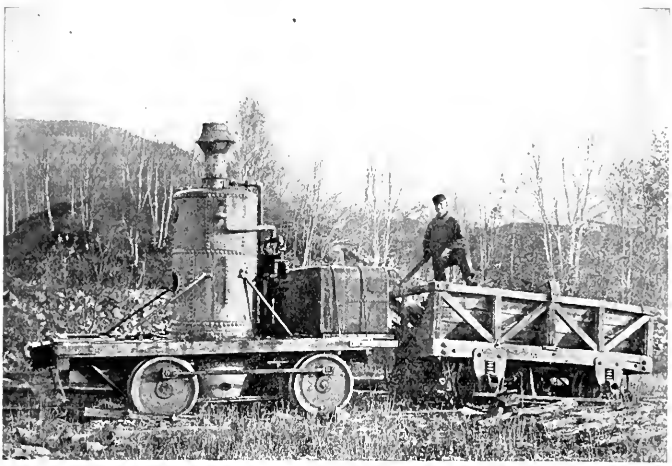
Special Apprentice Course.

A great many graduates of colleges and of technical schools have gone through the special apprenticeship course of the Pennsylvania Railroad which fits them for promotion to official positions. The course gives a young man a smattering of varied experience which may be made the basis of thorough railroad professional knowledge or it may be of very little practical use, all depending upon the disposition of the recipient. The course is:

Erecting shop, 6 months; machine shop, 6 months; vise shop, 3 months; air brake shop, 2; blacksmith shop, 2; iron foundry, 2; boiler shop, 2; car shop, 6; round house, 4; firing locomotive on road, 3; shop clerks, office, 2; motive power office, 2; drawing office, 3; test department, 5 months.

A Mine Worker of Long Ago.

Our illustration shows an interesting old relic of steam power which was used at the Michigamme mine about twenty years ago. Mr. A. L. Rose, of Marquette, Mich., sent the photograph to the *Locomotive Engineers' Monthly Journal* and the editor of that magazine has kindly lent us the engraving. Speaking of this curious old machine, Mr. Rose says, "It has a vertical engine which is attached to the axle by cog-wheels and the power is conveyed to the other pair of wheels by a rod on each side. The car behind is one of the old style ore cars that the Marquette, Houghton & Ontonagon Railway, now part of the Duluth, South Shore and Atlantic, had about eighteen years ago. It carried about eight tons of iron ore. As can be seen the car has only two pairs of wheels and used to couple with links and pins. The photograph was taken by Mr. Nathaniel Mortonson."



OLD STEAM LOCOMOTIVE ONCE USED IN MINE SERVICE.

Standardization of Disinfectants.

A great deal of interest must be felt among railroad men on the striking paper read by Dr. Wm. Dreyfus before the meeting of the American Public Health Association on the Standardization of Disinfectants, which led to the appointment of a committee consisting of five prominent bacteriologists to report on a standard test for proving the merits of anything that is offered as a disinfectant.

In the paper read before this meeting a technique was described that insures uniform results when carried on by different investigators, as the plan proposed is to take carbolic acid crystals as the standard of control and designate other disinfectants in terms which instantly indicate their comparative potency and is expressed in the words "Carbolic Acid Coefficiency."

This subject has been agitated abroad, especially in Great Britain, within the last few years, with great success, and quoting from a form used by the Central South African Railways, we find that the large consumers of disinfectants require those who supply them with disinfectants, shall guarantee the product offered and specify the carbolic acid coefficient of same, so as to do away with the uncertainty that now exists and which has allowed even those preparations which have no disinfecting value to find a considerable sale among large consumers.

Our attention has recently been directed particularly to this matter of disinfectants, in considering the offer made by a manufacturer to supply in one of his products a disinfectant which is from five to six times stronger than carbolic acid and the test has not only been surprising in showing the greater effectiveness of this disinfectant, but also in demonstrating that it was actually less expensive than disinfectants of less efficiency than carbolic acid, such as Formaldehyde, but also of those which were just as strong as carbolic or a little stronger.

We believe that when the subject is taken up by the railroads and the practice is adopted as instanced in the case of the railroad quoted above, purchasers will gain a double advantage by requiring those who offer disinfectants to specify the carbolic acid coefficiency of each.

The one to be trusted as your intimate friend is not the one you hear talking kindly to people when they are present and unkindly of them when they are not present.—*Standard.*

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances

Vol. XXIII. 114 Liberty Street, New York, March, 1910. No. 3

Grand Trunk Shops at Battle Creek.

These shops are centrally located on the western division, and take care of the repair work for 250 locomotives, covering over 1,000 miles of track. The general layout provides for a future extension of 100 per cent to each building in such a manner that the area for extension [illegible] not between the structures, in which [illegible] it would be necessary to carry material from different departments over this additional area. The power house is at the east side of the shops so as to be central when the car shops are erected.

A foundry, and carpenter and pattern shops are on the north side of the yard crane runway opposite the locomotive shops, and the frog shop is just east of the forge shop, on the south side of the yard crane runway.

All buildings are parallel to the main line of the [illegible] all yard track to buildings [illegible] with the main line so as to give the [illegible] of material to and from the [illegible].

The power house [illegible] a handsome substantial [illegible] concrete foundation of which [illegible] height of 5 ft. above the ground, and supports the steel structure with its colonial shale brick walls and flat composite roof of asphaltum.

The erecting and machine shop is a spacious building, under one roof, and constructed of steel, concrete and brick, being of self supporting type, having floor [illegible] of 120 x 612 ft. The roof [illegible] composition of felt and tar [illegible] with gravel, light being obtained through skylights and surrounding windows of the clerestory of the erecting [illegible] while the roof lighting of the machine shop is furnished through windows

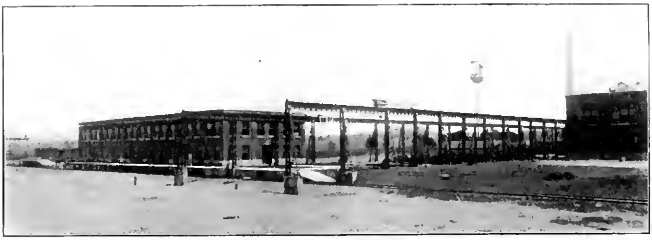
ERECTING [illegible] THE BATTLE CREE[illegible] OF THE GRAND TRU[illegible] WAY SYSTEM of sawtooth type. Particular attention has been devoted to obtain full benefit of natural light; instead of the ordinary window glass, the corrugated style was adopted, the effect produced, being a better diffusion of light, which almost entirely eliminates any semblance of shadow. Besides this the interior of the building is painted white and is thus an excellent reflecting surface.

Due consideration regarding the comfort of the employes is quite apparent in these shops. Situated on the balcony, which extends along the machine shop side of the wall, a length of 588 ft. x 40 ft. in width, are to be found three heating fans by means of which air is drawn over an aggregate of 43,500 lineal feet of 1-in. steam pipe coils. The heated air passing through "down" ducts, enters concrete tunnels, leading to the diffusers along the walls, slightly above floor level, from whence it enters the shop. It can be readily imagined that by this method, besides imparting warmth, a perfect circulation of air is steadily maintained. A 60-h.p. engine drives each of these fans, the exhaust steam passing through the coils, which steam, along with that from the steam hammers, pumps and main engine, is ample to cope with an outside temperature considerably below zero point.

In the erecting shop bay, which is 70 ft. wide by 612 ft. long, are twenty-five engine pits, each 43 ft. in length, having a space allowance of 24 ft. between their respective centers. Extending along the sides of each pit are recesses, in which are hung air piping and wiring conduits The former having connections for pneumatically operated tools, which in the latter are two plug receptacles to admit of the use of extension incandescent lamps. Water and steam pipe valves are placed at the back end of each pit to be used in connection with the customary boiler test. Between each two pits is located a work bench attached to which are two extension lamps similar to those in pits. Each of the benches are also equipped with two heavy vises.

It is worthy of note that to all the supporting columns adjacent to the back end of the pit, there are also attached air pipe connections and plug receptacles.

The erecting bay is served by two electric cranes, one of 120-ton and the other of 10-ton capacity. These are supported by separate runways, which are attached to the steel frames of the building. The larger crane being above the smaller one has ample headroom to carry a locomotive the entire length of the shops over the other, while the smaller crane expedites the work of stripping and erecting various parts of the engines. Motor-driven double emery wheels are placed along the walls immediately in front of the locomotives to assist materially in saving time on various portions of the work. There are two tracks which enter the machine shop opposite the sixth pit from each of the erecting shops to facilitate the transporting of engines to and from that shop.

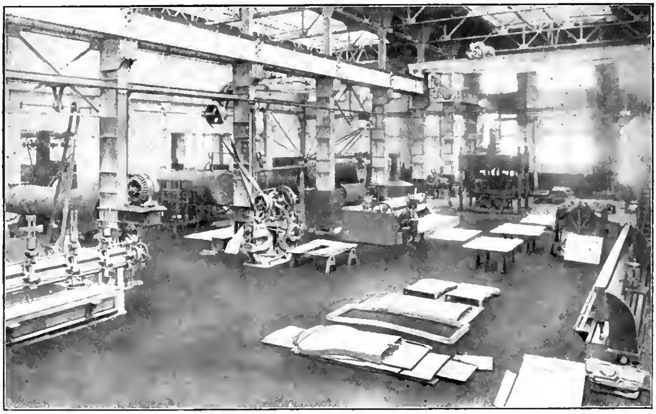


OFFICE BUILDING AND GENERAL STORE, G. T. R., BATTLE CREEK.

At one end of the erecting bay five pits are temporarily covered over, that portion being allotted to the pipe department, and also the welding and cutting of flues. It might be stated that due to the fact of an approved method of repairing flues, also the relative location of each machine and furnace, the process of accomplishing the work is of an expeditious character. A motor-driven pressure blower delivers a 14-oz. blast to both of these last named departments.

Running parallel with the erecting bay is located the heavy machine tool section of the machine shop. This section is 60 ft. in width and 612 ft. long. It is not at present used entirely in the interest of the machine shop, about 120 ft. being used as carpenter shop. The entire length, however, is served with a 10-ton crane. The machines in this section are driven by individual motors. With the exception of a portion of the wheel and truck department and the major portion of the general machine department, all the other departments embraced within the machine shop on the ground floor are arranged under the balcony. These are the wheel and truck, piston and crosshead, motion, tool, bolt and rod, the tin, paint, air brake, brass finishing, machine repair, belt, and electrical departments being on the balcony floor which is of reinforced concrete 6 ft. thick. In order that each one of the above named departments might be self-sustaining a sufficient number of machines of varied types have been allotted it, thus obviating the frequent handling of the work. A concrete caustic soda vat having inside dimensions of 10 x 20 x 10 ft. deep is placed in the main bay of the machine shop. By means of this the work of cleaning wheels, engine trucks, etc., is quickly accomplished. Through the medium of a small motor-driven exhaust-fan the fumes from this vat are conducted outside the building.

These shops are at one end of the machine and erecting shops at right angle thereto, being constructed on similar lines to that of the erecting shop, having floor dimensions of 180 x 205 ft. A brick curtain separates this shop from the erecting and machine shops. An opening, however, admits of the conveying of boilers to and from the erecting shop, the boilers being passed through by means of a truck with a revolving top. The main boiler bay is 60 x 180 ft. and has ample capacity to accommodate nine



CORNER OF THE BOILER SHOP AT BATTLE CREEK.

boilers at one time and is covered by a thirty-ton double trolley crane. In the machinery bay which has dimensions of 50 x 30 ft., an accumulator capable of exerting water pressure of 1,500 lbs. per sq. in. has been installed. This is supplied by two motor-driven pumps adjacent to it. The hydraulic tools consist of a large four-post flanger and a horizontal punch having a 60-in. throat. In addition to these there are in the forge shop two heavy shears, a large punch and a bulldozer, which receive power from this plant. A large annealing furnace forms a part of the equipment in this department, also a motor-driven splitting shears and punch, besides other miscellaneous tools. The brass foundry is also temporarily located in this bay. A ten-ton overhead travelling crane and several jib cranes facilitate the handling of the work in this bay. The tank shop is divided into two bays running parallel with each other, one on which truck wheels and axles are handled, and the other is for dealing with repairs to frames and tanks, the tank bay having a floor space of 65 x 205 ft., which gives ample room to place a tank and a frame on a single stall. A twenty-ton double trolley crane is employed in this bay.

HEAVY MACHINERY SECTION IN THE BATTLE CREEK SHOPS.

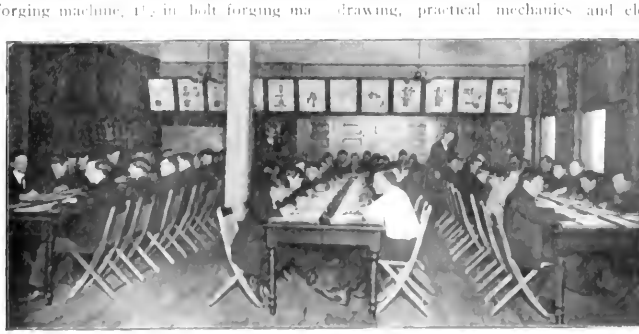
The forge shop is 66 ft. east of machine and erecting shop with the north end on yard crane runway. The building has a self supported steel frame with brick curtain walls, composition roofs and cinder floor. The inside dimensions are 100 x 200 ft., and 24 ft. 8 ins. from floor line to bottom of roof trusses.

The building is divided into ten bays, 20 ft. each. The windows are 15 ft. 8 ins. wide, and extend from concrete water table to bottom of roof trusses. The center of roof has a monitor top 10 ft. high, by 20 ft. wide, with a pivoted sash, mechanically operated for ventilation and light, and thus with wall windows give excellent lighting.

All steam piping is carried in an underground tunnel in center of building to and from steam hammers. The oil and water piping is carried underground in pipes laid in concrete and high pressure air is carried along on the roof trusses with outlets on columns. All material in this shop is handled by the jib cranes and cars on a 24-in. industrial track and serves all parts of the building. The coal and coke sheds are just south of shops, and an industrial track runs into it, so that coal can be taken to all forges on a small coal car. There are 10 double forges on the west side of the building, all light work is done on side next wall while on the side next the steam hammers, which range from 250 lbs. to 3,300 lbs., the heavy work is taken care of. Near the north end of the forges, in the center of the building, is placed a special fire, which is raised and lowered by air; this is used for welding frames and is close to a 3,300-lb. single frame hammer, both of which are covered by a jib crane and are close to yard crane for handling engine frames. The hydraulic bulldozer, the hydraulic bar sheer, 3½ in. forging machine, 1½ in. bolt forging machine, with their oil furnaces, are on northeast corner of the shop, and take care of all machine forging for the plant. Just south of this on east side of building is the axle department with axle furnace, 5,000-lb. hammer and double cut off and centering machine. This machine and the two forging machines are run by a 30-h.p. group motor. The 3,500-lb. hammer and furnace are just south of this, and take care of the heavy forge work.

The store and office building is a two-story structure, built of reinforced concrete and brick. It is 60 ft. wide by 200 ft. On the east and west sides there is a concrete platform 12 ft. wide. This platform is on a level with the first floor, which is occupied by the stores department, and the unloading tracks which run on either side of the building are at a level convenient for unloading freight from the cars to the platform. These platforms extend to the center of the midway where heavy material may be easily handled with the yard crane. The platform along the east side extends to and around the oil house, which is about 150 ft. from the store and office building.

On entering the building one finds himself in a spacious hallway; to the right is the clerks' office of the stores department, to the left the storekeeper's private office, while directly in front is a stairway leading to the motive power offices which occupy the second floor. The second story is occupied by the master mechanic, Mr. J. T. McGrath, and his staff; it is divided into two sections by a hallway running from the top of the stairway to the assembly rooms at the north end. The M.M's. private office is at the southwest corner in a commodious room 20 ft. sq. finished in quartered oak, maple floor and tinted walls. Continuing along the west side the drawing class room is next. This room is 32 ft. x 40 ft. It is fitted with tables, drawing boards, blackboards, etc., and across one end is a row of clothes lockers to accommodate the clothing of those who attend the evening classes. Two evenings a week are devoted to the instructing of apprentices in mechanical drawing, practical mechanics and electricity. Across the hall is a reading room 20 ft. x 40 ft. This room is provided with the latest periodicals pertaining to the mechanical, scientific and literary world. Leading from this room and also the drawing class room are vertical rolling



APPRENTICE CLASS AT WORK, BATTLE CREEK SHOPS.

doors, which may be opened into the assembly room, which is 60 ft. x 80 ft. and will accommodate about 400 persons easily, making an ideal place for social functions, lectures, etc. Continuing along the east side and opening from the reading room is the library, the book cases of which are well stocked with the latest works.

The oil house is a single-story building, 30 ft. x 40 ft.; it is built of reinforced concrete and brick. The floor of the building is about 10 ft. above the ground level, which happens to be low at this point and makes convenient place for the oil storage tanks, ten in number, with a capacity of 8,000 gallons each. The oil house is divided into two rooms of equal size, one is used as a pump room for pumping the oil from the tank below, the other for the storing of oil in barrels. The oil pumps are six in number, three of which are power pumps and the others are operated by hand. These are of the S. F. Bowser & Co. self-measuring type.

The Jacobs Superheater.

The Jacobs superheater is of the smokebox fire tube type, involving no change in the construction of boilers or front ends in its application to locomotives of the usual type. The superheater consists of two steel drums or sections with horizontal fire tubes and suitable steam connecting pipes. The gases of combustion after leaving the boiler tubes pass through and around the superheater sections, superheating the steam to an average of 100 degs. Superheating is thus accomplished by waste heat in the gases of combustion without sacrificing any effective heating surface in the boiler.

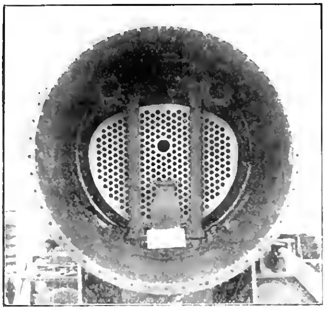


FIG. 3. REAR SECTION AND STEAM PIPES.

The construction of the superheater is shown clearly by Fig. 1. The forward drum is circular in cross section and is placed ahead of the exhaust pipe. The rear drum is somewhat oval in cross section in order to leave space above for the dry pipe and stands over 2 ft. ahead of the front flue sheet of the boiler. The steam is conducted from the dry pipe forward to the front drum of the superheater where it is circulated around the tubes by baffle plates of thin sheet steel as shown by Fig. 2. It is carried back from the front section to the top of the back section where it is again circulated around the fire tubes and the superheating completed. From this section the steam is carried into the steam chests through steam pipes as illustrated in Fig. 3.

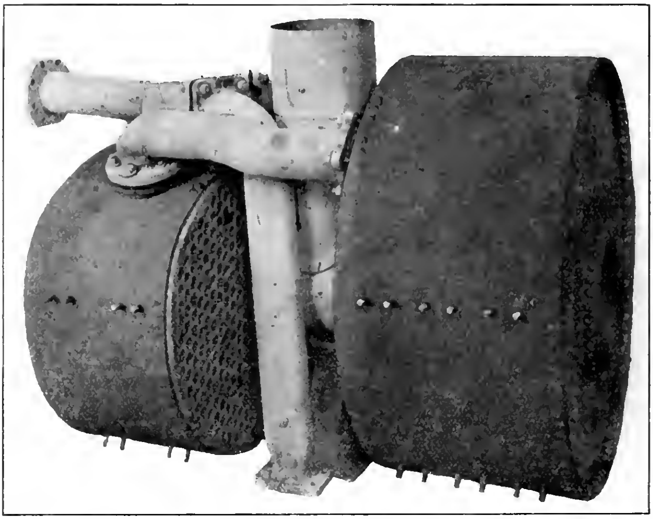


FIG. 1. FRONT AND BACK SECTIONS OF JACOBS SUPERHEATER.

The front section has a large cylindrical opening between the flue sheet as shown in Fig. 4. A smoke tube through this opening connects with the petticoat pipe by an elbow. The connections are made with tight joints so that the draft induced by the exhaust causes no direct current from the boiler tubes to the stack. The flue gases from the boiler are drawn forward by the exhaust through the tubes of both sections and back through the cylindrical opening in the front section, into the petticoat pipe and out the stack as illustrated in Fig. 5. Thus the gases are brought into contact with all the superheating surface and an equalization of draft in the boiler is secured which is not possible with the usual draft appliances. The use of netting and the diaphragm is entirely done away with and an even draft is induced in all boiler tubes and over all portions of the fire with consequent improved combustion and evaporation. In the indirect course followed by the gases through the superheater tubes, live cinders are so broken up and destroyed as to eliminate all fire throwing from the stack.

The drums or sections are constructed as light as safety will permit, thus reducing the weight of the superheater to the minimum and the thin sheets are efficient heating surfaces. The tube ends in the back section are welded to the flue sheets by the autogenous process, thus securing perfect and permanent joints. The tubes in the front section are expanded and beaded in the regular manner. Owing to the thinness of all superheating surfaces, the maximum degree of superheat is quickly reached after the locomotive is started.

For facilitating work on boiler tubes, the back section of the superheater is at a distance of 27 ins. ahead of the flue sheet, thus providing a working space between the two. A man-hole through the lower portion of the smoke arch affords access to this space. In line with the large cylindrical opening in the front section, one 6-in. flue is placed in the rear section in order that boiler flues may be cut out and removed through this hole.

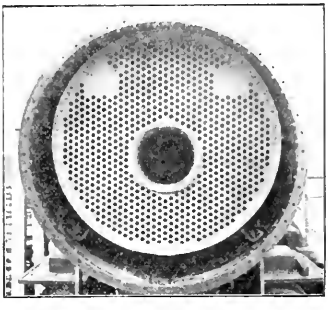


FIG. 4. FRONT SECTION IN PLACE.

All parts of the superheater are readily accessible and the drums may be easily removed from the smoke-box. Owing to the manner in which the superheater is built, there are practically no running repairs to be made while the engine is in service. Steam pipe connections have ball joints. With the elimination of all draft appliances, repairs to front ends of locomotives with this superheater is practically reduced to inspection. While the live cinders are broken up and all fire-throwing from the stack eliminated, the front end is self-cleaning and requires but little attention at terminals on this account.

The first Jacobs superheater was placed in service on the Santa Fe and applied to a simple locomotive leaving the shops in November, 1908, and has been in continuous service since that time with absolutely no repairs to the superheater. Since then and up to September, 1909, sixteen locomotives on the same road have been equipped with Jacobs superheaters, all of which were built in the company's shops and applied while the locomotives were in for repairs. Thirty-seven superheaters are now being built at the Topeka shops and will be applied to locomotives at present undergoing repairs and those scheduled for the shops in a short time.

The four Baldwin Mallet locomotives, two passenger and two freight, are equipped with the Jacobs superheater. In addition to these, the same type of superheater has been specified for 76 locomotives of various types recently ordered from the same works. It is also contemplated ordering 75 additional Jacobs superheaters from the Baldwin Locomotive Works to be applied to the Santa Fe tandem compound locomotives.

Necessarily, with the different classes of locomotives to equip, the style and construction of the superheaters has been altered to suit the locomotive to which they were applied. In addition to equipping simple locomotives, superheaters have been placed in the Santa Fe type tandem compound locomotives, the largest engines in the world on a single rigid wheel brace. Fig. 6 shows the construction of the superheater as applied to the tandem compounds. In this design, the steam receives an initial superheating in the front section and passes into the high pressure cylinders. It is discharged from there into the rear section and reheated, and then passes into the low pressure cylinders. The super heater here acts as a two stage super heater.

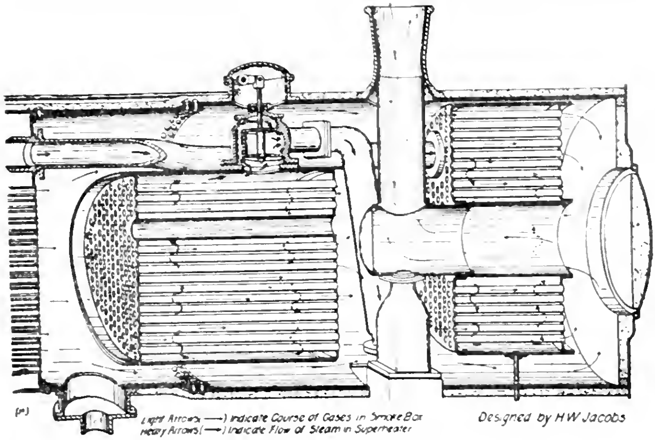


FIG. 5. SUPERHEATER AS APPLIED TO SIMPLE LOCOMOTIVE.

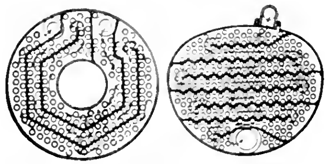


FIG. 2. SECTION OF HEATER FRONT AND BACK SECTION.

FIG. 6. SUPERHEATER AS APPLIED TO TANDEM COMPOUND.

In actual road service the locomotives equipped with the Jacobs superheater show considerable economy in fuel over locomotives using saturated steam, in addition to greater hauling capacity and lower repair costs. The tests conducted last August by the engineer of tests, on the tandem compound locomotives with and without the Jacobs superheater, show very clearly the superior performance of locomotives using superheated steam. These tests were on the mountain district between Raton, New Mexico and La Junta, Colorado, the running distance being 81.5 miles. This superheater was designed by Mr. H. W. Jacobs, assistant superintendent of motive power of the A., T. & S. F., at Topeka, Kan.

Inflammability of Treated Wood.

At the recent annual meeting of the Wood Preservers' Association in Chicago, Mr. H. M. Rollins, superintendent of the Texas & New Orleans Wood Preserving Works, read a paper on the "Inflammability of Treated Timber." He gave the experience of his road with the treated timber.

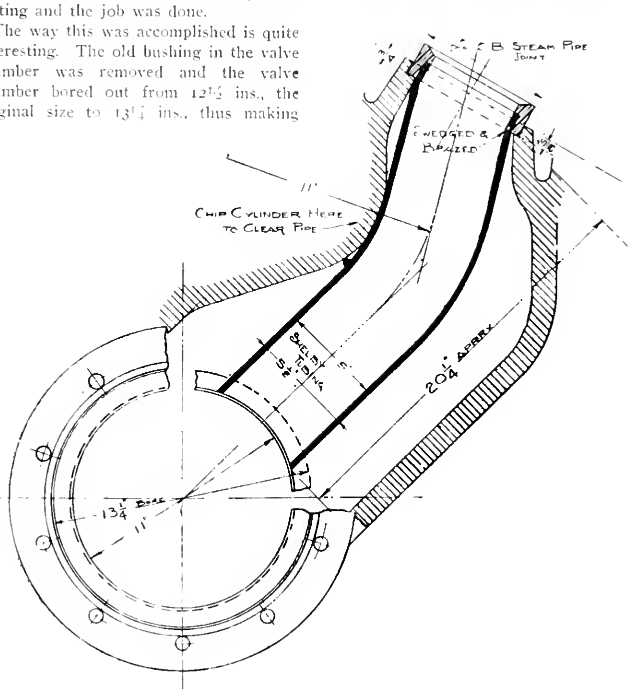
Mr. Rollins dealt entirely with wood treated by creosoting and said that it had been shown that wood so treated is at first more inflammable, but that it gradually loses this property and finally becomes much less inflammable than the untreated wood. This is due to the vaporization of the lighter oils and the consequent deposit of the residues on the inner surfaces of the pores of the wood. Fire tests on treated and untreated poles showed that the former were only slightly charred, the fire going out of its own accord, after about ten minutes, while the latter, under similar treatment, were completely burned through, the fire continuing for two and a half hours.

Never pass judgments in your disheartened hours. An honest soul never takes the verdict of its melancholy.

Ingenious Repair Work.

The method whereby a locomotive cylinder casting, cracked in the live steam passage between the branch or steam pipe joint and the valve chamber, was saved and practically made as good as new, at the Silvis Shops of the Rock Island Lines, deserves more than passing notice. Mr. G. W. Seidel is superintendent of these shops and to him is due the credit of having worked out the solution of the problem. The cylinder casting was designed for an eleven inch piston valve and the crack opened up so that steam escaped from the live steam passage before reaching the valve. A wrought iron steam pipe or sleeve was secured inside the live steam passage in the cylinder casting and the job was done.

The way this was accomplished is quite interesting. The old bushing in the valve chamber was removed and the valve chamber bored out from 12½ ins., the original size to 13¼ ins., thus making



METHOD OF REPAIRING CRACKED CYLINDER, C. R. I. & P.

the new bushing ¾ of an inch larger in diameter, to allow for the regular bushing to be applied, after 7-32 in. wear has taken place. When the new bushing was put in position, it, of course, cut off communication between the live steam passage and the valve chamber. A 5 9-16 in. hole was, however, cut through this bushing in the center so that steam could enter the interior of the chamber. Into this 5 9-16 in. hole a piece of 5 in. Shelby tubing was inserted, the tube was bent to suit the curve of the live steam passage, and at the upper end of this tube, the steam pipe joint was made.

Before applying the 5-in. tube, the steam pipe joint and the cylinder saddle was counterbored 7 ins. in diameter, ⅝ in. deep at the lower side and ¾-in. deep at the upper side. This was done so as to permit the use of a wrought iron ring which was brazed to the top of the tubing. This wrought iron ring was countersunk and ground to the old steam pipe joint ring. This arrangement holds the upper end of the tube securely in place and a tight joint is made between steampipe and tube.

The lower end of the tube is inserted in the 5 9-16 in. opening in the valve chamber brushing and is expanded or rolled into the bushing exactly as flues are rolled in a boiler. In this case a special expander had to be made with a long shaft and a universal joint close to the top of the hard taper pin upon which the expander rollers turn. This form was necessary in order that the operation of expanding the tube could be done from the smoke box. When the tube and bushing had been securely united by rolling, all the holes previously in the cylinder, for relief valve and oil pipe connection were drilled through the bushing.

This method of obviating a cracked cylinder has the merit of being practically standard for the class of cylinder for which it was designed. Any crack anywhere along the length of the live steam passage is handled by this method and the same treatment is applicable to either or both cylinders. Very considerable time and expense have been saved with any cracked cylinders which have appeared on the Rock Island Lines since Mr. Seidel's 5-in. pipe cure has been applied to the diseased engines.

The Trainmaster.

His duty, says Mr. F. E. Bolte, Terminal Railroad Association, St. Louis, is to take charge of the movement of the traffic, exercise supervision over the men employed in the movement of trains, interpret and enforce the rules pertaining thereto, take general charge of clearing the road in case of accident or obstruction and see that proper precautions are taken to insure the safety of property and trains.

He should anticipate conditions affecting the movement of trains, landslides, washouts, shortage of power, derailments and the various obstacles that suddenly confront him from time to time, and as far as possible have plans and preliminaries arranged for handling the traffic.

It is axiomatic that no official can be successful without the co-operation of those over whom he exercises supervision. The trainmaster needs this to an exceptional degree from dispatchers, yardmasters and yard men, station men, train and engine men, down to the humblest member of the department.

His personality will be largely instrumental in securing and retaining this support. Too much reserve, like too great an intimacy, will destroy it; but the perfect poise of the man of power will claim it at all times and the confidence that such an attitude inspires is productive of a loyalty to the company, to the division and its officials that is echoed in the splendid records that are daily being made where such conditions exist.

In the administration of discipline is to be found one of the supreme tests of ability. It must be done constructively at all times to be effective. Applied in any other spirit it fails of the purpose for which it is designed and serves to implant the seeds of discontent and sedition in a field thereby rendered peculiarly receptive, and many evils and abuses will arise to plague the unfortunate official who strays into such an error. Inability to understand and thus successfully handle men has been responsible for the failure of numerous officials possessed otherwise of brilliant talents. Absolute justice is difficult to render, but all can approximate it by excluding all personal feeling in dealing with infractions calling for its dispensation. The trainmaster who conscientiously endeavors to do this has little to apprehend, either from a reversal of his decision by superior authority or through a disgruntled organization.

General Correspondence

Variations in Painting Practice.

Editor:

The rather remarkable variations that exist in car painting practice were presented in a paper read before the recent convention of the American Chemical Society by Mr. Carl F. Woods, of the Arthur D. Little, Inc., laboratory of engineering chemistry, in Boston. As an indication of the unscientific way of dealing with paint problems, Mr. Woods notes at the outset that although there has been in recent years a strong movement for the standardization of paint products, very little attention is being given to the proper application of the standardized paints themselves.

There is no class of painting in which this is more clearly illustrated than in that of car finishing, for this is not a comparatively simple operation like house painting, but on the contrary is a complex and highly skillful procedure, requiring expert labor and involving the application of many coatings.

The object of car painting is both for protection and for decoration, although the latter consideration has exerted the greater influence on the modern practice of car finishing. It is possible to preserve the wood-work of a car body just as efficiently by frequent painting with suitable oil paints as by covering it with the ten to fifteen coats of paint and varnish customarily applied.

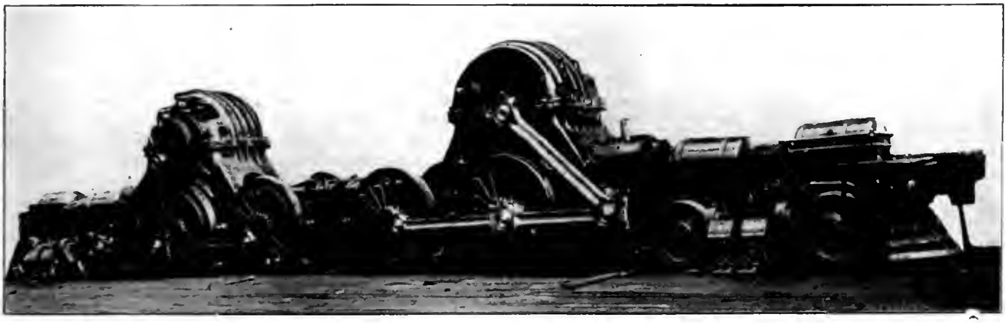
The cost of painting the same type of car varies on different roads from $30 to $60, and in certain cases even a larger amount, while some roads are forced to repaint their cars every two years, and others with the aid of one coat of varnish each year are able to operate for ten to fifteen years before complete refinishing becomes necessary. It is particularly significant that those cars which have had the most expensive finishing are not of necessity the longest lived. It is obvious, therefore, that there are certain underlying principles upon which the durability of the finish depends.

Car paints as a rule are mixtures of liquids and solids having widely different chemical and physical properties. While each succeeding treatment has its own specific demands, the entire paint coating must act as a unit to prevent separation of the various films under the physical stresses of service.

There are four fundamental operations in car painting which must be performed to obtain the proper finish and the desired durability: First, the pores of the wood must be thoroughly saturated to prevent the absorption of succeeding coats and to form a cementing bond between the wood and the paint films. Second, the natural inequalities of the surface must be corrected and a smooth, hard foundation prepared for the application of the succeeding color and varnish coats. Third, the required color must be applied in a smooth, homogeneous film which is sufficiently thick to cover the underlying coats and which at the same time possesses proper elasticity. Fourth, the color coat must be covered with a film of varnish, both to protect the underlying paints from the effect of the weather and to obtain the glossy, smooth finish desired. It is necessary that this final coat be hard enough to withstand the abrasive action of sand and dirt and the general deteriorating effects of sun, wind and weather, but at the same time possess the maximum amount of elasticity.

Three distinct processes for car finishing are in use, which may be called the lead and oil, the surfacer, and the color and varnish processes. Other methods of finishing are employed but all of them are abbreviations or combinations of the three main types.

The lead and oil process, the oldest system in use, consists in thoroughly saturating the wood with a thin paint of white lead and linseed oil, followed after proper drying by thicker coats of the same paint until the woodwork is properly primed and filled. On the foundation so prepared, several coats (usually three) of a special paint known as rough stuff are applied. This consists essentially of a mineral silicate of moderate fineness mixed with white lead and ground in varnish. Such a paint dries quickly and can be brought by rubbing with blocks of pumice stone, to a smooth, slate-like finish, which affords an admirable surface for the body color. After a sufficient amount of color has been applied, the entire surface is given several coats of varnish, allowing each to dry thoroughly before adding the next.



MOTORS, DRIVING WHEELS AND MACHINERY OF P. R. R. TUNNEL LOCOMOTIVE.

The surfacer process was devised about thirty years ago to reduce the time, labor and expense of the old lead and oil system. The fundamental difference between the two processes is that the surfacer system omits the lead priming and filling and the rough stuff coats, but builds up the surface rapidly by the application of specially prepared paints. After the building up coats have been laid, the entire surface is rubbed with block pumice to the desired finish. From this point on, the process is identical with the lead and oil system, the surfacer process confining its efforts to the rapid preparation of a surface for the color coat.

The color and varnish process is of very recent origin and is a radical departure from the older lead and oil surfacer systems. The fundamental idea of the new process is that the fewer the number of coats and the more similar these coats are in composition, the more durable will be the final results obtained. With this in view, a combination of coats is applied which are so composed as to prime the wood, prepare a surface, and obtain the desired color at the same time. This is accomplished by employing heavy silicate paints, containing the proper color ground in the same kind of varnish, each coat possessing suitable drying qualities for its respective demands. The best results are obtained by the use of dark colors such as green or brown, because the principal ingredient may be ochre, umber or some other natural earth pigment which not only produces the desired shade, but is well adapted for preparing a foundation. The surface so obtained is covered with a coat of the body color ground in varnish followed by one thick coat of finishing varnish.

Each of the processes referred to has its specific faults and virtues. The lead and oil process, if properly applied, requires from three to four weeks and the application of ten or more coats. The surfacer process requires about the same number of coats, but, owing to the quicker drying of the surfacers, requires but two to three weeks for application. The color and varnish process is the simplest of all, and has been applied with apparently successful results in from six to eight days, with an application of four to six coats.

The faults of the color and varnish process are not as yet thoroughly understood, as the method is of very recent development and has not been subjected to the test of long continued service. It should be understood that the aim of this shorter process is durability at the lowest cost, and that appearance is in a measure sacrificed; but it is claimed that the finish obtained is fully as durable as by the older methods, that it is free from many of their faults, and that it produces a finished appearance sufficiently good for the purpose. On the other hand, the process is dependent upon specially made paints in which adulteration is difficult of detection, and which if carelessly made are not only short lived, but render more difficult the refinishing of the car. The system is only applicable to dark colors as the lighter and more brilliant pigments do not possess sufficient covering power, but this is not in itself a failing, as the use of dark green and brown colors is rapidly increasing, owing to the greater stability and length of life obtained. In this connection it is of interest to note that the Pullman Company have adopted a brown body color as the most satisfactory shade available, while a large proportion of the railroads, both steam and electric, employ a color of similar nature.

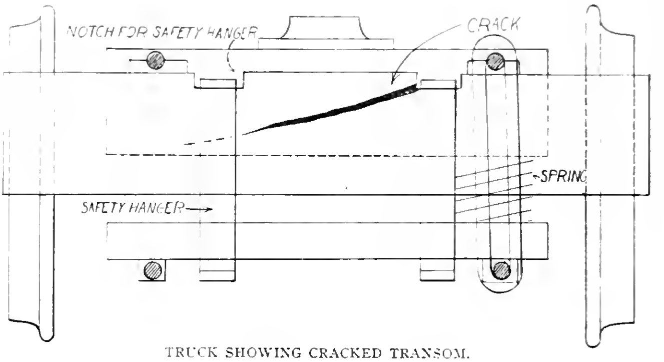
W. B. Snow.

Boston, Mass.

The Bad Right Angle Notch.

Editor:

Some years ago I had what Jim Skeevers would call a good object lesson on the bad results of notching or checking out of timber which is carrying a weight or under strain in any way. We were repairing some tender trucks, that is, giving them a good overhauling, and we put in a couple of new truck transoms in each, for oak was the thing at that time. The spring plank was new in each case and was made a little thicker than the old one had been, and altogether the work was done properly.



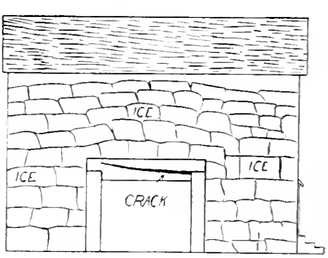
TRUCK SHOWING CRACKED TRANSOM.

The blacksmith had been given the safety hangers to heat up and anneal, and he had been told to make them a little longer on account of the new spring planks, but he misunderstood somehow or other, and when the trucks were ready to go under the tenders the safety hangers would not fit. Two of the engines had to go out that evening, so the top of the transom was notched out just sufficient to let the safety hanger go in place and hang clear of the spring plank, and everything was called all right.

The engines went out and ran their regular trips, but in about a month the transoms showed signs of cracking. The crack began at the notch for the safety hanger, and eventually new truck transoms had to be put in long before it would otherwise have been necessary. I do not know whether the sharp corner in the wood where the notch was cut is any more of a crak starter than if we had put in a fillet. I don't think a fillet in wood is much good, but some of your correspondents may be able to say positively, and if they can, I hope they will use the columns of Railway and Locomotive Engineering to tell us about it.

Another case of the same kind occurred the following winter. I had nothing to do with the second case except help to repair. A railway ice house was being filled with ice, and before the work was completed the manager of the railway restaurant prevailed upon the superintendent to have a chamber made in the ice house for hanging meat, etc. This chamber was reached by a door from the outside, and the restaurant people kept the key, and as the chamber was covered on both sides, back and top with ice, it was considered a good cooler. No ice could be taken out of the main ice house through the meat chamber. It had no opening into the ice house. The roof of the little chamber had rafters slightly checked out at the ends, no doubt with the idea of keeping the walls from crushing in, but the checking of the timbers started cracks in the wood, and before the winter was over the whole of the little meat house had collapsed.

While on the subject of checking out timber let me say that a very good form of shop ladder consists in nailing rectangular rungs to the two rails and filling the space between the rungs with a batton as wide as the ladder legs and



CRACKED ROOF TIMBER.

flush with the rungs. The usual way is to notch out the ladder legs and insert the rungs. Making the ladder the way I speak of causes less work than doing it in the usual way and makes a better ladder and pays due respect to the principle that you ought not to notch or check timber that is to be put under a static or a working strain.

G. Sherwood.

St. John.

Southern Pacific Engine.

Editor:

Enclosed you will find some photographs of Southern Pacific engines and trains, any one of which will, I think, interest the readers of your magazine.

E. McBurney.

Oakland, Cal.

[A very ingenious lamp for indicating train numbers may be observed beside the smoke stack, one on each side.

SOUTHERN PACIFIC TRAIN NO. 2 READY FOR THE START.

The lamp has five divisions so that five figures or letters may be shown at a time. The glass of each division is about 6 ins. wide by about 8 ins. high. The outer or weather side of each division is made of plain glass; behind that the stencil of figure or letter slides in a groove and behind the stencil is opal glass so that the figures are clearly visible day or night. The lamp has a curved back struck from a 20 9/16 ins. radius, and this curved back forms a reflector for the lamp. The flat face of the lamp is about 30 ins. long. Where an electric headlight is used the indicator lamp is fitted with an electric bulb. The faces of these lamps are set an an angle of 45 degs. to the line of the track so that it is possible to see the figures if one was standing directly in front of the engine or if he was at right angles to the smokebox. —Editor.]

Recklessness with a Whistle.

Editor:

Your article about care of boilers reminds me of an incident that made me wonder that explosions of boilers used for agricultural purposes are not more common than they are. I was sent to examine a boiler used in connection with a threshing machine in Missouri and found the back head badly bulged and three stay bolts pulled out. When I examined the boiler I said to the man in charge, you have been carrying too much steam; it's a wonder the boiler did not blow up.

"Why, Boss," said he, "that didn't do it, but I'll tell you what did it. You see I had a purty good head of steam when the belt came off. While they was fixing the belt I went down by the wood and brought back a fat rail fence that I used to chuck up the fire a little. The steam gauge pointer was up to the stop, but I had a big stone hanging upon the safety valve lever. When the belt was fixed I blowed the whistle before starting the engine and the end of the boiler blew out. That whistle did the job."

The owner of the engine came round when I was there and spoke very emphatically against the whistle. He declared it must come off right away. On the suggestion being made that the engineer was incompetent, the owner flared up and protested that the engineer was a good man and had worked in a blacksmith shop for two years.

Ex-Inspector.

Wheeling, W. Va.

Flange Lubrication.

Editor:

On page 10 of your January issue of Railway and Locomotive Engineering I notice a letter from L. J. Maloy relative to flange lubrication. In line with the last sentence I will give my little opinion for what it may be worth.

First, we must consider the cost of oiling devices and the oil; and oil enough to keep the flanges properly lubricated over any very great extent of track would soon run into a very expensive item. The tracks would necessarily become more or less oily, thereby causing great inconvenience at stations where people must pass over them often and run chances on ruining their shoes or skirts. Then too, the efficiency of the brakes would be greatly lessened by greasy flanges and track, thus causing greater liability for accidents. And lastly, the tractive power of the engines would be reduced to such an extent by slippery wheels and rail, that the cost of the reduction in tonnage rating which would be necessary to counterbalance this decrease, would far outweigh any saving that might be derived from reducing friction by flange lubrication.

C. A. Poland.

Atchison, Kan.

Abbula Railway.

Editor:

I am sending you a snapshot of a heavy passenger locomotive fitted with a snow plow, used on the Abbula railway in Switzerland, which may interest you. I am a boy of fifteen and took the picture myself. This railway runs from Chur to the Engadine at a height of 6,000 ft. above sea level. The grade of this railway is very steep, and it is a wonderful

SCENE ON THE ABBULA RAILWAY, SWITZERLAND.

piece of engineering. Its tunnels are very interesting because the railway turns about in them, and trains come out right over the place they enter. I also enclose a postal view of this railway. Your valuable paper is received and interests me very much. JOHN SCOTT BOYD, JR.

Poughkeepsie, N. Y.

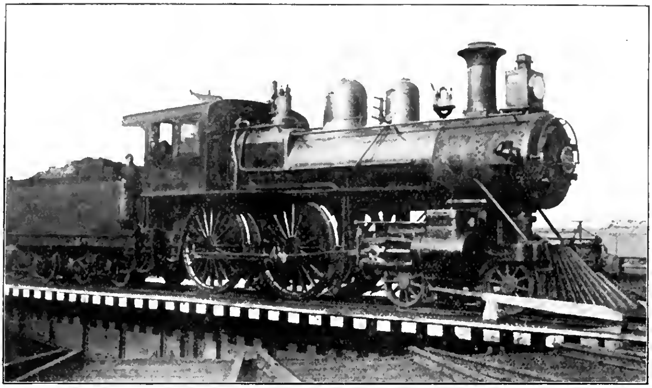


FIG. 1. AN EXAMPLE OF CLASS P ON THE P. R. R., BUILT IN 1893.

Engines and Trains on P. R. R.

Editor:

The article on the Pennsylvania Railroad locomotives published in your December number was very interesting and I am enclosing you some photographs of locomotives and trains on the Philadelphia, Washington & Baltimore Railroad (Pennsylvania System), which I thought might interest your readers.

Photograph No. 1 is a class "P" locomotive No. 5051, built at Altoona shops in July, 1893, and No. 2 is one of the old class "K" type No. 5142, built at Altoona shops June, 1892. No. 3 shows train 77, New York and Washington Limited hauled by a "D-16-B" Locomotive No. 5229, near Baltimore, Ohio. No. 4 shows train 68, another of the New York and Washington Express Limited's with a "D-16-B" on the head end.

Another which is not a very good photograph shows the Peninsula Express, better known as the Pigeon along a certain section of the road by the farmers, as its appearance is the signal for meal hour and quitting time. The locomotive is one of the old class "O" No. 5123, built at Altoona in the early 80's. There are quite a number of the "E-2" class on this end of the Pennsylvania, and quite a few of the class "E-2-A" equipped with piston valves and Walschaerts gear. The writer well remembers the wheel covers on the class "O," "K" and "L" engines and would like to see one in your paper.

Baltimore, Md. L. J. LAPSLEY.

Lead in the Walschaerts Valve Gear.

Editor:

We have been overhauling several engines here that are equipped with the Walschaerts valve gear, and we have been instructed to allow a quarter of an inch of lead in all cases. I am at a loss to know why it is considered necessary to allow so much of an opening of the valve, and if my experience is of any value the locomotives will not start as readily or pull as much, especially at a low speed, as they would do if the valve opening were much less. The subject has caused a good deal of discussion among the engineers and mechanics, and opinions are very much divided here. I am sure it would be interesting to have your opinion on the matter, and very likely some of your clever correspondents who may have had more experience with the Walschaerts valve gear than I have had, would also give us the benefit of their observations on engines equipped with that particular value gear. This is the first general repairing that has been done on the engines, and I have no knowledge about the original amount of lead that was allowed when this class of engine was new.

Superior, Wis. S. W.

[At first thought we are of the same opinion as our correspondent, but as the lead or opening of the valve at the end of the piston stroke is a constant quantity on engines equipped with the Walschaerts valve gearing, no doubt the large amount of lead alluded to is allowed for locomotives for fast pessenger service. As is well known the Stephenson valve gearing has the peculiarity of increasing the amount of lead as the travel of the valve is shortened. Sometimes the valve opening at the end of the piston stroke will exceed three-eighths of an inch. It would be interesting if the records of steam indicator diagrams could be secured in illustration of the results obtained on the locomotives referred to by our correspondent. The views of any of our readers, who may have had experience in this direction, would be welcomed. The tendency of modern locomotive practice is to diminish the amount of lead or valve opening, and the inventors have been busy devising means to open the valve rapidly after the piston had completed its stroke, rather than open the valve to any appreciable extent before the stroke was completed. Our latest new book "The Valve-Setter's Guide," discusses the subject very fully, but, as we stated before, we would be pleased to have the opinions of our readers, who may be situated so that their experience would be *prima facie* testimony on the question.—EDITOR.]

Position of Loads and Empties.

Editor:

I have heard a great deal of discussion among railroad men relative to the position of loaded or empty cars in a train. A great many of the transportation men claim that 20 loads next the locomotive and 20 empties next the caboose will pull as hard as when the position is the reversed, and that the dynamometer will prove it, while engineers claim that they get better results with the loads ahead. On a level and straight track it may not

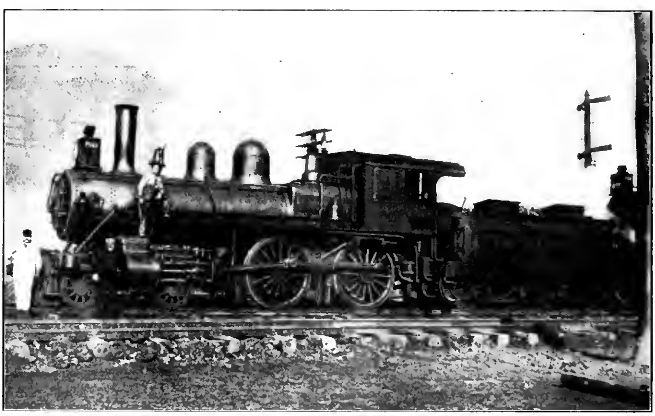


FIG. 2. OLD CLASS K, BUILT AT ALTOONA IN 1893.

make so much difference, but on grades and curves I fail to see why it would not be good policy to switch all loads ahead. As no doubt a great many would be pleased to have this question answered, perhaps the oracle will condescend to give his opinion in the columns of your valuable journal. WILLIAM SCOTT.

Pittsburgh, Pa.

[We would very much like to have the experience of enginemen on this subject. Tell us what you have seen and know about it. Don't write theory, send us some facts.—EDITOR.]

Burning Too Much Coal.

Editor:

With reference to question No. 10 on page 68 of your February issue it is as you say a difficult question to answer, but it appears to me that your correspondent does not say the height of the exhaust pipe. From the size of the nozzle, which is given, I judge it is too low, and draft cannot be regulated evenly through all the flues, which is one of the principal objects of locomotive drafting. W. R.

Cincinnati, O.

Keep to Your Calling.

Editor:

In your February number Mr. W. C. Brown, president of the New York Central lines, is credited with saying: "I would have a first-class manual training school attached to every high school, college and university, and I would make attendance compulsory."

These expressions indicate that Mr. Brown puts a very high estimate upon the value of manual accomplishments, but I as a mechanic of the old school happen to differ from the views of the New York Central Railroad's president and I should like to air my views before your readers.

There is growing up among us a passion for doing things differently from the way they were done in the past, and unthinking people are inclined to conclude that a new or novel method must necessarily be an improvement. In his zeal for industrial education Mr. Brown would like to impose upon the whole rising generation the duty of acquiring manipulative skill. Under existing conditions the high school graduate is required to devote time to studies that would help only in the learned professions. If he happens to choose a mechanical calling the greater part of the school knowledge he has acquired is useless. To make every youth attend a manual training school would be extending the training unsuitable for bread winning.

The ancients, who frequently expressed sound sense in proverbs, had the saying, *Sutor ne supra crepidam judicaret*, meaning let the shoemaker stick to his last. There is too great a tendency among our people to quit their last, imagining that they can do anything without special training. Men with a smattering of a trade are the most helpless malaperts that ever wearied a foreman in charge of mechanics. Do not let us foster or cultivate this breed. FOREMAN.

Dayton, Ohio.

FIG. 3. P. R. R. TRAIN NO. 77, NEW YORK AND WASHINGTON LIMITED.

Skidding Not Slipping.

Editor:

In the February issue of your esteemed contemporary, the *Locomotive Engineers' Journal*, I have read several letters on engines slipping when shut off and two of the correspondents appear to me to have hit the nail on the head.

The ordinary expression "slipping" as applied to a locomotive makes one think that the wheels must be spinning round faster than the speed of the train, just as the wheels might do if under steam. With steam shut off there is nothing to drive the wheels faster than the speed, but there may be something to retard them.

Mr. C. W. Chapman writing on the subject said he found the wheels turning at the rate of 25 miles an hour while the train was running 45 miles an hour. Mr. F. C. Miller, when on the same subject, says the engine does not slip but skids. The cause of this alleged slipping, which is really skidding, has been very fully dealt with before now in your magazine and I only write to call attention to the misleading use of the word "slipping" when applied to this retarding action, which comes from the wheels being out of quarter or pin bent or other irregularity between wheels and rods.

Wildwood, Ont. STUDENT.

Bridge vs. Clear Nozzle.

Editor:

There are a great many different opinions on this subject. Engineers raise discussions frequently, and I have heard some remark that this engine or that engine will not steam without a bridge in the nozzle. It is almost impossible to convince some engineers that the engine will steam without the bridge. My opinion is that putting a bridge or bar across the nozzle is not the proper remedy for the engine to steam.

In the first place it causes back pressure. This is not the only obstruction caused. When the exhaust strikes the bridge it is split and destroys the vacuum in the smoke box. Your fire does not burn evenly. I am inclined to think there is much more work put in the front end of a locomotive than is beneficial and does not do all that is claimed for it.

This exhaust nozzle is with the bridge, when the exhaust steam strikes it, is split and does not go straight up the stack, especially if this nozzle is below the center of the boiler, which I am inclined to believe is a disadvantage, and I do not consider that more than one petticoat improves the steaming qualities of the engine. An exhaust nozzle without a bridge will give far better results. This nozzle is level with the center of the boiler and

FIG. 4. P. R. R. TRAIN NO. 68 "OFF FOR THE CAPITAL."

one petticoat I would suggest for an engine, say with 21½ x 28 in. cylinder.

I would also suggest nozzle bored parallel, 3½ in. x 5 in. diameter, with one petticoat. This can be lowered or raised as may be required. There will be less back pressure with this nozzle than with one with the bridge and a much better vacuum obtained. Care must be taken that the exhaust is set central with the stack. M. J. VARLOW.

Fort William, Ont., Canada.

Name Plate Used 52 Years Ago.

Editor:

The enclosed is a matter of history and came off one of the old Boston & Providence Railroad locomotives. Mr. Griggs calls himself a machinist. The

OLD NAME PLATE, BOSTON & PROVIDENCE.

superintendent of motive power was unknown them. I think a reproduction of this old name-plate will interest your readers. HERBERT FISHER.

Taunton, Mass.

Roundhouse at Macon.

Our illustration shows the roundhouse on the Central of Georgia Railroad which is situated at Macon, Ga. There are 32 stalls in the roundhouse, making it a little over half a circle. The procedure here is that engines are brought in over the cinder pit, given coal and water, and then placed on an inspection pit. After inspection, if no work has to be done, they are turned and run out on storage tracks which have been provided for this purpose. Only such engines go into the roundhouse as require either boiler washing or repairs.

On each post between each pit there are connections for operating pneumatic tools, steam for blowing up boilers, and sockets for lights and for operating a small portable variable speed motor, which is mounted on a truck and can be taken about the shop as required and used to drive cylinder borer, valve setting machine, dome facer, etc.

The turn table is operated by an electric tractor. There are two ash pits provided with cross-over tracks between, so that it is possible to get at any engine and give it attention out of the regular order. Ashes from the cinder pits are handled by locomotive crane with bucket, the crane also being used for the lifting of coal to the coal chutes and for other purposes about the shop.

The roundhouse is to be heated by exhaust steam from the power house. What may be called daylight lighting has been provided for by having the outer wall built high and making it nearly all of glass. At night a vertical Cooper-Hewitt lamp has been placed between each pit. This throws the light on the running gear and outside parts of the engine and makes a pleasant light to work by. Mr. F. F. Gains, superintendent of motive power of the road, has kindly sent us the photograph from which our illustration was made.

CENTRAL OF GEORGIA RAILROAD. ROUNDHOUSE AT MACON, GA.

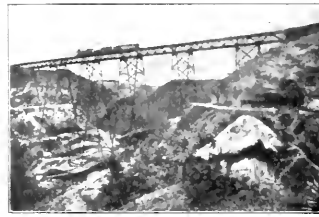
International Fuel Association.

The second annual meeting of the International Railway Fuel Association will be held at Hotel La Salle, Chicago, Ill., on May 23 to 26, 1910. The papers to be read at the meeting and the committees in charge are as follows:

Papers Nos. 1 and 5 have been consolidated and are "Grade of Fuel most suitable for locomotive use, considering cost per unit of traffic and best interests of producer": "Recommended methods of preparing coal as to size for locomotives." J. C. Crawford, chairman, fuel engineer, C., B. & Q. R. R., Chicago; Le Grand Parish, S. M. P., L. S. & M. S. Ry., Cleveland, Ohio; Curtis Scovill, A. G. S. A., Central Coal & Coke Company, Dallas, Texas.

Paper No. 2—"Standard uniform blank for reporting all items of cost in connection with fueling stations and handling fuel, for all types of stations and conditions." R. Emerson, chairman, assistant to general manager, Lehigh Valley R. R., So. Bethlehem, Pa.; F. V. Hetzel, chief engineer, Link Belt Co., Nicetown, Pa.; A. E. Averill, editor, *American Engineer and Railroad Journal,* New York, N. Y.; N. M. Rice, G. S. K., A. T. & S. F. Ry., Topeka, Kan.

Paper No. 3—"Accounting for fuel consumed. Individual records of performance." W. E. Symons, chairman, C. & G. W. Ry., Chicago; E. A. Foos, C. C. Fuel, Rail & Tie Department, C. B. & Q. R. R. Chicago; E. J. Roth, Jr., fuel inspector, B. & O. R. R., Baltimore, Md.



LA VOCAS BRIDGE, GUATEMALA R. R.

Paper No. 4—"Methods of purchasing fuel with regard both to traffic conditions and to producers interests. Relation between producer and railroad." W. H. Huff, chairman, V. P., Victor-American Fuel Co., Denver Colo.; L. L. Chipman, G. S. M., Fidelity Coal Mining Co., Kansas City, Mo.; W. K. Kilgore, fuel agent, C. M. & St. P. Ry., Chicago.

Paper No. 6—"Methods of supervision, instruction and encouragement in locomotive operation to secure greatest efficiency in fuel consumption." D. Meadows, chairman, assistant division, M. M. Michigan Central R. R., St. Thomas, Ont.; W. C. Hayes, superintendent locomotive operation, Erie R. R., New York, N. Y.; J. McManamy, R. F. of E., Pere Marquette R. R., Grand Rapids, Mich.

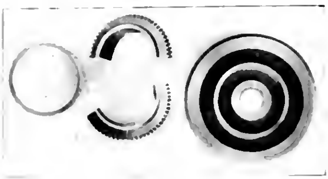
Special Paper "A."—"Character of membership that should be encouraged in the association and steps to secure that membership." S. L. Yerkes, fuel agent, Queen & Crescent System, Lexington, Ky.

Special Paper "B."—"Method of Kindling Locomotive Fires." C. F. Richardson, assistant to G. S. M. P., C. R. I. & P. Ry., Chicago.

Method of Attaching Circular Rack.

A new departure in the matter of attaching a circular rack to the wheels of electrically driven vehicles has been made by Mr. J. E. Osmer, formerly master mechanic of the Northwestern Elevated in Chicago. In what he calls the type "A" construction, a circular rack is used, the interior being machined to the proper size to shrink solidly upon the annular extension on the wheel after the rack has been heated sufficiently to bring about the expansion required, it is put in place and this is all the fastening necessary.

In this case the wheel is removed from the axle for rack renewals, whereas, with what he calls type "B" construction the circular rack is in sections, the flange of



DETAILS OF TYPE B CONSTRUCTION.

which is machined to a slip fit within the annular extension, holding the sections of the rack snugly together. To the outer end a ring may be applied to further aid the annular extension in holding the sections together, but this is only recommended on very heavy duty machines such as locomotives, etc. The sections are bolted to the annular extension. Keys are not required in either the types of construction. The wheel is not removed from the axle for gear section renewals, nor are the wheels and axles removed from the truck.

In both constructions the entire torque from the motor is transmitted directly to one wheel, and one-half through the axle to the opposite wheel. In ordinary construction the entire torque is transmitted directly to the axle, and divided, requiring a much larger axle, due to the necessity of a key-way.

The annular extension may be used with a cast iron or cast steel wheel center where a tire is used, either for electric cars or electric locomotives, or the same can be used in connection with the pressed or rolled wheels now in use on a great many electric roads, by welding the annular extension to the web of the wheel by means of the Oxy-Acetylene or Oxy-Hydric welding processes.

The advantages of this method of rack attachment, as explained by Mr. Osmer are that the present motor equipment can be used, either with the use of an extended axle bearing lining, if desired, or with the present axle bearing lining, using a split cast iron sleeve bolted around the axle to arrest the lateral thrust. With new motor equipment an extended axle bearing lining cap, with an extended lining housing made integral with the magnet frame, is used, thereby furnishing a longer bearing at the end of the motor where the torque is transmitted. Ordinarily this bearing is closer to the center of the axle the amount of the length of the gear hub than the plain side. In reality the torque end of the motor should have the longer bearing and be as close to the hub as possible. The device is covered by letters patent.

Supply Men, Attention.

Mr. F. A. Foster, graduate of the Worcester Polytechnic, mechanical engineer and designer of special and automatic machinery, who has been for some time past connected with the American Locomotive Company, is leaving for China the latter part of March. He intends to take a position in which he will have a great deal to do with machinery and mechanical work for railroads.

Mr. Foster is desirous of receiving catalogues from American manufacturers of railroad supplies, appliances and machine tools, etc. We would advise our advertisers and supply men and manufacturers of anything which can be used on railroads in China to send information to Mr. Foster. The catalogues should be addressed F. A. Foster, care of Mr. Albert C. Lee, Davenport Road, Tientsin, China.

Useful Air Brake Book.

"Developments in Air Brakes for Railroads" is the title of the Westinghouse Air Brake Company's special publication number 9014—dated November, 1910. This publication consists of a reprint of two technical papers, on the subject of "Air Brakes," one read before the New York Railway Club, in 1909, by Mr. W. V. Turner, the other read before the Western Railway Club, in 1906, by Mr. S. W. Dudley. These papers it may be said compose the most advanced treatise on the subject of air brakes that is in existence.

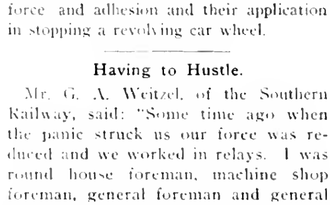
The paper read before the New York Railway Club by Mr. Turner sets forth the importance of the problem of air brake equipment, then deals with the requirements of a brake, fundamental principles in brake design, past and present conditions, and the "E T" locomotive brake, improved freight brake and modern passenger car brakes. The subject of braking power and wheel sliding is then taken up, and also the operation of the improved brake for passenger cars which is at this time the "L N" equipment.

The comparative value of old and new equipment is dwelt upon at length, and the book contains nearly 100 charts and diagrams showing the performance of improved brake equipment, many of the charts and diagrams which are something entirely new to students of the air brake will be reproduced in our air brake department as space permits. This paper is considered by air brake men to be the most complete and up-to-date air brake course yet printed. Mr. Turner is recognized as the foremost man today, not only by the Westinghouse Air Brake Co., but also by the Air Brake Association, where his expressions are accepted as from an authority.

The second paper by Mr. Dudley, entitled "What Stops a Moving Train," should be read by every air brake man. The fact that it was written almost four years ago does not make it of any the less value today, as the forces acting on a revolving car wheel as a brake shoe is applied, are the same now as four years ago, and this paper explains in detail frictional force and adhesion and their application in stopping a revolving car wheel.

Having to Hustle.

Mr. G. A. Weitzel, of the Southern Railway, said: "Some time ago when the panic struck us our force was reduced and we worked in relays. I was round house foreman, machine shop foreman, general foreman and general roustabout. I got up against it one day. One passenger train left at 2 o'clock, giving me 2:35 between trains. The engineer and fireman did not come to the round house and the sheds were about three miles away. While the hostler was going to make the change, the engine was getting hot and an expansion pipe blew out. I went to the hostler and he reported that the engine was foaming badly. The next engine had about six to eight staybolts out, and I had to have an engine. The main thing in handling the power quickly is



TYPE A TYPE B.

to have good organization in the round house. I had the inspector meet the engine at the pit. He let them knock out the fire; I got the report. I changed the water in that engine, put a spring in there (I have to use cold water) and had the engine back in town ready to take the train out without any delay. It gave me 2 hours and 35 minutes. This was a case of emergency. I broke up oil barrels to start the fire."

I should say sincerity, a deep, great, genuine sincerity, is the first characteristic of all men in any way heroic.—*Carlyle.*

Central South African Mallet Compound

The American Locomotive Company have recently completed a Mallet articulated compound locomotive for the Central South African Railways. This engine is designed for a 3-ft. 6-in. gauge of track and is the heaviest and most powerful articulated locomotive built so far by this company for a narrow gauge road. This locomotive weighs 29,000 lbs. more than the engine of this type built last year by these builders for the Natal Government Railways of South Africa.

The engine here illustrated is of the 2-6-6-2 type of wheel arrangement, having a two-wheel truck front and rear. Both trucks are of the radial center bearing, swing bolster type with journals outside of the wheels. The bolster is suspended by 3-point or stable equilibrium hangers. The frame, which is of cast steel of light but strong construction, is in three parts. The main frame has two arms on each side which extend outside of and partially surround the wheel, and between the ends of these arms the section forming the pedestal for the journal box is securely bolted. Coil springs seated on top of the boxes transmit the load to the journals. As the engine is designed to pass through curves of 350 ft. radius, it was necessary, in order to provide the required truck swing, and to bring the point of support as low as possible, to suspend the bolster underneath the axle and employ a long center pin which is built up in two parts, the lower one straddling the axle.

In working order, the engine has a total weight of 225,000 lbs., of which 192,500 lbs. is carried on the driving wheels. As far as the feature peculiar to the articulated type of construction is concerned, the design in general follows the builders' standard practice. The high pressure cylinders are 18 ins. in diameter by 26 ins. stroke and the low pressure cylinders are 28½ ins. diameter with same length of stroke. The exhaust passages of the low pressure cylinders are carried forward to the front of the cylinder, where they connect to the branches of a "Y" pipe. This has a ball joint connection with an elbow which is connected by a pipe fitted with a slip joint with an elbow having a ball joint connection with the exhaust pipe in the smoke box. This arrangement was necessary in order to secure a proper length of flexible exhaust pipe so as to reduce the angle of its deflections when the locomotive passes through sharp curves. In order to provide room between the top of the cylinder casting and the smoke box for the flexible exhaust pipe it was necessary, in this case, to provide an offset of 5⅜ ins. in the bottom of the smoke box from a point 15½ ins. back of the center line of the exhaust pipe.

Following the usual practice, the high pressure cylinders are equipped with piston valves and the low pressure with Allen-Richardson balanced slide valves, both being operated by a simple design of the Walschaerts valve gear. The reversing mechanism is so arranged that the weights of the parts of the two sets of valve motions counterbalance each other. Reversing is effected by means of the builders' design of power reversing gear, except that in this case the reversing cylinder is operated by steam, as this engine is not equipped with compressed air.

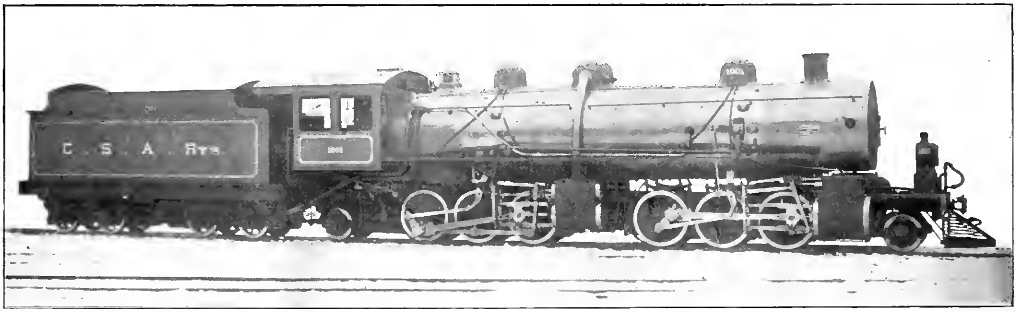
The frames, which are 4 ins. wide, are of wrought iron, the rear frames having a single front rail integral with the main frame, while the forward frames are fitted with double front rails. There is a single articulation connection between the front and rear engines. That part of the weight of the boiler which is carried on the front system is supported by a single self-adjusting sliding bearing, which is provided with the builders' usual design of spring centering device which acts with precision.

The three pairs of driving wheels of the front system are all equalized together and with the leading truck by a single central equalizing beam, while the rear set of driving wheels are equalized in a similar manner, except that the cross equalization is omitted and each side is equalized with the trailing truck by means of an equalizing beam which fits into a pocket in the truck center pin. This arrangement gives a three point suspended engine.

The boiler is of the radial stayed straight top type and the barrel measures 72⅛ ins. in diameter inside at the first ring. The design incorporates an 18-in. combustion chamber, the bottom of which is laid with fire brick. There are 271 tubes 2¼ ins. in diameter, each 20 ft. long, which provide a heating surface of 3167.7 sq. ft. The total heating surface of the boiler is 3324.2 sq. ft. This gives a ratio of total heating surface to the volume of equivalent simple cylinders of 281. The firebox is 107 15/16 ins. long and 66 ins. wide, and provides a grate area of 49.5 sq. ft. Following English practice, the inside firebox is made of copper, the crown and side sheets being in one piece, and copper staybolts are used for the water-space stays.

The tender is of the railroad company's design throughout. It is fitted with a tank having a water capacity of 5,000 Imperial gallons and space for 10 long tons of coal. The tender frame is of steel, the center and side sills being constructed of 10-in. channels. It is mounted on two four-wheel trucks of the equalized pedestal type, the frames being constructed of steel plate. The tender is equipped with automatic vacuum brakes, while steam brakes are used on the engine.

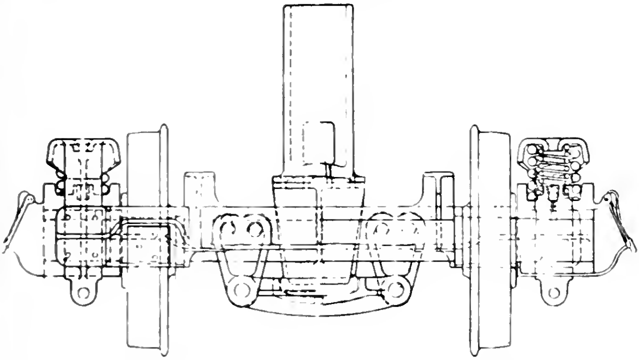
Some of the principal dimensions and ratios of the design are given in the following table:



MALLET ARTICULATED COMPOUND FOR THE CENTRAL SOUTH AFRICAN RAILWAYS.

R. F. Collins, Locomotive Superintendent. American Locomotive Co., Builders.

Weight on drivers ÷ tractive effort.......... 4.00
Total weight ÷ tractive effort.......... 4.68
Tractive effort × diameter drivers ÷ heating surface (B. D. factor).......... 606
Total heating surface ÷ grate area.......... 67
Firebox heating ÷ total heating surface, per cent.......... 4.7
Weight on drivers ÷ total heating surface 57.8
Total weight ÷ total heating surface.......... 67.6
Volume of equivalent simple cylinders, cu. ft.......... 11.8



SOUTH AFRICAN MALLET LOCOMOTIVE ENGINE TRUCK.

Total heating surface ÷ volume equivalent simple cylinders.......... 281
Grate area ÷ volume equivalent simple cylinders.......... 4.2
Track Gauge.—3 ft. 6 ins.; tractive power, 48,100 lbs.
Wheel Base.—Driving, 8 ft. 4 ins.; total 40 ft. 3 ins; total, engine and tender, 65 ft. 6 1/16 ins.
Weight, in working order, 225,000 lbs.; on drivers, 192,500 lbs.; on engine and tender, 352,000 lbs.
Heating Surface.—Tubes, 3167.7 sq. ft; firebox, 156 sq. ft.; total, 3324.2 sq. ft.
Driving Journals.—8 in. x 10 in.
Engine Truck Journals.—Diameter, 5½; length, 10 in.; trailing, diameter, 5½ in.; length, 10 in.; tender, 5½ in.; length, 10⅛ in.
Boiler.—Type, straight top; O. D. first ring, 73¾ in.; working pressure, 200 lbs.; fuel, bituminous coal.
Firebox.—Type, wide; length, 107 15/16 in.; width, 66 in.; thickness of crown, ½ in.; tube, 1 in. and ½ in.; sides, ½ in.; back, ½ in.; water space, front, 4 in.; sides, 2½ in.; back, 3½ in.
Crown Staying.—Radial.
Tubes.—Material, cold drawn seamless steel; diameter, 2¼ in.; No. 11 B. W. G.
Boxes.—Driving, cast steel.
Piston.—Rod diamter, 3.4 in.; piston packing, cast iron rings.
Smoke Stack.—Diameter, 17 in.; top above rail, 12 ft. 10⅛ in.
Tender Frame.—10 in. steel channels.
Valves.—Type, H. P. piston, L. P. Allen, Rich-slide; travel, H. P. 5 in., L. P. 5½ in.; steam lap, H. P. 1 in. and L. P. ⅞ in.; ex clearance, 3/16 in. H. and L. P.
Settting.—Lead, 3/16 in. H. and L. P.
Wheels.—Driving, diameter outside tire, 46 in.; material, cast steel, engine truck, diameter, 28½ in., kind, spoke centers; trailing truck, diameter, 28½ in., tender truck, diameter, 33½ in.

There are people who go about the world looking for sights, and they are necessarily miserable, for they find them at every turn—especially the imaginary ones. One has the same pity for such men as for the very poor. They are the morally illiterate. They have had no real education, for they have never learned how to live.

High Pressures of Long Ago.

The practice of carrying what might be regarded as excessively high pressure of steam that came into vogue with the compound locomotive, was by no means the first time that immensely high boiler pressure was tried. In 1850 when Robert Sinclair was locomotive superintendent of the Caledonian Railway he put to a practical test a theory that by using steam of very high pressure he could have unusually small cylinders that would do the work of much larger cylinders and use decidedly less steam.

Following out this idea, Sinclair built an engine in the shops at Glasgow with cylinders 10 x 22 inches and boiler carrying steam of 200 pounds gauge pressure. The prevailing pressure at that period was 100 pounds to the square inch. He calculated that this engine would perform the same work as was done by engines with cylinders 15 x 22 inches and do it at much less expense. The boiler was of Lowmoor iron half inch thick, the firebox was of copper strongly stayed, and the tubes were brass.

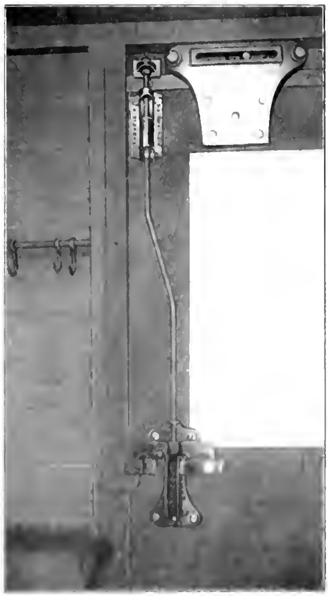
When put to service these little engines did the same work as those with cylinders five inches greater diameter and pulled the trains with greater ease. The first weakness developed was in the water glasses and these were constantly breaking. Several bad accidents happened from this cause and the pressure was reduced to 150 pounds, which took the vim out of the small engines. There was much trouble from leaky tubes, and breakage of staybolts was so common that the engines were considered dangerous and the steam was further reduced to the prevailing pressure. But it is a fact that inferior gauge glasses prevented the high steam pressure locomotives from making the expected success.

Sliding Door Fastener.

The Boston & Maine Railroad has recently made trial of a sliding door fastener and check, for baggage and other passenger train equipment. The device has been given a trial on cars passing through Concord, and it is the intention of the designer that the painful and serious injuries to persons caused by the sudden closing of a side door due to the violent stopping of cars will thus be eliminated. The device is the invention of Mr. W. H. Durant, air brake inspector of the B. & M.

The fastener handle swings pendulum-like in either direction, and in so doing unlatches the catch from the catch-plate which holds the door shut. At the same time it releases from the overhead track a check, or friction shoe, secured to a threaded depending rod which extends from the swing handle. This rod is surrounded by a coil spring, within a guide casting fastened at the top of the door, and assists the check to firmly grip the overhead track, thereby holding the door at any point in its travel.

The locking and the holding in position when open of a sliding door has been accomplished in a simple manner. At the same time a double holding device is presented for keeping a door closed to guard against the loss of car contents should the door happen to work open when the car is moving on the road. The fasteners are for right or left hand doors and are made in two



SLIDING DOOR FASTENER.

size. The whole device has been designed on scientific lines and should prove useful to railways. Further information in regard to the fastener can be obtained by addressing Mr. J. S. Elliott, of Lakewood, N. H. The inventor has called this fastener the "Laconia."

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances.

Published Monthly by

ANGUS SINCLAIR CO.

114 Liberty Street, New York.

Telephone, 984 Cortlandt.

Cable Address, "Loceng," N. Y.

Glasgow, "Locoauto."

Business Department:
ANGUS SINCLAIR, D.E., Prest. and Treas.
JAMES KENNEDY, Vice-Prest. and Gen. Mgr.
HARRY A. KENNEY, Secretary.

Editorial Department:
ANGUS SINCLAIR, D.E., Editor.
GEORGE S. HODGINS, Managing Editor.
JAMES KENNEDY, Associate Editor.

Advertising Department:
JAS. R. PATERSON, Manager, Chicago.

Boston Representative:
S. I. CARPENTER, 643 Old South Building, Boston, Mass.

London Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., 3 Amen Corner, Paternoster Row, London, E. C.

Glasgow Representative:
A. F. SINCLAIR, 49 Jamaica Street, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid in the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribe in a club, state the name of the agent.

Please give prompt notice when your paper fails to reach you regularly.

Entered at the Post Office, New York, as Second-class Mail Matter.

Confusion of Colored Signals.

Some extracts from a French technical paper published by the *Literary Digest* contain statements concerning confusion of colored signals that seem to emphasize the value of the World System of Railway Signals described and illustrated in our February number, page 60. In the *Digest,* under the heading of "An Optical Delusion," we read:

"To a pedestrian passing over one of the Paris bridges, the red and white lights on an adjoining bridge present a fine spectacle. If walking at an ordinary pace the eye be fixed on the group formed by a white light and the nearest red one, these two lights are first seen clearly separate; then as they draw nearer, the red light disappears completely, only the white remaining visible; then after another slight movement the white light drops out and the red remains. If the spectator advance further, the same phenomenon succeeds in inverse order, up to the moment when the lights are again completely separated."

After explaining the phenomenon by a diagram, the article conitnues: "It may happen in fact that an engineer running a locomotive casts a quick glance at a group of signals, and seeing, as he supposes, that they are all white, believes the way clear, when the signal for him to stop has been eclipsed and swallowed up, as it were, by a white light situated farther away and sensibly in the same direction."

We direct the attention of railway superintendents to the source of danger thus pointed out. There are so many dazzling lights within the perimeter of danger signals that all possible care should be exercised to prevent mistakes from being made. We are afraid that some of the mysterious mistakes about danger signals made by engineers may have been caused by the phenomenon described.

Boiler Inspection.

The third annual report of the Public Service Commission of the second district of the State of New York, which covers the calendar year 1909, has just come from the press. Under the heading locomotive boiler inspection there are some interesting facts given by the Commission. The total number of locomotive boilers in use in the United States is about 57,000, and about one-eighth of that number, or over 7,000, boilers have come under the supervision of the Commission.

The report calls attention to the fact that there are only two experts employed in this department of the Commission's work, the State boiler inspector and his assistant. It is therefore impossible for these men to exercise more than a general supervision over the inspectors who are designated by the railroad companies. The tabulated returns of the Commission indicate a general improvement of the whole matter of boiler inspection, maintenance and washing.

Among the accidents to boilers which have been investigated by the Commission there were four accidents in 1908 caused by plugs and studs blowing out. These accidents resulted in the injury of four persons. In 1909 no such accidents took place. Low water is the most prolific cause of accidents to locomotive boilers, according to the table referred to. In 1908 eleven low water accidents caused the death of eight persons and the injury of fourteen. The year 1909 saw only four such accidents, resulting in the death of six persons and the injury of six. It is, however, gratifying to know that the ratio of accidents to locomotives in service has decreased. In 1908 an accident took place for every 299 boilers in use. In 1909 there was only one accident to every 624 boilers. In 1908 one person was killed for every 829 boilers in service, and in 1909 there was only one to 1,267 boilers. The ratio of injured to boilers in service was in 1908 one to 266, and in 1909 one to 543, and in the first of these years there were 7,466 boilers in service as against 7,604 in 1909. Altogether, these figures seem to point to a small but general rise in the safety of life and limb as far as locomotive boilers are concerned, in this State.

In the year there were 1,147 boiler defects reported. The classification of some of the defects shows that 51 defective water glasses were reported; 56 defective gauge cocks reported, and 17 steam gauges were reported to be out of order. The Commission believe that the fewer low water accidents in 1909 is due to the better care of the gauge glasses and gauge cocks which has been brought about. In the matter of staybolts 977 were reported broken, but the government inspectors found 138 broken staybolts with tell-tale holes plugged, and they found that 46 boilers had tell-tale holes filled with paint. They do not specify the number of broken staybolts there were in these 46 locomotives.

It was stated in the report that it was entirely impossible for the two government experts to make a detailed examination of all the locomotive boilers in use. This was done only in special cases, and was intended to check the work of those railroad inspectors whose reports were considered doubtful. A general examination of 2,350 boilers was actually made.

The report of boiler inspection, while gratifying in a general way, shows the magnitude of the work ahead of the Commission and the good which can be accomplished by State and railroad co-operating for the safety of life, limb and property. The work of the Commission, while necessarily not complete in itself, has brought to light some interesting and instructive facts. In boiler inspection and maintenance, as in other departments of railroad activity, the Chancetaker will eventually be located and dropped from the ranks, as the most expensive item in the whole of the boiler shop outlay. The Commission's report, without naming any particular railroad, nevertheless indicates some weak points, which it is in the interest of everybody to have remedied. The report deals with a large number of subjects, but the pages on locomotive boiler inspection will be useful to the conscientious railroad man who is connected with one of the most important departments of railroad work. A copy may be obtained by applying to the Commission at Albany, N. Y.

Setting Up Wedges.

Much more trouble arises from the frequent slacking down of wedges than there is from setting them up. It is well to remind even the most experienced railway men that it is necessary that the locomotive should be under full steam pressure during the final adjustment of the wedges. This is obvious from the fact that while the frames do not expand to any great extent, those portions of the frames near the fire are more or less subjected to heat and consequently slightly vary in length from their condition while in the machine shop. It is good practice to place the locomotive so that the crank pins will be on the top quarter on either side that may be most convenient. This should be done by moving the engine with pinch bars, the forward movement having a tendency to press the driving boxes firmly against the shoes, leaving the lost motion, if any, on the back or movable wedge.

The wedges should then be firmly set up. It is well to have two pinch bars applied to the wheel in opposite directions. When the driving box becomes jammed in the jaws, the point at which the wedge stands above the bottom brace or binder may be marked and the wedge should be drawn down until the box again moves freely in the wedges. The amount drawn downward should in no case exceed one-sixteenth of an inch, but much depends on the condition of the wedge bolts. If they are much worn care should be taken, after the wedge has been drawn downwards the required amount, to raise the wedge bolt the amount of the lost motion, otherwise the wedge will have a tendency to move still lower on the pedestal jaw and induce lost motion. In the case of wedges that are equipped with bolts passing through the pedestal jaws and holding the wedges in place, the danger of the wedges moving on account of lost motion is obviated. Particular care should be taken in tightening the jam nuts. The tendency of these nuts moving is very great, and as there is generally some difficulty in applying a long wrench to the nuts, the best efforts of a skilled man should be made in applying all the force that these nuts will bear.

When the wedges have been carefully adjusted and securely fastened in place, the rod should be carefully tried on both of the dead centers, and the keys tightened and slightly loosened until the bearings move freely on the crank pins. The readjustment of the wedges while running should never be attempted except in urgent cases where the heating of a box may necessitate a further loosening of one of the wedges. It is needless to add that the careful lubrication of the wedges is an essential requisite. The tendency of a dry wedge to cut is very great, and this is often the cause of the beginning of the heating of the box. The promiscuous loosening of the wedges is a most pernicious habit and is always attended with bad results. It is a mechanical mistake which is not capable of amendment. It should be altogether abolished.

Factor of Adhesion.

Not long ago we were asked by one of our correspondents to define the expression factor of adhesion as applied to locomotives. We will endeavor to comply as briefly as possible. The usual answer to the question is that it is the result obtained by dividing the weight carried on the drivers of an engine by the calculated maximum tractive effort. On page 76 of our February issue we gave an illustrated description of two classes of engines for the C. & N. W. The first of these, a passenger engine, carried 151,000 lbs. on the driving wheels, and the calculated maximum tractive effort was 31,900 lbs., thus giving a factor of adhesion of 4.73.

The object of obtaining this factor may not be readily apparent at first sight. It has nothing to do with running the engine, but it is a very important figure for the designer, and it throws light on whether the engine is likely to be "slippery" or not. The ordinary co-efficient of friction of a steel tired wheel on a clean rail is 0.2 or ⅕. Some authorities give this figure as 0.25, but there is no hard and fast determination of this factor. This co-efficient varies with the state of the rail and may go below 0.2 for damp or greasy rail, or it may go above that, for a rail covered with good sand; but for the purposes of this article ⅕ is a very fair average.

This means that for ordinary purposes an engine can theoretically exert a draw-bar pull ⅕ of the weight on its driving wheels less internal friction. If an engine carries 125,000 lbs. on its driving wheels and can develop a tractive effort of 25,000 lbs., the factor of adhesion is said to be 5, and this engine will not likely show any tendency to slip. The C. & N. W. engine above referred to has a factor of 4.73, which is a fairly close approximation to the theoretical figure 5 as here assumed.

Some designers prefer to permit a little slip at the start, knowing that the engine will, when notched up, have a reduced tractive effort and that when working on the road there will then be no tendency to slip. In order to produce an engine of this kind, the tractive effort at the start may be arranged to give a factor of adhesion as low as 4 and indeed 4.25 and 4.5 is considered good practice and a slight margin of slipperyness might therefore exist just when starting, though with somewhat soft tires, or a little sand, or a careful start, the slipping might not be excessive, because in all cases the co-efficient of friction between wheel and rail is not an absolute or unvarying ratio.

On the other hand it would be possible to design an engine so that it would have a factor of adhesion of 6. Such an engine would have no tendency to slip, but it would not have as high a tractive effort as it might, or as good service conditions would warrant. The designer has always before him the advisability of securing the highest tractive power which he can for the weight to be borne by the drivers. In fact, as a rule the factor of adhesion is purposely shaved down a little below the theoretical limit. Yard engines, which are worked a good deal of the time in full gear, are as a rule designed so as to have a higher factor of adhesion and consequently less slip than passenger or freight engines, because a prompt start of a heavy load is constantly required of the yard engine.

If it were possible to design an engine as light as a hand car and yet capable of developing a tractive effort of 25,000 lbs., we would have a machine which would make very uncertain progress along the track but would spin its wheels around furiously when called upon to pull loads. The converse of this would be an equally unsatisfactory machine, one in which the power it could develop would be away below the limit and its hauling capacity would be low. If the co-efficient of friction between wheel and rail be assumed as 0.25, then appropriate calculations and allowances must be made for that figure.

It is always a matter of nice balance and fine judgment to so proportion the amount of draw-bar pull to what the engine will practically stand for, as far as weight on drivers is concerned, and most of our modern locomotives leave little to be desired in this respect. We have heard of cases where a carefully designed engine doing good work had its cylinders bored out so as to "pull another car," with the result that the hitherto satisfactory engine was "improved" into a magnificent slipper. The over-cylindered and the under-cylindered engine are the two extremes, which, like Scylla and Charybdis, must be successfully avoided by the designer steering a middle course.

Grow Catalpa.

About thirty years ago the Department of Agriculture made a strong effort to induce Western railway companies to plant catalpa trees along the right of way and on spare lands, but the movement was not successful.

The same department is agitating the subject again and they say that catalpa is an almost indestructible timber. Representatives of the Government Bureau of Forestry have been making detailed study of the uses to which the wood may be put. In southeastern Missouri they secured a post which for fifteen years served as a fence post on a farm at Charleston, Mo., and was then turned over to the St. Louis, Iron Mountain & Southern Railway where it played its part sturdily in another fence for twenty-three years more. Today it shows not the slightest traces of decay. A tie which had been in actual use on the lines of the Louisville & Nashville for eighteen years was found to be in perfect condition. Even where the spikes had pierced the tie the wood was thoroughly sound.

For telegraph and telephone poles the hardy catalpa is unequaled. The few groves in the west are speedily making their owners rich, and the Government experts are urging farmers to devote as much land as possible to the cultivation of this profitable tree.

These groves can be cultivated with little trouble and expense, and if ordinary vigilance is taken to protect growing trees from certain parasites, the hewn wood becomes practically indestructible; for nothing, the scientists say, can successfully attack the cut timber. It is the hope of the Bureau of Plant Industry that a realization of the great market for the hardy catalpa timber, which at present is very scarce, will result in vast tracts of artificial forests on the now treeless plains of the west.

The Superheating of Steam.

It is a noteworthy fact that mechanical appliances when introduced or resurrected with actual use are, as a rule, loudly heralded either as filling a long felt want, or effecting such a saving that makes the past seem full of senseless extravagance. Of course, something of this kind is to be expected, and such reports are promptly discounted by all men of experience. When the blowing of the trumpets has ceased, and the air has been cleared, it is usually found that the advance, if it is visible at all, is at the same sober pace that has marked the march of progress along the echoing corridors of the centuries. Occasionally there is something out of the ususal slow-paced movement that challenges general attention.

Among the mechanical appliances used in railways the most important innovation of recent years is the revival of the use of superheated steam. The revival began in Germany, and, like everything else made in Germany, was loudly advertised. At first it sounded as if Herr Schmidt and his compatriots were blowing off steam. The superheating of steam was nothing new. Many experiments were made during last century and little or nothing of value was accomplished. Herr Schmidt, however, introduced new methods, bringing the steam in its passage from the boiler to the cylinders almost literally through the furnace fires, and the reports of fuel saving and increase in pressures, and consequently increased efficiency were at first unbelievable.

The American engineers were quick enough to take up the matter, but as may be noted in our pages from month to month, the adoption of superheating apparatus is by no means in this country. The important items of construction and especially that of maintenance are much larger in American practice than the same items are in the glowing German reports. It does not follow, however, that the German estimates are wrong. Some of the differences are to be attributed to the use of anthracite in American locomotives as compared with the use of bituminous coal largely used in Germany. The high initial pressures generally used in American locomotive boilers, when subjected to superheating, combined to overtax the resistance of the necessarily thin pipes in which the steam was enclosed while undergoing the process of superheating. The ruptures of these pipes have been alarmingly frequent. Not only the steam pipes themselves but the joints have been a constant source of trouble. Our clever constructing engineers are meeting the problem with a degree of ingenuity that is admirable; but it seems that greater economy could be obtained by the use of superheating in the case of steam where the initial pressure did not exceed 180 lbs. per square inch.

The most recent statements coming as they do from official reports, tabulated and endorsed by the engineers of the Italian government, are worthy of serious attention. A number of locomotives of the 2-6-0 type running on the State Railways of Italy, fitted with the latest pattern of the Schmidt superheater, have been matched against an equal number of locomotives of the same type on which the superheating of steam was not applied. Those equipped with superheaters have been hauling passenger trains of average weight of 206 tons at average speeds of 45 miles per hour over level and slightly undulating lines, and the reports of coal consumption show for each 100 miles' run to be 8.68 lbs. On the other hand the simple saturated steam locomotives performing the same work on the same lines, but with an average load of 180 tons, show a coal consumption of 11.32 lbs. of the same kind of coal, thus showing an economy of 23.3 per cent. in favor of the locomotives equipped with the superheating apparatus, besides hauling an extra load amouting to an increase of 12.6 per cent.

This was not all. Special points for timing the speed of the locomotives were also established, and the distance traversed by the superheater locomotives in 94 minutes, took an average of 104 minutes in the case of the locomotives not equipped with the superheaters, a relative time economy of 0.6 per cent. By these computations a saving of 45.5 per cent. is effected by the use of the superheater.

In the matter of oil consumption, the locomotives equipped with the superheaters required an average of about 30 per cent. more oil than the simple engines, but this is a matter of small outlay in comparison with the other items referred to, and in general practice the advantage in favor of the superheater would at least foot up to 40 per cent.

It is to be regretted that the increased cost of construction and maintenance necessitated by the use of the superheater has not been tabulated with equal care by the Italian engineers; but the rapid adoption of the use of the apparatus in the case of the new locomotives used on the Italian State Railways is the best proof that they are satisfied that a considerable saving of outlay has been effected by the introduction of the Schmidt superheater on the locomotives in the service of the Italian State Railways.

Protection Under False Pretenses.

"To protect the public," is an expression that is used to cover a multitude of sins, a larger volume of them, indeed, than charity. The latest hollow pretense in this line is made by a combination of automobile manufacturers whose purpose is to milk the buyers of motor cars through the meshes of what have been known as Seldon patents.

The Seldon patents covered certain devices that could not be used in forming a practical automobile, but the threat that they covered essential parts of a gas engine operated machine has scared part of the public into paying blackmail on the patents for years. The lower courts have sustained the validity of the patents, which has added to the aggressiveness of the combinations controlling the patents, but the Supreme Court of the United States has yet to be heard from. The lower courts held the crude devices used before the Richardson safety valve to cover the same ground as the pop safety valve, but the U. S. Supreme Court decided that they were not practicable as means of quick relief of steam pressure and consequently did not perform the functions of an efficient safety valve. The want of efficiency is likely to prove fatal to the Seldon patent when it reaches the Supreme Court.

Trying for Electricity Direct from Coal.

The efforts of philosophers and inventors were devoted for over 2,000 years to the inventing of an apparatus through which the potential energy of fuel could be transformed into mechanical work. After such an experience that was in the end crowned with magnificent success, there is no saying that any object of human endeavor is hopeless.

Every few years some inventor proceeds to wrestle with the problem of converting the potential energy of coal direct into mechanical work without the intervention of steam. The favorite line of effort followed is to convert the heat of burning coal direct into electricity. We have watched for years the attempts of various inventors to perform that most desirable operation, but so far their labors have been in vain.

The favorite processes followed have been through forms of oxidation. Of course, ordinary combustion is a form of oxidation, but it is not adapted for the conversion of heat into electricity. Rusting burning and explosions are all forms of oxidation, the rapidity of chemical reaction marking the principal difference between them. It may be that through one of these processes carbon may yet be utilized to turn the immense power it possesses direct into electricity. Should that ever happen it would be bad for the locomotive, but the probabilities are that any evolution along this line will be gradual.

Energy in a Steam Boiler.

Most of the energy in a steam boiler under pressure is contained in the water, and only a relatively small amount of the energy in the steam. Take, for instance, the case of a horizontal tubular boiler carrying 150 lbs. pressure and having 160 cu. ft. of water space and 80 cu. ft. of steam space. The water weighs $160 \times 62.4 = 9,984$ lbs., and the steam weighs $80 \times .3671 = 29.37$ lbs. The energy in each pound of water at 150 lbs. pressure that would be liberated by explosion and expansion down to 212 degs. Fahr. is 11,823.4 ft.-lbs., and the energy in each pound of steam at the same pressure is 134,521.2 ft.-lbs. (*A Manual of Steam Boilers,* by Prof. R. H. Thurston, table entitled "Total Available Energy in Water and Steam"). The total energy in the water is therefore $9,984 \times 11,823 = 118,040,832$ ft.-lbs. and the total energy in the steam is $29.37 \times 134,521 = 3,950,882$ ft.-lbs. The energy in the steam is consequently less than 4 per cent. of that in the water. The water is the more dangerous content of the boiler. The total energy in the water and steam is $118,040,832 + 3,950,882 = 121,991,714$ ft.-lbs. If the boiler weighs, say 10,000 lbs., and if all of this energy were expended in an explosion in projecting the boiler vertically, then, neglecting the friction of the air, the boiler would rise to a height of 12,199 ft., or over 2 miles. The secret of avoiding boiler explosions is regular inspections at short intervals by competent men, and prompt compliance with their recommendations in regard to repairs and the allowable working pressure.—*The Fidelity and Casualty Company, of New York*

Book Notices

Freight Transportation on Trolley Lines. By Chas. S. Pease, C. E. Published by the McGraw-Hill Book Company, New York. 64 pages, illustrated, ornamental cloth. Price, $1.00.

This enterprising publishing firm has added a new and valuable book to their publications. The subject of freight transportation by trolley is a new and growing industry and has called into existence a class of rolling stock hitherto unknown in transportation. Mr. Pease discusses the subject with a degree of clearness and brevity that shows how thoroughly he has mastered the subject. The chapter on the reconstruction of old single truck passenger cars is particularly interesting as showing how economically a beginning in this new industry can be established. The book will be welcomed by those employed in the new and growing enterprise of which it treats.

More Light on Air Brakes.

Among all the books that have been published concerning air brakes, we believe it is safe to say that "Conger's Air Brake Catechism" has helped more men to understand the principles, action and mechanism of air brakes than any other publication. Like most other publications concerning developing mechanism, Conger's catechism gradually fell out of date and the author has now given his work revived vitality by preparing a new text which brings the book strictly up-to-date.

The new catechism has 42 pages more than the old one, and has both the No. 5 and 6 E T equipment, the K triple valve and the L type triple as well as a general revision. All the New York Brake Co. equipment up-to-date is included. This takes in the B 3 brake, the type J triple valve and the automatic control for locomotives.

While the new catechism is a decided improvement containing considerably more matter than the old one, the price remains the same, viz.: one dollar. Send in your orders as quickly as possible to Angus Sinclair Co., Engineering Building, Liberty street, New York.

Experience of a Veteran Engineer.

The world has been for many centuries interested in old soldiers and doing them honor was popular in all countries no matter how peacefully inclined the people may have been. The battles they had fought and the dangers they had passed through appealed to human sympathy.

In these days of piping peace the old locomotive engineer has taken the place in public sympathy that the old soldier held in the days of Auld Lang Syne. And this may well be the case, for the old soldier must have passed through many years of stir and strife to have encountered the dangers and hardships undergone by a locomotive engineer of sixty years' experience.

Stories concerning the lines of experience of exceptionally old engineers have lately been told in the *Locomotive Engineers' Monthly Journal.* One record is that of S. B. Clark still on the Wabash at Bluffs, Ia., who began work in 1848 as a water boy on a gravel train on the Northern Railroad of New Hampshire. He used to fire the engine "John" going to and from work which gave him the experience that commended him for a fireman's position. The "John" was a Baldwin of the "Miller" type, with single pair of drivers and four wheel truck, the precursor of the "American" engine which Baldwin did so much to bring into popularity.

In 1851 he got a regular job as fireman, but a year later left New Hampshire to take a position as second engineer of a flour mill at Jackson, Mich. The locomotive bee had, however, caught on to his bonnet and a year later he was firing on the Michigan Central between Detroit and Michigan City. The prospects of promotion were, however too slow for his taste on that line, so he returned to the Northern and fired there for about a year. There is something in the West like the mountain breezes that allures a man from the effete East. He reached the right hand side on the Northern but could not settle down, and in 1854 he was back on the Michigan Central where he got a job running in advance of old firemen he had known there before.

On the Michigan Central he was personally acquainted with the old engineers who organized the Brotherhood of Locomotive Engineers. Mr. Clark took an active part in promoting the Engineers Brotherhood. In 1869 he went to the Chicago, Milwaukee & St. Paul as traveling engineer, a position that did not last long for he went back to firing on the same road. After a time he drifted to the Wabash as engineer but left that to join the Union Pacific where he ran an engine between Rawlins and the Green River. That was too far West for his taste and he moved East to the Chicago, Burlington & Quincy, where he had the misfortune to take part in a head-on collision with a Wabash train. That laid him up for two years. When he recovered he returned to the Wabash where he still holds a place on the pay roll but is now employed in an office at Bluffs where he has been for 20 years.

In the notes of his experience Brother Clark says: "Sixty-two years connected with railroading! The experiences one has had in 62 years would fill quite a book, if told, and some of them would be hard to believe."

Why Should a Young Man Want to Become a Loco. Engineer?

The editor of RAILWAY AND LOCOMOTIVE ENGINEERING, who had often been asked why he became a locomotive engineer, answered without hesitation: "It was my earliest ambition, nurtured from watching the trains rushing past my childhood home."

Ambition drew him away from the occupation of running a locomotive; but he never regretted his first choice and never enjoyed any work so much as running a locomotive.

Several years ago the editor of a contemporary magazine asked the editor of RAILWAY AND LOCOMOTIVE ENGINEERING the question at the head of this column, an answer was given which we reproduce. Before doing so, however, we think it would be interesting if many locomotive engineers would send us short letters telling how they came to follow the calling of locomotive engineer.

The article by Angus Sinclair referred to reads:

"In the prevailing struggle for existence, it is no easy task for a young man, having no special training or technical education, to decide upon a calling which is likely to give him permanent employment with fair remuneration. In looking over the field of available occupations, I do not find one which is equal to that of locomotive engineer for providing a good income and congenial employment for the right man. The right man is a very important factor in deciding who shall be accepted from the numerous candidates for the appointments that lead to the position of locomotive engineer.

"The average youth who offers himself as a fireman with a view to becoming a locomotive engineer, gives himself little or no self-examination to ascertain if he possesses the attributes that will make a successful engineer. Therefore the officials controlling the employment of men have to be keen inquisitors into ability and character, to prevent the wrong man from taking a place in the line that leads to the running of a locomotive. This exercise of judgment is not always successful, for occasionally men become engineers who have not the natural capacity to care for any appliance more complicated than a wheelbarrow. The incompetence of such persons becomes a constant source of annoyance and danger when he is privileged to perform the duties of a locomotive engineer.

"The first requisite of a would-be locomotive engineer is the possession of a good constitution and a respectable character with steady habits. He ought to be naturally industrious and have a good common school education, be of observing habits, have good eyesight and hearing and be free from nervousness. He must also be courageous without being reckless and he must have the faculty to keep cool under difficulty or danger.

"If a man possesses these characteristics and knows that he has them, he may safely offer himself as a fireman, for his steady progress towards the right hand side of the engine is assured.

"The locomotive engine which reaches nearest perfection, is one which performs the greatest amount of work at the least cost for fuel, lubricants, wear and tear of machinery and of the track traversed. The nearest approach to perfection in an engineer, is the man who can work the engine so as to develop its best capabilities at the least cost. Poets are said to be born, not made. The same may be said of engineers. One man may have charge of an engine for only a few months, and yet exhibit thorough knowledge of his business, displaying sagacity resembling instinct concerning the treatment necessary to secure the best performance from the engine, while another man who appears equally intelligent in matters not pertaining to the locomotive, never acquires a thorough understanding of the machine

"There are few lines of work where the faculty of concentrating the mind to the work on hand is so valuable as in that of running a locomotive. The tendency to indulge in what is called mental wool gathering has led many a locomotive engineer to grief. A man may be highly intelligent and endowed with general knowledge, but on a locomotive he will make a failure unless he has the power while at work to devote his whole attention to the duties of taking the locomotive and train over the division safely on time. The man who permits outside hobbies or interests to occupy his thoughts while running a locomotive, is likely to fall into many troubles.

"People of a serious disposition are often regarded with favor for responsible railway employment, but I have not found that positively religious men make such good engineers as others less regenerate. Ahaziah Sims had drifted from the oil room to firing, then by force of staying became locomotive engineer. He was a demonstratively pious man, and some people imagined that his religious capital made up for no end of occupation shortcomings.

"One morning Ziah walked smilingly into the roundhouse lodge room and remarked: 'Had splendid run. Engine all the way kept saying 'Bless the Lord, bless the Lord.'"

"'I know vat was de matter mit your engine, Zi,' exclaimed Joe Dietz. 'Your valves vas oud an' you did not know id Hims odt say Bress the good Lord, an' den you haf four exhausts.'"

Ahaziah was less than a good average engineer, for he permitted his mind to praise the Lord in psalms when he ought to have been fondling his engine. Glory-fying the Lord and all his works is all right in its place; but it is better for an engineer on duty to be keeping an open ear on the deterioration of the pistons and valves or in watching the rhythm of rods, axle boxes, air pumps and other moving parts that utter notes of distress when suffering from any defect. Which of these pistons is beginning to blow or is it one of the valves? What is the matter with that injector which breaks occasionally? The man who cannot devote his mind exclusively to the working of the engine and to looking out for signals when on the road will not make a first-class engineer.

"I was a locomotive engineer between breaks for about twenty years, but I was in some respect a better engineer during the first five years of my service than I was in the last five years. The cause of my degeneracy was that latterly distractions had come into my life which prevented me from concentrating my attention upon the working of the engine with the intensity applied when I was younger.

"Severe hardships have to be endured by nearly all locomotive engineers, but the life has its compensations. A man who knows his business and performs his duties properly holds a very independent position. Concerning the attractions that might induce a young man to chose the business of a locomotive engineer, I testify that with all its drawbacks I do not know of a pleasanter occupation. It has been my good fortune to engage in many lines of business—some of them of high grade and of very honorable standing—but I never enjoyed any work as much as that of running a locomotive engine."

The Mallet vs. the Electric Locomotive

Commenting on the problem of electrification of the Central Pacific over the Sierras, Mr. Kruttschmitt, as reported in the *Wall Street Journal*, says: "Eastern critics may be inclined to the opinion that we are dallying with this matter. We have found that it pays well to make haste slowly with regard to innovations. Electrification for mountain traffic does not carry the same appeal that it did two years ago. Oil burning locomotives are solving the problem very satisfactorily. Each Mallet compound locomotive having a horse power in excess of 3,000 hauls as great a load as two of former types, burning 10 per cent. less fuel and consuming 50 per cent. less water."

I am not careful for what may be a hundred years hence. He who governed the world before I was born shall take care of it likewise when I am dead. My part is to improve the present moments. —*John Wesley*.

Applied Science Department

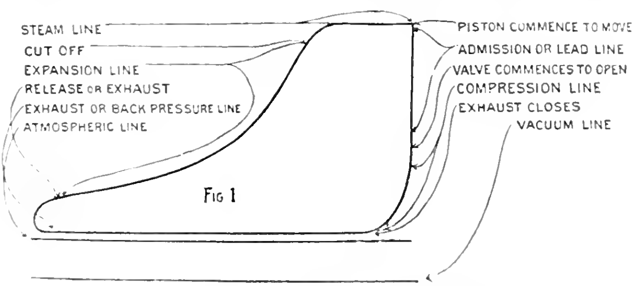
Reading Indicator Diagrams.

It is a singular circumstance that every man you meet is willing to talk about the state of his health, and will reveal, as far as it is possible to be revealed, his internal workings; but when it comes to some young mechanic who may be seeking information in regard to some of the mysteries of his calling, his elders are sometimes silent and an air of introspective profundity dwells upon them like the burden of Dumah, whatever that was. The kindlier spirit of the twentieth century is happily dispelling much of this ungenerous feeling. In locomotive practice in the olden days the valve-setters had the bump of secrecy developed to a most abnormal extent. Of course, there was a human side to it. They were generally paid higher wages than those who had been denied the opportunity of showing by practical experience what they were capable of doing.

The reading of indicator diagrams may justly be considered a much simpler matter than the adjustment of involved valve gearing, but there is much more to be found in these diagrams than may be at first supposed. Having described in the January issue of RAILWAY AND LOCOMOTIVE ENGINEERING the means used in taking these diagrams, it may be well to begin the attempt to thoroughly understand them by supposing that if it were possible that the piston of a steam engine could be acted upon on one of its sides by a steam pressure of 100 lbs. to the square inch, and if there were no pressure at all acting on the other side, and the steam pressure was maintained uniformly during the entire time that the piston passed from one end of the cylinder to the other, then the diagram would show a rectangle, because the spring in the indicator would be kept at an unvarying height during the entire travel of the piston, but steam engines that are not furnished with a condenser are subjected to a back pressure of at least 15 lbs. per square inch on account of the atmosphere finding its way into the exhaust passage. This reduces the steam pressure to 85 lbs. per square inch. The effect is to reduce the complete rectangle by a little more than one-seventh of its entire space along the bottom of the diagram. In common practice there is an extra pressure of 3 or 4 lbs. owing to the incompleteness of the exhaust, because steam, being a fluid of much grosser density than the atmosphere, is much slower in moving through space than the almost intangible air. When the piston is moving at an extremely high speed the back pressure increases, so that a back pressure of 20 lbs. per square inch or one-fifth of the entire amount of pressure that we have alluded to is not uncommon.

In the case of a steam engine when the cylinder is placed in connection with a condenser where the exhausted steam escapes into a vacuum, or partial vacuum, then the atmospheric pressure is largely removed, and the back pressure against the face of the piston may be reduced to 2 or 3 lbs., thus effecting a very considerable gain in the use of the steam, as the amount of steam used in each case is the same.

In the illustration of the indicator diagram before us (Fig. 1), it will be noted that the vacuum line is a considerable distance below the diagram proper, and there is also a limited space between the atmospheric line and the exhaust or back pressure line. The exhaust or back pressure line is a variable line, changing, as we have already stated, according to the impediment presented to the opposite face of the piston from which the steam is acting. The vacuum line is also slightly variable, diminishing in height in higher altitudes in a ratio to the distance above the sea level.



TYPICAL INDICATOR DIAGRAM WITH NAMES OF LINES

Following the exhaust line from left to right, it will be found that the line curves upwards at some little distance before the piston has completed its stroke. This is the point at which the exhaust closes, and as there is necessarily some steam still left in the cylinder, the compression of the remaining portion of steam begins. It is claimed that this compression or crushing into smaller space of this portion of steam has the effect of cushioning the piston, but of the merits or demerits of this compression we need not now dilate. It is sufficient to know that the pressure upon the face of the piston has already increased before the stroke has been completed, and before the valve has begun to open, allowing the fresh supply of steam to enter. In all well-constructed steam engines the valve opens rapidly, so that the full pressure of steam is admitted by the time that the piston is ready to move in the opposite direction. From the point where the valve begins to open, to the admission or lead line, the piston may be said to be standing still, but the pressure of steam is rising as the valve opens. As the piston moves in the opposite direction the full pressure of steam is maintained as shown in the illustration.

Supposing the cylinder to be 24 ins in length and the valve gearing so arranged that the valve closes at one-fourth of the stroke, that is, after the piston has traveled 6 ins. in its backward stroke, it will be found that the line begins to curve downwards before the valve has entirely closed. This is owing to the gradual cutting off of the supply of steam, so that by the time that the valve is entirely closed there is already a considerable diminution in the pressure of steam, and a consequent falling off of the pencil point in its path along the paper. After the valve is entirely closed there is a rapid falling of the line. This curved line is called the expansion line, and extends in a parabola, until the piston has nearly reached the end of the stroke, at which time the release of the pent up steam occurs and the curved line drops suddenly to the exhaust or back pressure line.

It will be noted that the line after passing the cut-off point drops suddenly, but a careful measurement of the distance traveled by the piston at any particular point will show that the line indicates an exact ratio of the pressure of steam in the cylinder in proportion to the distance traveled by the piston, so that if the pressure of steam during the first 6 ins. of the travel of the piston amounts to 100 lbs. per square inch, and the supply of steam is then cut off, it will be found that when the piston has traveled 12 ins. the pressure of steam as shown by the indicator will amount to about 50 lbs. per square inch, the enclosed steam thus having doubled its volume, and consequently diminished one-half in pressure.

The exact calculations in regard to this expensive use of steam will be treated more fully in the succeeding issues of Railway and Locomotive Engineering.

Celebrated Steam Engineers.

XXVII. William Hedley.

In the last issue of Railway and Locomotive Engineering we took occasion to call attention to the admirable work of John Fitch, an American pioneer in the work of steam navigation. This month we take pleasure in recalling another pioneer in steam engineering, William Hedley, whose production of the first locomotive used commercially in hauling cars marked him as one of the most noted pioneers in the great work of transportation by steam, which others were destined to take up after him and carry on to triumphant success.

The first we learn of the noted mechanic was as superintendent of the Wylam Colliery, near Newcastle-on-Tyne, England. He was a man of considerable scientific attainments, and was encouraged by his employers in his idea of using steam instead of horse power in moving the products of the mine to the market. Hedley was among the first to discover that sufficient adhesion could be secured in moving heavy cars on a smooth rail instead of the rack or toothed rails which had been found to be troublesome in practice. Hedley was fortunate in having under him a clever blacksmith named Timothy Hackworth, who afterwards became a celebrated locomotive designer and builder. Hedley's first locomotive was not particularly successful, but the second, entirely designed by him, and built by Hackworth in the blacksmith's shop of the colliery, was fairly successful and ran for many years, and is now on exhibition in the South Kensington Museum in London. It is generally known by the name of "Puffing Billy," and but for its top-heaviness it is in every way as creditable a production as Stephenson's "Rocket," which it ante-dated sixteen years.

This locomotive, built in 1813, had a return flue boiler, and became the model for all of the successful locomotives built previous to Stephenson's time. As a matter of fact this locomotive is literally two of Watt's engines cleverly mounted on wheels. The workmanship was excellent. The frames are of wood, very substantial in form, and rest upon axles without the intervention of springs. The four driving wheels are connected by inside gearing, and the motion is transmitted to a gear wheel on a separate axle. The water tank was an oblong iron box, and the water was conveyed by a leather pipe to the pump. The tank was attached to the locomotive by a chain, a method of coupling which still lingers in the freight traffic on some of the British railways.

A remarkable feature is the construction of the cylinders, which are made in two sections and substantially riveted together. The steam chest is a small cavity on the top of the cylinders, and there is a handle cleverly adapted for connecting the valve stem that catches on a vertical plug rod connected with the walking beam. The cylinders are 9 x 36 ins. The grate area 6 sq. ft. The valves are of the D-slide pattern, worked by a shaft motion. The vertical cylinders necessitate the use of what are known as grasshopper beams, which in turn convey the motion downward by vertical connecting rods to a shaft equipped with overhanging cranks set at right angles to each other. A spur wheel is attached to this shaft, which, with four other spur wheels, transmit the motion to the two main axles. The wheels resting on the rails are 39 ins. in diameter.

Hedley was really the beginner of the experiments in what may properly be called successful steam locomotion. The unevenness and insecurity of the tracks upon which his locomotives ran militated somewhat against their use in drawing passenger vehicles, but the commercial success of his locomotive encouraged that restless spirit of enterprise which culminated in the success achieved by Stephenson and others. In fact, it was while George Stephenson was employed as a mine foreman in the vicinity where he had numerous opportunities of observing Hedley's locomotive that he conceived the ideas of the marked improvements which culminated in the success which ultimately attended his efforts in the direction in which Hedley had so well begun.

It is gratifying to know that Hedley lived to see the complete triumph of steam as a means of transportation, and while greater rewards came to others that labored in the same field, there was nothing that savored of envy or jealousy in his character. He was eminently successful in his own limited sphere of industrial activity. He was a typical British mechanic of the highest and best kind. He was loyal to his employers and courteous and kindly to his subordinates, and was universally esteemed by all who had the honor of his acquaintance.

Questions Answered

DOUBLE HEADERS.

17. L. H. E., Dryden, N. Y., writes: On a certain branch of our railway whenever a double header is run, a car is coupled between the two engines. On other branches of the road, engines are directly coupled together. Can you explain this?—A. The object of putting the car between the engines is to avoid the concentrated load on bridges, culverts, etc., which two engines together would give. On the other portions of the line this precaution may not be necessary.

FACTOR OF ADHESION.

18. G. A., Apalachicola, Fla., writes: In your January issue you state that two engines of equal capacity, alike in every respect, but with different sizes of driving wheels, that the one with the small drivers can haul the most. Why is this when the power is limited by their adhesion?—A. Read our article on the meaning of the expression factor of adhesion in another column of this issue.

CHECK VALVE STICKING.

19. E. W. E., Belle Plaine, Ia., asks: Why will a boiler check valve stick open when there seems no apparent reason for its doing so, with no dirt on the seat, a good face on both valve and seat, and not too much lift. The type of valve we have has a threaded connection on each end to fit a standard hose nut and a cap on top with a guide in check valve case for stem below.—A. Sometimes the kind of valve you write about may stick when new on account of being, as they generally are, a neat fit, and the slight expansion of the metal when the boiler becomes hot, being sufficient to stick the check. This is a possible explanation, assuming that there is no obstruction or foreign substance under the wings of the valve.

IS A DERAILER A SWITCH?

20. W. M., Brunswick, Ga., writes: Would you kindly favor me with your opinion on the following subject? A train backing into a siding backed through a derailing switch which was in the siding clear to the main track. The accident occurred at night, and when the engine

was heading out, it mounted the rail. Would you consider the derailer a switch under the following rules: "When a train backs in on a siding to be met or passed by another train, the engineman, when his engine is in to clear, must also see that the switch is properly set for the main track." Also, "Both conductors and enginemen are responsible for the safety of their trains and under conditions not provided for by the rules must take every precaution for their protection." A.—The first rule you quote clearly indicates the main line switch. The second is the general rule for taking the safe side in all cases. It would appear to us that if the derailing switch had a light on it then it was the duty of the engineman to see it and be governed accordingly. If not, yet if he knew derailing switches were used on his road, the general rule for safety would have caused him to look out for one at the point in question. On some roads where there is no light and where derailers are the exception, the brakesman would be held responsible for the derailing point being closed under the circumstances you mention.

LEAKAGE FROM MAIN RESERVOIR.

21. D. R. R. writes: How can you determine whether leakage from the main reservoir into the brake pipe is from the rotary valve, lower body gasket, or past the P. R. R. standard cut-out cock?—A. Rotary valve leakage enough to be of any consequence can usually be detected by an escape of air from the emergency exhaust port of the brake valve as the badly worn or cut rotary valve leaks to the atmosphere as well as into the brake pipe. However, the brake valve must be taken apart to correct the disorder whether the rotary valve or body gasket is leaking. A bad leak past the P. R. R. cut-out cock will usually lift the equalizing discharge valve when the brake valve handle is placed on lap position. In this case, of course, equalizing reservoir pressure remains constant, but if any doubt exists as to whether a slight increase of brake pipe pressure is from the brake valve or from the cut-out cock, the brake valve can be placed in emergency position and the pipe disconnected from the large end of the cut-out cock, and any leakage past the cut-out cock into the brake pipe can then be noted.

USE OF CHECK VALVE.

22. D. R. R. writes: Why is a check valve used in the branch of the application cylinder pipe leading to the automatic brake valve when the stop cock of the H 6 brake valve is located in the main reservoir pipe?—A. This check valve is to prevent a backward flow of air from the application cylinder of the distributing valve to the automatic brake valve which would result in the release of the engine brake on the second engine of a "double header" in the event of an application from the first engine that would exhaust all the brake pipe pressure and consequently all the pressure surrounding the automatic brake valve on the second engine. If this check valve were not used the application cylinder pressure might unseat the rotary valve and escape under the conditions cited above. Again in the event of an application from the second engine in double-heading, which must be an emergency application, if all brake pipe pressure should escape the valve handle remaining in emergency position. If this check valve were not used, application cylinder pressure could flow into the feed valve pipe thence through the end of the cut-out-cock with the escaping brake pipe pressure and release the engine brake at a time when it is most desired to keep it applied.

BABBITT ON JOURNALS.

23. G. A., Apalachicola, Fla., writes: Please explain why babbitt is put on car brasses, crank pin brasses, etc. If the babbitt is to provide a suitable bearing, why is it put on brass? Would not iron do as well?—A. Babbitt is not usually put on car brasses. It is occasionally used in rod brasses, etc. Babbitt is an anti-friction metal and a little of it in a rod brass is all right. Iron would not do at all. Lead is often used as a lining for car brasses as it assists a new brass to get down to a smooth wearing surface without heating. The lead is slowly squeezed out and the brass comes down gradually on the journal as the lead gives way.

RUNNING TENDER FIRST.

24. R. L. C., Ceres, Cal: Please answer this question re the Southern Pacific Mallet compound, which you described and illustrated in your January issue, page 13. As it runs cab first is not some of its tractive power sacrificed, especially in starting train? In other words, would this locomotive have a greater draw-bar pull when running in the usual way?—A. We do not think this engine will lose any of its tractive power running cab first. In the old fashioned 4-4-0 engines, with large driving wheels, it was found that they sometimes slipped a little more readily in the start when backing up than going ahead, owing to the slight transfer of weight from driving wheels to truck when crank was at or near top quarter, due to the angle the main rod was in, when delivering its push. In the Mallet for the Southern Pacific the wheels are small, the main rod making a very small angle with the crosshead. If there was any transfer of weight it would be principally from the high pressure to the low pressure drivers. That from the low pressure group to the pony truck would not be much. All the wheels are heavily loaded, so there would not be much danger of a slip. In any case a Mallett almost automatically stops its own slipping. Tractive effort or draw-bar pull as calculated by the formula does not depend on which way the engine runs or on anything except dimensions of cylinders, steam pressure and diameter of drivers. It is not altered by slipping, a slipping engine simply does not use its full tractive power to pull cars. Furthermore the Southern Pacific Mallet was designed to run cab first.

BRAKE VALVE EXHAUST PORT.

25. E. W. E., Belle Plains, Ia., writes: (1) What is the size of the preliminary exhaust port in the G6 and D8 brake valves? (2) Is it the same in all brake valves?—A. The opening through the preliminary exhaust port bushing in the G6 and D8 brake valves is 5/64 of an inch. (2) The opening remains of the same size in all the late Westinghouse brake valves; that is, the size of this port is the same in the D8, D5, E6, F6, G6, H5, and H6 brake valves.

TEST FOR 9½ IN. PUMP.

26. B. B., Brooklyn, asks: How can you test the efficiency of the 9½ in. air pump while it is on the engine?—A. By using a dummy coupling with 3/32 of an inch opening. A 9½-in. pump, at a speed of 60 to 70 cycles, that is, 120 to 140 single strokes per minute, should maintain a pressure of 70 lbs per square inch against a leak through this sized opening. A fair test is to use a 11/64 of an inch opening and with a wide open throttle and no less than 150 lbs. steam pressure the pump should not allow air pressure to fall below 60 lbs. If it does the pump should be removed and replaced by one known to be in good condition.

TRACTIVE EFFORT AND ADHESION.

27. G. A., Apalachicola, Fla., writes: In your January issue you states that of two engines of equal capacity, alike in every respect but with different sizes of driving wheels, the one with the small drivers can haul the most. Why is this, when the power is limited by their adhesion?—A. Read question No. 2, January issue, page 24, over again and note what is said about the position of the crank pin. Take the formula for finding the tractive power and work out two problems in which each of the factors is the same except the diameter of the drivers. Tractive effort is a thing by itself and ought not to be mixed up with the adhesion between rail and wheel. Read article on the Factor of Adhesion in another part of this paper.

Air Brake Department

Conducted by G. W. Kiehm

Losses of Air Pressure.

The vast difference that sometimes exists between theory and practice is exemplified in the use of compressed air as a motive power or mechanical energy.

The results that can be achieved by combining theory and practice is manifested in an admirable and wonderful manner by the operation of the air brake.

Some years ago the use of compressed air for mechanical purposes was regarded with disfavor, and was considered any thing but economical, principally because of the loss of power which occurs after compression, and during transmission.

Today the value of compressed air for shop purposes is universally recognized, and the cost of production is of secondary importance. In air brake practice the results that are attained by the reduction and restoration of air pressure in a single piece of pipe under a train of cars is marvelous and almost beyond belief. In view of the fact that the air brake makes possible the operation of numerous heavy trains at high speeds and is an extraordinary safety device as well as the most practical and efficient method of stopping a train of cars, the cost of producing the compressed air cannot be taken into consideration and the losses that occur during compression and transmission are comparatively slight or of little consequence and have been well taken care of when the brake was designed. Even if the energy expended by the locomotive in compressing the air was taken into consideration it would be manifestly unfair to lose sight of the fact that the conditions under which the work of the compressor effect the steam pressure of the boiler are somewhat peculiar, that is, at the time the compressor is working its maximum capacity the locomotive is at rest, or drifting with the throttle closed, while at the time the locomotive is hauling the train the compressor is merely maintaining the air pressure against leakage. As stated before, the losses of power after compression and during transmission are in air brake practice so slight as to be unworthy of serious consideration, but as the student of the air brake art attempts by means of a mathematical calculation to determine the pressure that will result from a given number of strokes of the compressor or from different manipulations of the brake valve those losses are in evidence, and manifest themselves in the difference in the result of the calculation and the pressure that is actually attained, as indicated by an air gauge.

The results of the calculations always indicate a higher pressure per square inch than that which actually exists because of the losses that occur, and any mathematical calculation to determine the pressures that will result from expanding compressed air from one chamber into another is somewhat uncertain and at the best only approximate, especially immediately after compression, and the remainder of this space will be used with a view of explaining why the calculations are uncertain, and why the losses are encountered. In the first place the atmosphere, which is composed by volumes of 21 parts oxygen and 79 parts nitrogen, contains a variable amount of aqueous vapor sometimes referred to as the degree of saturation or relative humidity, and the pressure of the atmosphere per square inch varies, being 14.7 lbs. at the sea level, and 13.33 at one-half mile above. At a rough approximate it loses a half pound pressure with every ascent of 1,000 ft.

In a vessel filled with compressed air there is contained a certain number of atmospheres or a certain number of times its capacity in free air at atmospheric pressure; the number of times depends upon the number of pounds gauge pressure the vessel or reservoir contains.

Referring to 14.7 lbs. as one atmosphere which is not registered by the air gauge a little table showing the number of atmospheres required to compress air to different gauge pressures, or the number of atmospheres contained in a reservoir filled with compressed air, will be given. It being understood that so many atmospheres means so many times the capacity of the reservoir in free air, or at atmospheric pressure, that the pump will be required to compress in order to accumulate the number of pounds gauge pressures indicated. The number of pounds pressure given are principally those used in air brake practice.

Gauge Pressure.	Atmospheres.
15 lbs. =	2.02
30 " =	3.04
45 " =	4.06
60 " =	5.08
70 " =	5.76
90 " =	7.12
110 " =	8.48
120 " =	9.16
130 " =	9.84
140 " =	10.52

In calculations for practical purposes the variations in atmospheric conditions before compression may be disregarded but after compression the condition of the air is affected by the rise in temperature to such an extent that the variations in pressure resulting therefrom cannot be ignored.

It is during compression that the first serious loss of pressure is encountered. It is due in a measure to the necessity for a certain mechanical construction of the compressor, and any loss of pressure is of course a loss of mechanical energy. In order that the steam-driven air pump may operate, give good service, and be efficient when operating against high and low air pressures the reversing mechanism starts in motion as the compressor piston nears the end of its stroke, and at a high air pressure the movement is most difficult when it nears the end of stroke, giving the reversing motion more time in which to accomplish the reversal of movement and the stroke is consequently slightly shortened.

The matter of clearance for the air pump piston has been carefully looked after in the latest designs of air pumps, but no matter how skilfully the pump is constructed there is always a small space in the end of the air cylinder from which all the compressed air cannot be discharged and on the following stroke the air can expand into the space vacated by the piston's movement and occupy space that should be filled with free atmosphere.

The pump has therefore a calculated or theoretical capacity, and an actual capacity. The theoretical capacity is the diameter of the cylinder and length of stroke, or a cylinder full of free air compressed on each stroke; the actual capacity is the amount of air that is actually compressed on each stroke and the difference is clearance and space from which air is not compressed, pressure per square inch in this space and weight of air valves. Packing ring, or air valve leakage or leakage from the air cylinder to the atmosphere not being considered. As the pump's actual capacity, determined by test, is always less and a certain per cent. of its theoretical capacity, estimated by calculation, the difference is usually referred to by the expression "per cent. of efficiency." And if the pump actually compresses on each stroke 75 per cent. of the atmospheric air contained in the cylinder its efficiency is 75 per cent. or its per cent. of efficiency is 75. As the figures showing the actual capacity of the pump are used for all practical purposes, the losses mentioned do not affect a calculation. Those losses that do occur after compression.

The atmosphere is frequently referred to as a gas, and air pressure is sometimes referred to as a fluid pressure. When air is compressed the work which is done in the compression is converted into heat and shows itself in the rise in temperature of the compressed gas. After compression it cools down to the temperature of the surrounding atmosphere and in air brake practice this usually occurs before being used to do work. The mechanical equivalent of this dissipated heat is work lost.

The air we breathe is composed of fine particles of matter and forcing them together creates a friction, and this in turn generates heat, the heat tends to increase the volume or expand it, and as the compressed air is enclosed, it is unable to do so, consequently it results in a rise of pressure per square inch.

In this connection expansion may be said to have two different effects that is expanding the compressed gas by heat results in a rise in pressure actually expanding it by admitting it to another vessel or reservoir cools it, cooling it contracts it, lowering the pressure per square inch.

Thus the heat is dissipated by conduction and radiation and its mechanical equivalent is work lost, technically. "The compressed gas having again reached thermal equilibrium with the surrounding atmosphere expands and does work in virtue of its intrinsic energy." The intrinsic energy of a fluid is the energy which it is capable of exerting against a piston in changing from a given state as to temperature and volume, to a total privation of heat and indefinite expansion. It may be of interest to quote another expression, "The great cold which results when air expands against a resistance forbids expansion working," which is equivalent to saying forbids the realization of a high degree of efficiency in the use of compressed air. The loss of work due to the degree of heat developed by compression is entirely unavoidable. As the whole of the mechanical energy which the compressor piston spends upon the air is converted into heat and the heat of compression increases the volume, hence it is necessary to carry the air to a higher pressure in the compressor in order to finally obtain a given volume of air at a given pressure and at the temperature of the surrounding atmosphere.

The work spent in effecting the excess pressure is work lost. The loss encountered in the transmission of the compressed air is not a serious one, and is slight as compared with the loss encountered in compression and in the re-expansion or final application of the air. In transmission from the compressor it is constantly losing some of its pressure, and its volume is constantly increasing. Consequently, a calculation to determine the pressures at this time would be rather uncertain. It would be similar to attempting to obtain a definite or final result from a constantly changing condition and any mathematical calculation to determine the loss of pressure due to transmission would necessarily contain the factors, unit of time, volume of air, pressure of air, diameter of pipe, length of pipe, and difference in pressure or head required to maintain the flow. The loss of power or pressure incident to the transmission or conduction of air pressure from the locomotive to a train of cars is really not a loss from an economical point of view, at the time the pressure is limited by the adjustment of the pump governor as the governor at this time vents a small quantity of compression to the atmosphere with the object of avoiding a consideration in the steam cylinder which would result if the pump was stopped for any length of time; thus while the pump is slowly running to avoid a condensation of steam the loss in air pressure is at the same time supplied without any additional effort, the only time then that the loss is of any consequence is during the short time required to store and restore, after an application of the brake, the pressure used in the brake system. As stated before the friction encountered in compressing air heats it, and increases its pressure, but the friction encountered in transmission cannot heat the compressed air as it is at this time expanding into additional space and lowering its temperature and consequently its pressure. While new types of triple valves can have no effect upon the frictional resistance to the flow of air through the train, and the losses incident thereto, they do, however, produce to a certain extent some very undesirable effects such as opposition to the flow of air, both during the movement in release and application of the brakes. There is also a loss of pressure in expanding the compressed air from the storage reservoir into the brake cylinder, the loss is due to expansion, lowering of temperature, additional space vacated by the movement of the brake piston and triple valve piston, and leakage through the leakage and feed grooves.

The volume or capacity of the reservoir is sufficient, however, to supply all losses and create a pressure of 50 lbs. per square inch in the brake cylinder when the reservoir is filled with compressed air at 70 lbs. pressure and cooled to the temperature of the surrounding atmosphere.

Any and all natural losses incident to the compression and conduction of air are slight as compared to the losses that result from leakage that could be avoided, and about the only reason for mentioning or enumerating them is to show why a calculation to determine the results in pounds pressure per square inch is uncertain and at times shows a wide variation.

From an air brake point of view the effect of the natural losses is too insignificant to be considered, the actual loss of work, that which occurs at the brake piston being supplied by a slight addition to the volume stored in the auxiliary reservoir and that loss by compression and transmission being supplied by a few additional strokes of the compressor and they cannot really be termed additional strokes as it is advantageous to allow the compressor pistons to move slowly after the maximum pressure is attained.

Seventeenth Air Brake Convention.

According to the practice of recent years the executive committee of the Air Brake Association deferred the selection of subjects and committees to report thereon until a few months prior to the convention. This has been done with a view of having live subjects for the convention, instead of selecting subjects at the close of a convention which might become stale before the next meeting of the association.

The subjects and committees selected are as follows:

1. Air Brake Instruction, Examination and Rating, Messrs. Thos. Clegg, Geo. A. Wyman, H. H. Burns, H. A. Wahlert, T. F. Lyons.

2. Air Pump Piping, Fittings and Connections, Messrs, Geo. W. Kiehm, John S. Barner, F. F. Coggin.

3. Best Arrangement of Air Pump and Main Reservoir Capacity for 100-car Train Service, Messrs. P. J. Langan, E. H. Dewson, Wm. G. Kaylor.

4. Brake Cylinders and Connections and Recommendations for Overcoming Troubles Due to Cylinder Leakage, Messrs. W. P. Garabrant, L. M. Alberg, S. H. Draper.

5. Inspection and Cleaning of Triple Valves and Brake Cylinders, Mr. C. P. McGinnis.

6. Past Year's Developments in Air Brakes, Mr. W. V. Turner.

7. Questions and Answers on New York Brake Equipment, Messrs. T. F. Lyons, O. E. Moore, Wm. Owens, N. A. Campbell.

8. Questions and Answers on Westinghouse Equipment, Messrs. S. G. Down, S. J. Kidder, S. W. Dudley.

9. Recommended Practice, Messrs. S. G. Down, Geo. R. Parker, L. M. Carlton, Geo. B. Culver, H. A. Wahlert.

The secretary announces that each member is invited to forward any material or tell of any experience he may have had with reference to these subjects, communicate with the chairman of the committees. Members who are unable to attend the convention will greatly assist in the association's work if they will send written contributed remarks to be read at the convention and to be placed in the proceedings. As topical subjects are always interesting and instructive, each member is invited to send a topical subject to the secretary as early as possible, so that it may be placed before the executive committee for consideration. Some of the most useful and enlightening discussions have followed the presentation of a live subject for topical discussion.

Electrical Department

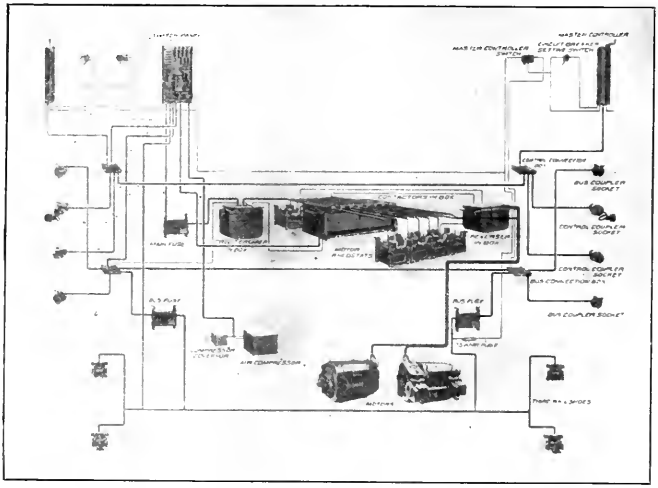
New York Subway Control.—II.

By W. B. Kouwenhoven.

Very often when there is trouble either with the master control or the motor control on the car at the head of the train, the best thing that the motorman can do is to cut out that car and run the train from a cab in the second motor car. Thus he saves the time that would otherwise be spent in going over the equipment.

Sometimes a train, instead of accelerating smoothly, will get up its speed in a series of jerks. This is caused by some trouble in the contactors on one of the cars, and it should not be permitted to continue. The motorman should ask his conductor to go back through the train and try to find the car which causes the jerking. As soon as he discovers the car in question he must make a report to the motorman, whose duty it is to go back and open the ten-point switch on the panel of the defective car.

If any unusual noise is noticed when the train is in motion by any one of the train crew, he should immediately make a report of it to the motorman. To prevent a serious delay arising from this trouble, the motorman should stop the train and ask the conductor to get off and stand beside the train while the motorman moves the train. In this way the conductor should find the cause of the noise, if possible. If the trouble is caused by some loose brake rigging, it should be tied up out of the way. If the sound seems to come from one of the motors and to resemble a hissing or singing sound, it is probably due to the fact that the brushes that press on the commutator of the motor have become loose or broken. This will cause severe sparking or spitting as the motor revolves, and if left to continue will very quickly burn out and ruin the commutator. The sound may be caused by some of the wound wire having worked loose from the armature slots and knocking against the field poles as the armature revolves. If the noise is caused by the brushes, the motorman can open the motor case and carefully clean the commutator with a piece of waste. Then he can adjust the spring that holds the brushes in place until they give a good even pressure. In the case of a loose armature coil the best thing he can do is to cut the power off from the motors by opening the ten-point switch. If the smell of the burnt rubber is noticed anywhere throughout the train, it is caused by burning insulation due to some of the wires becoming overheated by excessive currents. These excessive currents may be caused by an overload or a partial short circuit, or ground, as it is called, occurring between two wires. If the insulation is actually blazing, the extinguisher which is provided on every car should be used to put out the flames. In any case, the main switch and the ten-point switch on the car should be opened even if the insulation is only smoking.

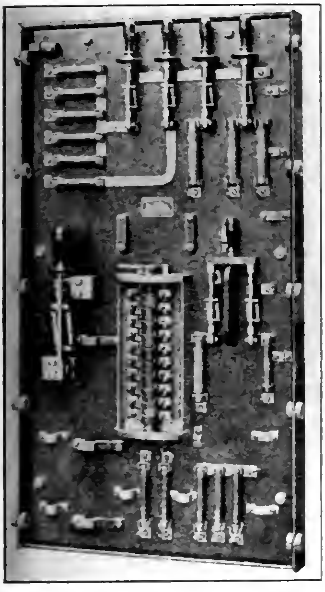


ARRANGEMENT OF CONTROL APPARATUS, AND MOTORS.

The subway trains are usually made up of eight cars, five being motor cars and the other three being trailers. When two or more of these cars have been disabled and then cut out by the motorman, the speed of the train is naturally very much reduced Even if only one car is cut out there is quite a material reduction in speed. In case of trouble on a car, the motorman should use his judgment as to whether it is best to stop his train and make an attempt to locate and repair the trouble or to cut out the car and proceed at the reduced speed to the terminal. If he is a considerable distance from the end of his run he should stop and try to find and repair the trouble if possible, following the method laid down in his book for instructions. Take for example the noise caused by the brushes sparking on the commutator. This would necessitate the motorman cutting out the car unless he thought that the delay caused by his opening the motor case, wiping off the commutator and adjusting the brushes would more than be made up by the increased running speed possible.

If a third rail contact shoe breaks it usually makes itself known by severe sparking or arcing as it bumps along, and if the shoe is left to drag it may cause a bad short circuit and set something on fire. The motorman should bring his train to a stop and pull the bus line jumpers on the car with the broken shoe. This will disconnect the car from the other cars of the train. On the platform of every car is provided a piece of board about three feet long and tapered at one end. This is called a slipper. The slippers should be removed from their holders and slipped between the third rail and the shoes that make contact with it. This lifts all the shoes from the rail and cuts off the current. Then the motorman should either tie up the broken portion of the shoe or remove it.

In case a fire occurs on a train in any one of the heating or lighting circuits, the switches controlling these circuits should be immediately opened and the fire extinguished with the appliances at hand. It sometimes happens so that an arc forms in the car wiring or underneath the car, between two of the wires coming into contact, or between a wire and the steel frame of the car. In this case the motorman must open the master controller switch in his cab, thus opening all the circuit breakers on the train. If this does not stop the arc, then he must open the main switches on the panels. If the arc still continues, a train hand must run to the nearest emergency box,



SWITCH PANEL

break the glass front of the box and pull down the ring inside. This starts the clock work mechanism in the main emergency box in the nearest passenger station, and rings a bell calling the agent's attention. It also drops an annunciator indicating the location of the box from which the alarm comes. The main box immediately cuts off the electric power from the section of track, and notifies the sub-station of the location of the trouble. If the accident occurs near a station the train man can run to the station and ask the station agent to turn in the alarm, which he must do from the main box in his station.

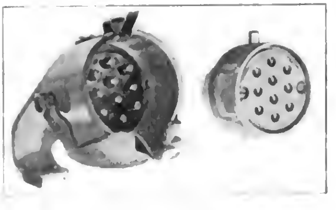
In case of a train jumping the track and causing a short circuit or ripping up of the third rail from its supports, an emergency alarm must immediately be sent in. After an emergency alarm has been sent in, a train man must go to the station and notify the train despatcher over the telephone as to the nature of the accident, the exact location, and the extent of the trouble. The power will not be turned on until the sub-station is notified by some one having the proper authority to do so.

These emergency boxes are placed about every 400 ft. along the line of the subway. They are painted white with aluminum paint, and are provided with a glass front, as stated. Immediately below the emergency box is placed a second box, a fire alarm, which is also provided with a glass front, but is painted red. In case the extinguishers provided on the cars fail to put out the flames or a serious fire is caused by a bad short circuit, a train man must run to the nearest fire alarm box as quickly as possible, break the glass and pull down the lever inside. This rings a fire alarm gong in the nearest station. The station agent must immediately send in an alarm to the city fire department, and direct them to the fire when they arrive. In case the train man does not send in an emergency alarm at the same time he sends in the fire alarm, then the station agent must send one in, because it is imperative that the power be turned off when the firemen enter the subway. The train despatcher must be notified, as in the case of an emergency alarm. The motorman and train crew have to be careful about sending in either of the above mentioned alarms, and before doing so they must feel certain that there is danger to life and property. If the electric power is cut off from a section of the track the motormen of other trains in the section should immediately throw their master controller handles to the "off" position, close the light switches and wait until the lamps light up again, indicating that the power is turned on again.

The automatic block signals used in the subway are similar to those found on many steam roads. They consist of home and distance signals and all the signals are numbered. When a motor man sees a caution signal ahead he must reduce the speed of his train and continue at a slow speed or control, as it is called. If he finds a home signal set at danger, then he should bring his train to a stop a little before reaching the signal, and wait until the signal clears before proceeding. If after waiting for one minute and the signal does not clear, then he may proceed with his train at a slow speed. First, however, one of the train crew must get down and release the automatic stop with which the subway is equipped. These automatic stops are T headed trips and are placed a little in advance of the signal and near the right hand running rail. They are so arranged as to engage with a dummy coupling on the air brake system under the body of the car. If a motorman runs by a signal the automatic trip engages with the dummy coupling, thus applying the brake in the emergency and opening the master control circuit and allowing all the contractors to drop, cutting off the current. When necessary the train man can release the trip on the track by means of a key which he carries, permitting the train to pass. The motorman must now proceed under slow speed until the next signal is reached. If that signal indicates a clear track, then he may run ahead again at full speed. At the next station the conductor must make a report to the superintendent on the telephone, giving the number of the signal that is out of order.

In case of doubt a motorman must always act on the safe side. He must acquaint himself thoroughly with the equipment of the road and with that of the motor cars, in much the same manner that a locomotive engineer must become familiar with his engine. However, the motorman must always be careful about one thing that the locomotive engineer need not think about, and that is the powerful and deadly electric current. The electric current is delivered at a pressure of 550 volts, and if a man makes a good contact with anything that is alive, the consequences may be very serious. In hunting trouble on the car equipment the motorman should always be sure that the main switch is open and that the power is turned off, because an accidental contact with some part of the equipment that happens to be alive may result in a serious and painful accident, if not in instant death. The current cannot be seen, but it is always there as a hidden peril.

No absolute rule for distance between trains is fixed. The distance should never be less than that in which a motorman can stop his train with ease. If he can only see 50 ft. ahead he should run his train so that he can stop within that distance. The motorman must not overrun platforms and always give proper attention to the grades, weather and to the state of the rails. When running he must coast or drift as much as possible, that is, run with



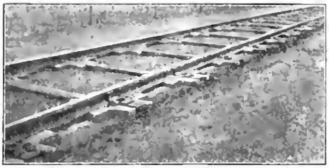
TRAIN LINE JUMPER.

the power turned off so as not to use any more power than is necessary. He should always remember that nothing justifies a collision, and that the safety of his passengers should at all times be his first consideration. Taking it all in all, his position is similar in many ways to that of his brother, the locomotive engineer, and it is identical in the responsibility for life and property.

Concrete Ties for Railroads.

By J. F. Springer.

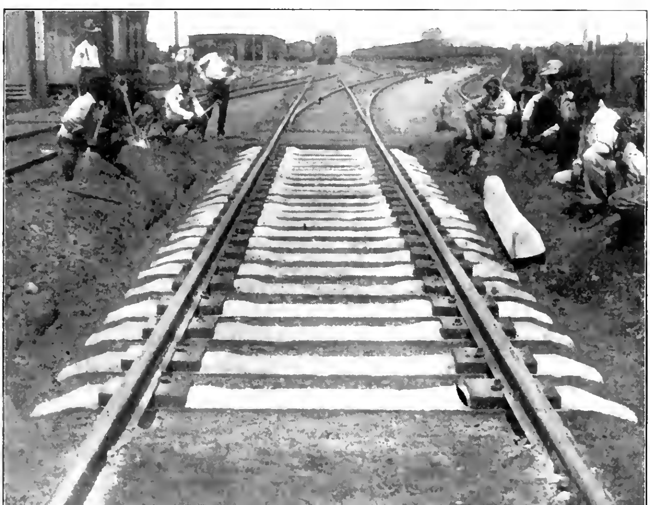
It might be thought to be quite a simple matter to design such a concrete tie. But a log of concrete will not do. Even if such a block possesses all other qualities, the necessity of attaching the rails to it presents quite a problem. But the problem of attaching the rails is not all. If one stops to consider a moment, he will soon see that with the tie loaded at each end, as is the case when a train



CORELL CONCRETE TIE.

passes over it, and has a tendency to break in the middle. This is a kind of treatment to which concrete is but feebly able to resist.

There is the Corell tie. It consists of two blocks of concrete, each about one-third the length of an ordinary wooden tie. These are separated from each other between the rails and thus they avoid the danger of breaking in the middle. A steel rod extends from one block to the other. This rod lies below the base of the rails in a groove recessed in the blocks. Now there is imbedded in the concrete body of each of the blocks a U-shaped rod. The curve of the U is sunk into the concrete about 8 ins. The arms of the U project upwards and by means of threads and



G. H. & H. TRACK LAID WITH PERCIVAL CONCRETE TIES.

nuts the rails are attached. It will be seen that the whole arrangement keeps the blocks from spreading or getting closer together and supplies a means of attaching rails. An advantage of this type consists in the fact that it permits continuous ballasting along the center of the track. This tie is, apparently, not correctly described as a reinforced one, unless one chooses to regard the U-piece as reinforcement.

There is a reinforced concrete tie, proper, which has been patented by a man in a position of responsibility. This is the device of Mr. James MacMartin, chief engineer of the Delaware & Hudson Railroad. In this tie the fundamental piece is a long block of concrete, about the same length as an ordinary tie. This is reduced in cross-section at the ends and between the rails. The main reinforcement consists of three ½-in. steel rods extending longitudinally along near the bottom until outside the rails, when they rise into the body of the concrete. The rail rests on a wooden block of yellow pine 2 ins. thick and extending over the whole of the concrete surface in the neighborhood of the rail base. Beneath this block is another of the same wood 4 ins. thick and smaller in area than the upper one. The upper block is removable, while the under one is permanent. There is concrete at either end of the upper block, but the resistance to movement lengthwise of the tie is still further strengthened by two metal plates somewhat of the form of a Z. These pieces of metal are deeply imbedded in the concrete. The wooden blocks permit the rail to be attached to the tie in the usual manner by spiking. The upper block when worn may be removed and replaced. It is of especial importance that, with this system of tie construction, it is possible to bring the rail to

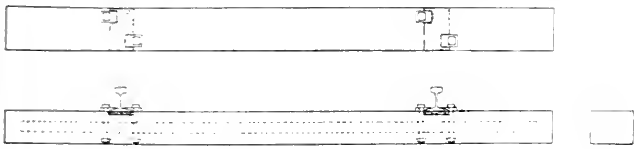
LONGITUDINAL CONCRETE STRINGERS.

surface by shimming, in case such readjustment is necessary. With the wooden blocks and spikes, reshimming becomes at one possible. This tie has seen actual service on the D. & H. Judging from what is stated, the results have not been such as to warrant the adoption of the tie without some modifications. The principal defects are thought to be danger of breaking in the center, and the liability of the tie to shelling off of the concrete at either end of the upper wooden block. It is now proposed to extend the thickened portions of the concrete body toward the center of the track and towards the ends of the tie. This will undoubtedly tend to correct the shelling off. To prevent center breakage, it is proposed to increase the amount of material at the center.

The Percival concrete tie is of very different construction. It consists, in the first place, of a log of concrete in which is imbedded steel reinforcement. This tie is of uniform breadth on top, but is sharpened underneath between the rails. An interesting feature consists in the method of attaching the rails to the tie. There is a metal tie-plate which extends across the top and clasps a wooden cushion at either side. This cushion is two inches thick and is bolted to the tie proper by means of a screw spike which engages in a babbit metal socket imbedded in the body of the concrete. The same spike holds rail, tie-plate and tie together. An experimental section in the main line of the Galveston, Houston & Henderson

Railroad at Galveston, Tex., has been laid with these ties.

Our line engravings show two somewhat similar ties. In the one, the reinforcement is an angle bar, 2½ x 2½ ins. and 5/16 in. thick, placed as shown on the cross-section view. In the other tie, which is for foreign service, the reinforcement consists of 29 rods placed lengthwise, the total cross section of these rods being 3 sq. ins. A wooden cushion is inserted as shown in the Affleck tie. In the Adriatic tie there is an inclined seat for the rail, in conformity with a practice abroad which has in view an inclined rail surface for contact with the cone-shaped tread of the wheels. In both ties the rails are secured by bolts inserted from below.

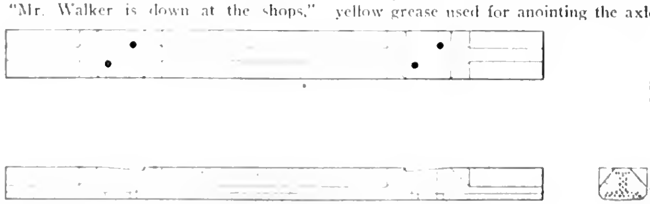


Affleck Tie (sketch)

CONCRETE TIE REINFORCED WITH ANGLE IRON.

Another type of concrete construction, while differing from the cross tie method of track support, may be referred to here. Instead of ties, there are longitudinal beams or girders of concrete. This system has been in use on a small railway where the locomotive weighs 15 tons and the loaded four-wheeled cars 10 tons. The weight of rail is but 40 lbs. to the yard.

The longitudinal supports are of substantial cross-section, being 2 ft. deep, 26 ins. wide at the bottom, and 22 ins. at the top. There are two series of recesses arranged to open along the upper surface. One series consists of rather deep holes. In the bottom of these holes is placed a layer of sand, or similar material, and above it is placed a block of vitrified brick. This block is to afford support for the rail. Between it and the sand, a layer of asphalt is arranged, and the block is set in the same material. This addition of asphalt is for the purpose of making the construction waterproof. By varying the amount of sand, adjustment may be made to secure any height for the surface of the rail that may be desired. As the sand is in a confined space, it cannot escape, and so may be relied on to properly support the weight of the traffic.



Adriatic Railway Tie (sketch)

CONCRETE TIE REINFORCED WITH SMALL ROUND IRON BARS

The man who has traveling men on the road selling goods and soliciting orders is frequently less than civil with the drummer who calls to solicit orders from his concern.

Sweeping an Engine's Chimney.

By Angus Sinclair.

On a bright April morning long ago in what was the springtime of my life, I was sitting in the office of the foreman of the locomotive department at Arbroath, Scotland, when an overgrown lad of about seventeen years came in and reported that he had come ready to begin work. Another foreman had engaged him as a wiper and he had come to take up his job.

He was an ungainly youth of great size, composed mostly of legs and arms. His rosy face and general demeanor betokened rustic training on blood-making porridge diet. He was dressed in a suit of the white duck overalls much affected by the Scottish workman and appeared to be proud of the snowy whiteness of his apparel. This was the introduction of David Wilkie to railway life and to me.

The foreman directed the youth to go to the running shed, as the engine house was called, and ask for a man he named, who would put him to work wiping engines.

Wilkie went to the running shed as directed and asked for Mr. Walker, the foreman, and the first person he met was a shop apprentice named Jack Moncrieff, a foppish sort of youth, whose purpose in life seemed to be mischief and deviltry.

"Mr. Walker is down at the shops," said Moncrieff, "but I'm his assistant; is there anything I can do for you?"

"A dinna ken," replied the rustic, "may be there is; A'm come tae be a cleaner."

"Yes, yes," said Moncrieff, "I understand. You will be under my orders. Come along and I'll put you to work." He then led the youth outside the running shed, cudgeling his brains in the mean time as to what kind of a trick he could play upon the newcomer. An engine was standing on the pit outside and a wicked idea struck Jack, and he acted on it.

"Do you know the first duty of a cleaner?" he asked the white garmented novice. "No; I hinna ony idee," replied Wilkie.

"Well, the first thing you have to do is to sweep the lums (chimneys) of the engines." That seemed reasonable enough, as all house chimneys have to be swept of soot regularly in Scotland.

"Now come and I'll help you make a start," said Jack.

With that he got a broom out of the running shed, opened the smoke box door of the engine standing on the pit and told Wilkie to get inside and push the broom up the lum, taking care to sweep off all the soot.

I happened upon the scene a few minutes afterwards, and found Wilkie pushing the broom vigorously up and down the chimney. His long legs were sprawling over the buffer beam, his head and arms were inside the smoke box, and the soot was showering down upon his white overalls. Jack was shouting directions, with merely a quiet smile on his face. The sight was too much for me. I fell down and roared.

Wilkie looked out of his smoke box, and, seeing me laughing, concluded that something was wrong. His red cheeks had received several patches of blacking, and his big nose looked like the handle of an ebony cane. His appearance was so ridiculous, that Jack could not maintain his role of serious overseer, and he too fell into a fit of laughing.

Then Wilkie slowly emerged from the smoke box, his slow powers roused to anger. His first act was to seize Jack Moncrieff by the axis of his trousers and push him into the smoke box, using the soot-begrimed broom to push him well in. Looking round he saw a bucket of the yellow grease used for anointing the axle bearings of British cars. With his hand, which held as much as an ordinary shovel, he scooped up a gob of this grease and plastered it over Moncrieff's head and face.

Mr. Walker, the foreman, appeared about this time and Jack was sent away for a fortnight's holiday. He was rather given to boasting of the tricks he played upon greenhorns, but he never mentioned the experience he had in sending Davie Wilkie to sweep the lum of engine 66.

Passenger and Freight Power for the Chicago Great Western

THE 4-6-0 TYPE.

The Baldwin Locomotive Works have recently completed twenty-four locomotives for the Chicago Great Western Railway. Four of these engines are of the ten-wheel type for express passenger service, while the remaining twenty are of the consolidation type for heavy freight service. Both designs follow the Associated Lines' standards in many respects, although important changes have been made in various details.

The passenger locomotives are of special interest, as they are equipped with the Emerson type of fire-tube superheater. This device was first used on the Great Northern Railway, and the results so far have been satisfactory. In the Emerson type, the smoke-box headers approximate the usual steam pipes in form. Each header is divided into two compartments, one for saturated, and the other for superheated steam. The large boiler tubes which accommodate the superheater elements, are placed immediately back of their corresponding headers, instead of being grouped in the the upper part of the boiler barrel, as is usually the case with fire-tube superheaters. In these engines the headers are straight, and stand vertically. The superheater elements on each side are placed in twelve headers and are arranged with a double loop in each large boiler tube. The loops are connected by cast steel return bends. A plug is screwed into the front of the header opposite each tube opening. An application has been made for a patent covering this design of superheater.

The smokebox contains a single high nozzle, and the stack is tapered, with a minimum internal diameter of 20 ins. An adjustable petticoat pipe extends downward from the stack base, and an adjustable diaphragm plate is in front of the nozzle. The boiler of this locomotive is straight topped with a wide firebox. The mud ring is 5 ins. in width all around, so that liberal water spaces are provided. The crown sheet is flat, and is stayed by inverted T-bars hung on expansion links. The longitudinal barrel seams are butt-jointed, with diamond welt strips.

The safety valves are set at 150 lbs., and with cylinders 26 x 28 ins. and driving wheels 73 ins. in diameter, the resulting tractive force developed is 33,000 lbs. The cylinders are equipped with 13-in. piston valves, having cast iron bodies and three snap rings at each end. The cylinder castings have heavy walls, and are secured to the smokebox and to each other by a double row of bolts. The by-pass valves are similar to the well-known P. R. R. design, which has been extensively used by the builders. In the present instance the relief ports are covered by a flat plate of cast steel, made in one piece with a central spindle which acts as a guide.

The valve motion is of the Walschaerts type, and presents a single arrangement of this form of gear. The link is mounted in a specially designed steel casting, which also serves as a support for the reverse shaft bearings. This casting is bolted at the front to the guide yoke, and at the back to a crosstie between the first and second pairs of driving wheels. The combining lever is pinned directly to the valve rod, and the latter is supported by a suitable bracket mounted on the upper guide bar.

Some of the principal dimensions are as follows:

Boiler—Material, steel; diameter, 70 in.; thickness of sheets, 11/16 in.; fuel, soft coal.

Firebox—Material, steel; length, 107 15/16 ins.; width, 66⅛ ins.; depth, front, 67½ ins.; depth, back, 49½ ins.; thickness of sheets, sides, 5/16 in.; thickness of sheets, back, 5/16 in.; thickness of sheets, crown, ⅜ in.; thickness, of sheets, tube, ⅝ in.

Water Space—Front, 5 ins.; sides, 5 ins.; back, 5 ins.

Tubes—Diameter, 5 x 2 ins.; material, steel; Number, 24 tubes, 5-in. dia., 203 tubes, 2-in. dia.; length, 16 ft. 9 ins.

Heating Surface.—Firebox, 149 sq. ft.; tubes, 2,206 sq. ft.; total 2,355 sq. ft; grate area, 49.5 sq. ft.; engine equipped with Emerson superheater, superheating surface, 460 sq. ft.

Driving Wheels.—Diameter, outside, 73 ins.; journals, main, 10½ x 12 ins.; others, 9 x 12 ins..

Engine Truck Wheels.—diameter, front, 33½ ins.; journals, 6 x 10 ins.

Wheel Base.—driving, 15 ft. 3 ins.; total engine, 27 ft. 1 in; total, engine and tender, 57 ft. 9½ ins.

Weight.—On driving wheels, 144,950 lbs.; on truck., front, 53,100 lbs.; total, engine, 198,050 lbs.; total, engine and tender, about 343,000 lbs.

Tender.—Wheels, diameter, 36 ins.; journals, 5½ x 10 ins.; tank capacity, 8,000 gals; fuel capacity, 11 tons; service, passenger.

PASSENGER 4-6-0 FOR THE CHICAGO GREAT WESTERN RAILROAD.

J. G. Neuffer, Superintendent of Motive Power. Baldwin Locomotive Works, Builders.

tubes, arranged in two vertical rows of six tubes each. The superheated steam section of the header is centrally placed between the two arms of the saturated steam section, the latter being divided at the top. At the lower end, the superheated steam sections are connected by a transverse equalizing pipe. The superheater elements are composed of steel tubes having an internal diameter of 1 in. These tubes are expanded into the

THE 2-8-0 TYPE.

The consolidation type locomotives use saturated steam at a pressure of 200 lbs. With 24 x 30 in. cylinders, and driving wheels 63 ins. in diameter, the resulting tractive force is 46,600 lbs. The weight available for adhesion is thus utilized to the best possible advantage. The steam distribution in these locomotives is controlled by balanced slide valves actuated by Walschaerts valve gear. The cylinders are arranged with their center lines coincident with the steam chest centers. Each combining lever is pinned to a long crosshead sliding in two brackets which are bolted to the top guide bar. This crosshead carries a lug to which the valve rod is secured. In this way the motion is transferred from the plane of the link to that of the steam chest center, without the use of a rocker.

The boilers of these engines are straight topped, with crown-bar staying, and so far as their construction is concerned, they follow the Associated Lines' practice closely. The design of the frames and running gear presents no unusual features. The tenders of both classes of engines are similar. They are mounted on arch-bar trucks having steel bolsters and Standard rolled steel wheels. The longitudinal sills are composed of 12-in. steel channels.

The following table contains the principal dimensions of the 2-8-0 class of locomotives.

Boiler.—Type, straight; material, steel; diameter, 80 ins.; thickness of sheets, 3/4 in.; working pressure, 200 lbs.; fuel, soft coal; staying, T-crown bars.

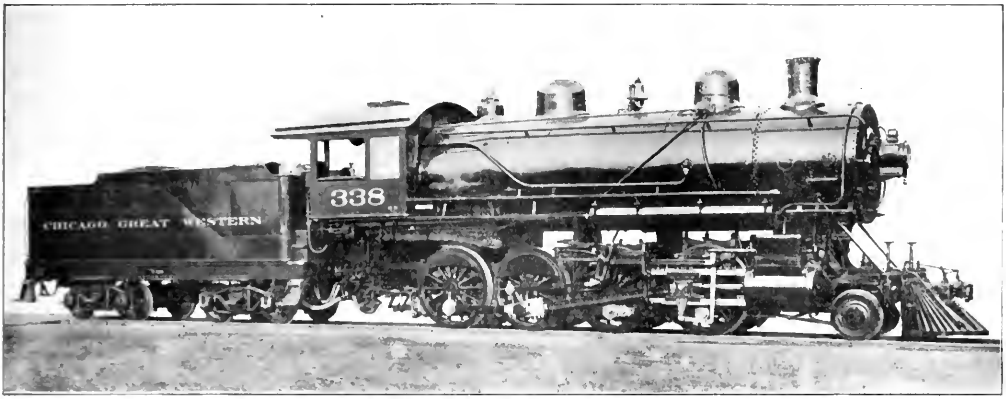
Firebox.—Material, steel; length, 108 1/16 ins.; width, 66 1/8 ins.; depth, front, 74 ins.; depth, back, 63 3/4 ins.; thickness of sheets, sides, 5/16 in.; back, 5/16 in.; crown, 3/8 in.; tube, 1/2 in.

Water Space.—Front, 5 ins.; sides, 5 ins.; back, 5 ins.

Tubes.—Material, steel; wire gauge, No. 11; number, 413; diameter, 2 ins.; length, 16 ft. 4 ins.

Heating Surface.—Firebox, 171 sq. ft.; tubes, 3,514 sq. ft.; total, 3,085 sq. ft.; grate area, 49.6 sq. ft.

Driving Wheels.—Diameter, outside, 63 ins.; journals, main, 10 1/2 x 12 ins.; others, 9 x 12 ins.



HEAVY 2-8-0 FOR THE CHICAGO GREAT WESTERN RAILROAD

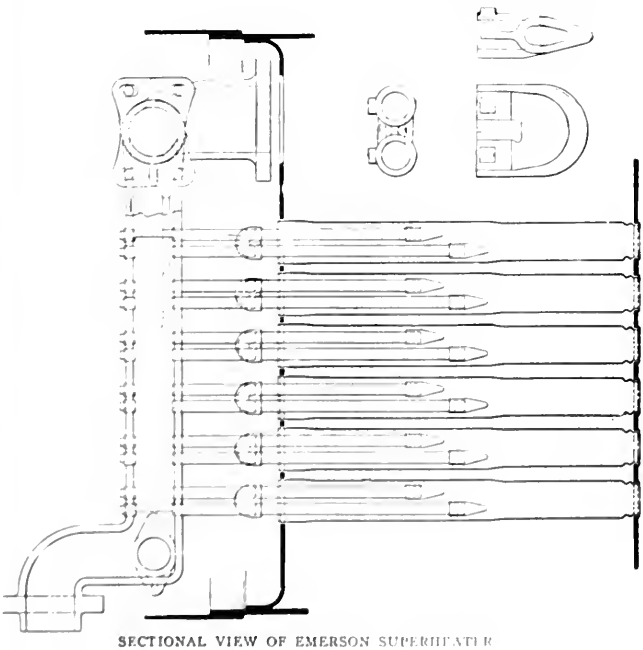
J. G. Neuffer, Superintendent of Motive Power. Baldwin Locomotive Works, Builders.

Engine Truck Wheels.—Diameter, front, 33 ins.; journals, 6 x 10 ins.

Wheel Base.—Driving, 17 ft. 0 ins.; total, engine, 25 ft 8 ins.; total, engine and tender, 58 ft. 6 ins.

Weight (estimated).—On driving wheels, 187,000 lbs.; on truck, front, 29,000 lbs.; total, engine, 216,000 lbs.; total, engine and tender, about 360,000 lbs.

Tender.—Wheels, diameter, 33 ins.; journals, 5 1/2 x 10 ins.; tank capacity, 8,000 gals.; Fuel capacity, 11 tons; service, freight.



SECTIONAL VIEW OF EMERSON SUPERHEATER

Rates of Long Ago.

Railway managers who are constantly abused for charging high rates for transportation service might look back longingly to the early days of the railway era when the common carriers were at liberty to charge what the business would stand without killing the goose that laid the golden egg. In the light of present day agitation what once was, is truly marvelous.

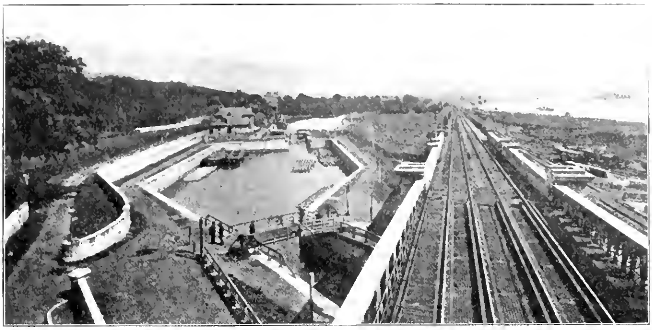
In 1840 the Philadelphia & Columbia Railroad was in a flourishing condition. Any citizen of Pennsylvania was allowed to run his own cars over the railroad on paying a toll varied from 6 mills to 4 cents per ton mile. During the first nine months of operating the Baltimore & Ohio Railroad the charge per ton mile was 6 cents.

In 1837 the charges for carrying freight on a few of our leading railroads were per ton mile: Baltimore & Ohio, 4½ cents; Baltimore & Washington, 4 cents; Winchester & Potomac, 7 cents; Portsmouth & Roanoke, 8 cents; Boston & Providence, 10 cents; Boston & Lowell, 7 cents; Mohawk & Hudson, 8 cents.

Passenger rates came closer to modern charges, for 2 or 3 cents per mile was rarely exceeded.

Road, River and Canal.

This unique combination of the highways of the world—road, river, canal and railway—running side by side, is to be seen at Bowling station on the Caledonian Railway. The road is the main thoroughfare between Glasgow and Dumbarton, Helensburgh, etc.; the river is the world-famed Clyde; the canal is the Caledonian Railway Company's Forth and Clyde waterway connecting the east with the west of Scotland; and the road is the line known as the "Lanarkshire and Dumbartonshire," which forms part of the Caledonian system. Close by is the striking monument to Henry Bell, whose tiny steamer, the "Comet," sailed the waters of the Clyde in 1812 with such far-reaching effect, while not far distant is the picturesque and historic castle of Dumbarton.



ROAD, RIVER, CANAL AND RAIL.

During the holiday season the picture from which our illustration was made was sent to Dr. Sinclair by Mr. John F. McIntosh, the locomotive superintendent of the line.

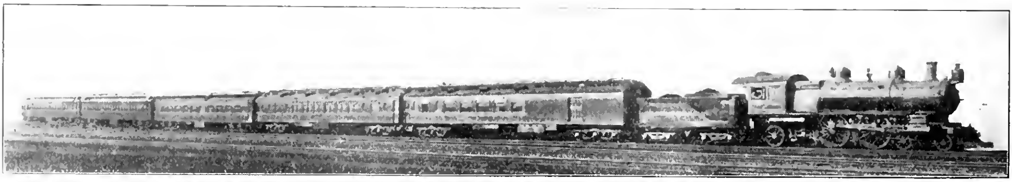
All Steel Trains.

What is probably the largest steel passenger car equipment owned by any railroad in the world is that of the Pennsylvania Railroad, which, with the cars just completed and those in course of construction, have 630 all-steel passenger cars. With this large number of cars the Pennsylvania intends to begin the operation of all-steel passenger trains on some of its lines of densest traffic.

On Aug. 12, 1906, the Pennsylvania Railroad announced that all future passenger equipment would be built of steel; not only were the cars to have steel frames, but to be steel and non-collapsible in every particular. In planning the cars and establishing standards which are now followed in all Pennsylvania passenger cars, no expense has been spared by the company to build a coach which should provide the greatest possible strength, a steel framing which could not be affected by fire, an inside lining which should be absolutely unburnable, and, at the same time, one that would not conduct heat or sound.

The Pennsylvania Railroad in November, 1906, ordered 100 all-steel passenger cars Since that time additional orders have been placed and there are now in service on the company's lines 245 coaches, 10 dining cars, 21 combination passenger and baggage cars, 29 baggage cars, 18 postal cars, and one company car, a total of 324 cars. In course of construction there are 140 coaches, 34 dining cars, 48 combination passenger and baggage cars, 4 baggage cars, 42 postal cars, 27 mail storage cars, and 11 baggage and mail cars

The Pullman Company, at the instance of the Pennsylvania Railroad, has for the past four years been at work designing all-steel parlor and sleeping cars. Some 500 such cars are shortly to be completed and placed in service on the Pennsylvania Railroad. With the all steel passenger equipment now in service or on order, and some 250 steel cars to be ordered on the 1910 passenger equipment programme, the Pennsylvania Railroad will, in a short time, have in service about 900 of its own steel passenger cars and 500 steel Pullman cars.



FIRST SOLID STEEL PASSENGER TRAIN ON THE PENNSYLVANIA RAILROAD.

Evening Schools.

In some districts on this continent excellent facilities are provided in the form of evening schools where people working during the day time may receive instruction in technical education; but in many places where workmen are numerous very little has been done to aid them in self help. This is a pity, for the very best class of mechanics are frequently ignorant of the principles of their business and have no means of repairing the educational defect. There is so much attention bestowed upon promoting technical school education through colleges that the night school receives very little attention outside the industrial centers.

In Great Britain, where evening schools have been unprecedentedly successful, the Government long ago recognized the necessity for teachers of evening schools being in sympathy with the needs of the scholars. In any district where a certain number of pupils can be obtained, the Council of Education establishes an evening school and teachers are selected, men having the technical knowledge most needed for the particular schools. By this system the technicalities of nearly all trades are taught in the evening schools. The value of this system of instruction is extending.

Among us a system of education of that kind would need to be carried out by the various States, and State authorities are difficult to move in anything non-political. Our railway companies are doing something to help out evening school education, but agitation should be carried on to make the several States perform their duty towards the education of workmen.

Some drummers make themselves a burden to the people they call upon, but those made of the proper material soon make themselves welcome. That class is the traveler who carries the news of his world. He brings the latest and the freshest gossip of a kind that adds to the store of a business man's knowledge The drummer who travels with his eyes open sees many things that are useful and profitable to his customers.

Items of Personal Interest

Mr. H. F. Smith has been appointed master car builder on the Chicago & Alton, with office at Bloomington, Ill.

Mr. J. T. Andrus has been appointed purchasing agent of the North Coast Railroad, with office at Spokane, Wash.

Mr. E. C. Anderson has been appointed mechanical engineer of the Colorado & Southern, with headquarters at Denver, Colo.

Mr. J. C. Stuart, vice-president of the Erie, has been elected chairman of the General Managers' Association of New York.

Mr. W. C. Ranous has been appointed superintendent transportation of the Minneapolis, St. Paul & Sault Ste. Marie Railway.

Mr. W. J. Bohan has been appointed mechanical engineer of the Northern Pacific, at St. Paul, Minn., vice Mr. J. E. O'Brien resigned.

Mr. W. J. Given has been appointed storekeeper of the Lake Erie & Western, with headquarters at Lima, O., vice Mr. B. J. Yungbluth, resigned.

Mr. George W. Davis, of Boone, Ia., has been appointed assistant foreman of the roundhouse at Boone, Ia., on the Chicago & North-Western Railway.

Mr. C. H. Montague has been appointed superintendent of motive power of the St. Paul & Des Moines Railroad, with headquarters at Des Moines, Ia.

Mr. F. D. Warner, heretofore locomotive foreman at Field, B. C., on the Canadian Pacific, has been appointed night foreman at Revelstoke, B. C.

Mr. E. A. Schultz has been appointed round house foreman of the Chicago & North-Western Railway at Milwaukee, Wis., vice Mr. J. W. Crysler, retired.

Mr. H. J. Palmer has been appointed purchasing agent of the Georgia, Southern & Florida, with office at Macon, Ga., vice Mr. W. P. Hopper, promoted.

Mr. R. P. Blake has been appointed master mechanic of the Montana division of the Northern Pacific, at Livingston, Mont., vice Mr. C. E. Allen, promoted.

Mr. J. Murrin has been appointed superintendent of locomotive shops of the Chicago & North-Western, with office at Chicago, vice Mr. Oscar Otto, resigned.

Mr. F. Kerby has been appointed road foreman of engines on the Baltimore & Ohio, with headquarters at Riverside, Baltimore, vice Mr. H. S. Peddicord, resigned.

Mr C. L. Brevoort, train master on the Cincinnati, Hamilton & Dayton Railroad, has had his jurisdiction extended from end of double track to Erie Junction at Lima, O.

Mr. W. Hamilton has been appointed master mechanic of the Western division of the Grand Trunk at Battle Creek, Mich, vice Mr. E. D. Jameson, assigned to other duties.

Mr. W. W. Spruell, locomotive engineer on the Louisville & Nashville Railroad, has been appointed traveling engineer on the road, with headquarters at Birmingham, Ala.

Mr. J. H. Leifield, formerly a machinist on the Chicago & North-Western Railway, has been appointed assistant round house foreman on the same road at Milwaukee, Wis.

Mr. W. C. Mehan, superintendent of the Grand Trunk Pacific at Melville, Sask., has been promoted to be general superintendent of the Mountain division at Prince Rupert, B. C.

Mr. H. P. Johns, chief draughtsman of the St. Louis & San Francisco at Springfield, Mo., has been appointed mechanical engineer of that road, with office at Springfield, Mo.

Mr. Carl C. Ahrens has been appointed traveling fireman of the West Iowa division of the Chicago & North-Western Railway. Mr. Ahrens was chosen from the ranks, for his ability.

Mr. Harry C. Stauffer has been appointed division freight agent on the Philadelphia & Reading Railroad, with office at Philadelphia, Pa., vice Mr. E. D. Hilleary, transferred.

Mr. R. J. McDonald has been appointed assistant traveling engineer of the Southern district of the Chicago & Alton. He will assist Mr. Joseph Turpin, the traveling engineer of that district.

Mr. N. N. Boyden, master mechanic of the Southern Railway at Atlanta, Ga., has been transferred in the same capacity on the same road to Knoxville, Tenn., vice Mr. J. F. Sheahan, resigned.

Mr. Edgar D. Hilleary has been appointed division freight agent on the Philadelphia & Reading Railroad, with office at Harrisburg, Pa., vice Mr. Benjamin R. Boggs, promoted.

Mr. W. J. Souder, auditor and superintendent of the St. Paul & Des Moines Railroad, has been appointed purchasing agent of the road as well as being auditor. His office is at Des Moines, Ia.

Mr. Charles Adams has been appointed round house foreman on the Cincinnati, Hamilton & Dayton at the Gest street shops in Cincinnati, vice Mr. A. P. Lowden, resigned.

Mr E. M. Sweetman, master mechanic on the Southern, at Sheffield, Ala., has been transferred as master mechanic on the same road to Birmingham, Ala., vice Mr. G. Akans, transferred.

Mr. J. E. O'Brien, mechanical engineer of the Northern Pacific at St. Paul, Minn., has been appointed superintendent of motive power of the Western Pacific, with office at San Francisco, Cal.

Mr. Geo. Akans, master mechanic on the Southern Railroad at Birmingham, Ala., has been transferred as master mechanic on the same road to Atlanta, Ga., vice Mr. N. N. Boyden, transferred.

Mr. R. S. Miller, general foreman of the car department of the New York, Chicago & St. Louis, at Cleveland, Ohio, has been appointed master car builder and his former title has been abolished.

Mr. G. W. Kirtley, who for several years has been superintendent of car service of the Erie, has been promoted to superintendent of transportation. The title he previously held has been abolished.

Mr. H. G. Osborne has been transferred as master mechanic to the Iowa and Des Moines Valley divisions of the Chicago, Rock Island & Pacific at Valley Junction, Ia., vice Mr. E. J. Harris, transferred.

Mr. P. S. Lindsay, formerly road foreman of engines on the Canadian Pacific Railway, has been promoted to be district master mechanic on the same road, with headquarters at Brandon, Man.

Mr. B. J. Yungbluth, heretofore storekeeper of the Lake Erie & Western Railroad at Lima, O., has been appointed general storekeeper of the Pittsburgh Railways Company, with office at Pittsburgh, Pa.

Mr. J. E. O'Brien, formerly mechanical engineer of the Northern Pacific at St. Paul, Minn., has been appointed superintendent of motive power of the Western Pacific Railway with headquarters at San Francisco, Cal.

Mr. T. F. Patterson, heretofore locomotive foreman at Kenora, Ont., on the Canadian Pacific, has been appointed district master mechanic at Moose Jaw, Sask., vice Mr. L. E. W. Bailey, assigned to other duties.

Mr. E. J. Harris has been transferred as master mechanic to the Kansas City terminal and the St. Louis divisions of the Chicago, Rock Island & Pacific at Armourdale, Kan., vice Mr. R. L. Stewart, transferred.

Mr. Henry Mel, formerly material

agent on the National Railways of Mexico at Beaumont, has been appointed assistant purchasing agent for the same roads, with headquarters at Beaumont, Tex.

Mr. W. Alexander, heretofore assistant district master mechanic of the Chicago, Milwaukee & St. Paul, has been appointed district master mechanic, with offices at Milwaukee, Wis., vice Mr. J. C. Miller, resigned.

Mr. E. W. Kolb, engineer of electric signals of the Chicago, Rock Island & Pacific, at Chicago, has resigned, to become signal engineer of the Buffalo, Rochester & Pittsburgh, with office at Rochester, N. Y.

Mr. R. L. Stewart has been transferred as master mechanic to the Missouri division of the Chicago, Rock Island & Pacific, with headquarters at Trenton, Mo., vice Mr. L. A. Richardson, transferred.

Mr. A. G. Hebb, heretofore road foreman of engines has been appointed district master mechanic of District No. 2, central division of the Canadian Pacific Railway, with headquarters at Winnipeg. This is a new position.

Mr. E. W. Hoffmann has been appointed train master of the Indianapolis & Springfield division of the Cincinnati, Hamilton & Dayton, with office at Indianapolis, Ind., vice Mr. H. F. Reynolds, assigned to other duties.

Mr. L. A. Richardson, formerly at Trenton, Mo., has been appointed master mechanic of the Chicago terminal and the Illinois divisions of the Chicago, Rock Island & Pacific in Chicago, vice Mr. D. H. Speakeman, transferred.

Mr. J. E. Buker, superintendent car department of the Illinois Central Railroad, has been elected first vice-president of the Chicago Car Heating Company, with headquarters at the Railway Exchange Building, Chicago.

Mr. W. H. Biggar, K.C., heretofore general solicitor, has been appointed general counsel for the Grand Trunk and Grand Trunk Pacific Railways, with office at Montreal. The office of general solicitor has been abolished.

Mr. Frank Johnson, general foreman of locomotive repairs on the Southern, at Knoxville, Tenn., has been appointed master mechanic on the same road, with headquarters at Sheffield, Ala., vice Mr. E. M. Sweetman, transferred.

Mr. Charles Postle. formerly night roundhouse foreman at Boone, Ia., has been appointed day foreman of roundhouse on the Nebraska and Wyoming division of the Chicago & North-Western ern Railway at Missouri Valley, Iowa.

Mr. C. E. Allen, master mechanic of the Montana division of the Northern Pacific at Livingston, Mont., has been appointed general master mechanic of the Yellowstone, Montana & Rocky Mountain divisions, with office at Livingston.

Mr. E. Howard Delo has been appointed electrical inspector on the Eastern Pennsylvania division of the Pennsylvania, having jurisdiction over the lines between Altoona and Philadelphia. The office of foreman of electricians has been abolished.

Mr. M. J. Griffin has been appointed superintendent of Cincinnati terminals of the Cincinnati, Hamilton & Dayton, which have been extended to the end of the double track north of Hamilton and include the Middletown branch. His headquarters are at Elmwood, Ohio.

Mr. P. J. McGill, who has just been retired from service on the Union Pacific, after forty years' continuous service with honorable record, was presented with a diamond ring by the members of the B. of L. E. division, running between Denver and Cheyenne Wells.

Mr. J. F. Sheehan, master mechanic of the Southern at Knoxville, Tenn., has resigned and has entered the service of the International & Great Northern in the same capacity at Palestine, vice Mr. F. S. Anthony, appointed superintendent of machinery.

Mr. James T. Wallis, superintendent of motive power on the Erie Division of the Pennsylvania at Williamsport, has been made acting superintendent of the West Jersey & Seashore Railroad, vice Mr. D. H. Lovel, granted a leave of absence on account of ill health.

Mr. Daniel Willard, who was recently elected president of the Baltimore & Ohio Railroad, has recently had his field of activity considerably enlarged. At a recent meeting of the directors of the Baltimore & Ohio Southwestern, he was elected president, to succeed Mr. Oscar G. Murray.

Mr. D. H. Speakeman, formerly master mechanic of the Chicago, Rock Island & Pacific terminals in Chicago, has been transferred in the same capacity to the Nebraska & Colorado division on the same road with headquarters at Goodland, Kan, vice Mr. H. G. Osborne, transferred.

Miss Anna Heinrichsdorff is the first woman to receive an engineer's diploma in Germany. After studying four years in the Berlin Polytechnic Institute she passed the electrical engineer's examination and received the mark of excellent in each branch. She has opened offices in Berlin and will now practice her profession as a means of livelihood.

Mr. W. M. Whitenton, who more than twenty years ago began his railroad career as a telegraph operator in Fort Worth for the Missouri, Kansas & Texas, and is now general manager of the Southern and the Choctaw districts of the Rock Island, has succeeded J. W. Robins as vice-president and general manager of the Chicago, Rock Island & Gulf.

Dean F. E. Turneaure, of the College of Mechanics and Engineering of the University of Wisconsin, recently gave two addresses before the instructional staff of the College of Engineering of the University of Illinois. His subject on the first day was "The Stress in Bridges Under the Load of Moving Trains," and on the second day, "Some Features of the Manhattan Suspension Bridge."

A correspondent writes us that Mr. H. H. Wallace, who was appointed traveling engineer of the Cincinnati, Hamilton & Dayton from Springfield, Ill., to, and including Cincinnati terminals, has by his efforts encouraged the men under him to give close attention to the proper method of firing with beneficial results. All are trying to "make good." Mr. Wallace was formerly on the Chicago, St. Paul, Minneapolis & Omaha at St. Paul, Minn.

Mr. O. F. Adams, who is now seventy years of age, has been notified that he has been pensioned by the Union Pacific, being among the first Atchison men to get a railroad pension and the only Union Pacific pensioner at Atchison, Kan. He worked for the road twenty-seven years without a mark against his name. Besides the pension, he and his wife have been given a life pass over the Union Pacific lines and a doctor's certificate entitling them to free medical attention.

Mr. J. M. Wakeman, general manager of the McGraw Publishing Company, New York, has resigned, owing to impaired health and will be succeeded by Mr. Hugh Wilson, well known through his connection with the *Railway Age*. Mr. Wakeman, who intends spending a year or two abroad, first entered the advertising field as representative of Locomotive Engineering and proved highly successful from the start. He is likely to represent Railway and Locomotive Engineering abroad.

Mr. John C. Sullivan, formerly locomotive engineer on the Cincinnati, Hamilton & Dayton, has been appointed a member of the railroad commission of Ohio, by Governor Judson Harmon. Mr. Sullivan's term of office will be six years. This appointment is very gratifying to the Brotherhood of Locomotive Engineers, who have for years advocated the appointment of one of their order to such a position as Mr. Sullivan holds. The personnel of the commission will be all the stronger by the presence of a practical railroad man among them.

Mr. H. A. Fabian, who for the last three years has been assistant to Mr. C. S. Mellin, president of the New York, New Haven & Hartford, has been appointed by that official and by Mr. Lucius Tuttle, president of the Boston & Maine, to the position of manager of purchases

(*Continued on page 127.*)

General Foremen's Association

System in Shop Repairs.

The foremen of many small railway shops fail to carry on the business of repairing through want of knowledge concerning systematic methods. These people might glean valuable hints from the following remarks made by Mr. E. C. Hanse at the last General Foremen's Convention.

"We have a form that we have to make out every week and a monthly sheet to make out at the end of the month. We show on the weekly form the repairs needed to every engine that is in service, and in the right hand corner we have a part set aside for engines in shop, engines turned out of shop and engines waiting repairs. On the left hand corner is the condition of passenger engines; on the right hand corner is the condition of freight engines, and on the bottom is the condition of switch engines. We also have a blue print that gives the classification of repairs needed. That goes by letters. Class 8 is light repairs; class 9 is extra, 6 is heavy repairs, and 5 is still heavier repairs. If we want to give an engine new flues, we put her in the shop for F; one-half set of flues, F 3. If you only have two-thirds set of flues, it is marked F 2. You designate the class of repairs; the sheet made out each week goes to the general foreman's office and it is marked. 'O' means good; '8' means light repairs to machinery, as we have more or less light repairs to do when we drop a wheel. If we drop all the wheels we put it in '7.' We have a yellow sheet with 365 different names. Whenever we put an engine in the shop we go through and mark it 'X' or 'O.' This is a very good system. I think it is incomplete because there are a lot of repairs that do not show, but there is a vacant place at the bottom and they can be written in. In the Jacksonville shops we carry from twenty-five to thirty engines all the time. At Portsmouth the superintendent looks over the sheet every morning. He can look at that report any time and see just exactly what is needed on an engine run on that division.

"We make out a weekly report showing where the engine was repaired last, and that is a separate sheet. It shows the condition, date when she came in and went out and the class of repairs, and at the end of that week it shows what came in the shop and what went out. Another space shows what is left in and when expected out, what class of repairs needed and the class of previous repairs. After I get through with the two weekly reports they go to the office and there a tissue copy is made. We have the tissue copy in the book to refer to at any time.

"In addition to that we have a daily report showing engines in the shop, engines out of the shop, and engine when taken shows the date; engines in service today; next place, engines remaining in shop today, and on the bottom is engines waiting repairs."

One of the Sawed-Off Class.

"Mr. Quayle has spoken of me as one of the sawed-off fellows like himself," said Angus Sinclair in addressing the General Foremen's Association. "That reminds me of the reception I received from Alexander Mitchell, the famous designer of the consolidation locomotive and master mechanic of the Lehigh Valley Railroad. In the course of my rambles I called at his office and sent in my card. He came out with the card in his hand, gazed at me with a curious expression, and said, "Are you Angus Sinclair?" I replied that such was the name people called me. "Well, well," he exclaimed, "I was never so surprised in my life. I have been reading your writings for years, and I pictured you as a big, raw-boned, red-headed Scot, always ready for a scrap. Your appearance does surprise me."

Ambition to Climb.

"Every opportunity which presents itself and which can be made to serve our needs must be harnessed that we may have an honorable, useful, prosperous career and attain by our efforts alone that position in the world of mechanics which is our ambition," said President Fay at the opening of the last General Foremen's Convention. He continued:

"As to our ambition to climb higher as an association, so it must be with the individual, and it is a duty we owe ourselves as well as our employers to give earnest heed to the qualifications of our successors, and to do what may be done to broaden the horizon of him who is to follow after. It is not enough for the individual to qualify himself for promotion; progress demands that the successor be so qualified that the work in hand be not retarded by the change, but that it be given impetus by the infusion of new blood and the organizing efforts of the promoted individual."

Plea for the Women at Conventions.

"My wife is an inspiration to me," said Mr. Robert Quayle at the General Foremen's Convention. "She makes me a better man than I would be without her. A woman moves quietly, but yet effectively, up and down through the avenues of life, and she is accomplishing things every day, and we rarely stop to give her credit for what she does. The man who stops to think knows what the women are doing. And do any of us stop to condemn the woman even over in London who is talking woman suffrage and who goes up in the face of a policeman and gets arrested because she wants to go into the House of Commons to make a speech? With that kind of determination, with that kind of activity, woman is goin to win."

Building Up a Working System.

A certain class of railway men think that as soon as they enter the business they are entitled to jump over the heads of older hands into responsible positions. The question was finely touched by President Fay in his address to the General Foremen's Association when he said: "It seems fitting to sum up what the man who must assume our duties and responsibilities must be prepared to do. He must prepare himself for leadership by efficient service in subordinate places. He must know men. He must help in building up an organization of men. It is a mistake to always seek genius. It is more important to build that combination of various abilities and temperament which will form a united homogeneous body before which the difficulties of the greatest problems will crumble and disappear. We should all strive to build up a working organization which shall be so complete and so satisfactory, with a correct policy so firmly established that those who follow will find little which they will be willing to change or discard."

The greatest obstacle in the way of forming definite conclusions from experiments, is the fact that, generally, more than one experiment is tried at the same time. Hundreds of experiments that count for nothing, would have been valuable in advancing both general and specific knowledge, if between them and others with which they are compared, some addition or alteration had not been made, the presumed influence upon the result leaving the latter problematical.

Railroad Character Sketches

Shaw Has a Vacation

By James Kennedy.

It was considered criminal to stay off work for a day, and it was folly to ask off. The very idea was absurd. Hence the railway men were nearly all like the Cretans—they were great strangers to the truth. They had cousins that died, and aunts that had to be buried, and they were called for jury duty, and they had to appear in Court, and they told lies with such serious faces that the superintendent almost believed them and let them go occasionally on the condition that they would do two days' work in one to make up for the loss.

Shaw's vacation came more naturally. Macfarlane and he were chipping a saddle. As usual the patternmaker had left plenty of stuff for fitting. The moulder had evidently added to the amount. Cast iron was cheap, and an inch or two more was safer than running the risk of losing a saddle by a shortage on the fitting strips. All day the rhythmic blows of their hammers added to the multitudinous murmurs of the machine shop. At intervals, when they had cut deep grooves into the wide strips, Shaw held a blacksmith's cleaver against the projecting superfluous portions of the remaining metal, and the mighty Macfarlane struck terrific blows with a heavy sledge and the flying splinters of broken metal flew like grapeshot. In one of these metallic fusilades a small splinter struck Shaw in the right eye. Billy was promptly on the job with his magnifying glass and magnetized needle, but a portion of the splinter remained embedded between the pupil and iris of the damaged optic, and the darkening daylight settled upon Shaw with a double gloom.

The sympathy of the boarding mistress took the form of an application of tea leaves. These were kept in place by bandages overlapping each other like the head-gear of a high caste Brahmin. There was an extra lap under Shaw's chin that gave him the fierce aspect of an English dragoon. Thus equipped poor Shaw retired to the darkness of his little hall bedroom. He was sick and sore. His soft hands were blistered with the oscillations of his hammer handle. The blows seemed to strike his injured eye and the throbbing re-percussions sank into his weary brain. Shaw closed the other eye and sleep fell upon him like a soothing poultice. Some invisible spirit loosened the ragged splinter and when Shaw awoke it was with a sense of blessed relief. An inspiration came to him. He would keep his eye bandaged in certain situations, and he would keep his eye open for a few days and see if he could find easier work somewhere else.

Among the railway men he remained turbaned and half blindfolded. He was an object of pity. Macfarlane would have started a raffle for him, but Shaw was getting paid for his time, so the feeling of pity was not unmixed with envy. At Clark's parlors Shaw took what he called an eye opener, and went out and had cards printed—J. Shaw, Machinist and Draughtsman. The latter part of his title might be misleading, but as he had sold many draughts of fishes when he was in the haddock business, the word was not entirely inappropriate.

Shaw struck a new job. Marine engines were being refitted for the coming summer. Day and night and overtime and easy money and a free supper and sleep in the boats and visions of a bank account came to Shaw, and both eyes and hands were on the job. He wrote a letter to Billy that the doctor had advised him to take a change of air, as the city air was bad for his optic nerve. If Shaw had had half as much skill as a mechanic as he had nerve as a story teller he would have made his mark. As it was he lasted about half a day. He kept his word, however, in regard to a week in the country and he took to the woods.

Some days afterward the coroner sat on a body found in the river. It was swollen and bruised, and had a contusion in the right eye. One of Shaw's cards was found in a tattered pocket. That was enough for the coroner. This was Shaw. Of course Macfarlane and Billy could not get off to identify the dead man, but on Saturday night they met in Clark's parlors and moralized on the vanity of human life and extolled the virtues of their departed friend. The night was stormy and the rain rattled in fierce gusts against the window panes. Customers were scarce and Clark was closing up his establishment. Macfarlane and Billy were having one more of something or other. A solitary blue flame of flickering gas gave out no light but rather served to make the darkness visible in Clark's parlors.

Shaw walked in!

A gust of wind blew out the trembling flame. Billy gasped. Macfarlane dropped a ponderous glass full of "Clark's Best" on the tail of Clark's brindled cat, cutting the tail off at half mast. A blood-curdling howl rent the startled air. Clark sank to the floor in a heap. The pig's feet in the capacious basin seemed to stand up as if ready for a two-step. The rats looked out of their holes for a moment and vanished into utter darkness. The bartender, as might be expected under such appalling conditions, forgot to ring up the last two drinks. The weather-beaten and rain-soaked apparition took off its broad-brimmed sombrero and swung it like a mighty pendulum, shaking a shower of real water on the floor. Then, in the voice of the old familiar Shaw, it asked for something, and the dazed and dumfound few knew that their eyes of flesh were dimly beholding the real Shaw again. Explanations were forthcoming. Dead?—not much. Not even dead drunk.

Shaw is back in the shop now in charge of the tool room, so that in the same month he had a vacation, a resurrection and a promotion.

Personals

(*Continued from page 124.*)

and supplies for the N. Y., N. H. & H., the Central New England, the New England Navigation, the Connecticut, the New York & Stamford, the Rhode Island & Housatonic, the Boston & Maine, the Maine Central and the Washington County & Summerset railroads.

Mr. F. D. Underwood, president of the Erie Railroad, has been explaining the cause of the high expense of living through a newspaper interview. Mr. Underwood says that only a few years ago farmers drove loads of their produce into towns and cities and frequently had to drive their loads home again for want of purchasers. They were producing more food stuffs than the consumers could use. The case is now different. The farmers cannot produce eatables as fast as the people consume them. There are too many consumers for the number of producers. That explanation is clear enough for any one to understand.

The Chanute Medal, which is each year awarded by the Western Society of Engineers for the best paper presented to the society in the field of civil engineering during the preceding year, has been given to Professor Arthur N. Talbot of the University of Illinois. Professor Talbot's paper, which has been made the basis of the award, is entitled "Tests of Cast-Iron and Reinforced Concrete Culvert Pipe," and describes an elaborate research which in its various stages has been in progress for a number of years at the University of Illinois. The foundation for the medal given by the Western Society of Engineers was established by Dr. Octave Chanute. The arrangement provides for three medals, one for work in the line of mechanical engineering, one in civil engineering, and one in electrical engineering. Professor Talbot's friends are congratulating him upon being the recipient of so distinguished an honor.

Mr. Richard W. Harrison, former engineman on the P. R. R. has been promoted to the position of motive power foreman at Delmar, Del., vice Mr. Murray Stewart, transferred. Mr. Harrison was born at West Grove, Pa., March 3, 1856; he entered the service of the Pennsylvania at the age of seventeen years and having spent seven years in the shops as machinist he was promoted to the position of engineman, in the year 1880, and was assigned to the Maryland division of the P. B. & W. R. R. On June 1, 1885, he was transferred to the Delaware division and served as a freight engineman until December 1, 1895, at which time he was essigned to passenger work. From this date until November 1, 1909, a period of fourteen years, he served as "A Knight of the Throttle" on the through passenger trains of the Delaware division. We hope his work at Delmar will lead to further advancement in the motive power department.

Mr. Frank P. Smith has accepted a position with the Hobart-Allfree Co., Chicago. He entered railway service in the early seventies as a locomotive fireman on the Milwaukee & St. Paul. He afterwards served in the same capacity on the Toledo, Wabash & Western and the Chicago & North Western, on which latter road he became a locomotive engineer. In this capacity he served successively on the Wabash; the St. Louis & Iron Mountain; the Chesapeake & Ohio; the Kentucky Central; the New York, Chicago & St. Louis; the Louisville, New Orleans & Texas, and the Cincinnati Southern. In the early nineties he entered the railway supply business with the C. C. Jerome Metallic Packing Co., and in November, 1895, he entered the service of the Hancock Inspirator Co., which is now one of the companies controlled by Messrs. Manning, Maxwell & Moore, New York. He remained in this position until December last, when he entered the service of the Hobart-Allfree Co., with headquarters at New York.

Mr. Alfred P. Prendergast, assistant master mechanic at the Mt. Clare shops of the Baltimore & Ohio, at Baltimore, Md., has been appointed master mechanic, succeeding C. T. Turner, retired, after 47 years' service in the same shops. Mr. Prendergast entered the service of the Baltimore & Ohio as an apprentice in 1885 at Wheeling, W. Va., and after completing his apprenticeship was engaged in the steel industry in the Pittsburgh and Youngstown districts. Several years later he returned to the Baltimore & Ohio as gang foreman, being given employment at Benwood, W. Va., and later became mechanic shop foreman at Cumberland, Md., where he also served as roundhouse foreman. He was later made general foreman of locomotives and car repairs and subsequently promoted to be division master mechanic at Grafton. Two years later he was transferred to the Baltimore & Philadelphia divisions as master mechanic, with office at Riverside, Baltimore, leaving that position two years later to go to the Mt. Clare shops at Baltimore, as assistant master mechanic, which position he held at the time of his recent appointment

The Straightport Coupling.

A form of steam coupling which has been designated by the makers as the "straightport" coupling forms the subject of our illustrations. The two-piece type is illustrated in elevation in cut marked Fig. 2, and shown in section in Fig. 1. Couplers made on precisely similar lines, in larger, as well as smaller, sizes, either one or two-piece designs, are also furnished by the makers. A form of coupler construction which secures a steam tight joint under all conditions, is furnished in the S-4 design, Fig. 2, which has had excellent record for such service and it has been adopted by many of the leading roads of the country.

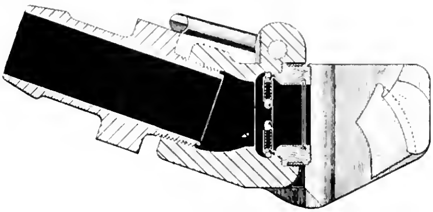


FIG. 1. SECTION OF COUPLING.

The castings of the coupling head, nipples and clamps are of malleable iron; and the surfaces of the engaging lugs are milled with great accuracy to insure perfect alignment of the gasket faces and a preciseness in interchange. This is a special and important feature of the manufacturing process of these couplings. The same care has been exercised in the design and workmanship of the gasket, which is molded from a specially prepared composition and is reinforced by metal bands inside and out; designed to prevent spreading of the composition, which under heat expands slightly and takes up any unevenness of wear in gasket faces, besides giving a desirable compression under steam. The manufacturers are placing on the market a gasket of harder materials, designed for use when high pressure steam is carried between the locomotive and baggage car for trains using the head-end system of electric light. Here the greater wear and tear on gaskets is in no way comparable with the lower pressure requirements of the heating equipment alone. The gasket retaining ring feature is a direct application of a simple, yet effective principle in mechanics. It is a spring ring, permitting the instantaneous renewal of gaskets without the use of special tools.

The locking feature combines effectiveness, economy and simplicity. In their coupled position the locks are thrown over the lugs on the opposite coupler and hold the couplers firmly under the usual conditions of service. If a train should accidently part, the destroyed or damaged locks can be quickly and inexpensively repaired or renewed.

The furnishing of the heads and nipples separately with clamps is also one of the innovations of the makers. The advantage being the ability to use over again, hose already mounted on new coupler heads, where the old heads have been damaged. The makers, the Safety Car Heating and Lighting Company, of New York, assure us that these steam couplings are now in use on upwards of fifty-five of the principal railroads in this country and are growing in favor. Any further information on the subject will be very readily given to those interested in the matter by this company.

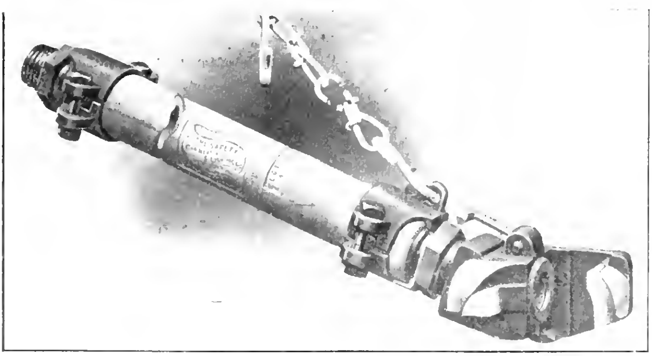


FIG 2. STRAIGHTPORT STEAM COUPLING, WITH LOCK.

Making Sure.

The housewives in Vermont have not yet abandoned the practice of stimulating the industry of workmen by a drink. One day a carpenter went to do some work in a house and the lady said to him: "Mr. Wright, I'm going to give you a drink of rum, will you take it now or wait till you are finished?" "Well, Ma'am," said the maker of chips, "we've heard so much of sudden deaths lately, that I'll take the drink now and make sure of it."

Block Signal Report.

The Block Signal and Train Control Board have just completed their report to the Interstate Commerce Commission. It is the second annual report and is quite a full presentation of the case as it stands. The report, however, does not confine itself exclusively to the consideration of block signals. Automatic stop signals are considered, and four different devices are given. Cab signals alone, and in connection with automatic stops, are discussed, and the requirements of the Signal Association are given.

Then comes the ash pan law, the present extent of equipment, and deficiencies when they exist. Devices in use and inventions are examined. Air brake matters are taken up, together with hose connections and pressure retaining valves. Loose wheel inventions and inventions relating to track, rail joints and track fastenings, etc., make up the large total of matters of vital interest to those who run on the road. The conclusions of the board are also given, and there is, of course, quite an array of interesting statistics. The book is published by the government and can be had free on application to Mr. Edward A. Moseley, secretary of the Interstate Commerce Commission, at Washington, D. C.

We would advise locomotive engineers, firemen, and, indeed, all those who have to "go up against it" out on the road, to send for a copy. A post card request will do, and on getting the report you will be able to see just what progress is being made in these matters which affect you in your everyday work, and you will get an idea of what the Commission is trying to accomplish. Mr. E. A. Moseley, Washington, D. C., is the man to apply to.

No Samples Carried.

The eminent lawyer had stepped from the London train and was making his way to a hotel, when he was approached by a porter. "I can see you're a commercial traveler," said the latter, with a touch of his cap. "Show me where yer luggage is and I'll carry it to the hotel for you." The lawyer smiled in a quizzical way. "I am a traveler," he said, "but I deal in brains." "Fust time ever I see a traveller as didn't carry no samples!" rejoined the porter, sarcastically.

The McConway & Torley Company, of Pittsburgh, Pa., have just issued a neat little pamphlet dealing with the Buhoup steel truck side frame. The cast steel side frame as a substitute for the built up construction has passed the experimental stage. It has fewer parts, greater strength where additional strength is required, and the expense of repairs and maintenance is correspondingly diminished. The Buhoup side frame embodies the desirable features of such cast steel frames, and has several features peculiarly its own. For instance, it has adjustable bolster columns which permit the insertion of a truck bolster after the rest of the truck has been assembled, and which also permits of removing and replacing bolsters without disturbing any other part of the truck. Brake hanger supports are cast integral with the adjustable columns. This further reduces the number of parts of the truck. This frame, with the lower journal box extension cast integral with the frame, dispenses with the use of tie bars and also makes it unnecessary to have two nuts on the journal box bolts, a split key being all that is required with this construction. If you wish to get further information write to the builders for a copy of this pamphlet. It is well worth looking over.

Splendid Road.

An admirer of one of our leading roads sends us the following as a good example of child reasoning: "An old lady, commonly known as Grandma Mason, died recently. The foreman of the roundhouse had a little tot of a girl about 3½ years old, and she asked where the old lady had gone. Her mamma replied: "To heaven, my dear." The friends of the deceased took the remains to Mt. Vernon for burial. The child saw the funeral procession leave the house which was in the same street. When her sister returned from school she said: "Clara, Clara, just think—Grandma Mason has gone to heaven on the North-Western road."

W. H. Nicholson and Company, Wilkes-Barre, Pa., began the new year in the right way. They have already issued three elegant publications describing and illustrating their expanding lathe mandrels, gas pipe taps, flue expanders and other devices. Their descriptive matter is very convincing in proving that the solid mandrel has outlived its usefulness and that calipering mandrels should be relegated to the region of the lost arts. There is no question about the superior workmanship and fine material of the company's products. They both spell economy in means and time. The locomotive eccentric mandrel and the tube expander are something new and will be gladly welcomed by all right-minded mechanics. Send for their publications.

Landed Softly.

At a small station in Maine an old man carrying a carpet bag, and accompanied by an old woman, entered the train.

It was apparent from their expressions

of curiosity, mingled with anxiety, that this was their first railway journey. The train started, and they both looked eagerly from the window, and as the speed increased a look of keener anxiety gathered on the old woman's face.

A few minutes later the train ran on to a long bridge, the sides of which could not be seen from the car window. With a little shriek the old woman clutched her husband's arm.

Meanwhile the train sped onwards, and was soon once more on solid earth. The old woman was quick to note the change. Her features relaxed, and she sank into her seat with the fervent exclamation:

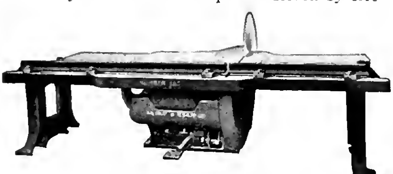
"Thank goodness, she's struck the ground again!"

She feared they had got on board a flying machine.

Automatic Cutting-Off Saw.

The machine we here illustrate is Messrs. Fay & Egan's latest improved cutting-off saw, designed for cutting off large timbers and material required in car, bridge, ship and mining construction work. It is very heavy and substantial and is capable of easily performing any work within its capacity to which it may be applied.

The carriage is mounted on planed ways on the frame, and is moved back and forth by double rack and pinion driven by fric-



RAILWAY CUTTING-OFF SAW.

tion. This arrangement permits the carriage to be advanced by pressure upon the foot treadle, at a regular speed for cutting off, and as soon as the treadle is released the carriage returns. The feed of the machine is driven by gears, no sprockets or chain being used. The carriage is driven by cut rack and pinion, with the pinion at the center of the travel of the carriage.

The machine has capacity for timbers up to 16 x 19 ins. One of the good features on this machine is the traversing of the saw carriage by friction, so that the rate of advance is always under control of the operator while the saw is running, and the movement of the carriage is automatically stopped in either direction. The table is equipped with adjustable idle rollers permitting the material to be easily moved across its surface. For further particulars, address the manufacturers, Cincinnati, Ohio.

Taking Dishonesty Out of Their Hides.

One of the greatest jokers of our acquaintance is Mr. Alexander B. Peacock, of Pittsburgh, known among his friends as "Aleck." The New York *Evening Sun* says:

"Mr. Alexander B. Peacock found reason to believe that his business was being robbed by some of his employees. They had been living extravagantly and Mr. Peacock satisfied himself as to the fact of their dishonesty, which mounted up to a total loss of some $250,000. Mr. Peacock forthwith discharged the group of men, and having made it clear to them that he had proof of their guilt sufficient to send them to prison, announced to them that he proposed to give himself the luxury of taking it out of their several hides. So he locked them in a room, one at a time, and proceeded to give each of them such a thrashing as has not been known before—no, not in Pittsburgh. One of the men is said to have declared, on escaping from Mr. Peacock's attentions, that he had been knocked down nine times."

Aleck is built on a Falstaff model. We are really sorry that we could not see him after he finished cleaning out that bunch.

Why He Saved the Man.

Suddenly a white form appeared at a window. All about leaped the mad flames. A portion of the wall had caved in, and it was too hot for the firemen to go up after the man, anyway. But see, a noble hero dashes under the ropes, makes his way to the elevator, and shoots up to the leventy-leventh floor, where the lonely form is still standing. Within about eight and one-half minutes he comes tearing out of the building with the life he has saved besides his own. Just then the entire building and the man who held the mortgage on it collapsed.

About seventy-five thousand people rushed over to the hero—the man who at the risk of his own life and without the aid of a brass band went to the rescue of one lone man.

"'Twas, indeed, noble of you," the people cried, with one voice. "Why did you do it?"

"Vell," said the hero, "I hat to. He owes me two tollars."

New Erie Railroad Map.

The Industrial Department of the Erie, of which Mr. Louis Jackson is commissioner, has published a most valuable map which is certain to prove of great interest to people connected with industrial enterprises. The territory between New York and Chicago traversed by the Erie is one of the greatest and most varied manufacturing territories in the world, and particulars of the immense facilities for new industries are given in this map and the descriptive matter connected with it. It ought to be in the hands of every person connected with industrial enterprises. Mr. Jackson will be glad to furnish the map and fuller information to those desirous of information.

Geese Crossing an Electric Railway.

When electric street railways were first introduced the conducting rail was left exposed under the impression that the low current would not be dangerous. Human beings did not suffer from shocks but some animals were less fortunate, and there were many amusing sights witnessed when animals received shocks.

Seeing a flock of geese getting across electrically charged rails was amusing. The flock would waddle along behind the leader which went on calmly until he put his foot upon the rail. Then he would spring back with a wild quack and look about fiercely to see what had committed the outrage upon his dignity. Seeing nothing that he could reasonably blame, he would utter some voluble remarks in which he was joined by a chorus of the whole flock. Then he would make another start and again touch the electric current which tumbled him backward, screaming and quacking all his companions joining to swell the tumult. They would keep making the wildest noises for a few minutes, running hither and thither in search of something to pour their wrath upon, but carefully avoiding the rail.

After they tired of this performance the flock would fly over the track sending forth their fiercest notes of defiance and contempt, but that flock of geese would never be seen waddling over that railway again.

Thermit Welding.

The repairing of steel and iron rolls is the subject of a special pamphlet just issued by the Goldschmidt Thermit Company of New York. This enterprising company have the happy faculty of fully and freely explaining their methods of operation and furnishing excellent illustrations for the guidance of those who are willing to take advantage of their new and important discoveries in the art of welding on new metal no matter where a fracture may occur. Their latest publication is a valuable educational contribution to the engineering literature of our time, and is well worthy of the perusal of all interested in Thermit welding. Send for a copy to the company's office at 90 West street, New York.

The Canadian Pacific Railway will in all probability double track the main line this year from Winnipeg to Portage la Prairie, which is about half-way to Brandon, the latter city being 132 miles from the Manitoba capital. Next year, the double tracking will extend all the way to Brandon. This section of the road is perhaps the most congested on the entire system, a great many of the company's branch lines feeding the main track between these two points, and traffic is particularly heavy over the single track when the grain rush comes on in the fall.

The Monthly Proceedings of the Car Foremen's Association, of Chicago, have recently been more than usually interesting from the fact that the revision of the M. C. B. rules have taken place and many important changes have been made which should be known to all who are interested in the subject. Copies of the publications, containing the reports of the December, 1909, and the February, 1910, meetings held in the Masonic Temple, Chicago, may be had on application to the secretary, Mr. A. Kline, 841 N. 50th court, Chicago.

At the annual stockholder's meeting of the King-Lawson Car Company, recently held at the offices of the company at Middletown, Pa., the following directors were elected for the ensuing year: Messrs, Thomas Lawson, G. C. Draper, Edward Bailey, Harold C. Hansen, Paul A. Kunkel, Arthur King, Howard W. Bible. At the director's meeting, called immediately after the adjournment of the stockholder's meeting, the following officers were chosen for 1910: President and general manager, Mr. Thomas Lawson; vice-president, Mr. Howard W. Bible; treasurer, Mr. Harold C. Hansen; Secretary, Mr. Paul A. Kunkel.

The J. M. Packing Expert is a breezy four-page circular issued by the H. W. Johns-Manville Co., Cleveland, Ohio, and will appear monthly. It should be gladly welcomed by all interested in the use of asbestos packing in high steam pressure. The apt quotations from Shakespeare with which the circular closes are not only complimentary to the marvellous genius of the Bard of Avon, but illustrate the fine eye that the accomplished editor has for apt texts conveying truths that, like the packing referred to, are everlasting. Send for a copy either to the Cleveland or the New York office.

Plain to Be Seen.

A Denver man who visited the museum at City Park recently tells of a farmer he saw there. The ruralist stepped in front of a portrait which showed a man sitting in a high-backed chair. There was a small white card on the picture reading:

"A portrait of E. H. Smith, by himself."

The farmer read the card and then chuckled to himself.

"Regular fools these city fellers are," he said. "Anybody who looks at that picture 'ud know Smith's by himself. They ain't no one in the paintin' with him."

On May 1 the Dearborn Drug and Chemical Works will move their general offices and chemical laboratories from the Postal Telegraph Building to the new McCormick Building, on Michigan avenue and Van Buren street, Chicago. The extensive growth of this business has made necessary this removal. The general offices and laboratories will occupy the greater portion of the top floor of one of the finest office buildings in Chicago. The Dearborn company will have the entire frontage on Michigan avenue for their office and laboratories, with a total floor space of more than 5,000 sq. ft. The company extends a cordial invitation to old and new friends to visit them at their new headquarters. At no place in Chicago can a better view of the city and Lake Michigan be had. Valuable information may also be obtained, pertaining to the successful treatment of boiler feed waters. This company's system is well worthy of investigation and anyone interested should write direct to the manufacturers if they are unable to visit the new and commodious quarters of the Dearborn Company.

A recent press dispatch from Binghamton, N. Y., says: "Three men were under arrest today charged with grand larceny in stealing an Erie Railroad bridge. The bridge was a small three-ton structure over a creek. It had recently been replaced by a heavier one and was placed alongside the tracks. When the construction train arrived this morning to remove the structure it was not to be found. An investigation resulted in the discovery that it had been disposed of to a junk man for $8 and three drinks."

Graphite as a Lubricant.

The Joseph Dixon Crucible Company, of Jersey City, N. J., announce the publication of "Graphite as a Lubricant," eleventh edition. This is just off the press, being the edition for 1910. Every two or three years the Dixon Company republish this pamphlet, which has become a standard work with them. Each new edition is thoroughly revised and brought fully to date. The present edition is more compact than its predecessor, the idea being to concentrate the information into convenient form.

The power house engineer and indeed others who have the care of engines or machinery will find the newest edition of considerable value. It deals especially with the lubrication and the treatment of power house machinery. The appearance of this last edition is good, and big readable type with liberal margins are used throughout the sixty-four pages of the book. It is easy to read and worth reading. A free copy of this eleventh edition of "Graphite as a Lubricant," will be sent to anyone interested in machinery and better lubrication. Address Joseph Dixon Crucible Company, Jersey City, N. J.

Tests were made last month of a street car driven by a storage battery which Thomas A. Edison has been working on for several years. The indications are that Mr. Edison has at last solved the problem of producing a storage battery which will compete economically with the dynamo current. Mr. Edison believes that the storage battery will revolutionize automobile and street car traffic.

Sudden Railroad Sociability.

"Speaking about the sociability of railroad traveling," said Robert Burdette, "I never got so well acquainted with the passengers on a train as I did the other day on the Milwaukee and Burlington Railroad. We were going at the rate of about thirty miles an hour, and another train from the other direction rushed into our arms. We were all thrown intimately into each other's society and brought into immediate social contact so to speak.

"I went over and sat down in the lap of a corpulent lady from Montreal and a girl from Minneapolis jumped over nine seats and sat down upon the plug hat of a preacher from Kenosha, with so much timid girlish enthusiasm that it shoved the hat clear down over his shoulders.

"Everybody seemed to lay aside the usual cool reserve of strangers, and we made ourselves entirely at home.

"A shy young man with an emaciated oil cloth valise left his seat and went over and sat down in the lunch basked where a bridal couple were wrestling with their first picnic. Do you suppose that reticent young man, had he been at a celebration at home, would have dashed impetuously between two strangers and sat down on a plate of cranberry jelly?

"Why, one young man who probably led the class meeting at home and was as dignified as Champ Clark, was eating a piece of custard pie when we met the other train, and he left his own seat and went over to the front end of the car and stabbed that piece of custard pie into the ear of a young and beautiful widow from Nebraska.

"People traveling somehow at times forget the austerity of their home lives and form close acquaintances that sometimes last through life."

If you really want to know the important improvements that have been made by the Detroit Lubricating Company in pressed steel or brass grease cups, send for their latest illuminated circular on the subject. These grease cups drawn from rolled sheet metal, possess many distinct qualifications of durability and efficiency. They are especially adapted for hard service in exposed places. The stems cannot twist or break off.

The young women known in this country as typewriters, after the machine they operate, are a useful, industrious class and deserve encouragement. Under the circumstance what are we going to say to the New York *Times* which has suggested calling them "dactylographers"?

Recent types of arc lamps and their operation are ably described by Mr. C. E. Stephens and published as Circular No. 1506 by the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa. The subject is full of interest. The emission of light from the incandescent crater of the positive carbon is full of mystery to the ordinary beholder. The care of the mechanism, and the trimming and caring for the lamps, has developed into a craft or occupation by itself, and the average machinist is as far removed from a knowledge of these things as the torch bearers of the tenth century were. Send for a copy of the circular and learn something new and full of illuminating interest.

School of Telegraphy.

The Pennsylvania Railroad have just completed the installation of additional machines for higher instruction, in connection with their School of Telegraphy at Bedford, Pa. In addition, a library of text books on electricity in all of its branches has been opened for the benefit of the students of telegraphy. When the Bedford school was first opened, extensions of the company's own telegraph wires were run through the class room, to give the students an opportunity of handling practical railroad messages. In addition, there was installed a miniature railroad, equipped with block signals, for explaining the block signal system. The latest innovation to be placed in the school is an automatic sending machine, with a transmitter that can be set at any speed. This machine is used to teach the students to receive messages, and as it transmits at a uniform speed, it is proving of great advantage.

Since the Bedford school was opened in September, 1907, there have been 234 students enrolled. Of this number 126 have graduated and are now employed as telegraphers. All graduates are offered positions on the Pennsylvania Railroad.

An old woman was profuse in her gratitude to a magistrate who had dismissed a charge brought against her.

"I thought you wouldn't be 'ard on me your worship," she remarked, as she left the dock; "I know 'ow often a kind 'art beats be'ind a ugly face!"—*Tit-Bits*

The leaders of the French revolution were fairly representative politicians who had no sympathy with science or learning. The science of chemistry was growing but the revolutionists guillotined Antoine Laurent Lavoisier with the shout, "The Republic has no need of chemistry," a sentiment that represented the height of ignorance and brutality.

Broad Views of Learning.

A famous instructor of science said: A good citizen of the world must be a man of large sympathies. Though color blind he must have common feeling with painters, and if tone deaf, the works of musical composers must not be without interest to him. And through it all, it must not be forgotten that distinction is a noun of limited number. The time may come when they who know as much mathematics as Newton shall be counted by scores. The time has come when they who know as much geometry as Euclid are to be counted by thousands; and they who know as much chemistry as Dalton by tens of thousands. But we are as badly in want of Newtons, Euclids and Daltons as ever.

It is the conviction of those whose opinions of today will count as truisms tomorrow, that as far as opportunities are consumed, the education of one should be the education of all.

A recent press dispatch from Pittsburgh states that the Pennsylvania Rail road have placed an order with the Baldwin Locomotive Works for fifty locomotives. For several months the company have been working on a number of large freight engines in their shops at Altoona, and with the increasing demand for motive power the company found that it was impossible to turn out a sufficient number of passenger engines to keep the supply up to the standard. It is on account of this, it is said, the road was compelled to enter the market for additional motive power.

Sterling.

Sterling means having a standard value established by the British. Gold and silver are spoken of as sterling—meaning standard quality. The name comes from Eastphalian traders whose name English merchants distorted into Easterlings. These people were such skilful craftsmen that numbers of them were invited to England to manufacture the coin of the realm. They were known as "easterlings," and in time the word became contracted to "sterling." In this contracted form the word has come to imply what is genuine in money, plate or character.

Nature's Work.

Things hadn't turned out too well with their love affair. The fatal word had just been spoken as he stood rejected. The mittened stood respectfully before her, listening to her elaborate explanations of her decision. Below, the smooth waters of Lake Chautauqua rested in awesome wonder. "I trust I have made myself sufficiently plain," she exclaimed. "You are all that" he answered sadly, "but it's only fair to give nature the credit for what she's made you."

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances

Vol. XXIII. 114 Liberty Street, New York, April, 1910. No. 4

Knoxville-New Line, Double Track

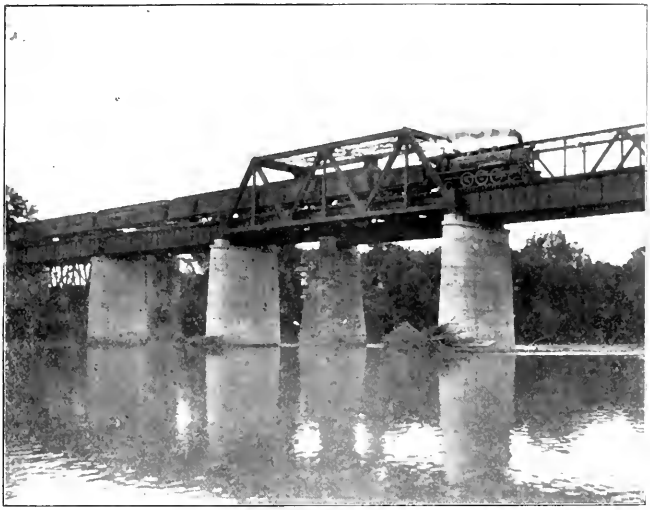
Our frontispiece illustration this month gives an excellent idea of the double track line on the Southern Railway. The photograph from which our engraving was made was taken near the 118th mile post and shows the section of double track west of that point. The distance from Knoxville to New Line, Tenn., was about 30½ miles, but in the work of providing the second track the mileage was slightly reduced, grades were cut down, curves made easier and many eliminated altogether. In fact about 436 degrees of curvature have been eliminated. Putting this another way, a train passing over the old single track before the improvements were undertaken would have gone round curves equivalent to one-and-a-fifth complete turns which it does not have to do on the new alignment. The difficulty of pulling a train round a curve is too well known to our readers to require any explanation here.

Formerly the curves were 6 degs. but these have been reduced to 5 degs. and grades from about 77 ft. to 52.8 ft. to the mile, this latter is called a 1 per cent. grade. The train tonnage has by this means been increased by about 200 tons. A feature of the new work has been the elimination of most of the open spaces or breaks in the track. These have been closed up by the building of reinforced concrete arches, as shown in one of our smaller half tone engravings. These arches have the advantage of allowing the regular ballast road-bed to be carried along in one unbroken sweep of double track road.

A new plate girder steel bridge has

SOUTHERN RAILWAY IMPROVEMENTS—DOUBLE TRACK AT MILEAGE [illegible], BETWEEN KNOXVILLE AND NEW LINE, TENN.

been built over the Holston River near Strawberry Plains, Tenn. Our illustration shows the new and old structures side by side. The bridge rests on concrete abutments and concrete piers. Nine of the spans are 100 ft. long while the channel span is 125 ft. long and is a through span while the others are deck girders. At many of the public highways, level crossings have been done away with. Concrete arches have been used and nine bridges over as many streams have been replaced by concrete.



NEW AND OLD HOLSTON RIVER BRIDGES AT STRAWBERRY PLAINS, TENN.

The work of double tracking, grade reduction, curve elimination was carried on without the interruption of the heavy traffic of the road. Several high bluffs of solid rock were cut down along the line of the existing road for the purpose of laying the second track. This work was done without any serious accident, although trains on the Southern Railway were constantly passing and repassing. At some places the existing track had to be raised 9 ft. to bring it up to the new level. Mr. W. B. Crenshaw, principal assistant engineer, was in charge of the work. We are indebted to Mr. H. B. Spencer, vice-president of the Southern Railway, for the photographs from which our half-tone illustrations are made.

More Men Eligible.

At the beginning of this year, 165,000 railroad employees were added to the 500,000 in this country to whom pension plans already apply. This large increase is due to the action of the New York Central and Rock Island Lines, which have installed pension departments.

Tractive Power Analyzed.

By Geo. S. Hodgins.

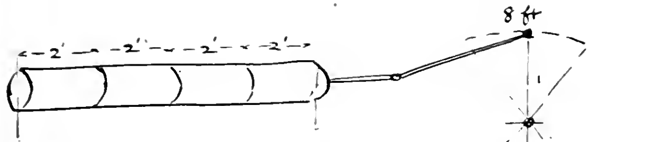
At first sight there seems to be very little analogy between the way a locomotive engine moves along the track and that of a man rowing in a boat. The engine progresses owing to the revolution of its driving wheels while the man in the boat "tugs at the weary oar." The oar, however, is a lever of the second-class with power applied at the handle, resistance applied at the rowlock and the fulcrum is in the water where the blade dips below the surface.

For example let us suppose that the oar, measured from the rowlock to the center of the blade, is 3 times the distance from the rowlock to the man's hand. It is readily seen that the fulcrum is at the end of the oar, by supposing that the man rows close to land, and puts the blade against a stone on shore. In this case there is no slip to the blade as there has been in the water. The arm of the power is from rower's hand to the blade, taken as 4, and the arm of the resistance is from blade to rowlock, taken as 3. The pressure on the rowlock is what causes the boat to move. Let us further suppose that the rower exerts a pull of 25 lbs. on the handle of the oar while drawing it toward him. He also exerts a push of 25 lbs. on the boat where his heels touch the foot rest. He therefore gives a pull forward of 25 lbs. on the oar and this gives a pressure of $33\frac{1}{3}$ lbs. at the fulcrum. The pressure on the rowlock in one direction is the sum of these, or $58\frac{1}{3}$ lbs. The pressure to retard motion is 25 lbs. and comes from the man's heels on the bottom of the boat. The pressure used to drive the boat ahead is therefore $33\frac{1}{3}$ lbs. applied at the rowlock. This explains the lever of the second class.

With these facts in mind let us glance at the formula for calculating the maximum tractive effort of a locomotive. It is of course the diameter of the cylinders squared, multiplied by the stroke, multiplied by the mean effective pressure in pounds, the whole divided by the diameter of the driving wheels, all space dimensions in inches. This statement of the tractive effort formula, while quite correct, yet entirely obscures the origin of the formula and the method of reasoning employed. The formula in its more extended form may be stated thus: Area of cylinder multiplied by twice the stroke (for one revolution of the wheel), mul-

CONCRETE ARCH OVER HIGHWAY, SOUTHERN RAILWAY.

tiplied by the mean effective, or average pressure in the cylinders, multiplied by 2, for the two engines of a locomotive, the whole divided by the circumference of the driving wheel, because the force de-



IMAGINARY DIAGRAM OF TRACTIVE EFFORT.

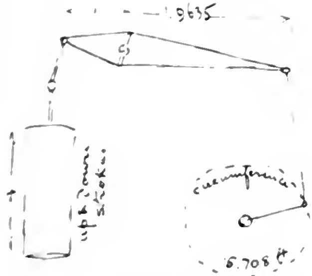
veloped in two strokes of two cylinders is distributed over a distance equal to the circumference of the driving wheel. This put in the form of an equation stands as follows:

$$T = \frac{d^2 \times .7854 \times 2S \times MEP \times 2}{D \times 3.1416}$$

It will be observed that the figures all cancel out and leave the letters which gives the formula in its shorter or usual form.

Taking as an example a simple engine with cylinders 20 x 24 ins., driving wheels 60 ins., in diameter, and 200 lbs. boiler pressure. This engine will have a calculated maximum tractive effort of 27,200 lbs. Either statement of the formula gives the same result, but it will be observed that the long formula shows two piston strokes on each side or four strokes in all. Each stroke is 2 ft. long so that the total piston movement accounted for, is 8 ft. long. A piston stroke of 8 ft. produces one revolution of the driving wheel 60 ins. in diameter. Thus the 8-ft stroke causes a movement of the engine 15.708 ft. along the track.

Suppose now we concentrate all the cylinders on one side of the engine and make one, 20 ins. in diameter and 96 ins. stroke. Taking the mean effective pres-



BEAM ENGINE, SAME PROPORTIONS.

sure at 85 per cent. of the boiler pressure, according to the Master Mechanics' Association practice, we have what might be called a horizontal pillar of steam at 170 lbs. to the square inch, pushing the piston through 96 ins. This gives a pressure on the piston of 53407.2 lbs. or nearly 26¾ tons. This pressure acting through 8 ft. does 427,257.6 foot-pounds of work. We know from the diameter of the driving wheel that the engine moves forward 15.708 ft. We have therefore 427,257.6 foot-pounds acting through 15.708 ft. and this gives a pressure of 27,200 lbs. which is the calculated maximum tractive power of the engine.

This same reasoning would hold good for a beam engine in a steamboat. A cylinder 4 ft. long and 20 ins. diameter, having a piston, acted on throughout a double stroke by 170 lbs. of steam, would in up and down strokes develop 427,257.6 foot-pounds of work, and if the walking beam was so proportioned as to cause the crank to describe a circle 60 ins. in diameter, the pressure on the pin would be 27,200 lbs. This analogy can be shown to exist in the wheel and axle or indeed any of the mechanical appliances, proportioned so that 8 ft. drive of the power will produce 15.708 ft. motion of the weight.

For the sake of illustration one might suppose the 8-ft. cylinder to be placed on one side of the locomotive with butt-end of connecting rod fastened to a crank pin at the upper end of a lever, so proportioned, that an 8-ft. motion of the upper end would produce a swing of 15.708 ft. at the lower end. Such a lever may be supposed to turn about some convenient point and the other end of the lever to rest against one of the ties in the track. This lever will impart exactly the same motion to the engine that the 20 x 24-in. cylinder and the 60-in. wheel do now. The proportions of this imaginary lever have nothing to do with the distance of the crank pin from the rail, nor with the distance the center of the axle is above the rail.

The reason for this is that no other proportions of lever except our imaginary lever will give the required motion of engine for this push of piston. Regarding the wheel as a lever with fulcrum on the rail is correct enough for certain calculations, but in the case before us the whole problem is practically one of efficiency. We put certain work into the machine, represented by the horizontal pillar of steam and we so proportion the machine as to make a definite advance with the stated number of foot-pounds. In this consideration of the matter the friction of the machine itself has been disregarded for the sake of simplicity, and the imaginary lever has been introduced for the same reason.

The tractive power formula does not take any direct notice of the position of the crank pin within the circumference of the wheel. The length of stroke, however, is one of the factors in the formula. The length of the stroke is of course intimately related to the position of the pin, but the real object of the calculation is to establish an equation between the work put into the machine and the work derived from the machine. If one may say so, the horizontal pillar of steam made up of pressure and distance is really the numerator of the fraction in the longer formula. The circumference of the driving wheel or the distance moved by the engine in one revolution is the denominator. This is distance

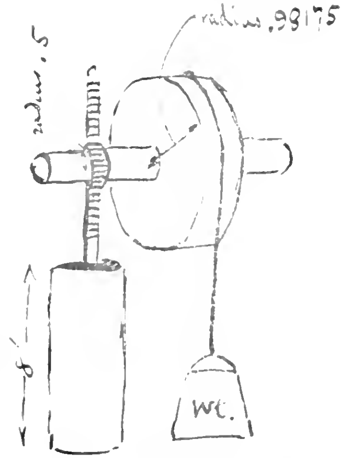


DIAGRAM OF WHEEL AND AXLE

only, so that solving or working out the traction gives us the other factor which is pressure, or tractive effort, or draw bar pull in pounds.

Heating Power of Wood.

Government reports are the dullest kind of reading, but there is an occasional line or two that redeems pages that are flat, stale and unprofitable. The following is worth reading: "The greatest heating power is possessed by the wood of the linden tree, which is very soft. Fir is next and almost equal to linden. Then pine, while hard oak and other hard woods possess more than 10 per cent. less heating capacity than linden."

Baldwin Mallet for the Galveston, Harrisburg & San Antonio Ry.

The Baldwin Locomotive Works have recently completed twelve Mallet locomotives for the Associated, or Harriman Lines. These engines are in service on the Galveston, Harrisburg and San Antonio Railway, part of the Southern Pacific System. They have been designed in accordance with Associated Lines' standards, and are similar in many respects to the consolidation Mallet engines built last year for the Southern Pacific Company. The new locomotives exert a tractive force of 64,700 lbs., and are of comparatively moderate size for an engine of this type. The weight is distributed over a wheel base of 44 ft. 10 ins., and the average load on each pair of drivers is about 45,000 lbs. The ratio of adhesion is 4.1.

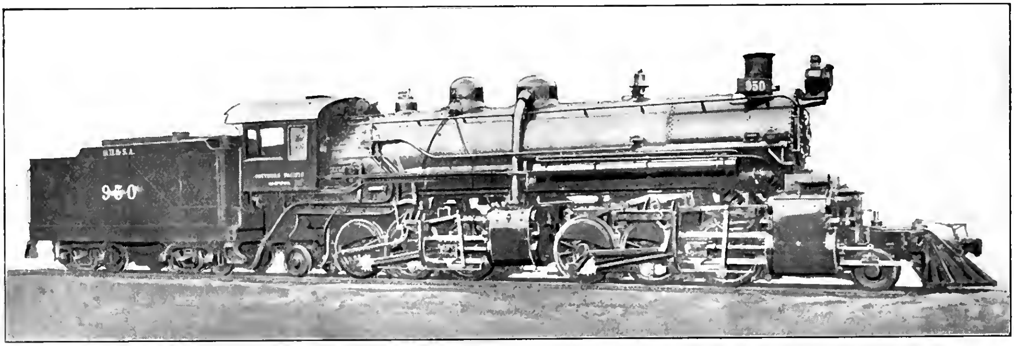
The boiler is straight topped, and is equipped for oil burning. The separable joint, feed-water heater and internal combustion chamber are omitted in this design. The tubes are 21 ft. in length, and are liberally spaced, with bridges 7/8 in. wide. The fire-box crown is flat, and is stayed by inverted T-bars hung on expansion links. Flexible staybolts, to the number of 439, are disposed as follows: In the throat and back head, they are confined to the two outside rows all around, the lower horizontal rows excepted; and in each side sheet they are in the three upper horizontal rows, and the two outside vertical rows at the front and back. The remaining bolts are placed in the sides, at the upper and lower corners. The boiler details have been worked out in accordance with Associated Lines' practice.

The steam dome is placed immediately above the high pressure cylinders, and steam is conveyed from the throttle to the high pressure steam chests through external pipes. The high pressure exhaust is then conveyed, by means of horizontal pipes, to the smoke box, where it is passed through a reheater. This device is similar in arrangement to a Baldwin superheater. The deflecting plate is cylindrical in shape, and is placed in a horizontal position, between the two sections of the reheater. It is closed at the back by a conical extension, but is open in front. The stack has a downward extension, communicating with the space enclosed by the deflecting plate. The gases circulate among the superheater tubes, and on reaching the front end of the smoke box, flowback, inside the cylindrical deflector, and so escape up the stack. This arrangement is intended to be self cleaning, and we believe has proved satisfactory. The steam leaves the reheater at the back end, and is then conveyed to the low pressure steam chests through a flexible pipe. The general arrangement of the steam and exhaust piping is similar to that used on the consolidation Mallets above referred to.

The steam distribution to all the cylinders is controlled by 13-in. piston valves, which are duplicates of one another, and are set with a lead of 5-16 ins. The reverse shafts are connected by a jointed reach rod, placed on the center line. The spring rigging is arranged with yokes over the boxes of the leading drivers. A leaf spring is suspended, in a transverse position, from these yokes; and in this spring rests the back end of the forward equalizer. The second and third pairs of drivers in the rear group are also arranged with yokes over the boxes, and the frames are supported on intermediate leaf springs. The back truck is side bearing, and is equalized with the drivers. The frames, articulated connection, and waist bearers are designed in accordance with the latest practice of the builders, and are similar to the corresponding parts used on the consolidation Mallets.

The tender is of the Associated Lines standard type with rectangular tank. The engine and tender trucks are equipped with rolled steel wheels, manufactured by the Standard Steel Works Co. of Philadelphia. These engines embody a large number of common standard details, and may be described as small editions of the consolidation Mallet locomotives now in service on the Southern Pacific system. The successful work done by those engines argues well for the performance of the new locomotives, one of which is here illustrated. Some of the principal dimensions are given below.

Cylinders, 21½ ins. and 33 ins. x 30 ins.
Valves, balanced piston.
Boiler—Type, straight; material, steel; diameter, 74 ins.; thickness of sheets, 2 3/32 ins; working pressure, 200 lbs.
Firebox—Material, steel; length, 116⅛ ins.; width, 66 ins.; depth, front, 72 ins.; back, 64 ins.; thickness of sheets, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube, ½ in.
Water Space—5 ins. all around.
Tubes—Material, iron; thickness, 0.125 ins.; number, 301; diameter, 2¼ ins.; length, 21 ft. 0 ins.
Heating Surface—Firebox, 198 sq. ft.; tubes, 3,708 sq. ft.; total, 3,906 sq. ft.; grate area, 53.4 sq. ft. Engine equipped with Baldwin smoke-box superheater; superheating surface, 512 sq. ft.
Driving Wheels—Diameter, outside, 57 ins.; journals, main, 10 ins. x 12 ins.; others, 9 ins. x 12 ins.
Engine Truck Wheels—Diameter—, 30½ ins.; journals, 6 ins. x 10 ins.
Wheel Base—Driving, 29 ft. 4 ins.; rigid, 10 ft. 0 ins.; total engine, 44 ft. 10 ins.; total engine and tender, 71 ft. 9 ins.
Weight, estimated—On driving wheels, 266,000 lbs.; on truck, front, 22,000 lbs.; back, 22,000 lbs.; total engine, 310,000 lbs.; total, engine and tender, about 480,000 lbs.
Tender—Wheels, diameter, 33 ins.; journals, 6 ins. x 11 ins.; tank capacity, water, 9,000 gals.; fuel capacity, oil, 2,850 gals.; service, freight.



GALVESTON, HARRISBURG & SAN ANTONIO RAILWAY MALLET ENGINE.
J. J. Ryan, Superintendent of Motive Power. Baldwin Locomotive Works, Builders.

Convenient Pickling Vat.

Lye vats, pickling tanks or "dope" tubs—under whatever name they may be known in locomotive repair shops—are generally something of a nuisance. The nuisance may be mitigated by the location of the tubs at a distance from the place where other locomotive repairs are carried on, or by such a form of construction that the objectionable features are reduced to a minimum.

The former method entails some expense in the matter of the time consumed in the taking of the parts to and from the place where other work is to be done upon them. The second method usually implies an arrangement under which the steam and lye fumes from the pickling vat are endured and absorbed by the men, but not in a spirit of satisfaction.

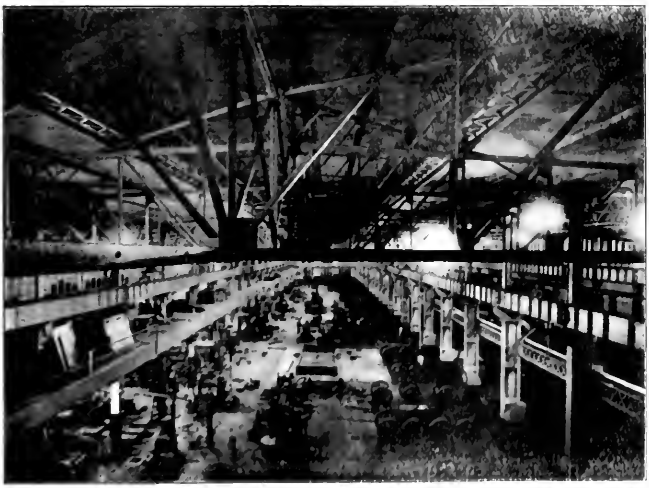
In the equipment of the new locomotive shops of the St. Louis & San Francisco Railroad at Springfield, Mo., a new arrangement, for which credit should be given to the motive power department and to the Arnold Company, has been designed and installed, and it is one which seems worthy of special mention. On account of the construction of the tank and the arrangements for taking care of the steam and lye fumes, it has been possible to place the lye vat where it is most serviceable and where the smallest amount of time and labor is required to make its operation available.

The tank and its location with reference to the work of the shop are shown in our engravings. In these shops, as is customary, the locomotive repair tracks occupy the bay on one side of the building, the machinery is on the opposite side, and the miscellaneous work on driving wheels and tires is done in the middle bay. The pickling tank is located near one end of this middle bay.

The tank is built of concrete with a curb extending 18 in. above the level of the floor, which for some distance around the tank, is of concrete sloping toward the tank. This space is used for such purposes as require a fire, such as setting and removing tires. The tank covers are made of steel in sections and they are handled by the overhead crane which serves the central bay. At one end of the lye tank is the washing tank and there are nearby hose connections with the water supply.

VENTILATED LYE VAT, FRISCO SHOPS AT SPRINGFIELD, MO.

The most interesting point in the construction of this type vat is the arrangement for carrying away the steam and fumes which are ordinarily the objectionable [illegible] of this part of locomotive repair shop operations. In the concrete walls of the tank, just below the upper edge is set a row of hollow tiles with [illegible] openings into the interior of the tank, and connection is made with the continuous passage thus formed on all four sides by a pipe running under the floor and up through one of the supporting roof columns to a fan chamber and fan located upon the gallery. The discharge duct from the fan leads to the roof. The completeness of the suction is such that even when the covers of the tank are removed most of the steam from the vat is taken up the ventilator and very little of it escapes into the shop, and when the covers are in place neither steam nor fumes are observable.



VIEW OF [illegible] SHOWING [illegible] LYE VAT.

The washing pit is also built of concrete and has a grating floor about 5 ft. below the top of the curb. Underneath this grating is a sludge pit about 2 ft. deep below the grate. When locomotive wheels or other parts are removed from the lye vats they are immediately swung by the traveling crane into the washing pit. The water and other matter passes down through the grating and falls into the sludge pit. As often as may be necessary the grating is lifted and the accumulation in the sludge pit removed by means of a grab bucket carried by the overhead crane.

By this arrangement most of the objectionable features of the lye tank are removed and the time and labor consumed in conveying driving wheels and other parts to an outside pit are saved. The lye tank is 20 by 10 ft., and the washing tank 10 ft. square.

Incidentally, the engraving showing the lye tank and washing tank in the foreground shows also another admirable feature of the equipment of these shops. This is in the manner of arranging the motor brackets. The gallery underneath the traveling crane projects some distance over the middle bay, giving a sufficient overhang for convenience in loading or unloading material to be taken to or from the gallery. This gives a space of some 4 ft. between the columns and the edge of the gallery, and in this space at a uniform height the motor brackets are placed, the outer edges of the brackets are suspended from the gallery and the inner edges are bolted to the columns. This plan is followed throughout the plant. Before erection all columns were punched uniformly for the bracket bolt holes and the brackets may be mounted upon the columns that stand in the most convenient position. Whenever it becomes necessary or convenient to erect other brackets or to change the location of a motor, another bracket may be erected upon any column or a bracket can be changed from one column to another in a few minutes by the removal of six bolts and their replacement after bracket and motor have been removed to the new position. No further work of adjustment is necessary.

Old Time Illinois Central Engine.

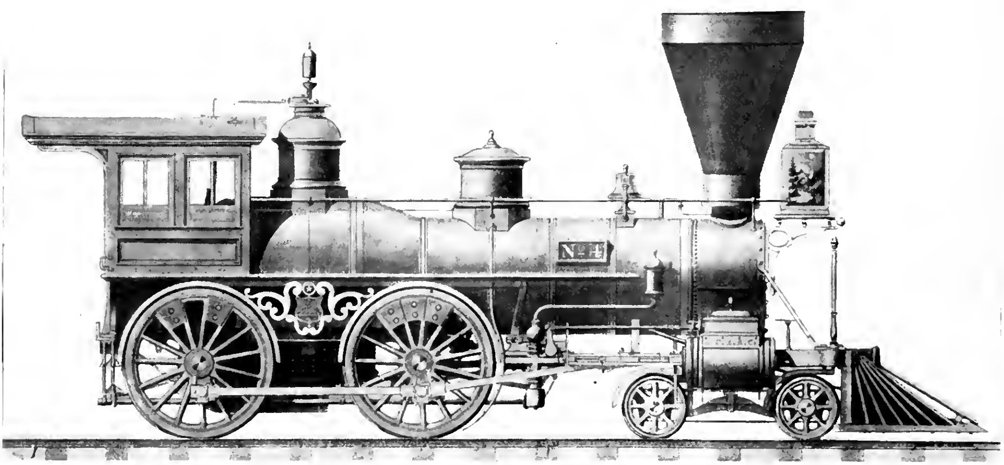
The old-time eight-wheel engine, here illustrated, that belonged to the Illinois Central Railroad possesses several points of interest that intelligent railroad men will examine with keen appreciation. In the first place the drawing of the engine was made by Mathias N. Forney in 1863, the draftsman who afterward became the celebrated engineering journalist and no doubt the designing was done in consultation with Samuel J. Hayes, at that time superintendent of machinery of the Illinois Central Railroad.

Samuel J. Hayes had been one of the Baltimore and Ohio pioneer master mechanics and was considered among the ablest mechanical engineer of his time. This No. 4 coal burning locomotive may well be regarded as representing the most advanced practice of designing up to that time, with spread truck providing for level cylinders, driving wheels sufficiently spread to give room for a fire box with ample grate area, wagon top fire box well raised, the boiler with barrel 57 inches diameter and sand box in the middle. A well designed link motion was employed, four-bar guides and the old familiar pump operated from the cross-head. The smoke stack which out dated the diamond stack, was of rather ample dimensions for coal burning and probably was suitable for wood when coal was scarce.

In working order the engine weighed a little over 60,000 lbs .with 36,500 lbs. on the drivers, which were 62¾ ins. diameter, The cylinders were 16 by 24 ins., a size which continued standard for many a day. There were 173 2-in. tubes, 11 ft. 4 ins. long providing 1,038 sq. ft. of heating surface. The fire box was 5 ft. by 34½ ins., the total heating surface having been 1,191 sq. ft. These proportions are considered good for a modern locomotive of this size and the heating surface was considered unusually liberal.

That form of engine became very popular and the proportions were imitated by several contract locomotive builders. In fact the general design became a sort of standard and has been called the "American" type.

We are indebted to Mr. W. O. Moody, mechanical engineer of the Illinois Central, for the photograph of the engine.



OLD TIME 4-4-0 ON THE ILLINOIS CENTRAL RAILROAD. DRAWING MADE BY M. N. FORNEY.

Promising Employment to Scholars.

For some time past there has been great difficulty inducing young men to make connections with correspondence schools or other institutions where practical instruction is given with a view of fitting so-called graduates for superior positions in railway and mechanical avocations. Some of the concerns giving practical instruction have fallen into the habit of promising to obtain lucrative employment for students who have remained a certain time under instruction. In many cases the managers of the various educational establishments and systems have been unable to make their promises to find employment good, and the graduates have been left lamenting.

We advise youths who have paid for instruction under the promise that employment would be found for them, to require a bond or legal document that would help to collect damages when promises for finding employment are not made good.

Not Considered Safe.

It is curious to know that what users of slang would call the first "sure-enough" railway in the world was laid between Manchester and Liverpool in 1830. It was twelve years later before the prudence of British ministers of state would permit their sovereign to travel by rail. Prince Albert, the Queen's husband, traveled frequently on the Great Western, and often at a high rate of speed, though he would sometimes say to the conductor, "Not quite so fast next time, if you please." But the first time Queen Victoria took a railway trip was in 1842 on the anniversary of the battle of Waterloo.

General Correspondence

The General Foremen's Page.

Editor:

It is with much interest and pleasure that I read the items on page 125 in the March number of your valuable paper. The first item, "System in Shop Repairs," should not be lost sight of. It is a good one and is similar to methods in force on Santa Fé system. The second item amused me, as it is a fact that often we picture, in our minds, the appearance of a writer, and when we meet the man himself we find that our imaginary picture is badly drawn. The addresses that have been made by the worthy editor, Dr. Angus Sinclair, at the General Foremen's Conventions, have been instructive and have assisted its members in organizing. His many years of work and experience makes him a valuable man as an honorary member of the association.

"Ambition to Climb" is the third item, and in it Brother E. F. Fay has covered the topic well, and if our many foremen all over the country would put this article into practice, very little effort on the part of the officers would be required to make the organization the pride of all associations and a credit to its members. It would then be looked upon by our superior officers of the systems on which we are employed, as necessary in the operation of their departments, and the association would help us to gain the end for which we and they are striving.

The plea for the women at the convention is the fourth item. Mr. Robert Quayle has made this subject plain. The presence of the women in our convention should help to encourage its members in the determination that we will succeed.

"Building Up a Working System" is the fifth item, and former President E. F. Fay certainly has not lost sight of this question, which is an important one. It is brought to my notice almost daily in the operation of my department. It is a matter that is being looked into by our superiors more thoroughly each day. The question as to the ability of the men in our positions and the kind of working system we are able to organize, and whether or not it will lead up to a high efficiency of economical methods of operation.

Your valuable paper furnishes its readers with a great deal of most useful instruction that, if practiced, much good will result. I have been a reader of RAILWAY AND LOCOMOTIVE ENGINEERING for a number of years and hope to still continue. If you will be kind enough to advise me of when my subscription is due I shall remit the amount to you promptly. I sincerely hope to meet Dr. Angus Sinclair at the convention of the General Foremen in Cincinnati, O., on May 3, 4, 5, 6 and 7 of this year. T. H. OGDEN,

President Int. Ry. Gen. For. Assn.

Dodge City, Kan.

[We are very much pleased to have this communication from Mr. Ogden. The items concerning the International Railway General Foremen's Association to which he refers are to be found in our March issue, page 125. In the present issue the reader is referred to page 166 for items concerning the association. We give the committees, the subjects, time and place of meeting and shop notes.—Editor.]

VIEW OF ERECTING SHOP, FRISCO SYSTEM, SPRINGFIELD, MO.

Incidents in Early Railroad Days.

Editor:

In answer to your kind inquiry for some of my old time reminiscences, let me say briefly that I was born in Richland County, Ohio, near Mansfield, on Oct. 19, 1840. My parents came to Ohio from Hagerstown, Md., by wagon in 1836. They located near Mansfield in what was then almost a dense forest; consequently I know something of the hardships of pioneer life. I grew to manhood amidst the hardy folks of that time. At barn raisings and log rollings and later on at corn huskings and country dances, it was absolutely necessary to know who was the best man. Physically that was tested by such feats as running, jumping, lifting weights and many times by forming a ring and then pelting away at one another till the best man won, with no pillows on our hands as are used today. Up to the present time the writer has not been defeated in some of these sports, namely jumping and running, but he has been worsted in some of the hard bouts, but not always. I had a record for jumping and running jump of 22 ft. 4 in. on the level.

When the tocsin of war sounded and our lamented Lincoln called for men I answered to that call on 21st April, 1861, for 75,000 men to serve three months. It is well known how far away the end of the war was at the expiration of that short term. Next 300,000 men were called for and I again responded this time for three years, and I served in all three years and three months. I came home with an honorable discharge feeling very much like the Irishman riding the mule. The mule began kicking, as mules will do, and finally got one of his hind feet in the stirrup. The Irishman said: "By cripes, if ye want to get on I'll get off."

On the 24th of March, 1865, I went railroading. Now right here remember that the young men who went railroading in those days were just branded by the country people and others, as being simply lost to all decent society. My parents, sweetheart and old associates threw up their hands in holy horror and predicted a term in the penitentiary or swore that hemp was growing for a noose around my neck. But the good Lord has dealt very kindly with me and I have gone along down the line, now 45 years, and see men of this profession occupying positions of honor in all walks of life. There have been a great many articles written and long records given, but few if any have as long a continuous record on one road. Nearly all of them have shifted from Dan to Beersheba. I began on March 24, 1865, on what was then the Atlantic and Great Western, six foot gauge, now a part of the great Erie system. I started as brakeman. Those were the days when conductors hired their own brakemen and engineers hired their firemen and discharged them if they did not suit.

Well, I was hired by conductor Polk Palmer and on the day following left Galion, Ohio, on the first freight train that left that terminal. The next terminal was then Akron, Ohio, 81 miles further on. We left Galion at 2 p. m. the 25th and arrived at Akron at 9.30 a. m. the 26th, and as we were the only train on the road we were first out when we got to Akron, but we did not get out for three weeks. It was a very common occurrence in those days to order an engineer to take a train out, without a conductor. In fact all work trains were run without conductors. The engineer was held responsible for the whole train. One trip that I made may be interesting to your readers. Engineer J. T. Pinkney was ordered to pick up a crew and take twelve empty box cars from Akron to Galion. I was that crew. Now I had only made one trip, but when he asked me about my experience I was so anxious to get out, I told him I was an old brakeman of the Pennsylvania. Then he asked me what I new about the whistle signals and I told him that one blast of the whistle meant to set the brakes and two to let them off. My examination was satisfactory and he said I would do well. We got out of the yard and the division had many long grades and the track was new, no ballast, and it was not good to let the train down these grades too fast, so he would call for brakes and I would crawl from one car to another as fast as I could and of course the brakes would not hold them much so he would call again. Then back I went and let them all off as he had whistled twice. See?

Well we got through some way or other but I now look back and wonder how it was done, because I did nothing. This same engineer, J. T. Pinkney, took a liking to me and in July of that year he discharged his fireman at an intermediate station and hired me. I fired for him two years on freight and passenger. The company was at that time running a wood train, all engines burned wood then, and that train, like all other work trains, was in charge of engineer C. C. Green. As I was the oldest fireman I was assigned to that run and ran the engine practically all the eight months. At the end of that time, Jan. 1, 1868, I was promoted to be an engineer. I ran the yard engine one week and then went out on the road, Jan. 8 being my first trip. Engine No. 64, Rogers build, 18 x 20 in. cylinders, 5 ft. driving wheel. She was then one of the large engines of that day.

I pulled freight and work train up to 1878 when I did extra passenger work until June, 1880. At that time I got a regular passenger run and now I am closing up my 45th and last year of continuous service on the same road. I never had but one accident, and in that one, no passengers were injured. I was laid up from my injuries seven months but no blame attached to me. In my experience

M. A. RICKSTICKER,
Locomotive Engineer, Erie R. R.

there have been some things that I think would be very interesting to the older class of railroad men, but as they have nearly all passed through the same I will not occupy space but will pass them by like the Irishman did the painter. An Irishman was told to hold the end of a rope down on the sidewalk while they rolled off a barrel of cement from the top of a new building. This painter was on a scaffold about half way up the building. He thought something was going to happen as the barrel weighed 250 lbs. and the Irishman 150 lbs. They called out from above, "Are you ready Pat?" Down came the barrel and up went Pat, past the painter. The barrel struck the sidewalk and busted. Up went the rope and down came Pat past the painter. The painter called down: "Are you hurt, Pat?" Pat looked up. "Go to hell, I passed ye twice and you wouldn't spake to me," says he. On Oct. 19 of this year I will reach the age limit and I will be canned. Unfortunately as the Erie has not joined the pension system I will be left on my own resources in my declining years.

M. A. Ricksicker,
Loco. Engineer, Erie R. R.
Galion, Ohio.

Relative Economy of the Mallet.

Editor:

Would you kindly advise me concerning the exhaust on a Mallet articulated compound? I imagine to the ear it is a jumble, and with one's eyes closed it would seem as though one were listening to a double header. It seems to me it might be difficult for an engineer running in the night to ascertain whether or not a Mallet was slipping, if he relied on sound, as I believe a good many engineers do. Perhaps I am wrong in this last, and if so, I shall be glad to be corrected.

I should also like to know if a Mallet articulated compound is not more expensive to keep in repair than two separate locomotives. It seems to me that being practically two complete and separate locomotives, each working by itself, so to speak, there would be a great strain on the machinery, especially as the two are coupled together. I should be very much interested to hear any results which you may have. I know as a general thing any new idea at first is always advertised to be a great improvement on the old style, and affords a great saving. This was the case at the time compounds were so general, but I notice that there are only a very few running compared to what there used to be and on some roads which I have in mind all of them have been changed over to simple engines. Thanking you for any information which you can give me. John Worcester Merrill.

Boston, Mass.

[This letter asks several questions which have arisen in the minds of many and on account of the general interest taken in the Mallet compound we have printed Mr. Merrill's letter. The exhaust, coming as it does only from the low-pressure cylinders, is not a jumble of sounds but are clear exhausts, two to the revolution of the driving wheel instead of four as in ordinary engines. The slipping of drivers is automatically regulated by the construction of the engine. If the high-pressure group slips high-pressure steam fills the receiver and increases back pressure sufficiently to check the slipping. If the low-pressure group slips the low-pressure cylinders run themselves out of steam faster than the receiver supplies it and that checks their slip. In the matter of repairs the Mallet is not as expensive to maintain as two separate engines would be. Boiler work is always a heavy item of locomotive repairs. The Mallet has only one boiler as against two in the separate engines. The cost of maintaining the machinery of the Mallet depends on circumstances and may not be more expensive than maintaining the machinery of two separate engines with total number of wheels, etc., equal. The Mallet has one air pump, two injectors, and in general terms one set of fittings and attachments, while the two engines have together, as a general rule, two air pumps, four injectors and two separate sets of fittings, etc. The high- and low-pressure engines on the Mallet type of locomotive are not coupled together. If any one of our readers, engineers, general foremen or others have any facts or figures bearing on this interesting question, the columns of our paper are freely open to them. —Editor.]

Hedley or Stephenson?

Editor:

I have my March copy of your most valued magazine and wish to take exception to some of the statements which you make about William Hedley under "Celebrated Steam Engineers."

You give a great deal of credit to Hedley which I think is quite undeserved. The first experiments in what may be called successful steam locomotion were due to a Mr. Blackett, the Wylam Colliery owner, together with Jonathan Foster, his engine-wright. My authority is "The Life of George Stephenson," by Samuel Smiles, which was published in 1869.

Smiles describes a number of the early experiments on locomotives and says that the "Puffing Billy" ("Black Billy" he calls it) was found capable of drawing nine loaded wagons and was designed and built by Blackett and his engine-wright, Foster. He also says that this engine gave so much trouble that it was known as a nuisance by all the workmen and had to be continually followed and aided by horses.

Smiles gives the credit of the first practical and commercially successful locomotive to George Stephenson, who, with the patronage of a Lord Ravensworth, erected his "Blucher" and applied the exhaust blast for the purpose of inducing draft. Before the use of the steam blast, the difficulty of generating steam enough was so great that the locomotives could not compete with horses, and it was only when Stephenson made this application that the locomotive became a real success.

Smiles states that Mr. Blackett employed Hedley as "viewer" or overseer in the colliery pit and that he took out a patent for an engine frame in Hedley's name. So if the accounts of Smiles are correct, you have given credit to Hedley which in no way belongs to him.

Hoping that you will favor me with the name of the author or authors from whom you have drawn your material for your article, W. R. Hanes.

Urbana, Ill.

[Comment on this letter will be found in our editorial columns.—Editor.]

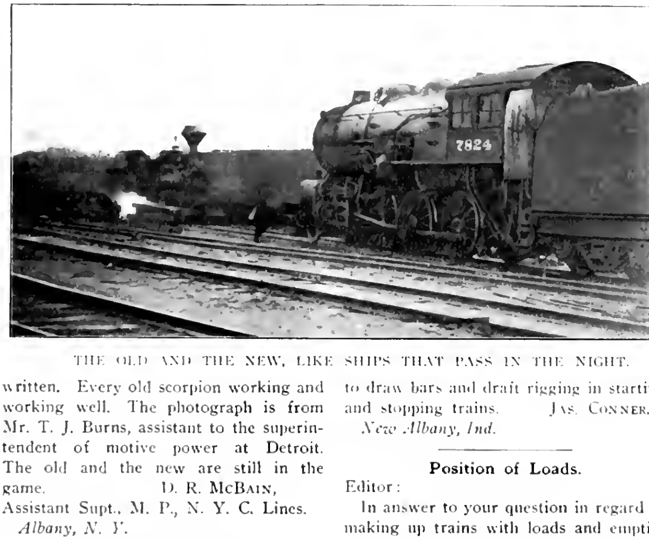
The Old and the New.

Editor:

This is a good example of the old and the new. We just happened to get the two extremes passing each other in regular service. Talk about "ships that pass in the night," here is an illustration of those about which no poems are written. Every old scorpion working and working well. The photograph is from Mr. T. J. Burns, assistant to the superintendent of motive power at Detroit. The old and the new are still in the game. D. R. McBain,

Assistant Supt., M. P., N. Y. C. Lines.

Albany, N. Y.



THE OLD AND THE NEW, LIKE SHIPS THAT PASS IN THE NIGHT.

Position of Loads in Train.

Editor:

The article in the March issue of your magazine in reference to the position of loads and empties so appeals to me that I feel it should have attention, being an engineer, and what I shall say is my conclusion from actual experience. I work over two divisions of the Chicago, Indianapolis & Louisville Railway, and over those divisions we handle an immense amount of stone coming from the Bedford, Ind., stone quarries. Well, over 50 miles of one division we handle 1,020 tons, but on arriving at this point we fill out to 1,050 tons.

The tonnage rating of our engines is within a few tons of what they will handle. Now, it frequently happens that on our arrival at this filling-out point with a train of this heavy stone loaded on cars of 100,000 lbs. capacity, that our fill out is composed of merchandise or light loads.

Practical experience has taught our engine and trainmen that to handle this train with any success or to avoid taking any chance of doubling a grade, we do additional work at this filling-out point that will enable us to keep those heavy loads of stone next to the engine, that we may have the benefit of an easier handled train.

You can readily see we make a distinction between heavy and light loads, and without a doubt it would be equally as noticeable between loads and empties. Our trains at all terminals are made up on this plan.

For instance, next to the engine are placed loads, then empty coal cars, then empty flat cars on rear end.

I firmly believe that an engine will handle a train made up in this manner with less labor and less likelihood of damage to draw bars and draft rigging in starting and stopping trains. Jas. Conner.

New Albany, Ind.

Position of Loads.

Editor:

In answer to your question in regard to making up trains with loads and empties it is my experience that a train made up with the loads ahead and the empties behind is the easier pulling train over a hilly and crooked division. Also having the heaviest loads ahead while on a level and straight track it does not make very much difference. This is where the grade is sometimes one per cent. You take a short train made up of all heavy loads and it will pull harder than the same tonnage train made up with more cars with lighter tonnage per car. This is in a very hilly and crooked piece of track and more tonnage can be pulled with the longer train.

C. F. Sundberg.

Sioux City, Iowa.

[We are glad to have this practical expression of opinion drawn from experience. Now if this is true what is the reason it is so? We want engineers who have this or different experience to let us have the benefit of their views. We have heard men who believed the short heavy train with few cars better than the same tonnage in longer trains. How about that?—Editor.]

Mind Your P's and K's.

Editor:

On page 100 of the March issue of RAILWAY AND LOCOMOTIVE ENGINEERING one sees a picture of what is styled Class K Pennsylvania Railroad locomotive, which is a mistake. Class K, of P. R. R. had wagon top boiler with sand box in wheel guards (see "Recent Locomotives," by M. N. Forney), and No. 10 P. R. R. was first of the K engines. There was not any of the Belpaire boilers used until the Class P engines; the first was, I think, No. 1321. HENRY F. COLVIN.

Philadelphia, Pa.

Good Record.

Editor:

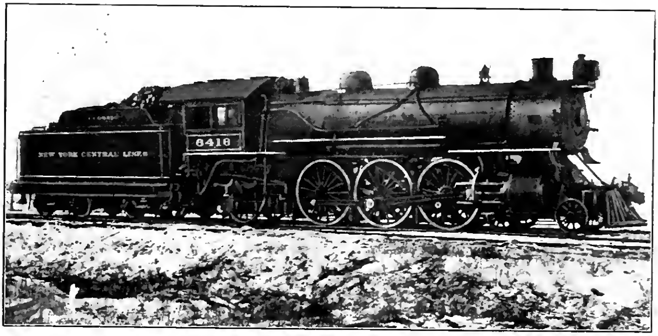
The following are facts connected with the wonderful record of durability made by Big Four Pacific type engine No. 6416.

This engine has made 200,581 miles without repairs; no new flues and without having tires turned (Railway Steel Spring Co.'s tires), only receiving light running repairs in the round-house between trips. The engine left the Bellefontaine shop on Nov. 20, 1907 and returned for general repairs Dec. 17, 1909. It hauled nine heavy express cars a day, running 288 miles at an average speed of 55 miles per hour. In the two years' time this engine had no failures of any kind. It was run by Engineers A. N. Jenkinson and Arthur Swisher and was kept in excellent condition through their careful attention, in particular watching the left main wedge. During this time the left main wedge was lined down four times, while the right was lined twice and so prevented the engine from pounding on her boxes.

This mileage certainly makes a good showing for the Bellefontaine shop and is an example of the work turned out. This, I think, under the conditions stated above, is the world's record. I am enclosing a photograph of the engine.

C. H. VOGES,
Gen'l. Foreman.

Bellefontaine, Ohio



ENGINE WITH GOOD RECORD ON THE BIG FOUR.

A Plea for the Bench Vise.

Editor:

Having read in your paper many articles concerning tool equipment, I have not yet noticed any which make more than a passing mention of the most useful, most abused, and most neglected, as regards repairs; namely, the erecting shop vise. Having worked in various erecting shops, I find the same case in each, that is, the bench vises are always in poor repair.

I do not think anything annoys a fitter more than when in a hurry to cut a piece of iron or file a bolt, as have to try two or three vises before he finds one capable of holding the job firm enough to work on it. As a rule there is one-third back lash in screw, and the outer jaw has in many cases, to be pulled out by hand, owing to collar being loose or lost.

In one large erecting shop in which I worked once, out of two hundred and fifty odd vises, twenty-four were only in first-class repair, one hundred and twelve were fair, and the rest were mostly scrap, taking up good bench room. All these could have been kept in decent repair and would have paid for that expense many times over. Because, as a rule, when a fitter tries to do a job in a vise and finds it won't hold, he waits till the first good vise is vacant, may be a quarter of an hour or 10 minutes, or he goes down the shop to a screwing machine, or shears, or an emery wheel, as the case may be, and loses more time walking there and back than would have done the job three times.

It is useless to expect a fitter to look after his vise in an erecting shop now-a-days as he never gets time to start re-setting jaws, etc. I think each large erecting shop should have a man detailed for nothing else, but to oil, fit new screws, and recut the jaws and keep all vises in first-class repair. It would save a lot of time and temper and make working in an erecting shop a lot more comfortable. If any readers of your paper know of any shops where a system of erecting shop tool and vise inspection is carried out I would like to know of it. J. L. G.

Winnipeg.

The Walschaerts Valve Gear.

Editor:

In the last issue of RAILWAY AND LOCOMOTIVE ENGINEERING, your correspondent, S. W., Superior, Wis., makes some timely comments on allowing a quarter of an inch of lead on locomotives equipped with the Walschaerts valve gear, and seems to have a doubt in his mind as to the advisability of allowing so much of a valve opening at the end of the piston stroke. S. W. must bear in mind that the opening of the valve in these engines is not increased with the shortening of the valve stroke, as is the case with engines equipped with the Stephenson link motion.

Three-eighths of an inch lead is quite common in passenger engines when the lever is hooked up, and while it is quite true that in certain positions these engines do not start as readily as those having less lead, it is found that after they are once moving they run better and pull more than engines do that have only a small amount of lead. It is not uncommon to see such locomotives as have a large amount of lead backed up a short distance so that one of the cranks may be on the top center to allow a full pressure of steam to be admitted for starting, then they will start readily.

Locomotives with the Walschaerts valve gear are not subject to changes in lead in ordinary repairs. Their original design is maintained in regard to the position and action of the valves. Others who are up against the same thing ought to let us hear from them through the columns of your valuable paper. G. D. RUGGLES.

Readville, Mass.

Age Proved Value.

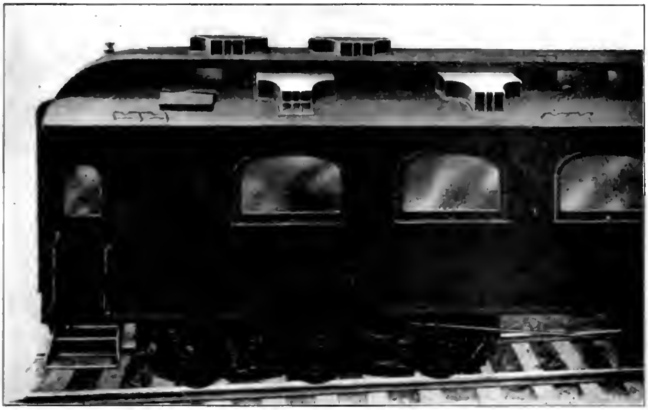
About the time "granger" sentiments were most powerful in Iowa a man who had accumulated wealth by fortunate farming and coal mining operations, conceived the idea of building a railroad to share some of the wealth that hauling freight and passengers was bringing to what he called the soulless transportation corporations. By means of old rails and second-hand material of all kinds, this anti-monopolist succeeded in getting a few miles ready for operating. Next thing was the purchase of a locomotive. He found an old engine popularly known as the Mud Hen, for her tendency to waddle into ditches, and he made a deal which transferred the machine to him.

When the purchase of this fiery steed had been accomplished, a friend cast doubts upon the value of the Mud Hen. "Not a good engine, did you say? Why, man, I have the best reason for knowing that I made a good bargain. The Rock Island Railroad used that engine for thirty-one years, and they certainly would not have kept her that time if she had not been a good one."

Ventilation of Cars.

A very successful method of ventilating freight and passenger cars has been devised by Mr. T. H. Garland, supervisor of refrigerator traffic on the Chicago, Burlington & Quincy. If one may so say the principle of the ejector has been made use of to promote the circulation of air in cars.

On a passenger car the ventilator is placed on the roof and opens into the deck light or clearstory window. It is made of No. 24 gauge, galvanized iron, and on the outer face presents six openings; there are all for exhaust air. There are four inlet openings placed so that two of them are always facing the direction in which the car is moving.



PULLMAN CAR, SHOWING VENTILATORS APPLIED.

Air entering the funnel-shaped intake pipes, when the train is in motion, is deflected through a right angle and blows out of the ventilator again, drawing with it air that is in the car. In the words of a well-known comic song the air "walks right in and turns around and walks right out again," but in its short excursion through the device it does some useful work. In fact air entering and leaving the ventilator as it does when the car is in motion is really the motive power of the whole scheme.

The funnel-shaped mouths of the ventilator are 12 x 4 ins. each, and the area of each is gradually reduced, so that on the sides of the device they measure 4 x 3 ins. These 4 x 3 openings are placed in others 5 x 4 ins., so that there is ½ in. above and below the discharge, and 1 in. at one side of it, and also a clear discharge duct 4 x 4 ins. in the centre. See Fig. 1.

In our illustration, Fig. 2, the feathered arrows show the course of the air forced into the ventilator by the motion of the train, and the plain arrows indicate the induced current of air which is drawn out of the car. It is said that the amount of air taken out by each ventilator is 400 cu. ft. a minute. When applied to a sleeping car a duct is run down to some convenient place in the neighborhood of each lower berth and in this way there is a constant but mild movement of air from the lower levels in the car.

The Garland system has been very successfully applied to the kitchens of dining cars, as well as to the dining compartment itself. When applied to dining cars the odor of cooking and the smell of vegetables and meat is entirely removed. As this kind of ventilation becomes more powerful with increase of train speed, a damper, if one may so call it, is provided at the inner side of the ventilator so that the amount of air drawn off can be regulated.

The exhausting of air at the rate of 400 cu. ft. a minute would, with six ventilators, amount to 2400 cu. ft., and this would be more than the contents of an ordinary car dining saloon. The air in this portion of the car would be changed every minute. The outward movement of air is compensated for in passenger cars by the constant open-

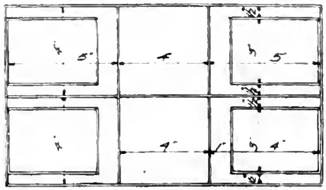


FIG. 1. FACE OF VENTILATOR SHOWING AREAS OF VARIOUS DUCTS.

ing and closing of the doors, and the inevitable leakage from windows, though it is said the passengers experience no draughts and are not conscious that the car is specially ventilated. No air can possibly enter through the ventilators, and thus dust, cinders, snow, sleet, rain, etc., cannot get in.

The application of this apparatus to refrigerator cars is similar in principle to that for passenger cars. The moving car causes its own ventilation, and air is introduced into the car through one or more of the drain pipes from the ice box, or by slightly raising one of the hatches. In this way air entering the car is made to pass over or around the lumps of ice, and is very much cooled in consequence. Very gratifying reports of the performance of this device have been received by Mr. Garland, and as there are no moving parts and nothing to get out of order the maintenance charges on this kind of equipment ought to be correspondingly low.

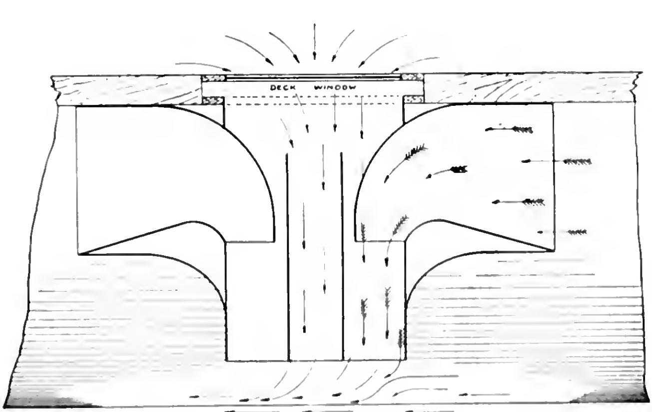


FIG. 2. PLAN OF VENTILATOR SHOWING DIRECT AND INDUCED AIR CURRENTS.

Grand Central Improvement Work.

The present station and train shed in the City of New York was originally built about 1870. The trains on the Harlem division prior to that time ran to a station in Madison Square Garden. In about 1900 a reconstruction of the yard and extensions of the office portion of the buildings was completed. The use of electricity as a motive power changed old conditions as it was only necessary to provide sufficient headroom for the trains. The railroad company for the payment of a sum of money was granted the sub-surface rights of all or a portion of certain cross streets in the vicinity.

The station building proper is set back on two streets so as to provide a wide plazza in front of those portions of the building where passengers enter and depart. The main concourse will be entered on 43d street, with a width of 120 ft., and a height of 100 ft., the floor level being some 10 ft. below the grade of 42d street. On the southerly side of this will be a large waiting room, toilet rooms, ticket offices, etc., the waiting room being so placed that it will not have to be passed through by passengers in going to and from trains. Around three sides of the course at about the street level will be a balcony to which carriage passengers and those entering from the street will have access. The main concourse connects only with outward bound trains so that the current of traffic through it will be almost entirely in one direction. An arrival concourse for through trains will be built on the easterly side of the building and will have independent exits to the subways and the street. Below these rooms on a floor immediately between them and the suburban track level will be a large mezzanin concourse, to which passengers have independent access. In planning the various concourses the idea of separating traffic going in opposite directions has been carried out.

The design of the station is unusual only in the magnitude of the quantities involved. There are, however, two or three features which may be interesting. Between 56th and 57th streets, where the four tracks in Park avenue tunnel widen out to ten, switches are required which prevent frequent column supports being placed. Two trusses were therefore erected in the center of the street to carry the street surface. These trusses are about 150 ft. long with their tops some 13 ft. above the street surface. To make these ornamental a curb was built just outside of the ornamental work and soil placed back of it in which ivy and shrubbery has been planted so that now this very utilitarian structure appears to be constructed for ornamental purposes. As none of the sewers in that vicinity of the city were low enough to drain the suburban level it was necessary to build a new low level sewer to the East River. The city has given the railroad company permits to proceed with work on various foot-bridges across the yard.

The new Pennsylvania terminal in New York occupies approximately 28 acres, the Grand Central terminal has 46.2 acres on the main level and 23.6 on the suburban level, making a total of almost 70 acres. The amount of excavation in the two terminals is approximately the same, about three million yards. There is approximately twice the mileage of tracks in the Grand Central terminal amounting to slightly under 32 miles. There are 46 tracks against platforms as compared with 21 in the Pennsylvania station. The car capacity of the old terminal was 366 cars. The capacity of the new one is 1,120 cars. The value of the facilities which are being installed can be appreciated when it is considered that the cost of producing space for one car (exclusive of the cost of the station), amounts to approximately $30,000.

The Grand Central terminal provides not only a terminal station but a storage yard for the handling of equipment and office building above the station with a large area on which revenue producing buildings may be constructed.

THE GRAND CENTRAL STATION, NEW YORK, AS IT WILL BE.

Mallet Articulated for the B. & A.

The American Locomotive Company have recently completed a Mallet articulated compound locomotive for the Boston & Albany Railroad. This is the first engine of the articulated type to be put into service on any of the roads comprising the New York Central Lines. It will be used in hauling freight on the Albany and Springfield division of the above mentioned road. This part of the road passes through the Berkshire Hills, and the grades are long and steep in both directions, the ascent between Chester and Washington having an average gradient of 1.5 per cent. At present the freight traffic is handled by consolidation locomotives, and pusher engines are used on the two ruling grades both East and West.

Although this engine is in a sense an experimental one, the success of the Mallet type on other roads where the conditions are analogous to those existing on the Boston & Albany, leaves little doubt but that it will prove to be a most efficient addition to the heavy power on that road. The Mallet engine has about 45 per cent. more tractive power than the consolidation engines now doing the work, while the average weight per axle is about 2,775 lbs. less, and the rigid wheel-base is 7 ft. 6 ins. shorter. Another interesting fact is that the grate area of the two classes of engines is the same, which gives a much larger proportion of heating surface to grate area in the Mallet engine than has been the previous practice in locomotives of this type. Service tests of Mallet engines designed to burn bituminous coal have, however, proved that larger grate areas have hitherto been provided than were required for slow speed service. In the engine here illustrated, therefore, the grate area was reduced in order to secure a better rate of combustion. This has the effect of facilitating the firing of the engine.

With the exception of a larger boiler and larger truck wheels, the Mallet engine is practically a duplicate in design of eight of the same type recently delivered by these builders to the Denver & Rio Grande Railway. As far as the features characteristic of the Mallet type of locomotive are concerned the design follows the builders' usual practice. The wheel arrangement is of the 2-6-6-2 type, having a two-wheel truck front and rear.

In working order the engine has a total weight of 342,000 lbs., of which 296,500 lbs. is carried on the driving wheels. The high pressure cylinders are 20½ ins. in diameter by 32 ins. in stroke, and the low pressure 33 in. in diameter with the same stroke. The boiler carries a working pressure of 210 lbs., and with driving wheels, 57 ins. in diameter, the theoretical maximum tractive power working compound is 66,600 lbs., which, with the Mellin System of compounding employed, can be increased to 80,800 lbs. by working the engine simple. The theoretical maximum tractive effort of the consolidation engines now used on this section of the Boston & Albany is 45,000 lbs.

One of the most characteristic features of this engine is a larger boiler capacity which has been provided, and would indicate that this engine can deliver its theoretical tractive power at the ordinary speeds of freight service. The boiler is of the straight top radial stayed type, and the barrel measures 82 ins. in diameter inside at the front end. It contains 410 tubes 2¼ ins. in diameter, each 22 ft long. The total heating surface of the boiler is 5,476 sq. ft., of which the tubes contribute 5,291 sq. ft., and the firebox the remainder.

The firebox is 108 ins. long and 75¼ ins. wide, and provides a grate area of 56.5 sq. ft. This gives a ratio of heating surface to grate area of 97 which is considerably higher than the usual practice for engines of this type designed for burning bituminous coal. The crown and sides of the firebox are in one sheet, as are also the roof and sides of the outside shell. Ample water spaces are provided around the fire box, the mud-ring being 4½ ins. wide on the side and back and 5 ins. at the front. At the back end the firebox is supported by a ⅝ in. buckle plate, and at the front end by sliding shoes on a cast steel crosstie.

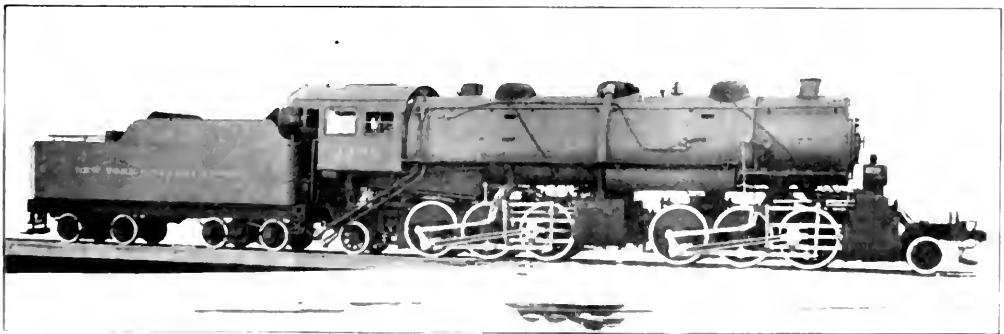
Cast steel frames are used throughout and there is a single articulated connection between the frames of the front and rear systems. A very strong and substantial system of frame bracing has been employed. In the front system the frame bracing consists of a heavy cast steel crosstie at the rear end, which is bolted to both the top and bottom rails of the frame, and to which the radius arm of the articulated connection between the front and rear frames is secured; a massive vertical steel casting placed between the second and rear driving wheels, which extends down to the bottom rails of the frames and the upper part of which extends outside of the frames and furnishes a support for the self-adjusting sliding boiler bearing; another steel casting of similar design located between the first and second pair of driving wheels which constitute the guide yoke and also the support for a second boiler bearing, and a cast steel front deck casting ahead of the cylinders which also serves for the engine truck center pin guide.

In the rear system, in addition to the cast steel foot plate at the back end, the cylinder casting and the steel casting at the front end, which includes the bearing for the center pin of the articulated connection, is a heavy cast steel guide yoke across the upper rails of the frame between the first and second pair of driving wheels and the cast steel crosstie over the middle pedestal which furnishes the support for the front end of the firebox.

The front and rear systems are equalized together in the usual way by vertical bolts connecting the upper rail of the front end with the lower rail of the rear frame. As in the engines of this type built by this company for the Virginian Railway, the load on these bolts is supported by a coil spring through which the lower end of the bolt passes and which presses up against the bottom of the rear frame rail, thus giving the flexible support at this point which is necessary in order that the three boiler supports, viz., the two sliding bearings and the equalizing bolt, may each bear its proportion of the load in any variation of the alignment of the three. Both the front and rear trucks are of the center bearing radial type with swinging bolster. The truck frame is of cast steel and the portions of the sides over the journal boxes are shaped to form caps for the coil springs which transmit the load to the journal boxes upon which they are directly seated.

The principal dimensions and ratios are as follows:

Weight on drivers ÷ tractive effort, 4.45.
Tractive effort x diam. drivers ÷ heating surface (B. D. factor), 693.
Total heating surface ÷ grate area, 97.
Firebox heating surface ÷ total heating surface (per cent.), 3.4.
Volume of equivalent simple cylinders cu. ft., 19.32 cu. ft.
Wheel Base—Driving, 10 ft.; total, 30 ft. 8½ ins.; total, engine and tender, 74 ft. 8 ins.
Weight—In working order, 342,000 lbs.; on drivers, 296,500 lbs.; engine and tender, 494,700 lbs.
Grate Area—56.5 sq. ft.
Axles—Driving journals, 9 x 13 ins.; engine truck journals, diameter, 6 ins.; length, 12 ins.; trailing truck journals, diameter, 6 ins.; length, 12 ins.; tender truck journals, diameter, 5½ ins., length, 10 ins.
Firebox—Type, wide; length, 108⅛ ins.; width, 75¼ ins.; thickness of crown, ⅜ in.; tube, ½ in.; sides, ⅜ in.; back, ⅜ in.; water space, front, 5 ins.; sides, 4½ ins.; back, 4½ ins.
Tubes—Number, 410; diameter, 2¼ ins.; No. 11 B. W. G.
Air Brake Pump—1, 8½-in. L. H.; 2 reservoirs.
Tender Frame—13 in. steel channels.
Tank—Style, water bottom, capacity, 8,000 gallons, capacity, fuel, 12 tons.



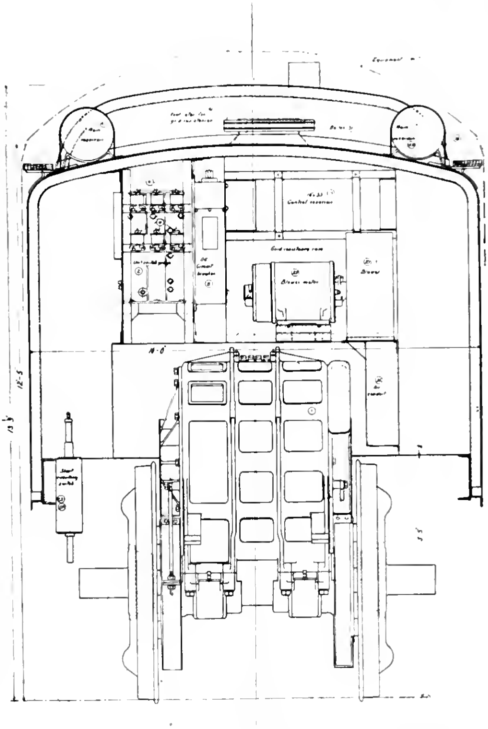
MALLET ARTICULATED FOR THE BOSTON & ALBANY

John Howard, Superintendent of Motive Power. American Locomotive Company, Builders.

Electric Locomotive for the N. Y., N. H. & H. Railroad

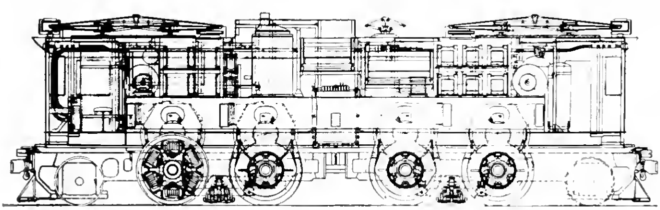
The Westinghouse Electric & Manufacturing Company have built for the New York, New Haven & Hartford Railroad an electric freight locomotive of large capacity, for use on the electrified section between Stamford and New York City. The locomotive has been designed primarily for handling fast freight service, but will also be used for hauling heavy passenger trains. The mechanical parts of this locomotive have been designed by the engineers of the Baldwin Locomotive Works and the mechanical department of the N. Y., N. H. & H., and were built at the Baldwin Locomotive Works.

The general plan of the trucks and running gear has been worked out in accordance with a patent granted to Mr. S. M. Vauclain, July 6, 1909. This patent describes an articulated locomotive in which the truck frames are connected by an intermediate draw-bar. One truck has only a rotative motion about its centre pin, while the other has a fore-and-aft as well as a rotative motion, in order to compensate for the angular positions of the trucks and draw-bar when the locomotive is traversing curves. The tractive force is transmitted through the truck frames and draw-bar, instead of through the main frame.



SECTION OF N. Y. N. H. & H. ELECTRIC LOCOMOTIVE.

In the present instance, the 2-4-4-2 wheel arrangement has been adopted. Each truck has two pairs of driving wheels, and a single pair of leading wheels. The driving wheels are held in alignment by cast-steel bar frames, similar to those usually employed in steam locomotive practice. The frames are placed outside the wheels, and are braced transversely under the centre of the locomotive by heavy steel castings provided with draw pockets in which the intermediate draw-bar is seated. The leading wheels are mounted in radial-swing trucks of the well-known Rushton type. The radius bars for these trucks are pivoted to the same cross-ties as the main draw-bars. The wheel loads are equalized as in steam locomotive practice, the springs of the leading wheels being connected to the driving springs by equalizing beams. One of the trucks is cross-equalized under the centre of the locomotive. The frame is spring-supported by the cross-equalizer, on each side of the centre line.



GEARED FREIGHT ELECTRIC LOCOMOTIVE FOR THE N. Y. N. H. & H.

The cab is built of steel plate, and measures 43 ft. 6 ins. in length, covering the entire locomotive. The frame which supports the cab is composed of two 12-in. channels, united at the ends of plates and angles. This frame is braced transversely by five cast steel cross-ties; one over each truck centre-pin, one at mid-length, and one near each end of the locomotive. The cab is supported on intermediate and end cross-ties, the weight being transferred through coiled springs which are placed in suitable pockets. The cab frame is held in alignment by the truck centre-pins, while the lower spring pockets are free to slide over the truck-frame cross-ties. The springs over the end cross-tie are placed 30 ins. apart, transversely. The middle cross-tie carries four springs; these are placed at the corners of a rectangle and are 84 ins. apart, transversely, and 53 ins. longitudinally. As both the trucks are free to rotate about their centre pins, the displacement of the spring pockets, even on a 20-deg. curve, is comparatively slight. A characteristic feature of the heavier details is the free use made of cast steel. This is particularly true of the truck frame cross-ties, which are interesting examples of mechanical design. The tendency to follow approved steam locomotive practice is also evident in many of the mechanical details of this locomotive.

The electrical equipment comprises four 350-horse-power single-phase geared motors, together with the necessary auxiliary apparatus for their operation from the 11,000-volt alternating-current or 600-volt direct-current circuits of the electrified sections which the locomotive will traverse. The motors are placed directly over the axles and are mounted solidly on the truck frames. Each end of the armature shaft is provided with a pinion; these mesh with gears mounted on a quill surrounding the axle and carried in bearings on the motor frame, similar to the usual axle bearings. The quills are provided with six driving arms on each end, which project into spaces provided between the spokes in the driving wheels. Each of these arms is connected to an end of a helical spring, the other ends of the spring being connected to the driving wheels.

This arrangement of drive smooths out the torque pulsations, and at the same time allows for the vertical movement of the axles. In addition to the spring connection between the quills and drives, flexibility is provided between the pinions and motor shaft, to equalize the torque on the gears. The quills are of large diameter permitting unrestricted motion of the wheels and axles. The centre of gravity of the motors, as well as that of the entire locomotive, is high, avoiding the transmission of strains and shocks from the track and roadbed to the motors.

The motors, of the standard Westinghouse type, have twelve poles built into solid frame, and are designed for forced ventilation. When operating on 25-cycle alternating-current with forced ventilation each of the four motors will carry continuously a load of 300 horse-power. An air-blast transformer is provided for lowering the trolley line voltage to that required by the motors. The control apparatus is of the well-known Westinghouse electro-pneumatic type.

When operating on alternating-current all four motors are connected in multiple, and the control is obtained entirely by changing the connections to various taps, but when operating on direct-current the motors are first grouped all in series, and then two in series and two in parallel, in combination with various resistance steps. Provision is made for cutting out any one of the four motors singly on either alternating-current or direct-current. A master controller and brake valve have been placed in each end of the cab so that the locomotive can be operated from either end, and the system of control is such that two or more locomotives of this type can be coupled together and operated from one master controller. Two pneumatically operated pantagraph trolleys are provided for collecting current from the 11,000-volt overhead alternating-current line. Pneumatically operated third-rail shoes are used to collect current on direct-current third-rail section.

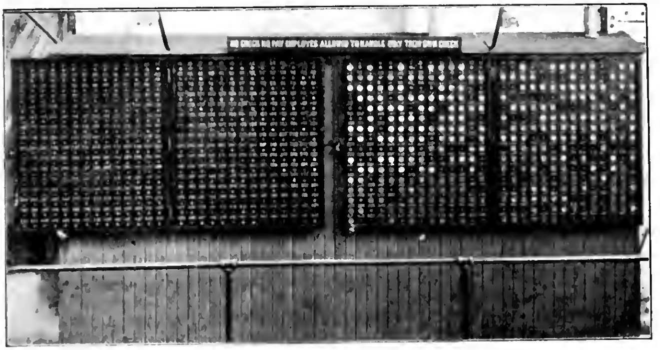
The locomotive will be capable of hauling a freight train having a maximum weight of 1,500 tons, at a speed of 35 miles per hour. When used in passenger service 800-ton trains will be hauled at a maximum speed of 45 miles per hour. A steam heater is provided on the locomotive for heating the cars of the trains when used in passenger service. Some of the principal dimensions are as follows:

Driving wheels, outside diameter, 63 ins.; driving journals, 8 by 13 ins.; truck wheels, diameter, 42 ins.; wheel-base, rigid, 7 ft.; wheel base, total, 38 ft., 6 ins.; length between coupler faces, 48 ft.; height over all, 13 ft., 9 ins.; width, 10 ft.; approximate weight, total, 260,000 lbs.; approximate weight on driving wheels, 188,000 lbs.

Apprentices at Dunmore, Pa.

The Erie Railroad is developing a system of training apprentices that might well be taken as a model in practical railroad shop engineering. We recently had the pleasure of looking in at the shops at Dunmore, Pa., and it was particularly interesting to observe how completely systematized the method of instruction has become. A shop schedule comprising a four years' course is rigidly adhered to. The course covers all the different classes of work in the departments within three years, and during the fourth year of service the apprentice is occupied in the work of which he has the least knowledge, or to the best advantage of the company in increasing the output of the shop.

The schedule for machinists embraces six months for lathe work generally, and three months each for planers and shapers. Slotters and boring mills have each three months. Vise work is carefully subdivided, so that the apprentice has three months on rods, four months on motion work, pistons, crossheads, etc. There is then six months' work in the erecting shop, which includes frame work, shoes and wedges, wheeling engines, putting up spring rigging, engine truck work, expansion gear and the like. This is followed by three months' work above the running boards, consisting of hand rail work, safety valves, whistles, boiler mountings and bells. The three years are completed by three months at putting up motion work, setting valves, lining guides, putting in pistons, putting up steam chests and adjusting packing.



CHECK BOARD AT THE DUNMORE SHOPS OF THE ERIE RAILROAD

It will be noted that in this course there is no mention made of the tool room, air brake department or surface table. The Erie instructors wisely conclude that these are special sections requiring special training, and a certain number of apprentices are specially selected for these branches. In the fourth year, however, as we have already stated, there is an opportunity given to every apprentice to gather a certain amount of experience in these branches also, including a knowledge of milling and grinding, and also some practical experience at the laying out table.

The same system of careful subdivision of time and work is used in the care of blacksmith and boiler maker apprentices, and all apprentices have special instruction in the elements of geometry, mechanical and free hand drawing. Models of valve gearings and an extensive assortment of charts and other illustrations furnish a complete course of instruction that leaves nothing to be desired except diligence and attention on the part of the student apprentice.

We observed at the entrance of the shops a new method of checking the time of the employees. Numbered checks are hanging on pins on a numbered board, and on entering, the check must be conveyed a few feet and hung on a corresponding space on another section of the board. When the whistle blows the timekeeper folds up the hinged board and a padlock attachment secures it. The belated mechanic or apprentice must need go and tell his story to the shop foreman. The operation of this apparatus seemed to us, at first sight, to be severe, but it is said to have a salutary effect, especially on the apprentices. The romantic scenery in the neighborhood seems to have an attraction for some of the youths, and they love to linger and watch the maples grow red in the clear, cool air and listen to the bluebirds prophesying spring. The specter of the hinged checkboard haunts their memories, and when the whistle blows they are generally on the job.

Appreciates Space in R. and L. E.

A short time ago one of our many satisfied advertisers while doing business at home in a very satisfactory way, received an enquiry from Portugal concerning their product. The inquiry came from readers of RAILWAY AND LOCOMOTIVE ENGINEERING. This fact was beyond question, and the advertising company wrote us in complimentary terms, but expressed some surprise that we had reached a far away land so effectively. We were of course pleased with the result, but were not surprised, as our foreign circulation is one of the things which is all in the day's work with us, and we just call our advertisers' attention to the fact that reaching foreign countries is one of the advantages that goes with "space" in our paper. Our foreign edition is exactly the same as the home edition and is printed in English, but it gets there just the same.

Railway & Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances.

Published Monthly by

ANGUS SINCLAIR CO.

114 Liberty Street, New York.

Telephone, 984 Cortlandt.

Cable Address, "Loceng," N. Y.
Glasgow, "Locoauto."

Business Department:
ANGUS SINCLAIR, D.E., Prest. and Treas.
JAMES KENNEDY, Vice-Prest. and Gen. Mgr.
HARRY A. KENNEY, Secretary.

Editorial Department:
ANGUS SINCLAIR, D.E., Editor.
GEORGE S. HODGINS, Managing Editor.
JAMES KENNEDY, Associate Editor.

Advertising Department:
JAS. R. PATERSON, Manager, Chicago.

Boston Representative:
S. I. CARPENTER, 643 Old South Building, Boston, Mass.

London Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., 3 Amen Corner, Paternoster Row, London, E. C.

Glasgow Representative:
A. F. SINCLAIR, 49 Jamaica Street, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid in the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribe in a club, state the name of the agent.

Please give prompt notice when your paper fails to reach you regularly.

Entered at the Post Office, New York, as Second-class Mail Matter.

Hedley or Stephenson?

In our correspondence department we publish a letter from Mr. W. R. Hanes, in which exception is taken to the credit we give to William Hedley for his work on the development of the locomotive, and claiming that to George Stephenson is due the credit which we accord to William Hedley. "The Life of George Stephenson," by Samuel Smiles, is given as the authority for belittling the work of Hedley and for magnifying the claims of Stephenson. The engineering world does not accept as history the statements made by Smiles in his lives of the engineers. Every person Smiles wrote about was created a hero, and everything worthy of credit in that line was claimed for them.

This tendency was displayed with unusual extravagance in the case of George Stephenson, who was credited with creations and performances that never came within the range of his ability. Smiles' romances have made George Stephenson popularly considered the inventor of the locomotive, when as a matter of fact he never invented a single improvement on that form of engine or any part or attachment which is used today. What George Stephenson deserves much credit for was his energetic advocacy of railways and for the persistency he displayed in favor of the locomotive being employed for motive power. He took this position, and adhered to it, when few engineers believed that steam could be applied to land transportation engines.

No events of industrial history are better known than those relating to the development of the locomotive engine. The first authentic record of steam being applied to the propulsion of a carriage relates to the invention of Cugnot, a French military officer, who experimented in 1769 with a steam driven gun carriage. Other inventors appeared from time to time with appliances designed to run on common roads. In 1803 Richard Trevithick, a Welsh mining engineer, built a locomotive that ran on rails and pulled a train of cars. The engine had one cylinder 8 x 54 ins., a boiler with a single flue and four carrying wheels. The exhaust steam was passed into the chimney, thereby creating draft. The engine possessed all the essential elements of the modern locomotive except the multitubular boiler; but it was badly over-cylindered and slipped on the least application of steam. Trevithick did not follow up the business of locomotive building, but it was taken up by others connected with coal mines who were finding horse traction too expensive. For several years after Trevithick's engine had slipped over a section of tramway in Wales, several inventors brought out appliances designed to overcome the supposed want of adhesion between wheel and rail.

About 1811 Christopher Blackett, owner of Wylam Colliery, in the North of England, finding the expense of horse haulage too expensive, applied to Trevithick for a locomotive. Failing to secure an engine, he suggested to William Hedley, his mine "viewer," as the superintendent was then called, to build one. As a preliminary to building the engine, they proceeded in a truly scientific manner to prove the co-efficient of friction between a wheel turned by power and an iron rail. Hedley put cranks upon the axles of coal tubs and made crude tests to find the adhesion. Then he built a special car for the purpose of testing the adhesion and found it sufficient for traction purposes.

A letter written by Hedley describing the experiment proceeds: "This experiment was decisive of the fact that the friction of the wheels of an engine upon the rails was sufficient to enable it to draw a train of loaded coal wagons. An engine was then constructed; the boiler was cast iron, the tube containing the fire went longitudinally through the boiler to the chimney. The engine had one cylinder and a fly wheel. It went badly.

"Another engine was then constructed. The boiler was of malleable iron, the tube containing the fire was enlarged, and in place of passing directly through the boiler, it was made to return again through the boiler into the chimney, now at the same end as the furnace. This engine was placed on four wheels and went well."

That is Hedley's own account of his first experience in locomotive building. The engine that "went well' was afterward known as the "Puffing Billy," and is now in the South Kensington Museum of London.

George Stephenson, who was enginewright at Killingworth Colliery, about twelve miles from Wylam, conceived the idea that he could build a locomotive, and began devoting close attention to "Puffing Billy." After a time he obtained permission from his employers to try his hand on the construction of an engine, and after ten months turned out the "Blucher," which had a single flue boiler, was very deficient in steam making, and compared very unfavorably with the engines built by Hedley, several of which were by this time at work.

The principal owner of the Killingworth Colliery, where George Stephenson was employed, was Lord Ravensworth, a powerful nobleman whose influence did much to put the enginewright into prominence. This influence put Stephenson into the position of chief engineer of the Stockton & Darlington Railway, the first public enterprise of that kind put into operation. This made George Stephenson the most prominent railway engineer in the world and led to his appointment as chief engineer of the Liverpool & Manchester Railway, the first to be opened for general traffic. He pushed railway engineering work and other enterprises with supreme vigor, but he left no trace of ability as an inventor, as a machine designer or improver of mechanism.

Position of Loads and Empties.

We have received one or two communications, which we print in the correspondence columns of this issue, on the subject of the best position to put loads and empties in a train. One correspondent tells us that on his road the heaviest cars go next the engine, and that even the loads are graded so that the lightest loads are farthest from the engine, and the tail end of the train is made up of empties if there are any. Our correspondent, reasoning by analogy, says that if a train is made up entirely of empties that he believes it would be advantageous to grade the empties on the same principle, that is, to put the heavier cars in the front and the lighter ones behind.

It is generally believed that if a train contains 500 tons of freight it will pull easier if that load is carried in a comparatively few cars, and that the same tonnage spread over a long train so that each car is not loaded to its full capacity, will be a hard pulling train. Therefore, the rough and ready rule for engine rating, that one load equals two empties is by no means true and is very often a most inaccurate method of estimating the relative resistance of loads and empties. This is a matter which locomotive engineers are good authorities on. What do you say?

The question involved in the placing of loads and empties in a train is an entirely different matter and depends on something which is not contained in any engine rating rule we know of. What we want our readers to do is to give us the result of their experience, first as to the actuality of the thing itself. Is it true that heavy cars at the front are better than at the back; or is the reverse of this the fact? Second, is the arrangement of heavy cars at one or other end better than distributing them throughout the train? Those two questions are important and our columns are open to any one who knows anything about the matter. The questions are good practical railroad ones. Let us have your opinion.

We also want to get at the "Why" of the whole matter. If loads are better ahead there is some reason for it. If empties ahead give good results in that position, there is a cause, one way or other. What is it? We want the ideas of our correspondents from what they find by their experience to be the best arrangement.

When a boy makes a pear-shaped kite, he provides it with a tail attached to the sharp or lower end. The tail is made of a stout cord often with knots and bows of paper at intervals along it, but the heaviest part of the tail is at the end, farthest from the kite, and the boy will tell you it is to balance the kite and keep it upright in the air. As a matter of fact the center of gravity of the whole thing is lower than it would be without the tail, but the kite pulls the tail and the arrangement works well. In the case of the train it is not a matter of center of gravity nor of upright position, but it works all right.

When a lifting magnet takes hold of a loose mass of pig iron the bulk of the load is carried close to the magnet, and odd pigs hang on irregularly below as if they were dripping from the mass above. These are two cases, one with load close to the lifter and the other camparatively far away; both work all right. We just give these as examples for sake of argument pro and con. We are not here concerned with which is better, nor do we ask our correspondents to explain either. What we want to get from our practical thinking readers is what is the best arrangement for light and heavy cars in a train and why. Let us have your views.

Firebox Stays.

In a report for the Eighth Railway Congress, prepared by Mr. H. Fowler and Mr. L. Archbutt, respectively works manager and chemist of the Midland Railway of England, the subject of firebox stays and their protection is dealt with. Among other things the report says that on the roads from which information was sought, viz.: British and Colonial, excluding Canada, in which the practice conforms closely to that of the United States, copper is still the principal material used for firebox stay bolts. Opinion is divided as to the use of bronze bolts.

The Tasmanian Government Railways use bronze stays only and believe that this material has a longer life than copper. They, however, found that a yellow bronze, the composition of which had not been determined, deteriorated very rapidly while in use, wasting away in two years from 15/16 to ½ an inch. Deterioration took place close to the water side of the firebox sheets and extended out about ⅝ ins. from that plate. The other quality of bronze used in a different set of bolts, and which at least in color resembled copper, showed no signs of corrosion but failed by fatigue and generally broke close to the casing sheet, though some few broke near the firebox plates. Some experiments were made on the London and North Western Railway with an aluminum bronze but the results were not satisfactory.

Speaking of the whole question of bronze stays the report points out the fact that the heads of bronze stay bolts inside the firebox, drop off much more readily than those of copper bolts. It is said that a possible explanation of this feature may be that, under pressure copper firebox sheets tend to bulge slightly between stays, and that this action, small as it is, when constantly repeated, tends to break off the stay bolt head. Copper stays do not seem to be as susceptible to the result of this bulging action and consequently do not give the same trouble in this way. Sometimes this breaking away of the bronze stay head carries with it part of the bolt to a depth of two or three threads which are inside the firebox plate. Some of our readers may remember that the early use of steel rivets in this country was often attended by the breaking off of heads, but this was no doubt due to the brittleness of the steel when subjected to the process necessary to form the head and not to any bulging and straightening of plates.

A form of failure, more or less common to all forms of stay bolts, that of heads burning off is mentioned in the report, with reference to copper stay bolts. This is specially noticeable in the area forming the track of the hottest flame. It includes perhaps ten stay bolts at the bottom diminishing several rows higher up where the flame turns over the brick arch, and may involve from 50 to 60 stay bolts. In this, the bronze stay bolt appears to be less satisfactory than the copper bolt, though other materials are also liable to have heads burned off in the zone indicated. In many instances provision is made for this form of failure by using a small stay at first, and replacing with slightly larger size several times before the holes in the firebox become so large as to require a bushing. This anticipation of failure, if we may so call it, implies very careful boiler inspection and prompt renewals. On the Midland Railway it is not customary to use bronze when the size of stay required is so large that copper will afford the required strength.

In dealing with the breakage of stay bolts owing to the expansion and contraction of the firebox, to which all stay bolts are liable, the report points out that American practice with flexible stays is not followed. Many forms of bronze stay bolts are, however, rendered flexible to a certain extent by sawing them in the direction of their length. The method followed is to subject the bolt to the action of a thin circular saw. Four saw cuts are taken parallel to the axis of the bolt, two are vertical, one on the top and one on the bottom of the bolt. The other two are sawed on the sides in a horizontal direction. This at least describes the position of the cuts, though, of course, the bolt is revolved a quarter turn for each cut. The saw enters the bolt at a point midway between the ends and penetrates the desired distance. The shape of the cut conforms to the curviture of the saw, being deepest in the centre and sweeping up toward the ends in conformity with the perifery of the saw.

In other words the saw-cut roughly resembles in outline, a piece of string held at its ends and allowed to sag in the centre. The cut, however, has the same radius as the saw. After the four cuts have been taken, the stay bolt is rolled so as to close the gaps made by the saw. The bolt is then ready to screw into place. A bolt so treated is known as Stone's flexible bronze stay bolt. The bolt is flexible in the centre in a vertical and horizontal direction, and one or other of these planes is more or less approximated to, when the bolt is screwed in place. This method is in principle at least analogous to the American method of turning off the thread of the bolt between plates, leaving a large fillet at each end. The report points out that the method of broken stay bolt detection, very generally followed, is by tapping each stay bolt. The Natal Government Railways as the New South Wales Government Railways use tell-tale holes, drilled into the stay bolts from both ends.

Wasting Money on Waterways.

The present session of Congress indicates that a large amount of the people's money will be wasted on that perennial fraud, the Rivers and Harbors bill. Many creeks that never will have sufficient water to float a fifty-ton schooner will be deepened as a menace to railway companies, and the Mississippi River will have money wasted upon vain efforts to decrease the obstacles to navigation. A proposal has been made to spend $200,000,000 on the Mississippi and Missouri rivers on the idiotic pretense that it will prevent railway companies from charging exorbitant rates. The scheme gives new interest to comments made in Mark Twain's book, "Life on the Mississippi." He says:

"The military engineers of the commission have taken upon their shoulders the job of making the Mississippi over again —a job transcended in size by only the original job of creating it. They are building wing dams here and there, to deflect the current; and dikes to confine it in narrower bounds; and other dikes to make it stay there; and for unnumbered miles along the Mississippi they are felling the timber front for fifty yards back, for the purpose of shaving the bank down to low-water mark with the slant of a house roof, and ballasting it with stones; and in many places they have protected the wasting shores with rows of piles. One who knows the Mississippi will promptly aver—not aloud but to himself—that 10,000 river commissions, with the mines of the world at their back, cannot tame that lawless stream, cannot curb it or confine it, cannot say to it, "Go here" or "Go there," and make it obey; cannot save a shore which it has sentenced; cannot bar its path with an obstruction which it will not tear down, dance over and laugh at. But a discreet man will not put these things into spoken words; for the West Point engineers have not their superiors anywhere; they know all that can be known of their abstruse science; and so, since they conceive that they can fetter and handcuff that river and boss him, it is but wisdom for the unscientific man to keep still, lie low and wait till they do it."

Looking Over the Valves.

The constant supervision of the action of the valves in all steam engines and particularly in the locomotive, is not only essential to the object of getting the best work out of the engine, but it is of much consequence in the important item of coal consumption. The skilled engineer or mechanic is well aware that no matter how carefully adjusted the valves may be when the engine is built, or overhauled, variations soon occur. These largely owe their existence to the fact that the valve being moved by a combination of rods and levers that are necessary in conveying the motion from the main driving rod to the valve itself, these couplings not only wear rapidly and create what is known as lost motion, but their wear is also of an erratic or eccentric character that is impossible to gauge or predict in advance.

The most common discovery made in looking over the valves is the variation in the lead or opening of the valve. It will generally be found that the opening has increased at one end of the piston stroke and diminished a corresponding amount at the other end of the stroke. In the case of a locomotive equipped with the Stephenson shifting link, this is a simple matter. A shortening or lengthening of the eccentric rod half the amount of the variation will set the valve right, at least for another period of service.

The most common mistake made in these alterations is the dependence which even the most skilled mechanic often makes is trusting to the original wheel markings in obtaining the dead centers or exact points where the end of the piston stroke occurs. It is a gross error to imagine that while these marks may have been correct at the time they were originally made that they remain correct after the locomotive has seen some service. It should be borne in mind that the rod connections have loosened. The locomotive in its entirety may be nearer the rails on account of the slight relaxation of the springs, while, of course, the wheels retain their original position. The result is that while the main rod may have become lengthened, the space between the center of the main axle and the center of the cylinder may be slightly shortened. These variations, however slight, affect the wheel markings, and it is time well spent to begin the operation of looking over the valves from the beginning, and make new marks on the wheels, and also prove that the markings are correct by trying the engine not only in the forward gear, but also running backwards, and so obtain as nearly correct as possible an exact basis on which to conduct the investigation.

It should also be borne in mind that in construction and general work the parts of the locomotive are almost always in a normally cool condition, whereas in practice the engine is subjected in some of its parts to intense heating. This change has a marked effect on the valve gearing, and one of the most variable points affected is the reach rod.

In the case of locomotives equipped with a radial link it is easy to observe the exact location of the link block when the reverse lever is in the backward as well as in the forward position, and any marked variation in the position of the link block should be rectified, otherwise undesirable irregularities in the motion of the valve will be produced.

Locomotives that are unfortunate enough to sustain even a slight shock in some apparently trifling collision are almost always affected in the delicate mechanism of the valve gearing. This can readily be accounted for from the fact that many of the essential parts of the motion are not traveling in direct paths and lend themselves readily to distortion and must be reckoned with among the causes that make necessary a systematic examination of the action of the valves.

Correspondence Schools.

We find that not a few railway people cherish very strong sentiments against the managers of certain correspondence schools and that RAILWAY AND LOCOMOTIVE ENGINEERING receives a share of opprobrium in that connection which is entirely unmerited. Such schools of correspondence have aroused much animosity, by means of glib-talking solicitors who induce people to enter into written agreements to pay for an expensive school course which is generally away beyond the capacity and industry of ordinary men. When the would-be student begins to receive the instruction, mostly in the form of expensive books, he soon discovers that he has agreed to purchase something in the nature of a gold brick and regrets entering upon the agreement. But regrets are useless. The pretended educators have got his signature and they leave no means untried to compel him to deliver up the pound of flesh. The result is that all correspondence schools have aroused the hatred of thousands of people who have been bitten and of many others whose friends have suffered.

We have repeatedly referred to the educational features of RAILWAY AND LOCOMOTIVE ENGINEERING as our Correspondence School, and we regret to find that some people believe that we operate a correspondence school outside of our monthly paper. That is a mistake. The subscription price paid for the paper covers the whole expense of our correspondence instruction. We are free to assert that the instruction contained in twelve numbers of our paper is worth much more to a practical railroad man than any of the expensive courses that prove a heavy burden to carry.

Come, Step Into My Parlor.

Some of our manufacturers are impressed with the belief that an exhibition of American products to be held in Germany this year will be the means of opening new markets for our products. The Houghton Line regards the scheme as another case of the spider inviting the fly to step into its parlor. We share that view. We have been attending expositions great and small for the last forty years and have been forced to the conclusion that the promoters of such affairs were as a rule the only people to derive benefits. There have been a few exceptions, but the people who have pushed their business in the old-fashioned way of employing good salesmen and the ordinary channels of publicity have found themselves better off than those who have burdened themselves with expensive displays that attracted principally idle sightseers and people bent on imitation.

As a parallel of the German-American exposition, the Houghton Line says: Let us suppose that the Standard Oil Company would issue a proclamation that, as they did not make all varieties of oils, they would like to know the best and cheapest sources for varieties they did not make, and therefore for six months 26 Broadway would be open, free to all oil manufacturers for the purpose of showing to the Standard their products and how they make them. Does any one suppose that there would be a panic in the rush for space? Not even if the great John D. himself headed the invitation and agreed to be present in person. In fact, no one would have any sympathy for the fool oil manufacturer who would accept. Yet this is precisely what the German nation has offered to Americans.

Telephone Train Dispatching.

Train dispatching by telephone has been instituted on the main line of the Lehigh Valley Railroad between Easton and Penn Haven Jct., Pa. This installation is the direct result of the success of telephone dispatching on the Mahanoy and Hazleton division. It is found that communication between the dispatcher and the offices along the line is much less subject to interruptions and delays than it formerly was, and the movement of trains is smoother and more rapid. One hundred and fifty-two miles of line are covered by this system.

Strict rules govern the sending and the receiving of all messages. The number of trains and engines and the names of stations must first be pronounced distinctly and then spelled out in full. The person at the receiving end writes out the order from the dispatcher exactly as if it were received by telegraph. A feature that has proved of great value is the possibility of talking directly with engineers and conductors. This direct conversation enables the men to carry out orders with fewer mistakes than when they receive them in the form of a telegram.

By a device known as a "selector" the dispatcher can call any office he chooses, without calling other offices. In a general way the "selector" may be compared to the face of a clock, with the names of stations in place of the hours. Pointing the hand, or indicator, to "Allentown," for example, the dispatcher rings up that place without disturbing the agents in the offices at Bethlehem, Mauch Chunk, or any other station along the line. Since the installation of telephone service on the Mahanoy and Hazleton division, Dec. 6, there has not been a single failure among any of the 36 selectors on that divisions. The current for the operation is furnished from a storage battery of 100 volts, the voltage being constant at all times.

The difficulty of summoning the man at the receiving end, which is often present with the telegraphing system, is completely done away when telephones are used. Part of the scheme of operation of the "selector" is to make the gong in the desired station ring, and continue ringing, until the call is answered by some one. In the case of telegraphic dispatching, it is often necessary to adjust the relay to the changes in the weather. If a man in any office along the line wants to call the dispatcher he first pulls the telephone arm forward, places his ear to the receiver and listens. If the line is busy he waits for his chance, and announces his presence by depressing a foot switch and giving the name of his station. The dispatcher acknowledges the call by saying either "right" or "cut out"; the latter expression is equivalent to the more general one, "ring off."

The telephones are being installed gradually, on one section after another of the Lehigh Valley, so that the operation of the system may be thoroughly effective from the start. The results up to date, in the speed and smoothness of train movement have been very satisfactory. On the divisions equipped with telephones, telegraph facilities are still maintained for the handling of car reports and other communications not pertaining to the movement of trains.

Book Notices

INTERNAL LUBRICATION OF STEAM ENGINES, by T. C. Thomsen. Published by the Technical Publishing Co., London, England. 112 pages, 24 illustrations, cloth. Price, 75 cents.

The publications of the Technical Company are noted for their conciseness and freedom from involved jargon. These fine features are well sustained in the neat volume before us. The author is an eminent authority on the important subject of the lubrication of steam engines, and his repeated experiments have conclusively shown that a pint of ordinary oil will save a ton of coal, and really good oil will save much more. The chapter on the subject of steam engines using superheated steam is particularly valuable and well worthy the careful notice of all interested in this kind of steam engine.

Mr. G. A. Sekon, the well known railway writer, and Editor of the British "Railway Magazine" and "Railway Year Book," who inaugurated those publications nearly 13 years ago and has conducted them up to the present time, has severed his connection with them. Mr. Sekon is producing on popular lines a new illustrated 6d. Magazine—"The Railway and Travel Monthly"—which, as its title indicates, covers the whole field of locomotion, and will doubtless be welcomed by all interested in railways and railway engineering and operation, as well as by tourists and travelers generally.

The Twenty-third Annual Report of the Commissioner of Labor has just been issued from the Government Printing Press, Washington, D. C., and forms a bulky volume of 810 pages. The first chapter is entirely devoted to national and international labor organizations, and describes with a remarkable degree of fullness their administration, membership, benefits and insurance methods. The third chapter is also of special interest, particularly to railroad men. Railroad relief funds are tabulated and the different methods are fully illustrated. As a reference work for all who are interested in the subjects treated of it would be difficult to find another medium anywhere comparable to the report just issued. Copies can be had on application to the Commissioner of Labor at Washington, D. C. This book being issued by the government for the information of the public, is sent free to those who desire it.

The Second Annual Report of the Public Service Commission of the State of New York is issued in two octavo volumes averaging 800 pages each. The work of the Commission, although apparently cumbrous in its operation, has resulted in the promulgation of a uniform system of accounts of corporations, and in the multiplex details of railroad management there is gradually being established a general systematic method of accounting for which there was much need. Copies of the Report may be had from the J. B. Lyon Company, State printers, Albany, N. Y.

Picture Postcards of Old.

A long forgotten book entitled "Almanac de la Petite Poste de 1777" has just been discovered, showing that even then the picture postcard flourished in France. The Almanac reports as follows: "Demanison, the printer, has introduced pictorial cards containing room for short announcements or letters. These pretty cards are sent through the post like letters at a cheaper rate, and are all the vogue."

Railway Amidst Roman Mounds.

On the Haverhill branch of the Great Eastern Railway of England an interesting feature is the Bartlow Hills, estimated to be 1790 years old. When the line was built in 1865, the company was compelled to erect retaining walls and an arch between two of the hills, as shown in our illustration. There are seven mounds in all; three of them are very low, but the others consist of one larger mound, 93 ft in height and 147 ft. in diameter, having two smaller ones 69 ft. in height and 100 ft. in diameter on either side of it. All three of these are on the south side of the railway. On the north is another mound 45 ft. high and 100 ft. in diameter. For many years their origin remained a mystery, but in 1832 they were opened and found to contain stone coffins with bones and iron chains, also vessels containing liquid and other relics of Roman funeral rites, and the further discovery of a signet ring and coins showed them to have been Roman burial places in the reign of Hadrian. Hadrain was in Britain in the years 120 and 121 A. D., during which time the famous wall between Newcastle and Carlisle, dividing England from Scotland, was built

ANCIENT ROMAN MOUNDS AND MODERN RAILWAY LINE.

Laboratory Work.

Laboratory work was in early days practically confined to the chemist. Later, medical science sought in it for the experimental verification of its theories. Perhaps the latest branch of science to take up laboratory work has been physical science, and engineering has profited in consequence. Educational establishments have bent their energies in the same direction. In fact the experimental laboratory has gained a recognized place in any industrial establishment today.

It is just here, as the *Engineering Record* points out, that there is very often too much uncertainty in the results gained in a commercial laboratory. In fact our contemporary believes that the tendency of commercial laboratory work is toward slovenliness. The secret of good laboratory work in experiment or research is in the correct of control of conditions, precision in handling instruments and appliances and in analyzing data. Disturbing factors which may practically be disregarded in the laboratory may exercise a seriously modifying result when the miniature laboratory object experimented with, has been expanded to working proportions for operation in regular daily use outside, where it is supposed to do its work. Working conditions may only have a partial or incomplete reproduction in the laboratory, and in such cases an experimenter failing to realize such discrepancy might be misled.

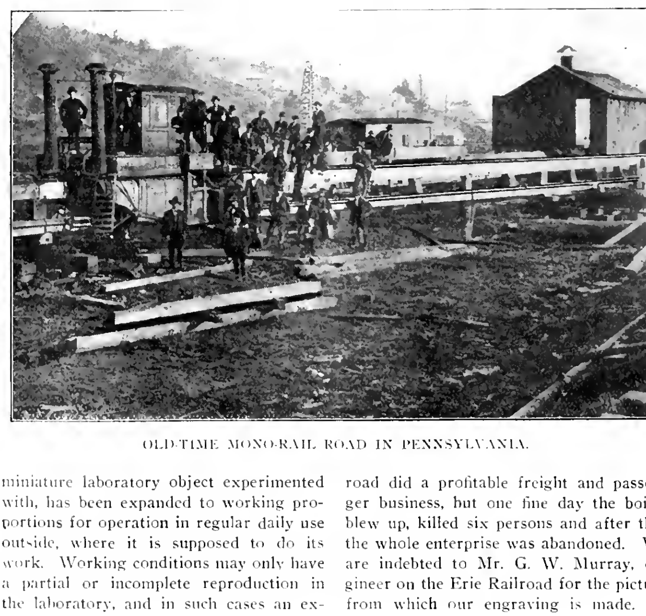
The experimental and research laboratory is one of the greatest helps in the advancement of science and it behooves all those engaged in such work to study accuracy and care to the highest point, particularly in conducting experiments which are necessarily removed from exigencies of business production.

Joint Railway Time Table.

The leading railway companies in Scotland, the Caledonian, Great North of Scotland, the Glasgow & Southwestern, the Highland and the North British, are discussing the propriety of issuing a joint public time table to take the place of the assortment issued by the various companies. Scotland is a small country and the idea is a good one. If it works well there it might be tried elsewhere with much profit to all concerned.

Old Time Mono-Rail.

Between the years 1878 and 1880 a rather curious railroad was operated between Stratford and Gilmour, Pa. This was a sort of mono-rail road, but it was long before the days of the gyroscope. The track looks more like a fence than anything else, but in reality it constituted what stood for permanent way. The upper part with rail on top supported the weight of the locomotive and the vehicles, the lower portion carried a guard rail on each side which prevented the engine and cars from tipping over. The section of the track was like the letter A. The road did a profitable freight and passenger business, but one fine day the boiler blew up, killed six persons and after that the whole enterprise was abandoned. We are indebted to Mr. G. W. Murray, engineer on the Erie Railroad for the picture from which our engraving is made.



OLD-TIME MONO-RAIL ROAD IN PENNSYLVANIA.

Applied Science Department

III.—The Steam Indicator.

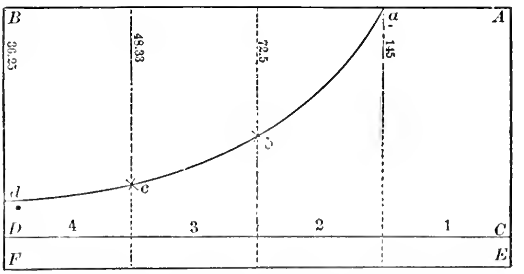
Having explained briefly the construction and method of using the steam indicator, and presented what may be called a descriptive diagram with an ideal outline of steam pressure curves, it remains to be more fully noted that the perfect diagram card is rarely described in steam engine practice and more especially in locomotive practice. The line traced by the pencil of the indicator necessarily varies under varying conditions of pressure. Not only are the diagrams of varying character as shown in the cards of different engines, but the cards vary materially even when taken from the same engine under different conditions. To the thoughtful observer this can be readily accounted for by observing the line carefully and comparing it either mentally with the perfect diagram that experience may have impressed on the mind's eye, or contrasting it with an ideal card as shown when an engine is running with the valve gearing perfectly adjusted, and the indicator in perfect condition.

The path through which the intelligent process of reasoning moves in the mind of the acute observer embraces the entire phenomena of the conduct of the steam in the cylinder. The degree of promptness with which the steam is admitted when the piston is at the end of the stroke, the apparent loss, if any, between the pressure of steam in the boiler and the pressure of steam in the cylinder. Then the loss by what is known as wire-drawing which is generally observable in the case of engines where the piston is traveling at a high velocity, and where the supply of steam fails to keep pace with the piston. Then the point of cut-off, or complete closing of the valve; this point is rarely as distinctly defined as it is in the ideal card, especially in engines where a sliding valve is used, and where the closing of the valve cannot by any kind of contrivance be so rapidly effected as in the case of valves having a short rotary motion as in the case of the Corliss valve and similar devices, which it may hardly be stated are not available for use on locomotives. Then follows the expansion line, the exact extent and character of which is also variable under variable conditions of service, and is particularly affected by the amount of back pressure with which the piston has to contend in its path towards the opposite end of the cylinder from which the expanding volume of steam that is rapidly diminishing in pressure is operating. There is also to be observed the beginning of the exhaust and a brief but comprehensive glimpse of the arrangements for the exhaust, indicating the amount and duration of the back pressure incident to the degree of readiness of release with which the pent up steam escapes into the outer air. In addition to these the point where the compression of the unexhausted steam that is still left in the cylinder is also to be observed, and the amount of that compression.

Thus it will be observed there are at least nine salient features to be observed in one stroke of the piston, and it will be readily understood that these features are doubled and rarely exactly duplicated in the returning piston stroke and any apparent variation in the lines marking the two strokes are full of significance, each telling its own story and pointing it may be to more or less error and consequently showing defects in construction and adjustment which if properly observed and remedied, contribute greatly to the economic use of steam, as well as effecting a saving in the wearing parts of the engine.

To these should be added variations that may occur by reason of defects in the mechanism and working of the indicator itself. These, although of rare occurrence, sometimes happen and their effect is very misleading unless detected and remedied. We shall allude to these as we go more fully into the subject. Meanwhile before illustrating some of the variations that are observable in indicator diagrams it might be well to estimate the mean pressure of steam used in the cylinder during one stroke of the piston. This can be readily accomplished by dividing the diagram into a number of equal parts as is shown in the accompanying illustration. One line will be observed as passing through the point of cut-off, which has been placed at one-fourth of the stroke, the other three lines being at equidistant positions, dividing the diagram which represents the cylinder into four equal parts.

Now supposing that the cylinder is 24 ins. in length, the cut-off point occurring when the piston has moved 6 ins. It will be readily understood that during this part of the piston stroke the pressure of steam on the face of the piston will be at or nearly at boiler pressure, and supposing this to be 145 lbs. per sq. in. When the valve closes, and the piston continues to move on its path the pressure of the enclosed steam decreases in a ratio to the distance traveled, so that when the piston has traveled 6 ins. further the pressure will have decreased to 72.5 lbs. per sq. in. When the piston has moved 18 ins. on its course, the steam will then occupy three times its original space and consequently will have fallen in pressure to 48.33 lbs. and so until the end of the stroke has been reached when the pressure will have fallen to 36.25 lbs. per sq. in. The mean or average pressure may then be found by adding these four varying estimates of pressure together and dividing the total by four, which would give an average pressure of 75.52 lbs. per sq. in., or a little more than one-half of the boiler pressure. In this calculation we have not made allowance for the steam wasted in clearance and in condensation and possible leakage. These items all tend to reduce the average pressure on the piston, so that in all calculations looking to estimating the horse power of an engine, it is safe to deduct ten per cent. of unavoidable loss in steam engine practice.



INDICATOR DIAGRAM DIVIDED SO AS TO FIND M. E. P.

Celebrated Steam Engineers.

XXVIII. Zerah Colburn.

The Lowell Machine Shops were the oldest locomotive shops in New England. It was here in 1847 that a fifteen-year-old farmer's boy, named Zerah Colburn, began his apprenticeship as a machinist. His education was of the poorest, but he brought with him the discerning eye, the impressionable mind, and an enthusiasm that marked him from the beginning of his engineering career as possessing the keenest intellect coupled with an industry that was tireless. In a few years he was not only one of the most expert machinists in New England, but he was among the foremost draughtsmen in America. He moved from place to place with the restlessness of youth. He was for some time superintendent at Souther's locomotive building works in Boston.

He was engaged for some time in the shops of the Concord Railroad, and his services as mechanical engineer were much sought after on several of the leading railroads. He early exhibited a fine discrimination in the co-relation of the various parts of the locomotive. The mystery of breakages in the early locomotives was solved by him very successfully, and a juster proportion of parts than anything hitherto accomplished manifested itself wherever Mr. Colburn was employed. These details in construction would appear trivial and common in the light of the larger experience in mechanism in the present century, but they were of vital importance in improving the efficiency and reducing the cost of the early locomotives. He could easily have attained the very highest position as a locomotive constructor, and he rejected many offers of lucrative positions.

It was while moving from place to place at this busy period that he began writing articles to the current technical journals about the work on which he was engaged. He was among the first and most successful in making engineering subjects absorbing in interest. Gifted with a fertile imagination, and rich in fancy, he had a gorgeousness of language that was something new in engineering writing.

Colburn became at an early age not only a master in mechanism, but also a master of classic English. He gave vocal utterance to the great work of harnessing the steam engine to the transportation problems of a new Continent. As editor of "Colburn's Railway Advocate," he became an authority of national importance on railway subjects. He established the "Engineer" in Philadelphia, and latterly was chiefly instrumental in founding "Engineering" in London. The latter illustrated weekly soon became the leading engineering magazine published in the British Empire. He was also the author of a monumental work, "Locomotive Engineering and the Mechanism of Railways," which was for many years the standard work on the subject.

As might be expected his analytical mind ran with mercurial swiftness through the intricate mazes of the diverse performances of the various types of the early locomotives. He was the first to advocate the increase of grate surface, and while holding the position of mechanical engineer with the New Jersey Locomotive and Machine Company, he found an opportunity to put his theories into practice. He designed a number of locomotives with fire boxes 7 ft. 6 ins. wide and 6 ft. in length. These were considered very powerful engines at the time, having cylinders 18 by 24 ins. and equipped with boilers having ample heating surface to fully supply steam for the cylinders.

This was in 1855, and although Mr. Colburn's original plans were not closely adhered to by his successors it is a remarkable fact that his general scheme of increasing the fire box to the widest possible capacity has latterly met with approval. The question of how far his plans influenced the design of the Wootten fire box and other similar forms has been much discussed, but the general opinion is that Colburn was the first to demonstrate the advantages of the wide fire box and all subsequent alterations or alleged improvements have merely been the natural outgrowth of the necessities arising from the increased size of the modern locomotives.

It may be stated briefly, however that it was not so much the value of any particular improvement that Mr. Colburn effected in the mechanical appliances used on railways as it was the clarifying effect of his writings. He was a great educational force. He raised machine shop and roundhouse discussions to the dignity of literature. He gave a philosophic impulse to mere manual labor. By his influence railroad men talked less and read more. He was a pioneer in the field of engineering journalism and set a standard of excellence which has been a mark for others that have followed in the same field, but which has not been surpassed.

Questions Answered

INCREASE OF LEAD OR PORT OPENING.

28. G. H. C., Topeka, Kan., writes: I have been carefully studying Mr. Kennedy's new book, "The Valve-Setter's Guide," and it contains more information in less bulk than anything I have ever seen on the subject. There is one point, however, that I would like further information upon, and it would be of valuable service to us if you would kindly explain how we can increase the lead or port opening, and where should we make the changes, that is, assuming that the valves are already adjusted to give ¼ in. port opening at the end of the piston stroke, what should we do to increase the port opening to 5-16 in. front and back on a locomotive equipped with the Walschaerts valve gear?—A. This is not, properly speaking, a valve-setter's job. This is the work of the constructing engineer. If the valves are square at all of the openings with one quarter of an inch lead, and it is desired to increase the opening to five-sixteenths of an inch, this can only be done by making a change in the combination or lead lever. If the locomotive is placed on one or other of the dead centers it will be observed that the combination lever is then in its extreme angular position, and the distance between the two upper joints of that lever determines the position or amount of opening of the valve. If the valve rod is coupled to the pin on the top of the lever as is the case with engines equipped with outside admission valves, it will be necessary to increase the distance between the two upper joints referred to. We could not state definitely the exact amount of increase unless we knew the entire length of the lever and the co-relation of the parts to which the lever is attached, but presuming that the lap of the valve and the amount of port opening are together equal to one inch, and the distance between the two upper joints of the combination lever is four inches, it follows that if four inches has moved the valve one inch from the central position, the distance between the two upper joints would have to be increased one quarter of an inch in order to move the valve one sixteenth further in the direction desired. As we stated this is a constructor's job, and it would be safer to experiment with a new combination lever rather than attempt blacksmith work on a part of the valve gearing where the joints are so near to each other and where it would be almost impossible to avoid a distortion of the exact parallel at which the joints should be maintained.

BROKEN AIR PIPE.

29. R. R. D., Philadelphia, writes: If we break the balance pipe on the second engine when double-heading, can we plug both ends of the pipe and allow the brake valve handle to remain in running position without danger of unseating the rotary valve, or is it necessary to cut the brake valve in, to get air on top of the rotary valve, then lap the valve, plug the train line exhaust and disconnect the release pipe at the distributing valve?—A. Assuming that the balance pipe referred to connects the large end of the Pennsylvania cut-out-cock with the brake pipe, it is only necessary to stop the leak at both ends of the break and proceed. Slight leakage at the rotary key gasket or at the union connection of the reservoir pipe would be supplied from the feed valve pipe which would be connected with the brake pipe, the air pressure unseating the supply valve and flowing backward through the feed valve.

An effective way to stop the leak from the end of the pipe connected to the cock would be to place the handle of the cock in a position half way between open and closed and wedge it in this position. Under the foregoing conditions should a leak drain away the pressure above the rotary valve faster than it could be supplied by the limited amount backing through the feed valve, the brake valve rotary would be unseated and must be placed on lap position and the reservoir cock opened, and in order that the brake can be released by an increase of brake pipe pressure the release pipe must be disconnected.

It would not be necessary to plug the brake pipe exhaust as the engineer who will follow this up and knows why he is doing it, will have no difficulty in seating the equalizing discharge valve if it is at this time forced off its seat by an increase of brake pipe pressure during a release of the brakes.

CENTER OF CYLINDERS.

30. C. R., Sunnyvale, Cal., asks: Why is the center point of the piston rod and crosshead usually placed a little higher from the top of the rail than the center of the shaft of the driving wheels; why are they not in a perfectly horizontal line with each other?—A. The horizontal center line of the cylinders is usually placed above the center line of the driving axles for the purpose of giving the truck more room, especially when the engine is going round a curve. By keeping the cylinders slightly higher, the designer can place cylinders in line with main crank pin, using a shorter pin than if he brought the cylinders low and had to keep them well away from the wheels. Raising cylinder center line helps a little in both these ways.

BALANCED COMPOUNDS.

31. R. L. C., Ceres, Cal., asks: Are balanced compounds at the present time looked upon with as much favor as they were formerly? Is the saving in fuel on such an engine more than the additional expense incurred in keeping the cranked axle and inside main rods and braces in good repair, especially on an engine with looped inside main rods?—A. The balanced compounds of which you speak have not been used extensively in this country. We have no data at hand showing the expense of maintaining the inside main rods and brasses in repair.

PRESSURE IN BRAKE CYLINDERS.

32. R. R. D., Philadelphia, writes: Why is it that on an engine equipped with the H-6 brake, having an auxiliary reservoir and triple valve on the tender a full application of the brake results in a constant escape of air at the high speed reducing valve on the tender?—A. It is due to the fact that the safety valve of the distributing valve is adjusted to maintain a higher pressure in the application cylinder than the reducing valve is adjusted to retain in the tender brake cylinder.

In order to avoid this, the adjustment of the high speed reducing valve must be increased to equal or slightly exceed that of the safety valve, or the adjustment of the safety valve must be lowered to a figure slightly less than that of the reducing valve.

If there are no special instructions covering the adjustment of pressure controllers under such circumstances, the air brake instructor should decide upon the course to be pursued.

If the engine and tender were equipped with the E. T. brake when built we would recommend that the safety valve remain set at 68 lbs., and the high-speed reducing valve be set at 70 lbs. However, if the tender had been built and equipped, and goes with an engine having the combined automatic and straight air brake, a man not knowing the percentage of braking power, the cylinder pressure it is based upon, or brake pipe pressure employed, it would be impossible to offer any suggestion relative to the adjustment of the pressure controllers.

DEGREE OF CURVATURE.

33. G. A., Apalachicola, Fla., writes: Please define a ten degree curve?—A. When speaking of railway curves the number of degrees which enclose an arc of 100 ft. gives the degree of curvature. In a ten-degree curve 100 ft. subtend an angle of 10 degs. This gives a radius of 572½ ft.

WEIGHT OF TRAIN.

34. G. A. Apalachicola, Fla., writes: When a thousand ton train is spoken of, does it mean that the train weighs that much on the scales or does it mean the draw-bar pull?—A. A thousand ton train means weight of train behind the tender—not draw-bar pull.

First Aid on the C. P. R.

One of the most popular movements on the Canadian Pacific Railway, of recent organization, is that of first aid to the injured, as carried on under the auspices of the St John Ambulance Association. First of all, the question, "What is first aid?" is best answered by stating what its objects are. To teach people, outside of the medical profession, to render assistance to any person suffering accident or sudden illness until the arrival of the doctor. To teach people what not to do in case of accident, so that there shall be no likelihood of a sympathetic but ignorant public causing unnecessary pain and suffering through improper treatment. That in case of emergency, that is, bleeding, poisoning, choking or drowning, a life may not be sacrificed for the want of a little elementary knowledge on the part of the bystander.

The Canadian Pacific Railway Centre of the St John Ambulance Association have, for some time past, realized the value of this movement to their employees and to themselves, as is seen from the fact that they have a large and complete organization at their works in Montreal, both in the car and locomotive departments, and now every shop has its quota of ambulance men, so that no matter in what part of the works an accident may happen there you will find an ambulance man, ready and willing to give immediate help.

The cost of instruction and the books and first aid material necessary are furnished by the management free of charge.

The class is taken in hand by one of the company's instructors, whose duty it is to teach the practical work, such as the proper application of bandages and splints to various parts of the body and lifting and carrying the injured on stretchers, etc. Before the instructor allows his class to go up for final examination they are expected to answer a series of test questions and to do the practical work in connection with them.

As soon as the instructor considers the class ready for examination he makes his report to the proper quarter, and a medical officer of the Canadian Centre of the St. John Ambulance Association is appointed to examine the class as, for obvious reasons, no lecturer is allowed to examine his own class. After the examination the men are given one hour per week in which to meet together for practice, and are by this means kept up to a proper state of efficiency; also, at stated intervals the men are inspected by a medical officer appointed by the management so that the company can find out for themselves if their men are up to the mark and able to do the work required of them.

One thing strictly impressed on all ambulance men is the exact relative position first aid has to the medical profession. The ambulance man is given clearly to understand that he is not expected, or in a position, to supplant the doctor, or to treat any accident to its final solution, for the simple reason, the work of the ambulance man ends where the doctors begin. As an incentive to employees to obtain the certificate, the management grant certain privileges. For instance, other things being equal, the man holding a first aid certificate has preference of employment, preference for promotion and also granted an extra pass over and above the usual annual pass and on the same conditions.

Mr. Lacey R. Johnson, assistant superintendent of motive power, is the chairman of this organization on the Canadian Pacific and Mr. S. A. Gidlow is secretary.

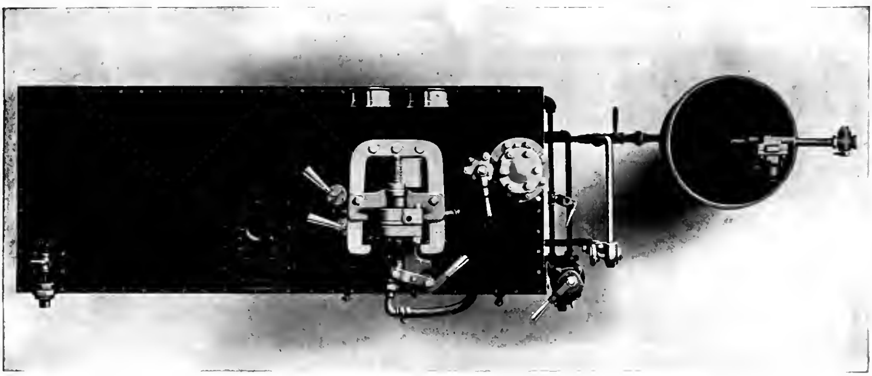
Air Brake Department

Conducted by G. W. Kiehm

Triple Valve Test Rack.

Our illustrations consist of a photograph of the improved Westinghouse Triple Valve Test Rack. The upper view shows the clamping device which is operated by air pressure. This rack is for testing the following types of Westinghouse triple valves, F24, G24, F25, F1 (H24) F2 (F46), H1 (F36), H2 (H49), P1 (F27), P2 (F29), M1, M2A, R1, R2, L1B, L2A, L3, K1 and K2.

The tests that are conducted are: (1) charging test; (2) leakage; (3) retarded release feature; (4) application test or service sensitiveness; (5) packing ring leakage; (6) friction test; (7) service port capacity test; (8) by pass valve, safety valve and graduated release test. While the space in this issue will not permit of a complete description this very important machine will be referred to in the following issue.



TOP VIEW OF WESTINGHOUSE TRIPLE VALVE TEST RACK.

Triple Valve Tests.

The triple valve testing machine, or test rack that is used in all up-to-date air brake repair rooms is considered by air brake men to be an absolute necessity even if the air brake equipment is to be maintained in only a reasonable, not to say, a high, state of efficiency.

There is no question but that these opinions are correct and it is a well known fact that a triple valve that applies and releases perfectly among 10, 15, or 20 other brakes gives no assurance that it will do so when it is coupled with 60 or 80 other brakes in a train of cars, and such being the case it naturally follows that better workmanship and a more rigid and exacting test is required at present than was altogether necessary in the past. It is very gratifying to know that many repair men would no more think of placing a repaired triple valve in service without first testing it on the rack than they would think of again placing it in service without cleaning and examination. Many are inclined to think that the repairman of the past or the man who repaired triple valves before the introduction of the test rack, or without modern facilities merely filed-down the slide valve and seat a little, hunted up a ring that would make a pretty fair fit in the bushing, ground it for a few minutes—and then considered the triple valve ready for service.

This may be correct in some, but not in all cases, because the average railroad mechanic when brought to face a situation and to know what is expected of him, will without doubt devise the means if within the range of possibility. If his company insists that he repair triple valves in a manner that will insure satisfactory service and yet furnish him with no means of determining whether the valves will do it, he will likely get up some sort of test of his own.

The writer has been employed in shops and engine houses where there were no facilities whatever for testing triple valves or any other parts of the air brake apparatus, and like a great many others, he has often found the locomotive or car due to leave about the same time he could finish the piece of work. This left no time for even an application or release test on the locomotive or car. Under such conditions a cleaned or repaired triple valve was given an improvised test while being assembled. Realizing that the efficiency of the triple valve depended principally upon tightness of the slide valve, graduating valve, check valve, triple piston packing ring, the capacity of the feed groove, freedom from undue resistance to motion and leakage to the atmosphere, the following form of test was usually applied.

After the check valve and seat was cleaned or ground to a bearing it was tested by removing the drain plug from the check valve case and filling the case above with water, if no water appears at the drain plug opening in a reasonable length of time the valve was considered tight, and was then bolted to the valve body with emergency valve, spring, piston and guide in their proper positions. The piston and slide valve were then placed in the bushing dry or without any lubrication and worked back and forth a few times, then the slide valve was tested for a leak from the triple exhaust port, by drawing the piston back just far enough for the slide valve to close the ports in the seat and by placing the mouth over the triple exhaust port and sucking out all the air in the exhaust cavity a vacuum would be created and the tongue or lips would adhere to the port if the slide valve was tight. If the slide valve leaked, the leakage would prevent the formation of, or quickly destroy the partial vacuum depended upon for the test. If the lips adhered to the port while the piston and valve were drawn to the end of the bushing and forced back several times the slide valve was considered tight and the piston was shoved against the slide valve end of the piston bushing and the hand held tightly over the brake cylinder port, the exhaust cavity would then be in communication with the cavity y, and if the same conditions just stated could then be obtained, that is, if the lips would then adhere to the exhaust port, the left hand being held tightly over the exposed brake cylinder port, the emergency valve and check valve case gasket were also considered free from leakage.

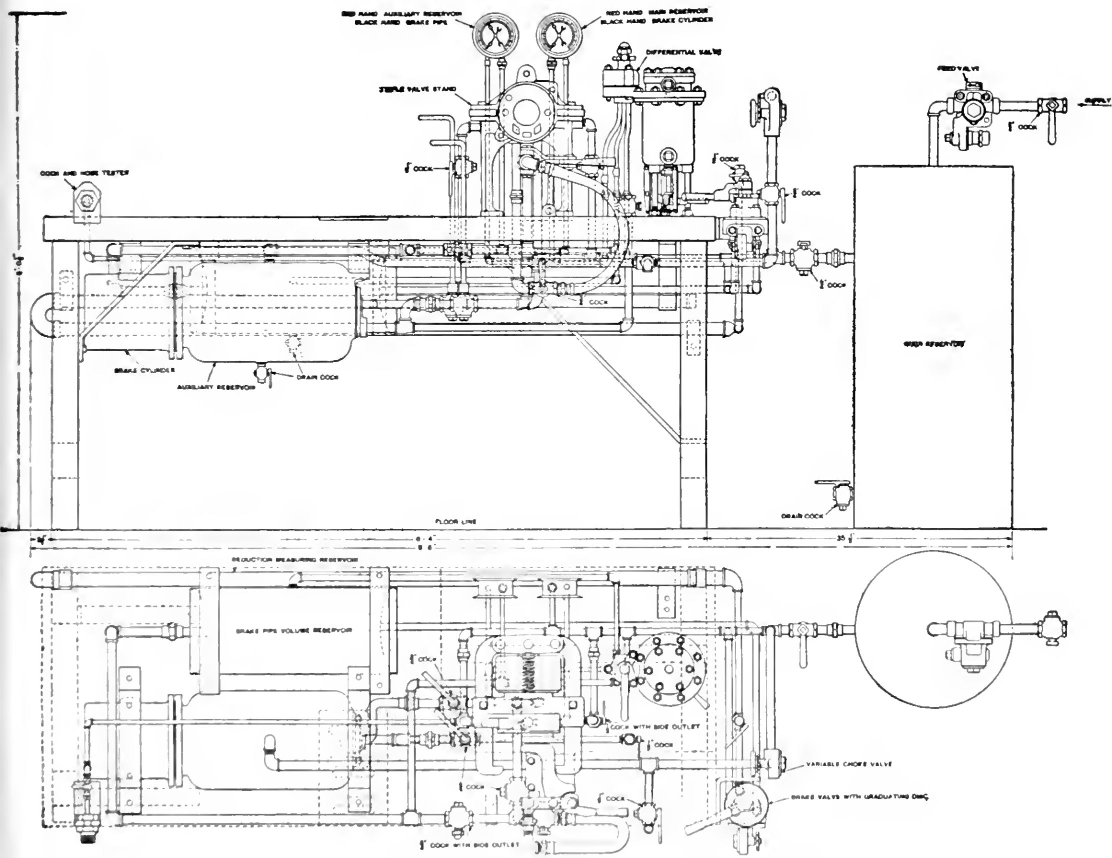
If everything was satisfactory up to this point the triple piston packing ring was tested by lubricating the slide valve and piston bushing, the piston bushing rather freely, and holding the left hand tightly over the end of the slide valve bushing and forcing the piston hard toward release position, a perfect cushion would be formed if the ring was tight, the slide valve having already indicated that it did not leak, and if the packing ring leaked the fact would be indicated by the hiss of escaping air or by bubbles showing in the lubricant at the edges of the piston, when the piston was finally forced against the slide valve bush, then the puff of escaping air that is noticed is from the feed groove.

Frictional resistance to the movement of the slide valve and piston was of course a matter of judgment. With a slide valve and seat having perfect wearing surfaces, and a slide valve spring of the proper tension and a properly fitted packing ring there will be no undue resistance to motion. If there was this resistance it takes but an instant to reverse the piston in the bushing to determine whether the packing ring or slide valve spring were at fault, and when the triple valve had apparently passed this test it was considered ready for service after the excessive lubrication having been removed from the piston bushing and the back cap bolted to the valve body, the condition of the feed groove and back cap gasket being a matter of observation rather than test.

In cleaning the feed groove a pointed piece of wood was used rather than metal to avoid the possibility of enlarging the groove and the use of the slide valve spring with sharp worn edges was carefully avoided, the graduating valve was tested like the slide valve.

There is no intention whatever of suggesting the above as a substitute where there is no test rack for cleaned and repaired triple valves, for the test rack has undoubtedly become a necessity, and an essential part of the apparatus used for air brake maintenance. It tests triple valves under working conditions, shows the resistance to movement under pressure, shows the capacity of the feed groove and packing ring leakage in pounds per minute which is something definite, and it makes satisfactory repair work a possibility. In fact there are test racks in use that show frictional resistance to the movement of the triple piston in inches of vacuum.

It is neither the intention of the writer to uphold the repairman of the past or criticise the repairman of today, but in spite of some of the poor repair work of the past the air brake usually operated in a very satisfactory manner, and at the present time improvement and increased facilities have placed the air brake equipment in the best condition it probably

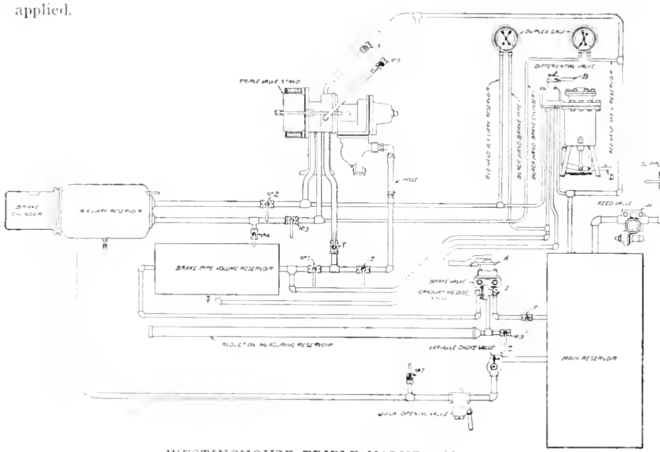


FRONT AND TOP SECTION OF WESTINGHOUSE TRIPLE VALVE TEST RACK.

ever has been in. All this is notwithstanding the fact that today one can go through a freight yard or repair shop and find passenger triples in freight service, triple piston of a P1 (F27) valve in an H1 (F36) valve body, check valve springs from 1¼ to 2½ ins. in height, and springs in the back cap, one might almost say varying from a coiled hair pin to a throttle latch or a reverse bar spring. It is repair work of this kind which constitutes one of the many problems that we have always with us.

Broken Air Brake Couplings.

The average individual having but a casual interest in the subject of parted trains and broken couplings, overhearing some of the discussions relating to this matter, would likely arrive at the conclusion that the air brake would be of valuable assistance in stopping a train if it could in some way be prevented from tearing the train in half every time it is applied.



WESTINGHOUSE TRIPLE VALVE TEST RACK.

No doubt trains have been parted by a triple valve moving to emergency position when a service application was intended, but it is absurd to attempt to create the impression that the train will be parted every time the brake is used in the quick action position or every time quick action occurs. No doubt a quick action application starting from the rear of a train is more likely to part it than one starting from the front end, but if the train has once parted quick action is pretty sure to occur if the parting is between air braked cars.

Undesired quick action is but one of the air brake defects that has a tendency to part a train, a short piston travel at the rear end of a freight train and a long travel at the head end, a defect of the triple valve or retaining valve at the rear end that would prevent the exhaust of brake cylinder pressure in a reasonable length of time or a defective brake valve, are also among the defects of the air brake that are liable to part a train.

A defective or cut out driver brake can under certain conditions set up a greater strain on the couplings than the pull of the engine in attempting to start a train, for in starting the train the engine can exert but its maximum tractive effort, while the inoperative driver brake can in some cases allow the entire weight of the engine to be thrown on the couplings. It is sometimes a very easy matter to shift the responsibility for a broken train on to some defect of the air brake equipment but the condition of the draw gear itself and the make up of trains are often the reverse of what they should be, and the manner in which the train and engine are handled is by no means the most remote cause of parted trains.

Opening the engine throttle before the brakes have had time to release is often responsible for broken couplings in spite of the fact that the manufacturers of the brake have for years attempted to impress upon the minds of all concerned the importance of this matter, and it requires but a little thought and attention to observe that more time must be allowed in which to release the brakes on a train if leakage or the condition of the pump allows but a little or no excess pressure, than would be required if the pump is in good condition and there is a high main reservoir pressure to release the brakes with.

Severe strains to the draw gear and break-in-two can also be caused by releasing at low speeds, attempting to release the brake before the application is actually completed, using the quick action application at low speeds, or in fact at any time as well as catching an engine that is slipping, by the use of sand. The importance of uniform travel of the brake cylinder piston or rather the effect of unequal piston travel as a factor in parting trains is invariably ignored because the travel, unless slack adjusters are used, is always more or less unequal, and it is not given the attention it should be as it is constantly increased by wear, therefore requires continual adjustment.

It is not unusual to find in a train of freight cars, some pistons traveling 5 ins. and some 10 ins. In fact, it is the rule rather than the exception and it is a well known fact, that by calculating from the ordinary locomotive gauge, a brake pipe reduction of 10 or 12 lbs, results in a brake cylinder pressure of about 20 lbs. per sq. in. in a brake cylinder with 10 ins. piston travel while the same reduction results in practically a full brake cylinder pressure of 45 or 50 lbs. in a cylinder with 5 ins. piston travel.

In pursuing an investigation along the line of rough train handling or broken trains, a matter of this kind cannot be ignored, and this important part of air brake maintenance is likely to be neglected until some rigid rules relative to the matter are strictly enforced. Leaky brake cylinders are even worse in this regard than the unequal piston travel, both having about the same general effect in producing shocks to trains, but the unequal travel is preferable for a continued reduction will at least result in some braking power. Brake cylinder leakage and improper piston travel on the engine and tender does not have this effect when the engine is equipped with the E. T. brake, but a misuse of this brake can produce worse effects than those it was designed to overcome.

The engineer is in the best position to determine the cause of break-in-two, and to handle trains, in a manner that would tend to reduce to a minimum, the effect of those troubles. Such a man requires experience as well as knowledge and good judgment, and neither the manufacturers nor air brake men ever attempt to explain except in a general way, how different trains should be handled, because grades and curvature enter into the matter and the condition of the brake itself is one of the most prominent factors in determining the correct manipulation of any brake.

Consolidation.

A correspondent having asked the origin of the name "Consolidation," as applied to locomotives and similar questions, we sent him our illustrated card showing different types of locomotives. We feel called upon to give more particulars about the origin of the word "Consolidation" in that connection. The first Consolidation engine was designed by Alexander Mitchell, then master mechanic of the Lehigh & Mahoning Railroad. Just about the time the 2-8-0 engine was completed the Lehigh & Mahoning was consolidated with the Lehigh Valley, and the name "Consolidation" was given to the engine in honor of the event.

Electrical Department

Inspection and Repair of Motor Cars.

By W. B. Kouwenhoven.

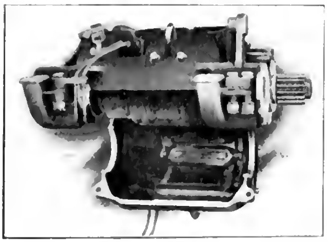
Thorough inspection and repair of railway equipment at regular intervals does much to decrease the depreciation of apparatus and to increase its life. It also lessens the delays caused by break-downs with their resulting blockades. The articles appearing in the February and March number of the Railway and Locomotive Engineering on the New York Subway Control, made clear the fact that in reality the duties of the motorman and those of his brother, the locomotive engineer are very much alike. In the same way the repair shops of an electric road takes the place of the round house of the steam road. A large portion of the equipment of an electric motor car is placed underneath the body of the car. This makes it necessary to provide a number of pits in the repair shop in order that the repair gang may have easy access to this part of the equipment.

The cars when sent to the repair shop, should first be thoroughly cleaned and the windows washed. A test should always be made for live parts. Some times the insulation becomes worn and a live wire comes in contact with some metal part of the car body or frame. Now all the metal parts of an electric motor car should make good electrical contact with each other and the tracks, but this cannot always be depended upon. For instance there may be some part, such as the master controller-cover or an iron door sill, which makes such poor contact with the trucks and other steel parts of the car, that for all practical purposes it may be considered as insulated from them. Iron rust forms a fairly good insulation, and the metal parts of a car that once made good contact, may in time become so corroded with rust, that this contact is defective. The object of having metal car body and parts make contact with the truck at all times is a safety feature.

If a live wire wears through its rubber coating and comes in contact with some of the iron work on a car in which all the metal parts make good contact with the running rails, a short circuit or ground, as it is usually called, will result. A short circuit or an electric railway is generally spoken of as a ground. A ground when formed at once makes itself known and calls for immediate action. If all the metal parts of the cars are not making good contact with each other, and a live wire comes in contact with one of these parts, it also becomes alive or charged, as it is usually called, and forms a source of very grave danger to workmen and others.

This is doubly dangerous because the charged portion gives no indication that the electric current is present until some person makes contact with it. When a car becomes charged and is sent to the repair shops it should be very plainly marked in order to prevent any of the men whose duty it is to sweep out the car and clean the windows from entering the car. It is never safe to make personal contact with the third rail current, a man will at least likely receive a heavy shock if not a more serious injury.

When a car comes into a shop for overhauling a test should be made for live parts. To do this a bank of five incandescent lamps connected in series may be used. One terminal of the bank of lamps is connected with the running rail, and with a wire connected to the other terminal a man goes about the car touching all the metal parts. If the bank of lamps fail to light everything is all right. If, however, he find on touching some metal part that the lamps light up, then he knows that that particular part of the car is alive. The slippers, which are pieces of board, are then placed between the third rail shoe and the third rail, and the wires in that part of the car that is alive are then carefully examined and the necessary repairs are made.



MOTOR OPEN FOR INSPECTION.

In overhauling the motor equipment, the motor leads are first disconnected from those of the control circuit. Some railway companies solder the control wires and the motor leads together. Others, instead of soldering them, employ a connection box containing heavy lugs in which the leads may be securely clamped together. It is a very simple matter to remove the leads with such an arrangement. After the leads have been disconnected, the field frame is unbolted and opened and the armature is then removed. The armature is now thoroughly cleaned by an air blast which forces out any dust that may have lodged in the winding or ventilating passages.

The armature is then carefully tested for insulation, grounds, short circuited coils, broken coils, and other troubles. The insulation test consists of applying several thousand volts to the armature, one wire of the supply being connected to the commutator and the other to the armature shaft. This test voltage is much higher than that which the armature works under in practice, and if there are any weak spots in the insulation they will give way under the strain and can then be repaired. If the armature withstands the test voltage satisfactorily, then there is not much danger of its failing from this cause when on the road. This insulation test, in which the high voltage is applied to the armature windings in the repair shop, finds an almost identical test in the round house. The test referred to is the one in which a high pressure is applied to the boiler shell to see if it will safely carry its working pressure. This is the ordinary hydrostatic test. If no leaks develop and the boiler withstands the strain produced by the high pressure, it is declared safe. In the same manner, if the insulation or the armature satisfactorily withstands the strain produced by the high voltage, it is also declared safe. Thus boiler shell and insulation can be relied upon to withstand their normal working pressure for some time.

If, upon testing, any of the coils are found to be broken or burnt out, they are removed from the armature and replaced by new coils. In soldering the new coils to the commutator bars a resinous flux is used because an acid flux would be very injurious to the insulation. The phosphor-bronze bands that hold the armature wires in place are carefully inspected to see if any are broken. After this the commutator is thoroughly cleaned from any accumulation of carbon dust, oil and grit that may have collected. If the commutator is rough or if there are bars that are higher than their fellows, the armature is placed in a lathe and light cuts are taken over the commutator. The commutator is then carefully filed and sand papered until it is perfectly smooth and bright. Emery cloth is never used for this purpose, because small particles of emery often become lodged in the mica that separates the commutator bars. These particles ruin the insulation. The armature is then given a thorough coating of some air-drying insulating varnish.

The brush holders and the field frame are next carefully cleansed from dust and grit. If the brush holders show wear or are burnt on the commutator side, or are rough, they are filed smooth and clean and painted with some insulating varnish. The field windings are tested by the repair gang for insulation, short circuits, broken wires and grounds, as in the case of the armature windings. If a field coil winding is defective or damaged it is either removed and repaired or else replaced by a new coil.

The motors are now reassembled, new brushes are put in place and the contact springs are adjusted. The repair gang then turns its attention to the rheostats, the contactors, the third rail shoes, and to the other parts of the motor equipment. A piece of asbestos board fastened on the car bottom above each rheostat affords a very excellent protection against fire. If any rough places are found on the contacts they are filed smooth and the entire equipment is put in good shape.

The controllers should be examined very often, as they get out of order more easily than any other part of the car. The repair man first removes the cover and proceeds to the inspection of the controller proper. Each finger and contact strip receives careful attention. The fingers sometimes bend and then jam against the contact drum or cylinder and prevent its rotation. The badly burned and worn fingers are replaced by new ones. New contact rings are placed on the drum wherever needed and any contact rings or fingers that are found to be rough are filed smooth. The tension of the fingers is carefully adjusted by the workman. All the insulation and wiring is carefully cleaned from dust and then given a coat of insulating varnish.

The car wiring, the train line, and in fact all the wires on cars of modern design are either run in iron pipe conduit or else in flexible conduit, and the system is as nearly fireproof as possible. The switches and fuses are also grouped in one fireproof box. The repair gang carefully tests all the circuits and replaces any lamps that may be burnt out. If any wires are grounded or broken they are carefully repaired.

The leads that run from the car body to the motor deserve very careful attention. The trucks, on which the motors are mounted, swing in rounding curves; this places severe strain on the insulation due to the bending and chafing of the wires. This chafing and bending is liable to cut and wear through the rubber insulation and cause a short circuit or ground. One very good way of reducing this difficulty is to mount a hard wood block on the motor frame and a block on the bottom of the car near the king-pin Holes about 2 ins. apart are bored through the blocks to carry the wires, and the slack is arranged in either an S- or a U-shaped loop. The nearer that the block on the car is to the king-pin, the less the relative motion and wear on the insulation will be. Repair men often wrap old pieces of rubber hose or canvas about the leads to protect them.

The bearings on a motor car are just as important as they are on a steam locomotive or coach, and the need of good lubrication is just as great. Additional inspection is required by the armature bearings, in order that they may not become so badly worn as to let the armature rub on the field poles. If this took place it would quickly ruin an armature. Wool waste thoroughly saturated with oil is considered the best method of lubricating bearings, and is used almost exclusively on electric roads as well as on steam. Some of the early electric roads made a large number of experiments of different lubricants and methods. They finally arrived at the same conclusion that the steam roads had arrived at years before. It would have saved time, trouble and expense if they had accepted the work already done by the steam roads. Electric practice has sometimes unnecessarily endeavored to blaze a new trail.

Three classes of wheels are used on motor cars, namely, cast iron, steel-tired, and solid pressed steel wheels. These three types are also used on steam roads. Flat wheels are of common occurrence on roads where the traffic is heavy, the grades steep and the stops frequent. The wheels are usually trued up by grinding.

The question of when and how often a motor car should be inspected and repaired is just as important as the method and thoroughness of the inspection and repair itself. There are two methods of determining when a motor car needs inspection and repair. One is based on the time elapsed between the visits to the repair shops and the other is on the mileage system. By the first method the cars are inspected every three or four days and completely overhauled and repaired once every twelve or fourteen months. By the mileage system the cars are sent to the repair shops after they have run a given mileage and are then put in perfect repair.

On some electric roads the depreciation of the cars when they are out on the road in charge of the motorman is enormous.

If the motorman on these roads was held personally responsible for a train and its equipment when in his charge, just as the locomotive engineer is held responsible for his engine, the results would probably be different.

Electric Locomotive for the B. & O.

During the present year the service of the B. & O. tunnel has demanded a further enlargement of the electric locomotive equipment and a new contract was placed for two additional locomotives to meet the requirements. In general the new type has a flexible wheel base consisting of two trucks coupled together and surmounted by a platform carrying a steel cab and running the whole length of the locomotive. The two trucks are permanently linked together with a heavy hinge and carry the draft gear and bumper on the outer end frames. With this construction all hauling and pushing stresses are transmitted through the truck framing on approximately the same horizontal line and are not carried through the center pin into the platform framing. This relieves the platform of all stresses except such due to its own weight and that of the apparatus on it. The principle embodied in this type of locomotive construction is not new but is one whose success has been demonstrated by its practical application to steam locomotives for a number of years. The B. & O. Mallet compound locomotive resembles the new B. & O. electric type in that it has a wheel base made in two halves hinged together and taking the hauling stresses directly through this hinge.

The apparatus for controlling the locomotive is mounted on the platform and enclosed in the cab. This cab is divided into three parts, a main operating cab, occupying the center part of platform, and two low auxiliary receptacles extending from the main operating cab to the outer ends of the locomotive. These receptacles contain such parts of the control apparatus as do not require continuous inspection and care. The engineer's seat is in the cab, well back from the forward end of the locomotive, and so placed as to afford him the best command of all the apparatus under his control. The cab is so short that without leaving his seat the engineer can obtain a fair view of the train behind or of a switchman at the coupler.

By means of the multiple unit control, which is a feature of these locomotives, two of these 90-ton units can be coupled together and operated by one engineer in the forward cab. All the motors are controlled simultaneously by one operating handle, and one engineer thus has under his control a maximum capacity of 3,500 h. p., or a maximum tractive effort of 90,000 lbs., developed from one 180-ton locomotive, which could move off on a level track with a 6,000-ton load behind it or take a 1,000-ton load up a grade 80 ft. to the mile.

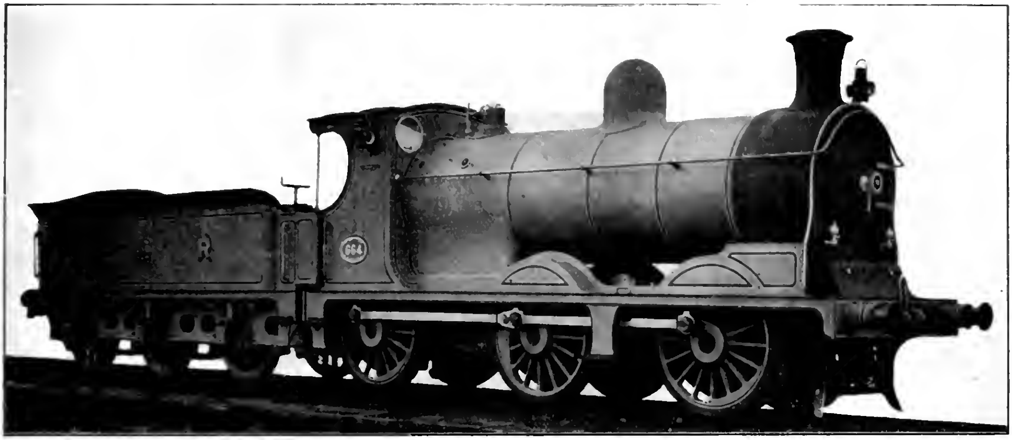
New Locomotives for the Caledonian

Our illustration shows a type of locomotive which the Caledonian Railway have added to their stock for the purpose of working goods trains. The engines were turned out from the St. Rollox workshops, built to the designs of Mr. J. F. McIntosh, the company's locomotive engineer.

The engine is an 18½ x 26 in. cylinder engine with 5 ft. six-coupled wheels, and is of the 0-6-0 type, with inside cylinders driving on the middle axle. The tubes are of mild steel, galvanized, 275 in number, and 1¾ in. external diameter. The firebox shell is 6 feet 5 ins. long by 4 ft. 0½ in wide at the bottom, and the crown of the copper box is stayed with girder stays. Ramsbottom safety valves are 3 ins. in diameter and adjusted to blow off at the working pressure of 160 lbs. per square inch.

The cylinders are inside the frames and the slide valves are operated by Stephenson link motion. The built crank axle has journals 8½ ins. diameter by 7½ ins. long, and the connecting rod bearing is 8½ ins. diameter by 4 ins. long. The leading and trailing axles have journals 8 ins diameter by 7½ long. The engine is equipped with steam brakes It has also an ejector and "through" vacuum brake pipe, thus permitting of the working of express goods trains

A special feature in the construction is the introduction into the smokebox of a novel form of spark arrester which bids fair to at last solve the difficult spark problem by diminishing live-coal throwing while keeping the dead cylinders in such a position in the smokebox as to remain entirely clear of the bottom rows of boiler tubes This effective and extremely simple arrester is the invention of Mr McIntosh and is the result of extended study and experiment in this particular direction; and so satisfactory has been its behavior in actual working under severe and varying conditions that arrangements have been made for fitting it to all new Caledonian engines. An illustrated description of this spark arrester was given in RAILWAY AND LOCOMOTIVE ENGINEERING for February, 1909, page 53.



CALEDONIAN RAILWAY 0-6-0 LOCOMOTIVE NO. 664.

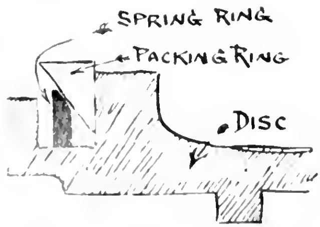
The Charles Balance Valve.

The method of balancing main valve of locomotive here shown is applicable to ordinary slide valves or even those which have had the Richardson system applied to them. The Charles system consists of a cast iron disk about ¾ ins. thick, the under side of which is planed to fit the valve back, which is also planed to suit. Two strips on the under side of the disk engage with two shoulders cut in the back of the valve, or drop into the Richardson slots as the case may be.

The disk is held tightly to the valve by means of four hollow studs screwed into the valve with nuts on the upper side of the disc keeping it in place. The passage through the studs leads into the exhaust cavity of the valve so that any slight leak past the packing ring will find a ready exit. On the upper side the disk is cut out near the circumference as shown in our illustration. This recess ⅝ x ⅞ in. deep carries the packing ring and the spring ring The packing ring is ½ in. wide on top The inner side is vertical, while the outer side tapers to an angle of 60 degs from the horizontal It is against this tapered face that the spring ring presses and this pressure tends to force the packing ring up against the friction plate, and also causes it to hug the upright wall of the disk and also to close up the thin diagonal cut in the packing ring The packing ring has therefore no tendency to float or cant in any direction, but is practicaly equivalent to a solid ring making a tight joint all the time with the friction plate above it.

The spring ring is made of hard cast iron, bored eccentric 1-16 of an inch, giving it a thickness of 7-32 of an inch at the part remote from split, at the split it is 5-32 of an inch thick. The spring ring being made of hard cast iron is not affected by heat any more than the packing rings of a piston are, and for this reason the cast iron ring is more satisfactory than steel springs.

The whole arrangement, which has been devised by Mr. Frank Charles, of Atlanta, is exceedingly simple and the entire work of finishing can be done on machines and this avoids hand work such as filing and scraping. After the device has been finished in lathe and planer, it is ready to be put in place and is expected to stay there until the engine goes into the back shop. Our free hand sketch shows roughly the position of the assembled parts, and how the packing ring is constantly forced upward. The Charles Balance Valve Company of Atlanta, Ga., are handling this balance valve, and will be pleased to give further information on the subject



PARTS OF CHARLES BALANCE VALVE.

Items of Personal Interest

Mr. F. W. Warren has been appointed locomotive foreman at Brockville, on the Grand Trunk, vice Mr. J. D. Scott, transferred.

Mr. F. W. Poignand has been appointed instructor of apprentices on the Erie Railroad, vice Mr. Keller, resigned.

Mr. P. C. Withrow has been appointed mechanical engineer of the Denver & Rio Grande, with offices at Burnham Station, Colo.

Mr. W. D. Gillott has been appointed a road foreman on the Eastern division of the Western Pacific, with office at Elko, Nev.

Mr. G. Woodsum has been appointed acting locomotive foreman at Island Pond, Vt., on the Grand Trunk, vice Mr. M. B. Dube, resigned.

Mr. R. M. Conley has been appointed a road foreman on the Western division of the Western Pacific, with office at Sacramento, Cal.

Mr. E. A. Sherman has been appointed train master of terminals of the Cincinnati, New Orleans and Texas Pacific Railway at Cincinnati, O.

Mr. F. C. Link has been appointed road foreman of engines of the first, second and third divisions of the Seaboard Air Line Railway.

Mr. T. F. Johnstone, formerly engine inspector of the Chicago Great Western, has resigned to accept service with the Baldwin Locomotive Works.

Mr. Oliver M. Colston has been appointed assistant to the vice-president and general manager of the Fort Worth & Denver City Railway.

Mr. Ira Schreck has been appointed road foreman of engines on the Indianapolis division of the Big Four, with headquarters at Bellefontaine, O.

Mr. James H. Atworth has been appointed road foreman of engines on the Cairo division of the Big Four, with headquarters at Bellefontaine, O.

Mr. J. H. Reed, a locomotive engineer on the Erie, has been promoted to the position of roundhouse foreman at Avoca, vice Mr. G. E. Van Orsdale, resigned.

Mr. Benjamin R. Boggs has been appointed assistant general freight agent on the Philadelphia & Reading Railroad, with office at Philadelphia, Pa.

Mr. C. W. Wall, in addition to his present duties as general foreman of the Erie elevator, has been appointed fleet engineer of the Union Steamship Line.

Mr. E. H. Williams, heretofore locomotive foreman at Kipling, Sask., has been appointed general foreman at the Brandon shops at the Great Northern Railway.

Mr. H. L. Roth has been appointed general foreman of the Cincinnati, New Orleans and Texas Pacific Railway shops at Ludlow, Ky., vice Mr. J. H. Murphy, resigned.

Mr. W. H. Preston, heretofore general car foreman, Farnham shops of the Canadian Pacific Railway, has been appointed general air inspector Eastern Lines, Montreal.

Americans to Exploit Asia Minor.

The American syndicate of capitalists of whom Charles A. Moore, of Manning Maxwell and Moore of New York is a leading spirit, are negotiating with promising success to secure control of all the railways about to be constructed in Asia Minor. The intention is not only to build the railways but to supply all the rolling stock and machinery. As it is the purpose of the Turkish Government to establish a very extensive system of railways in Asia Minor, the call for rolling stock, bridges and machine tools will help materially to increase the activity of our manufacturing establishments.

CHARLES A. MOORE.

Asia Minor is a great peninsula forming the Western extremity of Asia and was the seat of many famous and powerful kingdoms of antiquity. It was the seat of many of the most bitter conflicts for supremacy waged by world wide conquerors who struggled to secure or maintain supremacy in this fair and fertile region. Most antiquarians locate the Garden of Eden in Asia Minor, but the land is now desolate and in many places barren. All that is needed, however, is water which will be provided by a vast system of irrigation.

Mr. J. W. Small has been appointed superintendent of Machinery of the Kansas City Southern, with office at Pittsburgh, Kan., succeeding Mr. F. R. Cooper, resigned.

Mr. D. B. Trueblood has been appointed general foreman of the Montgomery district of the Baltimore & Ohio Railroad at Tuscaloosa, Ala., vice Mr. H. C. Stevens, resigned.

Mr. F. M. Falck has been appointed assistant superintendent of Wilmington and Columbia Division of the Philadelphia & Reading Railway, with office at Reading, Pa.

Mr. J. D. Scott, heretofore locomotive foreman at Brockville, Ont., on the Grand Trunk Railway, has been appointed locomotive foreman at Turcot, Que., vice Mr. R. Ivers, resigned.

Mr. E. D. Pelley has been appointed road foreman of engines on the Galesburg division of the Chicago, Burlington & Quincy Railroad, with headquarters at Galesburg.

Mr. Richard Lanham, road foreman of engines of the St. Louis, Iron Mountain & Southern, at De Soto, Mo., has been appointed a master mechanic, with office at Paragould, Ark.

Mr. R. A. McAdam, heretofore air brake instructor on the Canadian Pacific Railroad, with office at Montreal, has been appointed air brake inspector, vice C. W. Carey, deceased.

Mr. S. J. Hungerford, heretofore superintendent Winnipeg shops, C. P. R., has been appointed superintendent of rolling stock of the Great Northern Railway, with office at Winnipeg, Man.

Mr. C. H. Mitchell has been appointed train master on the Cincinnati, New Orleans and Texas Pacific Railway, first district, with offices at Danville, Ky., vice Mr. E. A. Sherman, transferred.

Mr. H. C. Harragin has been appointed assistant air brake instructor on the Canadian Pacific Railway, vice Mr. G. A. G. Bartlett, promoted. Mr. Harragin's headquarters are in Montreal.

Mr. J. J. Hurley, foreman of the rod department in the Cleveland shops of the Erie Railroad, has been appointed roundhouse foreman at Briar Hill, on the same road, vice Mr. J. Hanson, resigned.

Mr. W. H. Kirby, heretofore assistant foreman at West Toronto Jct. on the Canadian Pacific, has been appointed locomotive foreman at Port Burwell, Ont., vice Mr. D. S. Taylor transferred.

Mr. E. J. Murphy, heretofore locomotive foreman at Havelock, Ont., on the Canadian Pacific, has been appointed assistant foreman at West Toronto Jct., vice Mr. W. H. Kirby transferred.

Mr. D. S. Taylor, heretofore locomotive foreman at Port Burwell, Ont., on the Canadian Pacific, has been appointed locomotive foreman at Havelock, Ont., vice Mr. E. J. Murphy transferred.

Mr. F. A. Reidel has been promoted from the position of engine inspector at Avoca on the Erie Railroad, to that of night engine dispatcher, at the same place, vice Mr. R. W. Winterstein, resigned.

Mr. W. R. Thomas, road foreman of engines of the Cincinnati, New Orleans & Texas Pacific, has been promoted to general foreman of the mechanical and car departments, with office at Ludlow, Ky.

Mr. G. A. G. Bartlett, heretofore assistant air brake instructor on the Canadian Pacific Railway, has been appointed air brake instructor with headquarters at Montreal, vice Mr. A. A. McAdam, promoted.

Mr. Robert F. McKenna, of Scranton, Pa., formerly master car builder of the Lackawanna, has been successfully operated upon for appendicitis and kidney trouble. His condition is most favorable for a complete recovery.

Mr. J. F. Sheahan, master mechanic of the Southern Railway at Knoxville, Tenn., has been appointed master mechanic of the International & Great Northern, with office at Palestine, Tex., succeeding Mr. F. S. Anthony, promoted.

Mr. H. C. Stevens, formerly general foreman of the Mobile & Ohio Railroad at Tuscaloosa, Ala., has accepted the position of master mechanic on the Denver & Rio Grande Railroad, with headquarters at Alamosa, Colo.

Mr. W. Hamilton, heretofore locomotive foreman at Stratford, Ont., on the Grand Trunk, has been appointed master mechanic on the Western division, with office at Battle Creek, vice Mr. E. D. Jameson, assigned to other duties.

Mr. Roydon V. Wright, for several years editor of the *American Engineer and Railroad Journal*, has become a member of the staff of the *Railway Age Gazette*, with supervision of the mechanical department and the shop edition.

Mr. J. H. Holt, formerly general foreman of machinery and car department on the Detroit, Toledo & Ironton at Ironton, Ohio, has been appointed roundhouse foreman on the Atchison, Topeka & Santa Fe at Topeka, Kan.

Mr. A. J. Roberts, heretofore chargeman Temiskaming & Northern Ontario Railway shops, North Bay, Ont., has been appointed locomotive foreman at the Stratford, Ont., shops of the Grand Trunk Railway, vice Mr. W. Hamilton, promoted.

Mr. Harry Hoover, a former well-known foundry foreman, has accepted a position with the S. Obermayer Co., manufacturers of foundry facings, supplies and equipment. He will look after the interests of this company in Buffalo and Dunkirk, N. Y.

Mr. H. N. Williams, general yardmaster of the New York, Chicago & St. Louis at East Buffalo, has been promoted to be trainmaster of the road at Fort Wayne, Ind., and is succeeded by Mr. John E. Colligan, who has been his assistant.

Mr. F. E. Whitcomb has been appointed engineer of signals at Boston, on the Boston & Albany Railroad, vice Mr. J. M. Fitzgerald, promoted to be assistant signal engineer of the Boston & Albany and of the New York Central, vice Mr. W. A. Peddle, resigned.

Mr. W. L. Park was recently elected vice-president of the Illinois Central Railroad with headquarters at Chicago, and as such he will have charge and supervision of the transportation, maintenance, motive power, construction, purchasing and pension departments of the company.

Mr. J. H. Guess, purchasing and fuel agent of the National Railways of Mexico at City of Mexico, Mex., has been appointed general purchasing agent of the Mexican International and the Interoceanic, with office at City of Mexico, and his former title has been abolished.

Mr. John A. Talty, of Buffalo, road foreman of engines on the Delaware, Lackawanna & Western, and president of the Traveling Engineers' Association, and first vice-president of the Central Railway Club, has been appointed assistant supervisor of equipment by the public service commission of the second district of the State of New York. Mr. Talty is a man of progressive spirit and ideas, and his intelligent handling of questions relating to mechanical subjects has brought him into conspicuous notice. The public service commission in a bulletin announcing the appointment of Mr. Talty, says that he headed the civil service list with a percentage of 85.75; also that he has served as freight brakeman, fireman, engineer, air brake inspector and traveling engineer. This recognition of his ability is highly gratifying to his many friends.

Mr. H. G. Crissinger has been appointed road foreman of engines on the first district of the Cincinnati, New Orleans & Texas Pacific, vice Mr. H. L. Roth, promoted. He was born at Derry, Pa., in the year 1866. He came from that good old German stock that did so much to shape the destinies of the Keystone State. He came to Kentucky in 1884, securing a position as fireman on what was then known as the Cincinnati Southern Railroad. Later this road was reorganized and is known as the Cincinnati, New Orleans & Texas Pacific. He was promoted to be a locomotive engineer in 1886, in which capacity he continued until his promotion to that of road foreman of engines. During his entire service as a locomotive engineer he did not have a day of suspension, nor was discipline administered in any form. He has been a member of the Brotherhood of Locomotive Engineers for more than twenty years and has continually served as chief of Subdivision 603 since its organization.

Mr. C. C. Steinbrenner, the new vice-president of the Galena Signal-Oil Company, was born in Cleveland, Ohio, on Sept. 20, 1863. He was educated at the public schools of that city. In 1881 he was employed as stenographer and assistant clerk in the motive power department of the Pennsylvania Railroad. In 1882 he went to the C. & P. Railroad at Wellsville as assistant shop clerk, after which he became assistant clerk in the office of the superintendent of machinery,

C. C. STEINBRENNER.

C., C., C. & I. at Cleveland. In 1885 he was promoted to be secretary to that official and stenographer to the general attorney of the same road. In 1890 he was promoted to chief clerk, motive power department, of the Big Four. He resigned that position later to become chief clerk, motive power department of the Illinois Central. Shortly afterward he became auditor of the railway department of the Galena Signal-Oil Company, which place he held until his election to the vice-presidency on Feb. 10. General Charles Miller, president; Mr. Samuel A. Megeath, first vice-president and general manager, and Mr. L. J. Drake, vice-president, were re-elected.

Obituary.

We have regretfully to record the death of S. A. Teal, formerly master mechanic of the Sioux City & Pacific Railroad, and also of the Fremont, Elkhorn & Missouri Valley Railroad. These roads form part of the Chicago & North-Western system. Mr. Teal retired on a pension about four years ago and lived at Waterloo, Neb. He was buried at Council Bluffs, Ia.

General Foremen's Association

Business for the 1910 Convention.

The Executive Committee of the International Railway General Foremen's Association has arranged for next convention to be held at Cincinnati, O., beginning May 3, with headquarters at the Grand Hotel, a most convenient location, being close to the general station.

Secretary Bryan has sent out a list of the subjects on which reports will be submitted. They are:

(1) "Best Method of Cleaning Ash Pans to Conform to Inter-State Commerce Law." Committee—J. T. Shepard, general foreman, Soo Line, Wyerhauser, Wis.; C. L. Walters, general foreman, Great Northern Ry., St. Paul, Minn.; T. F. Griffith, general foreman, C., C., C. & St. L. Ry., Indianapolis, Ind.

(2) "Use of Commercial Gas as Fuel." Committee—H. G. Kelly, general foreman, C. & N.-W. Ry., Chicago; J. M. Davis, general foreman, C. & S. Ry., Denver; W. G. Reyer, general foreman, N. C. & St. L. Ry., Nashville, Tenn.

(3) "Advisability of Installing Hot Water Wash Out and Filling Systems." Committee—F. G. Colwell, general foreman, I. C. Ry., Chicago; F. Bauer, Big Four Ry., Indianapolis; D. E. Barton, general foreman, Santa Fe, Topeka, Kan.

(4) "Use of Oxy-Acetylene Process of Welding Fire-boxes, Boiler Sheets, Frames, and Other Locomotive Work." Committee—J. M. Davis, general foreman, C. & S. Denver; E. F. Fay, shop superintendent, U. P. Ry., Cheyenne, Wyo.; W. F. Lauer, general foreman, Erie, Huntington, Ind.; Thos. Zinkan, general foreman, Big Four, Delaware, O.

(5) "Wide Fire-box." Committee—P. F. Flavin, Standard Railway Equipment Co., Chicago; C. Bowerson, general foreman, T., St. L. & W. Ry., Frankfort, Ind.; H. O. Olson, foreman, D. & I. Ry., Two Harbors, Minn.; C. H. Voges, general foreman, Big Four, Bellefontaine, O.

(6) "Superheaters." Committee—G. W. Keller, general foreman, N. & W. Ry., Portsmouth, O.; E. C. Roddie, general foreman, I. C. Ry., New Orleans; A. L. Ball, general foreman, C. & I. S. Ry., Kankakee, Ill.; E. C. House, general foreman, S. & L. Ry., Savannah, Ga.

In connection with these subjects of investigation we wish to offer a word of advice similar to that which we have given to members of the American Railway Master Mechanics' Association for years. When you receive the circular or this paper put it in a conspicuous place and keep it before you until you are able to write something to the chairman of the committee. You may not be able to send in your mite of information about all of the subjects, but send in what you have got. Don't say, "My help is not of much value." It is of decided value. The great river is made up of small springs and tiny brooks. The most valuable reports submitted to railroad associations have been formed from driblets of information sent in by individual members.

Effective Way of Starting Fires.

Talking on the troublesome process of starting fires, Mr. A. F. Bradford, of the Big Four, said: "We cover our grates all over with coal, which makes a good foundation. We have a covered round vat in the engine house where we mix crude oil and shavings together. The man who fires up takes two ordinary water buckets of shavings soaked with crude oil and scatters the contents over the top of the coal in the fire-box. He uses a piece of burning waste to ignite the kindling material on the coal and shuts the door, which is not opened until there is steam in the boiler.

"At one time we blew the crude oil in with a burner but that did not work so well as mixing it with shavings."

Driving Axle Wear.

It is not so long ago that 200,000 miles was considered good service for the driving axle of a locomotive, but material must be improving for we find that some railroads are making more than double the old mileage out of driving axles.

At last General Foremen's Convention the statement was made that on the Illinois Central we have a limit of wear on an axle of from 225,000 to 250,000 miles. If it is worn more than three-eights the axle would be removed, and if it was a large one it would be put in a smaller engine. We have done it frequently by sounding the engine, but we have never pulld it away from the bearings. We have located cracks when they had not run their mileage.

Mr. C. H. Voges, of the Big Four, did not think much of the Illinois Central practice and remarked: "We have the heavy freight and passenger engines and we run them 400,000 miles and three-eights limit wear. We have a long jack for testing which we place between the drivers, and I strike the axles with a sledge hammer and of course clean them. I remove the liner of the hub of the wheel and clean that thoroughly, and if there is any crack develops there at all it will be removed. If a crack runs lengthwise you can determine it in the heavy freight service, but if the crack runs crosswise, I would remove the axle at once. I would not recommend pressing a wheel off an axle. I think you will lose the pressure of the wheel fit. We have axles from one-half to one-eighth; it all depends on what class."

Novel Method of Soliciting Ads.

When Mr. J. Will Johnson, secretary of the Executive Committee of the Entertainment Committee of the I. R. G. F. Association, started out to solicit ads for the Annual Report, he found the atmosphere exceedingly cold at first. Then he posted the following notice:

"The supply man, now attending this convention, who is in the habit of hugging the typewriter had better quit or we will publish his name in the next proceedings."

The second day of the convention fourteen of the boys came to the secretary, invited him out to dinner and left fourteen one-half page advertisements and told him not to pay any attention to foolish stories. We cannot possibly say just how the fourteen took that notice but we do know that people may dread slander but they all fear the truth more.

There are few general foremen have failed to make the acquaintance of Vim Leather Air-brake Cup Packing. The Houghton Line, Philadelphia, makers of that packing, have published St. Patrick stories in the March number of their magazine. Send for it. The stories are always fresh and the magazine will be sent complimentary.

It is stated that out of $2,700,000 appropriated by the Lake Shore & Michigan Southern for enlarged locomotive and car shops at Elkhart, Ind., $600,000 will be expended this year. Twelve large buildings, more than 20 tracks and a first class mechanical installation, are included in the improvements to be made.

New subjects of investigation are hard to find, but much searching and consulting ought to be engaged in before a motion is made to carry over a subject to another year.

A correspondent has asked us about the upkeep of the Mallet type of engines. If you have any information let us have it.

Steam Coupling and Lock.

The Gold Car Heating & Lighting Company, of New York, have recently developed a lock for steam train line couplers which can be very quickly tightened or loosened, without the use of tools. It is the generally accepted opinion that the couplers for air, signal and steam connections between cars should automatically separate in case the cars are uncoupled or a break-in-two occurs. Most roads, however, require their trainmen to separate the hose couplings by hand when trains are broken as it is more or less injurious to the hose if they are pulled apart. The shape and weight of the coupler heads in connection with the angle at which the hose is attached, ordinarily maintains the gaskets in close contact when coupled, but at the same time permits automatic uncoupling.

FIG. 1. GOLD STEAM COUPLING, UNLOCKED.

The high speed of modern trains together with the increased steam pressure often carried in the trainline to operate electric generators in the baggage car makes a positive lock, one that cannot be loosened and caused to leak by vibration or excessive pressure, very desirable between engine and tender and also between engine and baggage car. The lock we show here, very simply performs this function. Our illustrations represent a pair of couplers with the new locks, the couplers connected, but not locked, being shown in Fig. 1. A pair of locks, detached from the couplers are seen in Fig. 2, and the coupler with locks tightened, in Fig. 3.

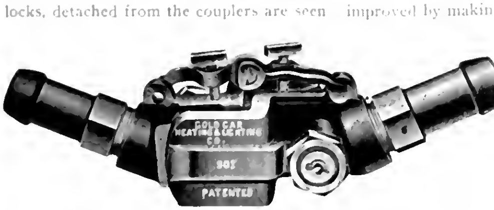


FIG. 3. GOLD STEAM COUPLING, LOCKED.

In the eye, cast in the coupler, immediately over the gravity relief trap and where the chain was sometimes attached, is now inserted one end of the lock which is shaped like a pin and secured with a cotter. The chain may then be attached to the hose clamp if desired. The other end of the lock has a projection shaped like a cylinder split through its axis and an opening of similar shape to engage the semi-cylindrical part of the adjacent lock. A thumb screw near the middle serves to force the locks upward when engaged and so pull the couplers tightly together like a toggle joint. The point of the screw bears against the body of the coupler and is rivetted over, to prevent working out of the lock. This lock is made of malleable iron and has sufficient play in the eye of the coupler to allow of readily inserting the half cylinder in the half circular opening of the mating lock. A few turns of the screws, which have large T heads, bind the couplers firmly together.

These locks are made for each size of coupler and are so designed that where couplers of different sizes will couple the locks will also operate properly. It is not necessary to confine these locks to the couplings at the head end of trains, however, and they may be used when desired between the various cars of a train. This has been done on some of the large lines in the Northwest, where it was felt that the additional security against leakage was more important than the automatic uncoupling if the train should break in two, a contingency which seldom happens. It incidentally prevents pulling apart in switching and thus reduces the wear of hose in charge of careless trainmen.

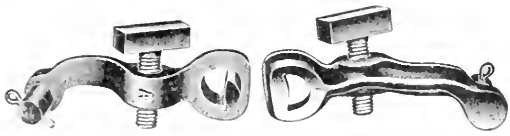


FIG. 2. LOCKING APPARATUS, GOLD STEAM COUPLING.

Our engravings show the gravity relief trap which has been favorably known for a number of years. It has been recently improved by making the seat so wide that the gasket maintains a smooth surface against the seat, preventing leakage due to wear. As this trap is operated by gravity, it simply falls open when pressure ceases, allowing the water of condensation accumulated in the train line to fall to the ground and so avoid freezing the coupler in cold weather. This also reduces the time required to get steam to the rear of the train even in moderate weather because there is no water in the pockets, to be driven to the end of the train line. Trainmen can always tell if pressure is on the line by simply tapping the valves, and so avoid being scalded by steam, when uncoupling. With this trap it is unnecessary to separate the hose coupling every time the train is laid up, which operation is often forgotten, and under ordinary conditions if a cold night comes on unexpectedly, the hose may be ruined and delay caused when steam is turned on the next day. The Gould equipment is designated to obviate this trouble. The life of the hose is also increased by reducing the amount of twisting and bending which is a necessary accompaniment of the process of coupling and uncoupling.

Through Traffic Uninterrupted.

Mr. and Mrs. Arnold Koscziosk, of Gary, Ind., have broken up housekeeping. It might be more correct to say their house was broken up for them. A man who was moving their domicile yesterday carelessly left it on a railway track about three minutes and while he went after a piece of chain a freight train came along and demolished it. The worst of it is the Koscziosks are away on a visit. When they return all they will be able to collect of their former furnishings are a small section of blue border from a rag carpet and the handle with which Mrs. K. used to lift the griddles off the kitchen stove. It was at the Broadway crossing of the Michigan Central about 6 p. m. When a pulley chain broke Mr. Thornton started after another chain, but forgot to notify the agent that his house was on the track. A few minutes later a fast freight train, eastbound and heavily loaded, came along about 30 miles an hour and passed right through the Koscziosk's sitting-room. Beds, tables, chairs, stoves, dishes, pillows, sheets and all the other appurtenances of a first-class household flew hither and thither through the air until some of the superstitious inhabitants of the town thought that a comet had hit Mars and the inhabitants of that planet were coming, with their belongings, to earth via the parachute route. The train wasn't even delayed. It ran about three blocks before the engineer could stop.—*Chicago Record-Herald.*

Based on calculations made in 1883, engineering experts belonging to the London & Northwestern Railway led to the conclusion that about one pound of steel went into dust daily on every mile of track operated. On a similar basis we believe that the track of the Pennsylvania Railroad between New York and Pittsburgh grinds up about 2¼ pounds of steel per hour for every mile of track.

Railroad Character Sketches

Billy's Half-Haliday

By James Kennedy.

When Billy was transferred to a clerical position in the office, he took a swelling of the head, but it was not accompanied, as is usual in such cases, with a contraction of the heart. With the kind of collars he began wearing he could not readily look around and see all of his old companions without running the risk of severing his carotid artery. By walking straight ahead and neither turning to the right nor to the left he found his way to where Macfarlane was setting up wedges and tightening bottom braces in the roundhouse pit. Billy beamed benevolently from his lofty attitude in the upper world. Macfarlane grinned through the wheel spokes like a Gibraltar monkey. Would he go to Coney Island on a trip this afternoon? Would he—what? Say that again. Billy repeated the invitation. An electric thrill of joy ran through Macfarlane. How about Shaw? Of course he was in the swim.

The way that Macfarlane and Shaw worked the remainder of the forenoon would gladden the hard heart of a cold blooded contractor. They simply made things dance. Macfarlane trammed the wheels and attached the rods and rammed in the pistons and marked the valve rods and screwed down the steam chests and put on the casings and the superintendent came along and smiled a smile of satisfaction. Shaw gathered tools from the far corners of the roundhouse and tossed blocks of wood hither and thither like a cyclone. He lifted ponderous hydraulic jacks out of the pit with one hand, and when a laborer came clamoring for a jack to lift an ash pan, shaw jumped into the pit and lying on his back lifted the pan to its place with his mighty feet like a Japanese juggler balancing a barrel.

It was Saturday afternoon and the golden glow of the coming summer was in the air. The worthies, three abreast, made for the river. A pillar of cloud went with them. Billy's perfectos were much in evidence. Billy loved to hear himself speak. Macfarlane kindly encouraged him. Shaw liked to listen. Macfarlane's old toothless terrier seemed to catch something of the bloom of youth and occasionally pulled at the string as if to break away into a private excursion of its own. At the dock the half blind creature in an unguarded moment tumbled into the river. The salt water freshened him up a little more. At the island the quartette had themselves photographed and weighed and electrified, and their fortunes told Billy was to marry a rich lady. Macfarlane was to rise in the world. Shaw was to have troubles until he was fifty. Then he would be used to them. The dog was to have a change of master and an early death. Then they had beer by the mugful and clams by the plateful, and sausages by the handful. Thus sustained and fortified they sallied forth to see the sights. Like many other sightseers they became a part of the sight themselves. Macfarlane beat the record at striking blows with a hammer. Shaw lifted weights that were past belief. Billy was a splendid backer. He paid for everything and talked so much that the crowds gave up listening to the "barkers," preferring the eloquence of Billy. A pair of wrestlers challenging the crowd in a roped arena met their match in Macfarlane. He threw one of them with such violence, that the other one weakened. The proprietor offered Macfarlane a position as champion, which he promptly declined.

This was too good to last. Shaw was the first one to weaken. In the aerial swings he sickened. He had become so accustomed to the air of the slimy pits. that the upper air was too much for him. Billy advised him to take a walk by the seashore. Shaw strolled leisurely away. The buffoonery of the place made him tired and he sat down on the lonely sands, and the breath of the salt sea soothed him to sleep. He dreamed he was selling haddocks again. The incoming tide crawled nearer and nearer. Presently a wave big and round as a locomotive boiler rolled over him, and he sprang to his feet. The myriad lights of the city by the sea were flashing into crosses and crescents and wreaths of electric fire. What time was it? His ninety cent Waterbury watch was gone. So was his sixty cents of loose change. The prophesies of the fortune teller were being partly fulfilled.

When Shaw found his companions, Billy was waltzing in a whirling maze of youth and beauty. Macfarlane was selling his dog to a bleary-eyed youth who seemed to have more money than sense. Macfarlane was so busy telling the dog's pedigree that he was unconscious of Shaw's presence. As soon as he observed Shaw he called upon him to verify his statements in regard to the dog. Shaw's teeth were chattering, but his evidence seemed to satisfy the youngster and the bargain was completed. Macfarlane took the money without a tremor, and in giving some parting words in regard to the qualities of the dog he administered a parting kick to the decayed canine. This livened the helpless creature somewhat and imparted a false vigor to his movements. Billy expressed the wildest regret at the idea of parting with a dog of such breed. Billy insisted on buying it back, but the new master was immovable.

Shaw was wet outside, and his friends soon moistened his clay inside. They sailed home and at Clark's parlors their exploits were recounted. Clark had another dog ready for the market, a black and tan without a single redeeming feature in its repulsive character. Those ignorant of Macfarlane's devious methods marveled at his interest in such dogs. Appearances were against them, and they were habitually guilty of all sorts of crimes and misdemeanors, but like old books they were bought for next to nothing and in the hands of a skilful manipulator they brought good prices.

Next week Shaw had a new watch, a present from Macfarlane, a new hat, a present from Billy, and Macfarlane had a new dog, a present from Clark, and they are looking hopefully forward to another trip to the white city by the sea.

Train Resistance.

What is called Bulletin No. 1001 issued by the American Locomotive Company deals with the important subject of train resistance, and is a very handy publication for the use of those who are interested in such matters. Formerly train resistance was computed before the introduction of what is called the large car. At the present time solid trains composed of fifty-ton capacity cars are in general use, and the resistance per ton for such cars has been more accurately determined. It appears that the best data on the subject shows that the resistance varies from about 2.5 to 3 lbs. for seventy-two-ton cars and from 6 to 8 lbs. for twenty-ton cars. Grades are also taken into consideration in this bulletin and altogether it is a useful addition to our stock of knowledge on the subject. The company will send this bulletin free on request.

While on the subject of train resistance it may be interesting to refer to some tests made on the engine of the Empire State Express in 1892, by Angus Sinclair. His observations helped to establish a formula for train resistance which was put forward by the late A. M. Wellington, author of the standard work, "Economic Theory of Railway Location." Mr. Wellington writing on the subject at that time refers to the observations of Messrs. H. P. Dudley, D. K. Clark, O. T. Crosby and William Stroudley. Another observer, Wilson Worsdell, he considers should have some allowances made in his figures, and he says, "Considering that the Worsdell observations are known to need small corrections at least, Mr. Sinclair's two records come extraordinarily near to giving the mean of the four others."

In this way the curve for train resistance which had been plotted as the mean, from experiments giving widely different results by themselves was found on analysis of Dr. Sinclair's work to be the really accurate record of train resistance and upon the curve so plotted Mr. Wellington deduced the simple formula for train resistance: $R = \frac{1}{4} V + 2$.

Fast and Slow Is the Way They Go.

The guard of a Caledonian goods train one day reported the driver for slow running. The driver meant to have his revenge for this, and a short time after, when running a fast goods train, and having a clear road for some miles before him, he thought he would give Mr. Guard a startler, and did the run at the rate of fifty miles an hour. The old van, of course, rocked like a cradle, and on pulling up the driver went back to see what the guard thought of it. He found that he had lashed himself to the brake wheel, having previously chalked up on the van, "If found dead, killed by furious driving."—*The Weekly Telegraph.*

Prevent Breakage of Pistons.

During recent rambles among railway repair shops we have found that many annoying delays have been caused by the breakage of piston valves. The Erie people have found a remedy for this source of trouble by making the valves of Hunt-Spiller gun iron which is a very strong close grained iron having an average tensile strength of about 30,000 lbs. It has exceptionally fine wearing qualities, which with its strength make it particularly desirable for cylinder packing, cylinder bushings, piston valve packing, piston valve bushings, crosshead shoes, eccentrics and straps, driving boxes, shoes and wedges, etc. It is used very extensively now by many of the largest railroads in the country for these parts. The first cost is a little higher than ordinary cast iron but the advantages of using it more than offset this for it eliminates enginehouse repairs, thereby saving much money.

Men Were Sad When He Sung.

At a certain Scottish dinner it was found that every one had contributed to the evening's entertainment but a certain Dr. MacDonald.

"Come, come, Dr. MacDonald," said the chairman, "we cannot let you escape."

The doctor protested that he could not sing. "My voice is altogether unmusical, and resembles the sound caused by the act of rubbing a brick along the panels of a door."

The company attributed this to the doctor's modesty.

"Very well," asserted the doctor, "if you can stand it I will sing."

Long before he had finished his audience was uneasy. There was a painful silence as the doctor sat down, broken at length by the voice of a braw Scot at the end of the table.

"Mon," he exclaimed, "your singin's not up to much, but your veracity's just awful. You're richt about that brick!"

The Janney X.

The McConway & Torley Company, of Pittsburgh, Pa., have recently got out a neat little pamphlet describing the Janney X coupler. Some of the special features set forth in the pamphlet are that cars equipped with the Janney X, couple automatically by impact. The knuckle can be thrown open without the necessity for a trainman to go between the cars. Uncoupling from the side of the car by means of an operating or uncoupling lever, by the operation of which, the locking block is raised to the uncoupling position, and so allows the cars to part. The lock-to-the-lock, and the lock-set devices are favorably known and require no detailed description here. The couplers are made from acid open-hearth steel. They are made in two sizes. If you would like to have the descriptive pamphlet write to the company for a copy.

Excuse in Verse.

In spite of the bad weather that prevailed over most of the country during the last four months, passenger trains have been run with wonderful punctuality on most of the lines. One night a freight train on the Milwaukee road was stalled and delayed an important passenger train. An irate super wired the engineer the well-known ominous phrase, "What was the cause of your delaying No. 8?" The engineer is a friend of Shandy Maguire and a rival of the engineer-poet. He answered:

"The wind was high, the steam was low;
The train was heavy and hard to tow;
The coal was slack and full of slate—
That's why we held up Number 8."

Thermo Jet.

The Thermo Jet System for car heating is one of the products of the Safety Car Heating and Lighting Company of New York. A very full and clearly illustrated description of it is to be found in a loose-leaf catalogue which this company has just got out. They report a successful introduction of their apparatus, which, they point out, combines in one system a steam and air system below 212 degs. F., a vapor system at 212 degs. F., and a pressure system above 212 degs. F., giving the advantages of three systems in one.

One may say that the advantages claimed are very neatly summed up in what would be called an acrostic made on the words "Thermo Jet" in the catalogue. This publication, which is the same page size as our magazine, is well illustrated throughout, but has an insert which gives one of the clearest and most effective pictures we have seen, drawn in perspective, of the whole apparatus. The parts are all numbered for reference and yet none of the figures obscures the view, as is often the case. The Thermos Jet System is new, and a look at the pamphlet is interesting. It will be sent direct to any one who applies for a copy. The address of the company is No. 2 Rector street, New York.

Nearer the Work.

Two Irishmen were digging a sewer. One of them was a big, strong man about six feet four inches in height, and the other one was a little, puny man about four feet six inches. The foreman came along to see how the work was progressing, and noticed that one of them was doing more work than the other. "Look here," he cried, "how is it that little Dennis Dugan, who is only half your size, is doing nearly twice as much work as you, Patrick?" Glancing down to his partner, Pat replied, "And why shouldn't he? Ain't he nearer to it?"

"Hydraulic Valves and Fittings" is the title of a 120 page illustrated catalogue just issued by the Watson-Stillman Co. of 50 Church street, New York. Its pages gives an exceedingly large and full list of types and combinations of hydraulic valves and fittings. Almost every page contains some hint or a piece of valuable advice as to the best piping arrangements such as what types or combinations of valves are best suited to certain work; how the valve arrangement may automatically operate a number of cylinders or machines. Any engineer will find this book handy when estimating or planning new hydraulic installations or when making changes on old ones. The catalogue is neatly and suitably bound and is of the 9x6 M. C. B. standard size. The illustrations are clear and the letter press concise. In the majority of cases prices are quoted, and altogether the catalogue is one that a practical man would like to have. It will be sent free to any one requesting catalogue No. 78.

Conscience in Cheating.

"James," said the milkman to his new boy, "d'ye see what I'm a-doin' of?" "Yes, sir," replied James; "you're a-pourin' water into the milk," "No, I'm not, James; I'm a-pourin' milk into the water So if anybody asks you if I put water in my milk you can tell 'em no. Allers stick to the truth, James; cheatin' is bad 'nough, but lyin' is wuss."

Wendell Phillips says that the best education in the world is that got by struggling to make a living.

Safety Record of the D. & H.

The Delaware & Hudson Company has made a good record in the matter of safety of passengers. From July 1, 1907, to the end of the last official year, June 30, 1909, this road carried 13,888,355 passengers without a fatality. In this period the passenger mileage as it may be called, that is, the number of passengers carried one mile, was 264,283,047. The company attributes this good record to the facts that the road and equipment were kept in good condition, that their line is well supplied with telegraph, passing sidings, yards and other facilities, and that the main line was almost all equipped with block signals. Another most important fact which had largely to do with the result is that the discipline of he employees was kept as nearly perfect as possible. We believe the men responded in a most creditable manner. That may be called doing good work.

Coal Pile Watch Dog.

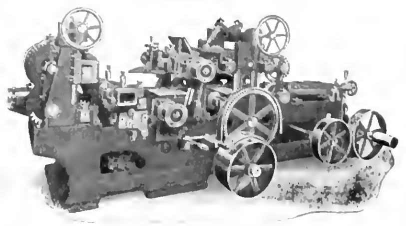
The efficiency of the coal used in a railway power plant is a desirable thing to know. To operate such a plant economically, it is necessary to keep a check not only upon the quantity of the coal used, but upon the amount of steam it is producing. A record of the weight of water evaporated in the boilers from day to day enables those in charge to detect

KENNICOTT WATER WEIGHER.

inferior coal, scaly boilers, defective furnaces, inefficient firing, etc. It enables the power plant manager to stop any waste he may find. Such a record can be kept by the use of a Kennicott Water Weigher. This device is designed to be a check upon the efficiency and economy of the plant. It is in fact very like a careful inspector who is always on duty. The object of the device is to produce economical operation and it is worth while looking into the claims made for it. Write for particulars to the Kennicott Water Softener Company. They are located at Chicago Heights, Ill.

Car Shop Tool.

The machine we illustrate is designed for any kind of heavy planing, matching or surfacing in car shops. It is made in five sizes to work car material 10, 15, 20, 24 or 30 ins. wide and 8 ins. thick, and is made with or without overfeeding rolls. The frame is a heavy cast iron structure and in use is free from vibration. Cylinders are solid crucible steel forgings, four-sided and slotted on each side. The pres-



DOUBLE CYLINDER PLANER AND MATCHER.

sure bars are adjustable to permit the cutting of molding 1 in. deep. The matcher spindles are adjustable across machine, and may be drawn completely out of the way for surfacing the full width of upper cutting knives. The feed mechanism consists of four or six powerfully driven rolls 7½ ins. in diameter, all double geared. The in-feeding rolls are driven down and an even pressure is maintained by spring tension. The in-feeding rolls are carried on one pair of side housings, and geared to raise simultaneously by means of a hand wheel convenient to the operator. The out-feeding rolls are driven from the in-feeding end of the machine by means of a chain and sprocket, thus eliminating a long chain of gearing. For further particulars concerning this machine address the manufacturers, J. A. Fay & Egan Co., Cincinnati, Ohio, who make a standard line of car shop tools.

Sick of Love.

It was a Sunday school class in Buffalo, and the teacher, a woman, had asked the children to look up verses in the Bible in which the word love occurred as a groundwork, of course, for moral instruction. When the time came to answer one small boy put up his hand, and, leave given to quote his text said: "Song of Solomon, chapter ii, verse 5, 'Stay me with flagons, comfort me with apples, for I am sick of love.'"

Discipline.

Near sighted Lady: "The boy who is trying to tie that tin can to that poor dog's tail ought to be thrashed within an inch of his life—the horrid little brute."

Maid: "It's your boy, mum." "My boy?" "Yes, mum." "Tell him, if he'll stop, I'll give him some cake."

Pensions for Soo People.

The extension of the welfare work among the employees and the pension system now in vogue on the Canadian Pacific Railroad to the Soo line and its connections will be made this year, according to an announcement made at the Soo general offices in Minneapolis several weeks ago. The pension system will be established first and gradually other features of the welfare work will be developed. The Canadian Pacific has just made public the annual report of its work along these lines.

The pension system which will be duplicated on the Soo system calls for no contributions from the employees themselves. All employees who have been in the service of the company for ten years or longer are to be retired at the age of sixty-five years with an annual allowance proportionate to the length of their service and the rate received during the last ten years of their employment. The minimum pension allowance authorized will be $30 a month.

One Roan Horse.

"One roan horse" was the description of an animal that occupied a car in the Central yards. Two yard men were sent to bring out the roan horse. They switched the car to the cattle chute and boldly broke the seal, but a single peep at the animal sent them away in terrified flight. They had found a rhinoceros consigned to a circus. They sent for a four-horse van to transport the animal and when they mustered courage to make its closer acquaintance found that the beast was stuffed.

The Railway Supply Manufacturers' Association met some weeks ago for the drawing for the assignment of exhibit space at the mechanical conventions to be held at Atlantic City, N. J., next June. Messrs. B. E. D. Stafford, chairman, S. P. Bush and C. P. Storrs formed the committee. There was about 95 per cent. of the entire exhibit space applied for, and possibly 80 per cent. of the applicants were given their preference as to location. It is the purpose of the committee to endeavor in some manner to locate all who may wish to exhibit this year. The badge committee has prepared a very beautifully designed badge for 1910 for the supply men and their friends. Mr. A. L. Whipple is chairman of this committee. Mr. John D. Conway is secretary of the Railway Supply Manufacturers' Association, 313 Sixth avenue, Pittsburgh, Pa.

A Humorless Englishman.

Senator Chauncey Depew, Mark Twain and other humorists, once crossed the Atlantic on the same steamer, and they held a banquet on the last evening of the voyage.

Mark Twain, after delivering an exceedingly humorous speech, was followed by Chauncey Depew.

Depew began in his usual facetious manner and soon had the table in an uproar.

"The gentleman who has just preceded, if indeed I may call him a gentleman, has done a very mean thing. This afternoon as I was pacing the quarter deck I met Mr. Clemens, and, rehearsing the speech I had prepared, asked him what he thought of it. He replied that he thought it a very good speech, and now, to my astonishment, he has just repeated that speech, word for word, and left me in a very unpleasant predicament."

Of course everybody roared. The next morning as they were coming up the harbor an Englishman approached Mr. Clemens and said: "Mr. Twain, I had always heard, aw, that Chauncey Depew was such a remarkable after-dinner speaker, don't you know; but don't you know that speech of his which you delivered last night was a very poor affair, don't you know. Really, I couldn't see why you thought it was worth repeating."

Selling Wooden Cars.

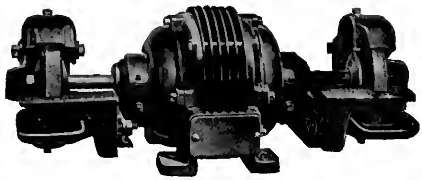
Owing to the fact that the Pennsylvania Railroad are receiving many steel passenger cars the company offers now for sale a large number of their wooden passenger cars. Since 1906 some 630 steel cars have been built or are in course of construction. In addition, about 250 cars will be ordered for 1910 delivery. With this large number of cars now on hand the Pennsylvania are able to operate solid all-steel trains on their lines of densest traffic and it is, therefore, possible to dispose of much of their wooden passenger equipment. The first consignment which is to be disposed of by the Pennsylvania Railroad Company consists of 140 coaches, 13 dining cars, 5 café cars, 39 postal cars, 1 baggage car, 22 combined passenger and baggage cars, and 4 baggage and mail cars.

The health officers of Washington have had a violent fit of watching milk dealers. A boy delivering milk was stopped on his round by two police officers who asked him if his employer ever put anything in his milk. "Oh, sometimes," was the innocent answer. The officers thinking they had a clear case of adulteration, offered the boy a quarter if he would tell them what was put in. "Gie, give me the quarter first," said the little fellow. The quarter was duly handed over, with the question, "Now, what does your employer put in the milk?" "Well," said the boy with a sad smile, "he puts the measure in every time he takes any out."

Electric Grinding and Buffing.

The General Electric Company's new and improved types of alternating current buffing and grinding tools are designed for use in wood working, machine and repair shops, foundries, large manufacturing establishments, etc., where alternating current is available. These devices find a ready application for dressing small castings, accomplishing the work much more quickly, and giving a finer finish than can be obtained with machine tool, clipping hammer, chisel, etc.

The grinding equipment consists of an



G. E. GRINDING EQUIPMENT.

alternating current motor with substantial supports fitted with tool rest and water attachment; these latter accessories are rapidly clamped to the bearing brackets in such manner as to permit ready removal when desired. Each end of the extended shaft is fitted with two steel flanges, two leather washers, and one nut for clamping the emery wheel securely in position. The motors are rendered splash and dust-proof by totally enclosing them; while shafts, bearings, attachments, and all working parts are made extra strong and durable to withstand hard and constant usage. The installation of one of these grinding equipments where it is readily accessible to the shop force, enables the men to always keep tools sharp, and improving the quality of the finished product. As sharp tools require less power to operate than dull ones, the cost of power may be sensibly diminished by keeping all cutting edges in the best condition.

The self-contained, compact and rugged buffing equipments provide a very effective polishing device, the use of which invariably results in a great saving of time and labor. These devices are similar in construction to the grinding outfits, with the exception that the tool and water attachments are omitted. The shaft is also longer, each end being tapered and threaded for recovering the buffs. The bearing brackets are circular and so designed that they may be turned through 90 degs. to admit of side wall installation, thus allowing relocation of the device at will.

The following equipments may be supplied for operation on single two or three phase, 110-220 volt circuits. Capacities: Single phase, ½, 1, 2 and 3 h. p. Polyphase, ⅜, 1, 2, 3, 5 and 7½ h. p. Neither emery wheels or buffs are furnished with the standard equipments. Further information may be obtained from the General Electric Company of Schenectady, N. Y.

Careful.

The brakeman was a novice, and on his first run here there was a very steep grade mount. The engineer always had more or less trouble to get up this grade, but this time he came near sticking. He almost lost his head way. Eventually, however, he reached the top.

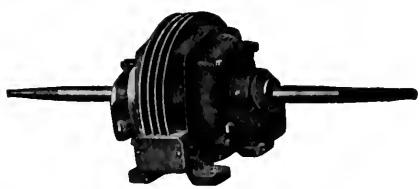
At the station that crossed the top, looking out of his cab, the engineer saw the new brakeman and said, with a sigh of relief:

"I tell you what, my lad, we had a job to get up there, didn't we?"

"We certainly did," said the new brakeman, "and if I hadn't put the brake on we'd have slipped back."—*Washington Star.*

A Senator's Hat.

The most conspicuous article in Senator Culberson's office at Washington is his hat, a big broad-brimmed black felt headpiece. The hat reminds some of the older Capitol attachés of the Texas Senator's father, Judge David Culberson, one of the



G. E. BUFFING EQUIPMENT.

leading figures in the House for more than twenty years. Judge Culberson had a peculiar gait, which he acquired, he said, from driving steers when he was a boy. "And that's one fault my boys, Bob and Charlie, won't have," the Judge used to say, "because I have given them two precepts that I hope they will follow. One was to learn how to walk and the other was to remember where they put their hats. By George, I've spent one-third of my life looking for my hat, and I want the boys to save the time."

Deaf Off the engine.

A curious case of a deaf engine driver on an Irish railway was once scientifically investigated. Report was made that Patrick Kelly, the driver in question, was too deaf to be trusted to manage an engine. He was suspended and a specialist of high reputation was called in to examine the man. This specialist examined the driver in a quiet room and found that he could not hear ordinary conversation, and so reported. "I may be as deaf as the celebrated Burke in a quiet room," said Kelly, "but that is not where I do my work. Go out with me upon the engine and see if you can hear better than I can." This was done and the specialist had to admit that Kelly heard perfectly well when the engine was running and the more noise made the keener this driver's hearing became. He was returned to duty and the famous aurist astonished the scientific world with a paper on "When a deaf man hears better than others."

A High Speed Element.

"I have a spinthariscope," says Thomas A. Edison, "which is a tiny bit of radium, of a size that will go through the eye of a needle, mounted on a piece of willemite. It has been shooting off millions of sparks for the six years I have had it, and I expect it will be shooting off sparks the same way for thousands of years. There will be enough sparks given out by that fragment of radium to cover and illuminate the State of Rhode Island. Some say that this is at the speed of light; others, 12,000 miles a second. The speed is the source of radium's power."

Cup for Graphite Lubrication.

The Campbell graphite lubricating system was devised and patented by a locomotive engineer on the Iron Mountain System, and is now controlled and marketed by Adreon Manufacturing Co., of St. Louis and Chicago. Briefly, this system assists the valve oil to produce better lubrication. The surfaces of valves and cylinders are generally more or less rough and graphite fills up the small imperfections and glazes over the surfaces, thus rendering the operation of the reverse lever easier. It is an unquestioned fact that a properly lubricated machine will produce the maximum power for the coal burned.

The graphite lubrication cup is bolted to the boiler in the cab and operated by the engineer. He has at all times control over the quantity of graphite to be used. The Campbell system has been tested very carefully under various conditions and its use effects a very important saving by reducing wear and tear on valves, pistons, cylinders and packing, in addition to reducing the consumption of valve oil. The Adreon Co. are willing to furnish one or more of these devices for test, and can submit to mechanical department officials letters bearing on the merit of the device which will be interesting. They will be happy to furnish further information to those who are interested in this matter.

Decidedly Shady.

It is a well-known characteristic of the Scottish Highlander, particularly when he is under cross-examination, that he never commits himself to a definite statement of any sort involving himself or his friends—if he can help it. A certain gentleman asked a Scotsman whom he had in his employ what he thought of the character of a certain man. After due deliberation the Highlander replied in his native tongue: "Heaven forbid that I should say a bad word of any one, especially of a neighbor, but this I'll confess—if you were to gather all the rascals in this town together, I should say the number was not complete if Dempster was not in the company."

Good Performance.

The Mallet articulated compound engine built by the American Locomotive Company for the Natal Government of South Africa is reported to be doing good work in the land of the kopje and the veldt. This engine, the builders inform us, which was of the 2-6-6-0 type of wheel arrangement, has a total weight in working order of 196,000 lbs., 179,500 lbs. on the driving wheels, and a tractive power of 46,600 lbs. It has been in service for several months and has fully met the expectations of the Natal Government Railway officials and has proved a most efficient and successful locomotive for conditions existing on that road. On a 3.3 per cent. grade it easily handles 325 long tons, which is 50 per cent. more than their heaviest engines of other types can haul. It has also proved a remarkably good curving engine, passing through the sharp curves, many of which are of 19.5 degs., much more easily and with less flange friction than their eight-coupled engines, with rigid wheel bases.

Good Collateral.

Alex. Peacock used to be an intimate friend of David McCargo, at one time general superintendent of the Allegheny Railroad. Mr. Peacock enjoyed free access to riding on trains and locomotives and was in the habit of sharing the pleasure with lady friends. One day Alick took a charming lady friend for a ride on one of the locomotives. The road was very crooked and Alick put his arm round the lady's waist, explaining that this was necessary to prevent her from being thrown down by the lateral swinging of the engine.

"I understand," exclaimed the girl; "there is lateral danger and you give me collateral security."

Canada carries second-class mail matter, which includes newspapers and magazines, for one-half cent a pound and makes money in the business. The United States postal service charges one cent a pound for second-class matter and claims that the business is done at ruinous loss.

The Boss.

We all know him and speak of him by this name, but it is not freely recognized as a word belonging to the English language. Purists in language regard it as a slang word but as slang expressions by usage become polite parts of language, the word Boss may be working its way into respectability.

Philologists, the people who interest themselves particularly, in the origin of words, are a little divided about the origin of the word boss. Those proud of Celtic learning attribute the word to the Gaelic word *bos* meaning hand. We can see no earthly connection between the Gaelic bos and the popular boss.

Those who have listened to Dutch people talking should have no difficulty in identifying the much used *baas*, master, with boss the Americanized equivalent. The pronounciation is almost unchanged.

Master or employer in all the early Dutch settlements was baas and boss it become with the English speaking people who hated and repudiated a master but were willing to endure the same personage under a foreign name. That was one of the numerous bitter pills that have their obnoxious taste entirely disguised by a thin coating of sugar. There are many people who respect bosses that would not consent to work under masters.

Her Indorsement.

"I want this check cashed," said the fair young matron, appearing at the window of the paying teller.

"Yes, madam. You must indorse it, though," explained the teller.

"Why, my husband sent it to me. He is away on business," she said.

"Yes, madam. Just indorse it—sign it on the back, so we will know and your husband will know that we paid it to you."

She went to the desk against the wall, and in a few moments presented the check triumphant, having written on its back:

"Your loving wife, Edith."—*Today's Magazine.*

Smuggling by Screws.

In these days when tariff matters are prominent in the minds of Americans the following incident told in the *American Machinist* years ago by George Escott Setters will be of interest. The story reads:

The house for which my grandfather was head received through the Spanish Consul an order for a large number of wrought iron screws, bored out leaving a certain thickness of shell, the hole to be closed by a close fitting plug. The Consul explained that the screws were made hollow to reduce the weight as they had to be transported part of the way to the mines in South America on the backs of mules.

The screws were made, and they were sent away by a large wholesale drug house.

Years afterwards when the old Mint was dismantled, I noticed some old screws among the rubbish which looked familiar, and on talking about them to the coiner he told me this story:

When the screws were made mercury was cheap in Philadelphia and dear in the mining regions of South America, so the screws were filled with mercury and safely carried to the gold mines for use in refining the precious metal. The duty on screws was much lower than the tariff on mercury.

After the mercury was run out, the hollow body was used as an ingot mold and cast full of gold, the plugs returned and securely riveted. Some of the screws were bent purposely and all were allowed to rust badly before they were shipped to the United States as old scrap iron, having offered no attraction to robbers ever ready to possess themselves of gold under transportation.

Dangerous Knowledge.

"Brother Philander," said Bert Walker the other day to the boss deacon. "I have something serious I want to say to you. I know that you keep a bottle of liquor in your cellar. Suppose our minister and the rest of the deacons would find it out? What would you do?"

"Well," replied Philander, very slowly and thoughtfully, "the first thing I should do would be to find a new hiding place for the bottle."

Valve Setter's Guide.

The Valve-Setter's Guide, by James Kennedy, is undoubtedly the most popular engineering book published this year. The first edition is already exhausted in less than two months, and as we are proceeding to press a new edition is being issued. The book is substantially bound in ornamental cloth, and besides the descriptive matter there are twenty-five illustrations. The book is meeting with high commendation from the best authorities. The standing orders from our own special agents and others will be promptly filled early in April.

Endless Flow.

A truly eloquent parson had been preaching for an hour or so on the immortality of the soul.

"I looked at the mountains," he exclaimed, "and could not help thinking, 'Beautiful as you are, you will be destroyed, while my soul will not.' I gazed upon the ocean and cried, 'Mighty as you are you will eventually dry up, but not I!'"—*Everybody's.*

Telling the Time in Egypt.

The working of the Oriental mind was delightfully illustrated in a story which Professor Turner told the Mathematical Association recently. He had been spending the Christmas vacation in Egypt to supervise the erection of a telescope at Helouan. Captain Lyons, who was in charge of the instrument, said that he had found that at noon every day a gun was fired, and was anxious to know how the system worked.

Accordingly he interviewed the gunner and asked how he knew when to give the signal. "Oh, I look at my watch," said the official. "And how do you correct your watch?" asked the captain. "I take it to the maker in Cairo and he tells me the error." Forthwith Captain Lyons interview the watchmaker and asked him how he checked the error of the watch. "I get the correct time from the gun," said that simple craftsman. And thus time was told in Egypt.—*London Evening Standard.*

Corrugated Fireboxes.

We are informed by Mr. W. H. Wood, president of the William H. Wood Loco Firebox Co., of Media, Pa., that locomotive No. 2490, of the New York Central, has been running nine months on that road without loosing a trip. This engine was equipped with the corrugated firebox designed by the Wood company. At the time this engine was in the shop, engine 2494, similarly equipped, came in for some repairs to tubes and we are told that the staybolts of both engine were found to be unbroken. From a report by Mr. Wood's expert it appears twelve telltale holes were drilled in the radial staybolts of each engine for the purpose of still further testing the staybolts. In the first of these engines it was found, after the lagging had been removed that just over the left hand fire door two staybolts had been fractured and in the second engine at about the same place one staybolt had been fractured. The safety valves of these engines were tested and everything was found to be in good condition.

Times Had Changed.

Several years ago Lord Clonmel brought to this country a string of race horses and at the close of the season Phil Dwyer gave a banquet in his honor. Sheriff Tom Dunn of New York was called upon for a speech.

"Faith, and this is the wonderful country!" said Dunn. "I was a poor Irish lad and me dear old mother, God rest her soul, hardly had pennies enough to bring me over. And here I am tonight sitting cheek by jowl with Lord Clonmel himself! Why, me friends, back in the old Tipperary days I couldn't get near enough to his lordship to hit him with a shotgun!"—*Everybody's Magazine.*

Flue Scraper and Tube Cutter.

A handy leaflet describing the Ryerson flue scraper and the Wernicke boiler tube cutter has been issued by Joseph T. Ryerson & Son of Chicago. The scraper is simple in construction and has few parts. There are eight scraping blades held fast at one end while able to move radially inward. The arrangement of the blades is such that they have a tendency to dig into the walls or the flue and so remove all scale and soot.

The Wernicke tube cutter is so made that with one size of tool, any size of flue from 1¾ up to 4 ins. in diameter can be cut off. This is accomplished by attaching various sized bushings on the cutter end of the machine so as to force the cutting wheels out into contact with the inside of the tube to be cut. The machine will cut off tubes either inside or outside the boiler head as desired. Write to Joseph T. Ryerson & Son for further information. They have offices in New York, Chicago and Pittsburgh.

Not Always Sober.

"Among the amusing characters we had on the Kansas Pacific in early days," remarked John Mackenzie, "was Con Considine, one of the best engineers on the road and one who could be depended upon to take his train through under the most difficult circumstances. But Con liked company, was an excellent story teller, and the very best kind of boon companion, so the inevitable happened. Con got to liking the bottle too well and became unreliable. The droll stories he told, the jolly songs he sang, and the funny bulls he made kept him in high favor with the trainmen, and they did all in their power to shield Con; but in the end that failed to shield him and he was finally discharged.

"A few days after he received his time, Con came to me sober for once and asked for a letter of recommendation. I wrote out a fine letter, telling that he was a first-class engineer, but said nothing about his personal weaknesses. Con looked over the letter and said: 'Faith sir, would not ye's put in that I was a sober and industrious man of poor but honest parents?'

"'Well, Con,' I replied, 'I do not mind putting in the poor but honest parents, but I can't well say anything about your being a sober man.'

"'Well, sir,' he replied, 'you might put down that I was sober frequently.'"

Nothing.

A teacher was examining his class, and he said: "I will give a quarter to any boy that can tell what nothing is." A small boy at the back of the class put up his hand. "Well, Willie, and what would you say it is?" "Please, teacher, it is a bung hole without a barrel round it." Willie got the quarter.

Bulletin No. 35.

"A Study of Base and Bearing Plates for Columns and Beams," by N. Clifford Ricker, has just been issued as Bulletin No. 35 of the Engineering Experiment Station of the University of Illinois. It includes a discussion of results obtained from tests of steel and cast-iron plates of different forms; an analysis of the theory employed in determining the resistance of such plates to fracture; general formulas which may be employed in determining the safe load which may be imposed upon such plates when supporting end of a beam, or of a column; and a series of tables by the use of which resort to complex formula may be entirely avoided. Copies of Bulletin No. 35 may be obtained gratis upon application to Dr. W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.

Good Road Bed.

Speaking of some fast runs in the British Isles the *Daily News* says: To the London and North-Western belongs the undoubted distinction of possessing the finest permanent way and the straightest road in England. The old London and Birmingham Railway was built at a period when railway engineers thought that a train could not run at top speed round even the slightest curve. That is why the line between London and Birmingham makes the finest stretch for non-stop running in the kingdom. The most wonderful part of new run between London and Birmingham, if finally scheduled at 1 hour, 47 minutes, will be the outward climb at over 60 miles an hour of the Tring bank. Tring lies at the summit of a long and steady gradient in the Chiltern Hills, 31 miles from Euston.

Conger's Air Brake Catechism.

The twenty-fourth edition of The Air Brake Catechism by Clinton B. Conger is just off the press. The book contains 270 pages, 4 x 6½ ins. It is neatly bound in cloth and we sell it for one dollar. This edition contains more matter than those which have gone before and is up-to-date in every way. The very latest information on the construction and operation of the Westinghouse and New York Air Brake equipments is given, and both are well illustrated in the book. At the end there is a list of examination questions such as are asked in examinations for promotion. If you can answer these questions there is no danger of your failing, and the answers are contained in the text matter of the book. We will have more to say of this excellent little book next issue, but you will get the full worth of your money when you send an order for the book. The book is the result of original work on the author's part and is not in any sense a reprint of an instruction pamphlet. Write to us for it. Price one dollar.

Quite an Order.

He was out with his best girl, and as they strolled into the West-End restaurant he tried to put on an I-do-this-every-evening kind of look. When they were seated at a table a waiter approached them.

"Will monsieur have à la carte or table d'hôte?" he asked.

"Both," said the young man, "and put plenty of gravy on 'em."—*Tit-Bits.*

Branch Offices Moved.

The Chicago and Baltimore branches of the H. W. Johns-Manville Co. have moved to new locations. The Chicago branch recently on Randolph street, is now in the four-story and basement of building Nos. 27-29 Michigan avenue, in the block between South Water and River streets. With 32,500 sq. ft. of floor space, offices, store and stock rooms all under one roof. The Baltimore office, store and warehouse is now at No. 30 Light street. Here the company have considerably more room than before, and in both cities the company keeps on hand a large stock of J-M products so as to give all orders prompt attention.

Peat for Locomotives.

The Swedes are experimenting in the use of peat fuel for the State railways. Their experts claim that a mixture of equal parts of peat and coal by weight, or two baskets of peat to one of coal, gives the best results. The price of coal is twice that of peat, and a considerable saving in cost of fuel is effected. No change of the locomotive furnaces have been found necessary, and it is also claimed that the grates can be more easily kept clean than with coal.

Good Idea.

Most of the station platforms on European railways are level with the floor of the passenger car, the compartment door opening a few inches above. A practice intended for the safety of passengers has been introduced at some of the stations on the Great Western Railway of England. This is to paint the edge of the station platform white for a width of about 12 ins. This is intended as a caution which automatically calls a passenger's attention to the position of the edge. It is no doubt useful at all times but would probably be particularly serviceable at night.

Self Reliance.

We have seen it asserted that a college is a great place for learning self reliance. If that is one of the best things to be said about college experience we would prefer starting out our young boys as newsboys. That is the department of experience where self reliance shines out with genuine luster.

INDEX TO ADVERTISEMENTS.

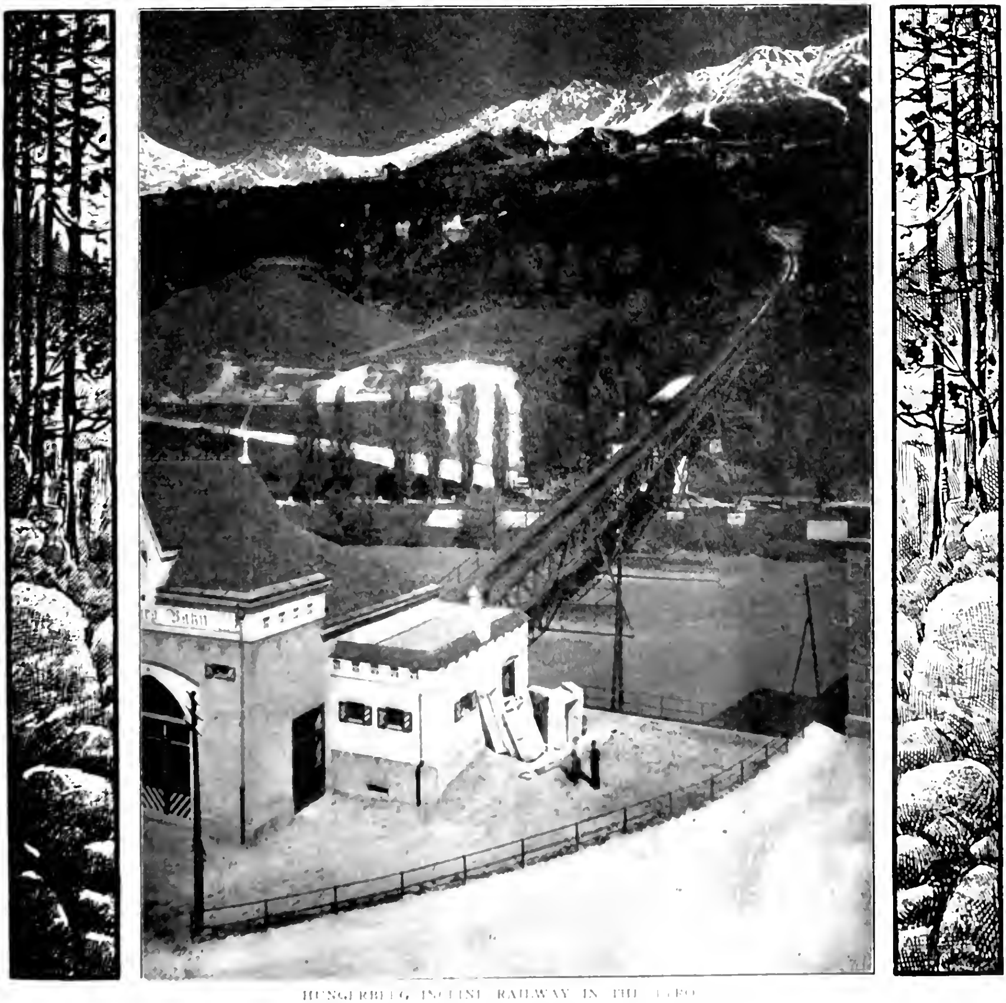
Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances

Vol. XXIII. 114 Liberty Street, New York, May, 1910. No. 5

Railroads in the Tyrol.

There are thousands of railroaders on our plains who have never seen an inclined railroad, and have no idea of the steep gradients of some short distance Continental tracks. Some of the more pronounced range from 55 to 65 per cent. Our frontispiece this month shows an inclined railroad, operated by electricity up the Hungerberg incline. The other illustration also gives an idea of these short but well built mountain roads of the Austrian Tyrol.

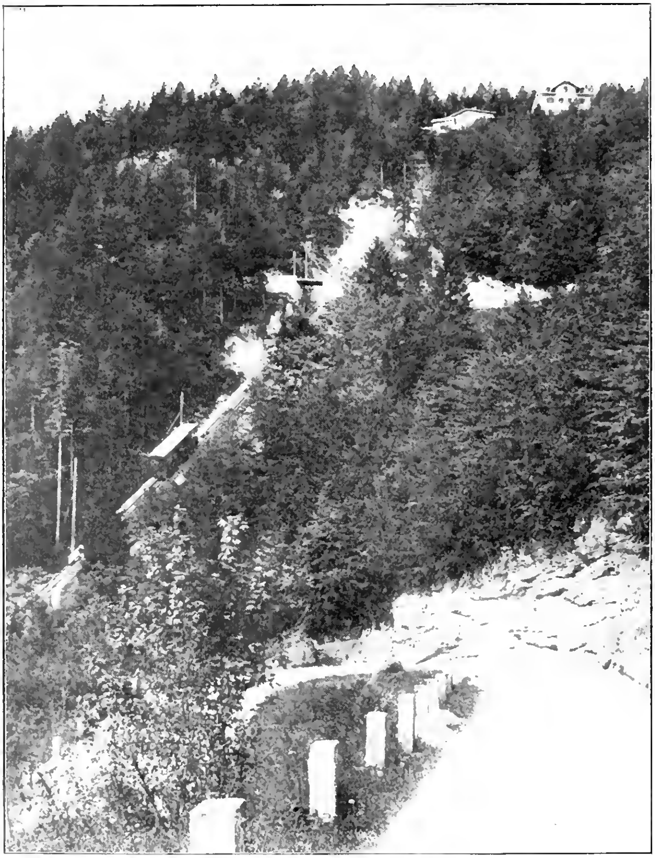


HUNGERBERG INCLINE RAILWAY IN THE TYROL.

This region is one of great magnificence and beauty. In fact the Tyrol may be regarded as an eastern continuation of Switzerland. It is traversed by the great chain of the Alps. The highest mountain in this chain is the Gross Glockner, which rises to a height of 12,776 ft. The Ortler Spitz, in the Ortler range, rises to a height of 12,818 ft. above sea level. The mountains are covered with vast glaciers and on the higher slopes the dazzling brightness of the snow adds to the glory and majesty of the scene. It is to the water power, derived from the torrents which flow out from beneath the mantle of ice that the snow on the silent peaks has been poetically called the "white coal of the Alps."

The needs of tourist travel have been the main factors in callling these steep-graded roads into being, and the Yankee dollar helps largely in maintaining them. The style of motive power has a wide range, varying from steam to cable, hydraulic, electric, to simple gravity roads. They are naturally located among some of the most ravishing scenery in the world, charmed with all the poetry of distant prospects and vast horizons.

The usual conception of a switch or siding is on a level piece of land, even in the most mountainous country; but in one of the views presented of the Virgl ascent in the Tyrol, we see that the very pronounced topography of the short distance over which the grade ascends, did not allow of anything but a siding in almost the steepest part of the gradient, yet these roads are operated with a remarkable degree of safety and annually carry thousands of sightseers and tourists.



THE MENDEL INCLINE, AUSTRIAN TYROL.

Shandy Yarns on Land and Sea.

You have made many sea voyages, and are reticent in a large degree of sights on the way: I have only made one, several moons ago, and I am gloating over it yet. Small blame to me, as the exchequer says, "It was your first—and last."

I always loved to read of sea voyages. In the long ago, when I used to give a show to every nostrum recommended to make a mustache sprout, I ran away from home here in Oswego and went sailing before the mast on "the lakes," as we designated the five great inland fresh water seas. It was customary for young kids to do so. We learned the rollicking walk, chewing tobacco, damning our tarry top lights, and drinking grog, all of which sailors can do to the queen's taste; and to be a full-fledged A. B., we had to go aboard a schooner to catch on to the rest, which included the three heads of nautical knowledge, "to hand, reef and steer." With these things handy in our knowledge boxes, and an ability to perform them, we were duly qualified to assume the stature of manhood, whether the mustache was visible or not, even under a microscope.

Not liking the calling, after I found out the slavish conditions men are treated to who follow it, I made a pier-head jump and cut the job; went to an old friend of mine, who held down the position of roundhouse foreman against all comers—the grief committee hadn't been yet evolved from the womb of time—and I got it. Then began a railroad career which lasted for forty years.

I didn't write the foregoing to give you an autobiography, by any means, but I wanted to tell you that before I was a week on the job of stuffing a wood burner's gullet I originated a conundrum, all my own, and as the M. M. was riding with us between stations one day to watch how she'd burn her fire, I suppose, I fired it at him. I said: "Mr. Morgan, what is the greatest nonsense in the world?" He gave me a look of wounded pride, bleeding at every pore, and in the essence of sarcasm replied: "I don't know." "Well, I do; shall I tell you?" Out came a guttural "yes" from the gall-duct of his internals, and I said: "Putting a cushion on the fireman's side of this old ballaboo." That was the commencement of a railroad career which lasted for forty years and which terminated about 14 months ago on account of the ills of age coming to keep me company. I endeavored to cut their acquaintance here on freedom's soil, but found out I could not shake off their acquaintance, so, like all interesting invalids, I resolved to make a sea voyage.

On the 1st of May, last year, on board an ocean liner, I started for "foreign parts," as Mickey Free said in the novel of Charley O'Malley. We swung out into the North River, and I intently watched old familiar sights on each hand until we got outside Sandy Hook, and our course was laid for the British Isles.

I had another conundrum all my own on the rail, as a kind of solace to a wounded heart, when a newly fledged throttle-bar manipulator would be telling me how his valves required squaring, and it was this: "What is heaven?" The reply was: "Standing on the forward deck of an ocean liner, in the good old summer time, when passing Sandy Hook, as she headed east." I really reveled in the enjoyment I experienced as it came to pass.

Ere the sun sank to the west of Staten Island we were out of sight of land and boring a hole through wind and water at a 17 knot gait. Then my glance from sky line to sky line, all around the horizon, told me that sail was swept from the seas and the mighty giant, Steam, had replaced it.

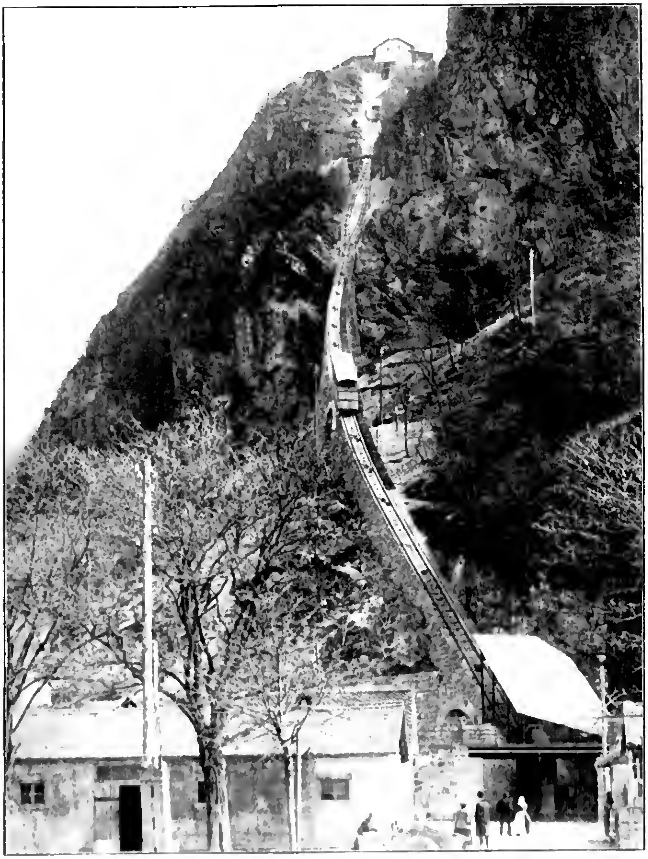
The last time I was east of Sandy Hook was many a long year ago, when the immigrant ships were carrying their living loads to the American shores, and when from one to three months were often required to make the voyage from the Mersey to the Hudson. Now a trifle of time over four days is all that is required, which makes us exclaim, "the world do move," or the liners move, whichever you like.

There being nothing of a very interesting nature to occupy our minds watching the great body of water through which we were cleaving our liquid way, outside, I resolved to have a look inside, and note places of interest there, particularly the second class cabin, where I was domiciled. Everything in the shape of bed linen and covering was exceedingly neat, and the staterooms scrupulously clean; the food very appetizing, and the stewards, assistants and chambermaids decidedly obliging. "Let us take a look into the first cabin," I said to a congenial chum I picked up with since coming aboard. We started and found an iron gate barring entrance, with a good big padlock on it. "No, you don't," said my chum. "This gate bars the way to the land of dollars, where the guests shake gold dust on their griddle cakes and wash them down with dry Mumm." While we were with our noses through the bars a man in uniform was convenient on the luxurious side of the gate, and I asked him if there was any show to get a glimpse of the first cabin. He very kindly answered, "Yes; by applying for a stateroom therein to the purser and paying the difference in the price." I said, "Thank you, sir. Will you kindly answer me one question?" "Go ahead." "Please advise—blank that word advise. It sticks yet in my throat since the great Mogul's letters used to salute me, telling me of a 10 minutes' failure on the night line on account of injectors giving out at Salins, sixty miles away, and asking me to please advise, I tossing in a restless bed at the time—if you know at any time on board of a ship like this when there will be perfect equality and when dollars won't count?" "No, sir; I do not." "Well, I do, and it is when the order is given to 'clear away the boats.'"

There were parts of that ship I desired to explore, and I decided to shake my chum and go it alone; but, alas, "the best laid schemes of mice and men gang aft agley," and I didn't succeed in getting beyond the steerage.

After spending about three months beyond seas I was one of many who were huddled in together on the tender at Queenstown to be carried out to another big liner waiting for us in the offing to take us home. I had resolved I'd explore her from the bridge to the keelson—and I did, hence this letter to you.

As we were passing in through the gangway from the tender a uniformed official, presumably the purser, stood there with an assistant. When I got along I said, "Room 84, first cabin." I was steered off in that direction, and in half an hour or so after the tender left us I had seen all I desired of the land of gold and silver, and when I saw none of it, for the spirit of envy was rampant in my breast. I made my way to room 84, second class which was mine to Boston, good enough for any one who never saw luxury in such great abundance as I did in the fairy bowers of magnificent splendor of the saloon. We were domiciled well aft, and the steerage was away forward, and I made my way there without any interference, as the occupants were at supper. There were about 700 sons and daughters, kids and grandkids of southern Europe, and all with most beautiful appetites, devouring meat, potatoes, bread, butter and other dishes unnamable to me, and licking their lips and fingers after each course and pushing out their platters for more. I tell you there was no need of bicarbonate of soda there in that crowd; potatoes and hash was the slogan of their mother tongue, and I was unacquainted with its curves, but I watched the waiters respond and the food disappear.



A TYROL INCLINE RAILWAY WITH SWITCH ON STEEPEST GRADE.

I inspected their bedding and found it clean, and as everything around the berths was made of iron and wire, I think it would be safe to call it sanitary also. One thing I do know, it was a vast improvement on conditions 60 years previous on board the immigrant ships.

The next place I was anxious to get into was the engine room. Ah, but there was the rub. The engineer next to the chief was a young, honest-faced looking fellow on the sunny side of 30. He used to come into our cabin every day, and I soon caught on to the reason why. He was very intimate with a lady passenger, as if they were "little boys and girls together." As it was about as impossible to get permission to view the sights below the water line as to get to glory, I looked around for another way. After the First Engineer, as I'll call him, took his departure from the lady one afternoon, after gulping down moonshine for a couple of hours together, I said to myself, "That lady can get me permission." I went to her, saying, "Please pardon me, lady, for what you may consider impertinence on my part for addressing you without an introduction, but you resemble a most beautiful lady of my acquaintance so much who has a sister abroad studying music, and who is expected to return this summer, and you bearing such a charming resemblance to her sister, I have trusted to the good nature I see in your face to not feel offended if I ask if you are from Chicago?" She did not. She permitted me to hold a brief conversation with her, and did not appear to be strange in the slightest degree. You see, I had been at the blarney stone but recently, and I am a convert to its virtues. She told me the First Engineer is an old friend of the family—they were little boys and girls together—and she enjoyed his company and appreciated it, as it relieved the monotony of the voyage. I complimented his general appearance, and told her that his position was a much more responsible one than was that of the captain; that I was somewhat acquainted with steam, and it would cap the climax of the voyage's pleasure if I could see the sights of the engine room, but I am exceedingly sorry to say that my desires will never be gratified, as the orders of "no admission" are so strict. "If that is all you require to make you happy I think your wish will be gratified."

Next day I was down amongst the wizards of nature, which were harnessed by the genius of man and obedient to his will. I had heard much of the terrific heat of the fire room, and I supposed that physical endurance was put to a terrible test to keep steam-generating fires. I first went to the coal bin. A young man was wheeling some to a battery of four boilers *with his coat on.* I wheeled a barrow of it to be sure of conditions. I dumped it in front of the furnace doors, and laughed at my life-long suppositions. Two men were cleaning fires. "Here," said one of them, "take this in your hand and see will you laugh," meaning the rake. I did—with my coat on—and I cleaned the fire and covered it, and save a little moisture under my hat, there was no perspiration. I was not prepared for this. The thermometer showed but 70 degrees in the engine room. What a sight to me was the long, long shaft, and its 16 ins. in diameter. I walked beside it till it passed out of my sight aft. When I got back again in the engine room I looked with intense pleasure at the tremendous expansion cylinders, and the music of the machinery reminded me of McAndrew's Hymn, by Kipling:

"The crank-throws give the double bass;
the feed pump sobs and heaves;
And now the main eccentrics start their
quarrel on the sheaves.
Her time, her own appointed time, the
rocking link-head bides,
Till—hear that note? the rod's return
whings glimmering through the guides.
* * * * * * *
Fra skylight lift to furnace bars, backed,
bolted, braced and stayed,
And singin' like the morning stars for joy
that they are made."

I next was shown the engineer's quarters, which were very comfortable, containing many ornaments and a well-stocked library. From there we went into the firemen's cabin, and it was clean, well ventilated and contained comfortable berths. Their food was excellent and abundant, and I considered them well housed, but I have seen excerpts taken from letters written by Samuel Gompers giving his experience of what he saw on an ocean liner. I take exceptions to parts of it. He was a first cabin passenger on the "Baltic" to Liverpool, last June. He got permission to go over the ship with a guide. He represents himself as hustled along through the second cabin, the steerage, and they came to a small, steep and narrow stairway, with an iron ladder leading down below—it must have been to the engine room the entrance led—and when he showed an inclination to go down he was told by the guide that passengers never go down there, that it was "too hot." Hot air is described as belching up and conclusions drawn that it was "an infernally hot place below." Mr. Gompers should have been told by the guide that there is a body of cold air continually being driven down through big pipes, and the hot air up, and it must be that he stood at or near the hot air pipes. Anyway, I'll wager that down in her engine and fire rooms the Baltic had all modern appliances for comfort. I have no retainer from any steamship company to sing their praises; it is only simply stating things as I found them, for justice sake, that I write of them.

Mr. Gompers says: I asked where the sailormen were lodged. "In the fo'k'sle," said the guide, "but visitors never go there. The sailors work four-hour watches, so the fo'k'sle has a lot of chaps in it asleep, and visitors might wake them up." Well, the guide told the truth there. The officer of the watch would not enter the fo'k'sle except on very urgent business unless at eight bells, when one watch has turned out and another getting ready to turn in, as going to bed is called on shipboard. Mr. Gompers, not being a sailor, did not know the rules. I agree with him relating to the obnoxiousness of the tipping system; but why should we kick at it on sea, when all around us on land is growing rotten with it. Take a night in a Pullman, for instance. A story is told of a passenger who was ready, grip in hand, to get out, and his royal nibs came up to him and said, "Brush you off, sah?" "No," said he, "I prefer to walk off."

Let us reform the land ere we tackle the sea.

There are many other things in Mr. Gompers' letters deserving notice, but I have ground out enough of grist for the present and, in the language of shipboard, I'll sing out "Belay!"

SHANDY MAGUIRE.

Faults of Tallow.

During a recent visit to New England we foregathered with some veteran engineers, and, as usual, railroad reminiscences were in order and the ancient way of using the tallow pot was amusingly described. "Going to the front end, tallow pot in hand, was no picnic when the engine was rolling on the rough track," said Walsh, "but getting new tallow into the steam chest was worth the risk and trouble. No groaning piston or cut valves after that soothing dose was given regularly."

Most of the company agreed that Billy Walsh was telling the truth, and the strongest endorsement was given of the tallow pot and its contents. Its use was a reminiscence and therefore worthy of report.

A white-haired veteran named Wilson was, however, inclined to demur from the general praise of tallow. He said: "What about the effect of the tallow in eating holes through the castings?" This was partly agreed to, but a voice was raised blaming the poor quality of castings for the corrosion of cylinders, pistons and valves that caused so much trouble when tallow was used.

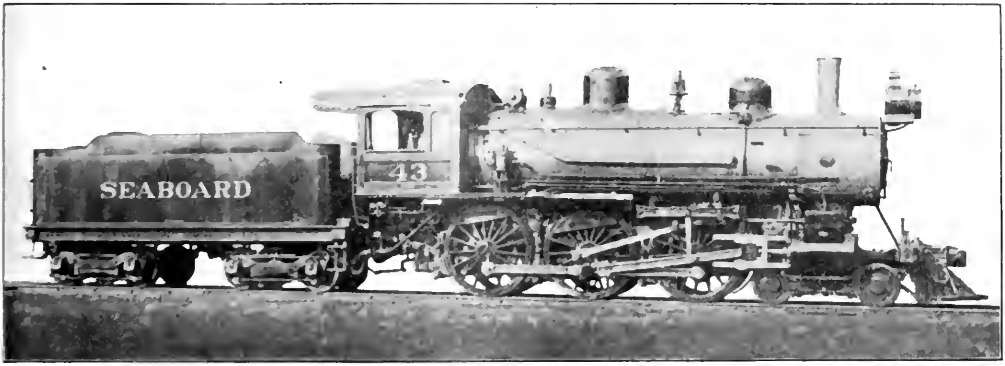
"No," said Wilson, "the castings were not to blame, and the copper joints were not to blame. They were probably all right. It was the acid in the tallow that did the damage. My master mechanic, who was a natural investigator, had the tallow analyzed and found 20 to 25 per cent. of free acid in the tallow. The people supplying the tallow never tried to purity the stuff. All they wanted was big profits, and that practice killed their golden egg goose. Mineral oil used for cylinder lubrication is mixed with tallow, but the makers take care that the tallow they use contains very little free acid."

Passenger 4-6-0 for the Seaboard Air Line Railway

The Baldwin Locomotive Works have recently delivered twenty locomotives to the Seaboard Air Line Railway. Five of these engines are of the six-coupled type for switching service, while the remaining fifteen are of the ten-wheel type for express passenger service. The following description is confined to the passenger locomotives.

The Seaboard Air Line has had a wide experience with ten-wheel engines in general road service. For work which does not demand exceptional steaming capacity this type of locomotive possesses features of unquestioned merit. The new Seaboard engines develop a tractive force of 29,000 lbs., and having a liberal factor of adhesion, they should prove capable of handling heavy trains without difficulty. They will operate over grades of 1¼ per cent.

These locomotives have wagon-top boilers, with narrow fireboxes placed above the engine frames. The latter are



A. J. Poole, Superintendent of Motive Power. 4-6-0 FOR THE SEABOARD AIR LINE RAILWAY. Baldwin Locomotive Works, Builders.

depressed between the main and rear driving pedestals, so that there is ample depth under the tubes. The firebox is radially stayed; one T-bar, hung on expansion links, supports the front end of the crown, while the flexible bolts number 325. These stay the entire throat sheet, and are placed in the outside rows in the sides and back. The furnace is equipped with a brick arch, supported on four 2½ in. tubes. The boiler barrel is composed of three courses, the smallest being 63¼ ins., with the gusset sheet in the center.

The cylinders are single expansion, and the steam distribution is controlled by balanced slide valves driven by the Baker-Pilliod gear. This motion is similar to the Walschaerts, in that the valve derives its travel from a return crank secured to one of the crank pins, and is given lead by means of a crosshead connection. Here, however, the similarity ceases, for the Baker-Pilliod gear dispenses with the link and sliding block, and consists of an arrangement of pin connected rods and bell-cranks. The peculiarities of this gear and of the Walschaerts are very fully explained in the *Valve Setters' Guide* by James Kennedy and sold by this office. The parts of this gear are supported by a cast steel cradle, which is placed outside the leading drivers, and is bolted in front to the guide yoke, and at the rear to a suitable cross-tie. The valves have a constant lead of 3/16 of an inch. The Baker-Pilliod gear is a patented device, and the mechanism applied to the Seaboard Air Line engines was designed by the Pilliod Company of New York.

The frames of the locomotives under notice are of cast steel, 4 ins. in width, with single front rails of forged iron. The equalization is arranged with leaf springs over the leading driving boxes, and yokes over the boxes of the main and rear drivers. The frames are supported on leaf springs placed between the axles and also back of the rear driving pedestals. This arrangement provides four springs on a side, and should promote easy riding.

The tender frame is composed of 10 in. steel channels and oak bumpers. The trucks are of the equalized type, with cast steel bolsters. All truck wheels under the engine and tender are of forged and rolled steel, and were supplied by the Standard Steel Works Co. of Philadelphia. The principal dimensions of these engines are given in the accompanying table.

Cylinder [illegible]

Valve [illegible]

Boiler—Type, wagon top; material, steel; thickness of sheets [illegible] ins.; working pressure, [illegible]; fuel, soft coal; staying, radial.

Firebox—Material, steel; length [illegible]; width [illegible] ins.; depth, front, [illegible]; depth, back [illegible] ins.; thickness of sheets, sides, [illegible]; thickness of sheets, back, [illegible]; thickness of sheets, crown, [illegible] in.; thickness of sheets, tube, [illegible] in.

Water Space—Front, 4 ins.; sides, 3½ ins.; back, 3½ ins.

Tubes—Material, iron; wire gauge, No. 11; number, 328; diameter, 2 ins.; length, 14 ft. 1⅞ in.

Heating Surface—Firebox, 184 sq. ft.; tubes, 2,418 sq. ft.; total, 2,602 sq. ft.; grate area, 30 sq. ft.

Driving Wheels—Diameter, outside, 72 ins.; journals, 9¼ x 11 ins.

Engine Truck Wheels—Diameter, front, 30 ins.; journals, 6 x 10 ins..

Wheel Base—Driving, 13 ft. 6 ins.; total engine, 24 ft. 4 ins.; total engine and tender, 40 ft. 2 ins.

Weight—On driving wheels, 136,850 lbs; on truck, front, 368,500 lbs; total engine, 173,700 lbs.; total engine and tender about, 295,000 lbs.

Tender—Wheels, diameter, 33 ins.; journals, 5½ x 10 ins.; tank capacity, 6,500 gals.; fuel capacity, 10 tons; service, passenger.

Answering Circulars.

May and June are the months when several of the railroad mechanical conventions are held and the investigation work of the year harvested. Chairmen of committees are generally chosen owing to their familiarity with the subjects which they are helping to investigate, but the members ought to remember that the committee members depend upon the association at large to supply the information required to make up a good report. This can only be done by the members generally answering the circulars of inquiry. Unless this is done the usefulness of the associations is seriously curtailed and the practical value of the organization reduced.

Most of the members of the various mechanical associations are proud to tell their general officers about the valuable work done at the conventions they have attended, but comparatively few of them are able to give particulars of their own work in helping to produce useful reports. The failure to do so generally results from oversight and indifference. We give this hint in time in the hope that indifference may be changed to zeal and industry.

Smooth Wheel and Rail.

In an article on the factor of adhesion which we published in our March issue, on page 107 we had occasion to remark that if it were possible to design an engine as light as a handcar, yet capable of developing a tractive effort of 25,000 lbs., we would have a machine which would make very uncertain progress along the track, but would spin its wheels around furiously when called upon to pull loads.

One of the most interesting experiments ever made in the early days of the locomotive was that by William Hedley for the purpose of ascertaining what conditions were necessary for a locomotive to pull a load upon a smooth track. Locomotives had been built, but it was not only generally assumed by engineers of that time, but firmly believed, that the locomotive with smooth wheels would not pull loads along a smooth track.

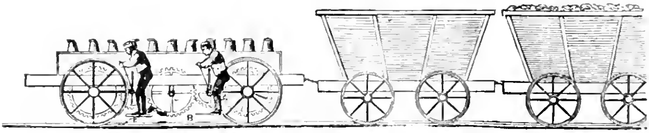
Belkinsop used a cog wheel engaging a rack rail. This engine did satisfactory work, but the rack rail was expensive and its maintenance costly. Chapman's engine worked with a central chain, which frequently broke. Burton used movable legs. These engines are shown in Dr. Sinclair's work, "Development of the Locomotive Engine," to which the reader is referred for further particulars.

It was in the interval between the appearance of Chapman's engine and Burton's walking locomotive that Hedley succeeded in demonstrating the possibility of a locomotive with smooth wheels on smooth track being made to pull a load.

The illustration we present shows the form of machine used. Hedley had a car rigged up with drivers and gear wheels. A couple of men standing on small platforms or steps on each side of the test car operated handles which turned the gears. At first no doubt the wheels slipped, but at last, as weight after weight was added, the machine progressed along the track and pulled coal wagons after it. Thus Hedley disproved the theory which had influenced all engine builders up to that time, that smooth wheels were not effective on a smooth track.

At the time this experiment was made the co-efficient of friction between wheel and rail was not known, and Hedley's test did not establish it. The tractive effort of a locomotive was not then known and this experiment threw no light on it. Hedley found out that with sufficient weight on the drivers, a locomotive with smooth wheels on smooth rails could be made to pull loads. The other engines of that period had generally been over-cylindered, as we would say, and the builders wrongly concluded that because their engines would slip with smooth wheels, that all engines must necessarily slip without some holding point to work on. Hedley, in showing the fallacy of this theory, made one of the most momentous advances in the science of locomotive engineering which has ever been made. He destroyed an error and opened up the road of progress.

After making this discovery concerning smooth wheel traction Hedley built a locomotive in which he used the frame, wheels and gears of his test machine. This engine, however, was not a success on account of the failure of its boiler to make sufficient steam. Then came Burton's mechanical traveler in May, 1813, and in the same month Hedley built a second engine, commonly called "Puffing Billy," which, with smooth wheels on smooth track, a return-flue boiler and exhaust carried up the chimney, was a complete success.



HEDLEY'S TEST CARRIAGE.

B, B, are stages for the men to stand upon. There were other two on the opposite side.

One Engine Pulled More Than Another

There are still superstitions about certain locomotives pulling more cars or steaming better than others of the same dimensions, but the modern engineer generally discovers the cause of the difference without much searching, and he nearly always realizes that the difference is due to some cause that is no mystery.

Two engines were doing the switching around a rolling mill, and it was found that one of them could haul more cars up a certain grade than the other, which was built in the Pittsburgh Locomotive Works. It was some time before a complaint about the weak engine reached the superintendent, but he lost no time in making an investigation. The grade was short and the steam was always at the popping point. The super. listened to each of the engines working and ordered the smoke box door of the weak engine to be opened. He found the exhaust nozzle choked to about an inch and a half in diameter. The front end door of the Baldwin was then opened and they found that the nozzle tip had been removed. The engineer explained that the engine steamed all right without a nozzle tip. The tip was removed from the Pittsburgh engine and it then pulled as many cars as the other.

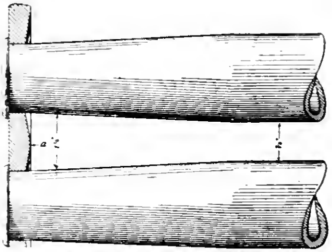
Furnace Cement.

A new fire-resisting cement has been recently put on the British market, adapted for use on the brick bridges of boiler furnaces, or, in fact, in any brick work that has to withstand a high temperature. It adheres to the smoothest surfaces, and is supplied in the form of paste, and requires an equal quantity of water added to it when mixing for use.

Method of Flue Setting.

Our illustration shows a method of flue setting for locomotive boilers which has been devised by Mr. E. C. Stocker, a locomotive engineer on the North-Western Pacific Railroad, and by Mr. James McAdams, foreman boiler maker on the same road. Writing of their invention, for which patent is pending, the inventors say:

"It consists in the construction of the tubes and the manner of their attachment or setting, which prevents the erosion and leakage caused by intense heat in the combustion chambers and on the tube sheets. It is accomplished by reducing the section or thickness of metal interposed between the water and fire and forming arch at *a*, in drawing, it being a well known fact that the life and endurance of all joints in steam boilers is determined by the thickness of metal interposed between the external heat and the contained water. It also consists in swedging or reducing in diameter the end of the tubes entering combustion chambers, and by so doing, it doubles the capacity for water at that vital point and induces free circulation of water around the tubes, limiting the expansion caused by the temperature, also giving space for scale to drop from tubes at that particular place.



NEW METHOD OF FLUE SETTING.

"The object of reducing the tube ends at combustion chamber is for various reasons; to limit the rapid flow of hot gases through them, still maintaining the heating surface by the expansion of the gases as it passes from small to larger diameter of the tubes, which means reducing stack temperature and cost of fuel. It also gives greater distance or pitch between the tube holes and greater stability to the tube sheets."

General Correspondence

How I became a Locomotive Engineer.

Editor:

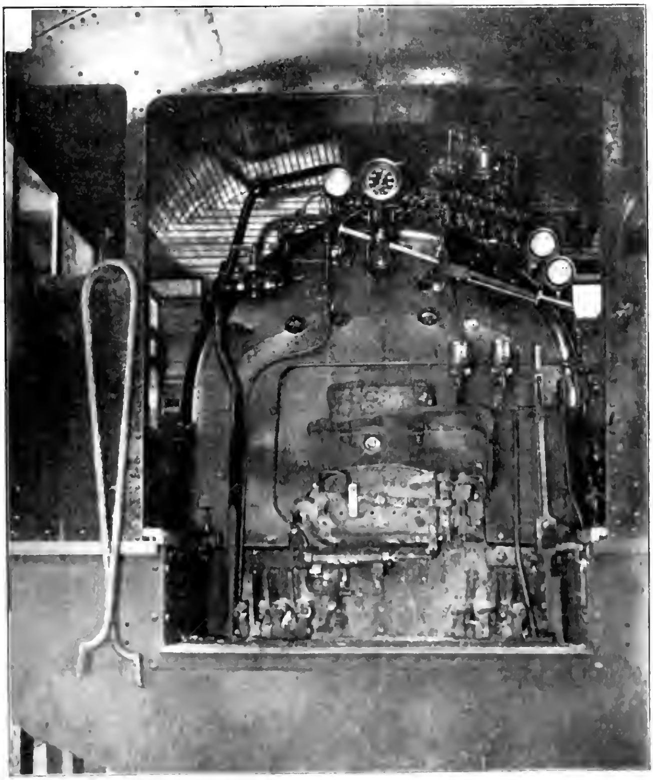
In response to your invitation to locomotive engineers to write short letters telling why they took up that line of work, I take this opportunity to tell the story of my beginning. My father died when I was but seven years old, shortly after I was living with an uncle in Union Co., Ohio, on a farm. The old Nip and O, as it was called in those days, (N. Y. P. & O.), ran along beside my home. While living there I cannot say that I became more than an ordinary observer of things pertaining to a railway.

When I was about ten years old uncle moved to Dayton, O. After being there a few years one could always find me wending my way to one of the roundhouses of the several railways having terminals there. These trips were always made on a Saturday afternoon. My uncle and aunt had made one of those Ohio homes characteristic of that day, and Saturday afternoon was the only playtime I had which would permit me to be gone from home long enough to accomplish the above named purpose.

I will never forget the kindness of an engineer running between Dayton and Cincinnati. He was in passenger service and ran the first extension front locomotive I ever saw. He would let me ride from the roundhouse to the station, and if it did him half as much good as it did me, he certainly has never regretted letting me ride. I was then about eleven years old, and I certainly made up my mind to become a locomotive engineer.

The summer of 1870 found me employed on a farm in Wayne Co., Mich. There was no railway running close by to nurture my ambition to become a locomotive engineer. In the fall of that year there came to work here a man by the name of C. H. Derry, who was very ambitious to get a job firing. This fellow remained for a little more than one year, and his talking about what a good job firing was caused me to settle the matter with myself, and I determined to become a locomotive engineer when I became a man.

I remember along about these years I was at Three Rivers, Mich. The Michigan Central had two passenger trains that tied up there over night. One night I watched the train crew as they sidetracked their train. Then after the engine was cut off I went up alongside of the coaches and commenced looking. I had noticed the brake cylinder exhaust as the train was being moved to the siding, and to satisfy my curiosity I finally opened the bleeder valve of one of the auxiliary reservoirs. It having considerable pressure in it I became frightened, and not waiting to close the valve I ran for my life. Not knowing what I had done I was worried that night, and never went to watch the crew put away their train again.



INTERIOR OF CAB, BALDWIN MALLET COMPOUND FOR THE A. T. & S. F.

I finally became a locomotive fireman against the advice of the farmer for whom I worked in Wayne Co., Mich. I remember one day he told me if I would stay working for him at the end of 20 years I would have more of this world's goods than I would have if I went "railroading," as he termed it. I did not believe him at that time to be right, but I know now he was. But then there is this about it. If I have not as much now at the end of the 20 years, having spent it on a railroad, I certainly have spent a great deal more during these years than I would have spent had I remained on the farm. This money has not been foolishly spent, but has served to do good in one way or another.

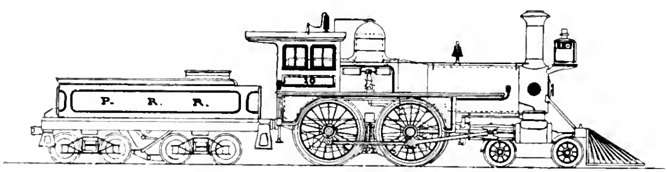
The position of locomotive engineer is in all a good one, and I would advise the right man not to hesitate further than to make sure that he is the right man. The right man is he who has a good common school education, good habits, is not inclined to want to lay off often. He must be of a strong constitution and have his mind fully made up that he wishes to become a locomotive engineer. Then when he begins his training, he will enter into his duties with a degree of satisfaction that one must have to attain success. He must know himself that he is the right man; and if he is, he will not become discouraged in convincing those who employ firemen that he is the right man. My experience as locomotive fireman is, as I look back over the years employed as such, foremost in those things that go to make up what might be termed a good job. To please my engineer was my greatest responsibility, and when I knew I was doing this my work was easy. But as the years rolled by I began to plan on a position of greater responsibility. Have run a locomotive for about 14 years, am still employed as locomotive engineer, and I never did any work so agreeable, take it all round, as running a locomotive.

F. W. BEAIRD,
Engineer G. R. & I. Ry.
Grand Rapids, Mich.

Long Legged No. 10.

Editor:

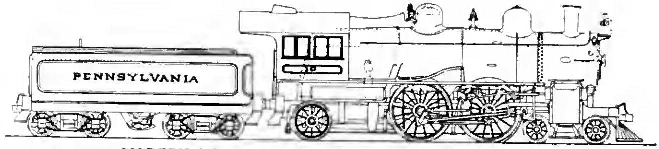
Several contributions and pictures in recent issues of your paper have dealt with old Pennsylvania engines. No doubt many of the younger men have heard of "Long Legged" No. 10 on the Pennsylvania, but probably few know what the engine looked like. No. 10 was one, and, I think, the first one, of a class of high-speed engines designed by the Pennsylvania Railroad, and officially known as Class K, of which nineteen were built in 1881 and 1882. On the road they were known as "Bicycle" engines, because of their large driving wheels of 78 ins. diameter. This class inaugurated many innovations in American locomotive practice; the boiler was set higher than on any previous passenger engine, and there were dire predictions of derailment or overturning of the engine due to the excessive height; the firebox was placed on top of the frames, which made possible an addition of about 4 ins. to the width of the box over previous types; beading was dispensed with, and the dome and stack were very pleasing in their curved and flowing outlines. Alligator crossheads and two-bar guides, and sandbox placed in the wheel covers, made their appearance on these engines, and were used thereafter for all new passenger engines for many years.



OLD LONG-LEGGED NO 10 ON THE PENNSYLVANIA.

The curious device noticed beside the dome and under the hand-rail, was a steam reverse gear, and the engineman could "hook her up" to a much finer degree than usual. These engines were probably the first to have the air pump placed on the left hand side. In subsequent years, extension fronts were added, the steam reverse gear removed, and the sandboxes removed to the top of the boiler. Otherwise they remained as built.

The K's were very handsome machines for their time, as will be seen by a study of the line drawing, and many good records were made. For example, on Sept. 9, 1881, one of them made a mile in 52 seconds, equalling 72 miles per hour. On May 15, 1883, engine No. 184 ran eleven miles in 9 minutes and 52 seconds, or at the rate of 66 9/10 miles per hour; and on Nov. 28, 1891, engine No. 340 made 227 miles in four hours and 11 minutes, or at a net rate of 56.75 miles per hour.



MODERN NO. 10. PASSENGER 4-4-2 ON THE P. R. R.

Engine No. 10 ran her inevitable course in life, first on an express, then on lighter trains, and ten years ago could have been seen daily running an accommodation train out of Jersey City, being retired with her mates only about four or five years ago. These engines were always used between New York and Philadelphia and Camden and Atlantic City, occasionally being sent as far as Washington, but they never saw mountain service.

The present No. 10 is one of a very large class of Atlantic type engines, and she does her trick daily on the Pennsylvania's famous eighteen hour train to Chicago, making the run from Jersey City to North Philadelphia, 84 miles, in 83 minutes by the time card. There are several classes of these Atlantics, differing only in minor details, some having Belpaire and some round-top boilers, some 20½, others with 22 ins. cylinders; in other respects the types being practically the same. Engine No. 10 belongs to the latest class, E 3d, which is the most recent development of standard type, having Walschaerts valve gear and Belpaire boiler, wide firebox, Vogt type of enclosed crosshead guides. These Atlantics are doing most excellent work, and are found on all divisions of the line, from the level Jersey stretches to the division west of Altoona across the Alleghanies. A vivid comparison of the two types can be obtained from a study of the drawings made to the same scale; and a further comparison may be made from the table of dimensions below:

	Class "K."	Class "E 3d."
Cylinders	18 x 24"	22 x 26"
Diameter of drivers	78"	80"
Driving wheel base	7' 9"	7' 5"
Total wheel base	22' 7½"	30' 9½"
Minimum diameter of boiler	49¼"	65⅝"
Working steam pressure	140 lbs.	205 lbs.
Height to center of boiler	7' 5¼"	9' 3 5/16"
Fire-box, inside length	119⅞"	111"
Fire-box, inside width	41¾"	72"
Number of tubes	201	315
Diameter of tubes	1⅞"	2"
Length of tube	10' 11 13/16"	15' 0"
Total beating surface	1205 sq. ft.	2640 sq. ft.
Grate area	34 8/10 sq. ft	55 5/10 sq. ft.
Weigbt on drivers	65,300 lbs.	112,000 lbs.
Total weight	92,700 lbs.	180,000 lbs.

C. B. CHANEY, JR.
Brooklyn, N. Y.

Honor to Whom Honor.

Editor:

Referring to the article on page 96 of your March issue, "Ingenious Repair Work." It seems to me there must be some mistake as to who the credit for this method of repairing cracked cylinders is really due. Mr. G. L. Van Doren, superintendent of the Central Railroad of New Jersey shops at Elizabethport, N. J., worked this scheme up and applied the first one in February, 1907, before our brother's visit from Silvis shops to ours. I want to add that we have changed sixty engines since that time. Therefore we believe Mr. G. L. Van Doren should receive the credit for priority.

W. H. HAWKINS,
General Machine Foreman.
Elizabethport, N. J.

Position of Loads and Empties.

Editor:

I think a train will handle easier with the loads ahead as far as pulling is concerned, or with the tonnage contained in as few cars as possible. There is a question in this which none of your correspondents have as yet touched upon. That is the braking power. It is well known that the braking power of a car is reduced proportionately according to the weight of the load contained. With the empty car you will get the full percentage of braking power, and with empties on rear of train the most severe braking is on rear end, resulting in a stretch out of train which may result disastrously to draft rigging.

With the loads on rear the brake power is reduced enough to avoid this, account of load of cars, and still not enough to cause the loads to run against the empties like going against a bumping post. As to loads and empties mixed through a train, it causes too unequal a distribution of braking power.

A Constant Reader.

Chicago, Ill.

Position of Loads.

Editor:

Your article in April number has been read with interest. Relative to loads and empties, I am in a position to know, as I have handled trains of 100 empties, 85 loads, and 85 loads and empties. Suppose I have a train of 50 loads and 35 empties, the empties on head end. In starting train, won't empties start quicker? and what happens when we come to the loads—a knuckle or draw bar is broken.

If air hose should burst with empties on head end we would have a wreck, this is why empties should be on rear end of train. All big cars should be on head or all large loaded, because the heft of the train being on head end will help the light ones.

J. Hungerford.

Buffalo, N. Y.

Position of Empties and Loads.

Editor:

Referring to the letter of William Scott in your March number relative to frequent discussions among railroad men as to the position of loads and empties in a train and your request for enginemen to give their views, or, rather, experience, also facts and not theory, on the subject, the writer has had an experience of nearly twenty years on locomotives of all kinds and sizes, and has handled freight, passenger and mixed trains made up in every conceivable way, and has been a close observer of all the conditions relative to the handling of trains, and has repeatedly heard the "Old Timer" and the young engineer make the assertion that a train made up with empties ahead and loads on the rear pulled harder than if the same train was made up vice versa, but has never had a fact established nor a theory advanced to back up their assertion.

There is no reason why trains made up with empties on the rear should pull easier than if they were ahead, and the loads on the rear, but a train made up in that order can be handled much nicer and smoother with less strain on the drawheads and less shock to the train in general and less discomfort to the occupants of the "dog house," than if the empties were ahead and the loads behind. If the engineer is particularly careful in the handling of the throttle and the brake valves, he can eliminate all shocks and discomforts, except when the train is running through sags or over "hog backs." It is not within the power or skill of any engineer to avoid the "stretching" or "bunching" of the train, and this same "stretching" and "bunching" has caused more damage to couplers and draw gear than most all other conditions combined.

Many an engineer has been demerited for damage to draw gear or the pulling out of the end of a car starting from a water tank when the "evidence" and report from the car inspector indicated a "new break" or "freshly damaged," which, in the opinions of the super and M. M., could only be caused by rough handling in starting the train by the engineer. As a matter of fact, the initial and major part of the damage occurred miles back while running through a sag or over a hog back, the parts barely holding together until the first stop was made. A train made up with twenty empties ahead and twenty loads on the rear will not pull any harder than if made up in the reverse order, but it might seem so, and this accounts for the impression made on the mind of an old-timer, who said "my train was made up with the loads on the rear and the empties ahead, and it was like trying to pull a cat over the carpet by the tail." Superintendents and train masters should insist that all freight trains should be made up with the loads ahead to avoid the possibility of breaking in two, the parts colliding and spreading the wreckage on another track to be run into by another train, as frequently happens.

Engineer.

Point Pleasant, N. J.

Loads and Empties.

Editor:

I note with much interest the discussion on the positions of loads and empties in the train in the current number of your valuable paper.

My experience has been that the general character of the road over which the train is handled is the factor which makes the difference. In handling a train on a level road or one on which the grades have a uniform ascent free from any level stretches followed by a sharp raise, the position of loads and empties is of no importance, but when handling trains over a rolling country where a sharp descent is followed by a short ascending grade which must be taken at high speed to avoid stalling, the loads should be ahead to insure a good pulling train. The idea being to get the heavy part of the train over or well up on the grade before the speed is very much decreased; also on long grades embracing numerous sharp curves the loads ahead will be the better proposition, doubly so if a slippery rail is encountered, as the jerk from loads at the rear when drivers are slipping badly will often stall the engine when the same loads ahead would not have the amount of slack necessary to do any harm.

The fact that a train can be started with less likelihood of damage to draft gear when the loads are ahead cannot be doubted, but stopping is another question, and the experience we have had along this line convinces us that empties on the rear of long trains are bad actors when the air brake is applied at low speed, and not infrequently the train separates when running at a speed of twenty-five miles per hour.

Our method of tonnage rating may be of interest to your readers, for example: Our locomotives starting from one of the terminals are rated at 2,140 tons. This is carried on the average of 35 cars when all are loaded, and an allowance for resistance of nine tons a car is allowed, bringing the net tonnage down to 1,835 tons. The road is a river grade for 24 miles, rather winding and having several short grades of about 25 ft. to the mile. We then come to the foot of a grade of 60 ft. to the mile with a tonnage rating of 1,000 tons and an allowance for resistance of seven tons per car. At the top of the hill we again fill out to 1,370 tons, with a resistance of four tons to the car.

From this point the road is rolling with a ruling grade of about 45 ft. to the mile. Our experience is that the long train of light cars is the easy pulling train from the terminal to the top of the hill, but from that point, owing to the many "hog-backs" the short train of heavy loads is better, as a much higher speed can be attained through the hollows and the train being short, speed does not decrease so much over the knoll. The only reason I am able to give for the short heavy trains pulling harder up the hill is that we have many sharp curves and the flange friction of heavy cars and the great weight on center and side bearings makes the cars hang back on the curves. Many times stalling results if an engine slips much when rounding one of these curves, but by backing out of the curve they never have any trouble in again starting the train and again going on up the hill. Then again, the more cars in the train, the more allowance for resistance, thus reducing the actual number of tons pulled. In figuring the resistance no distinction is made between loads and empties.

S. B. Morris.

Elmira, N. Y.

The Position of Loads.

Editor:

I read what has been said in the April issue of your valuable magazine relative to the make up of freight trains, with respect to the position of loads and empties. This is an important subject and calls for the best kind of judgment being used on the part of employees, whose duties require them to make up trains at terminals. We must admit that there are employees engaged in this branch of service, who, for some reason or other, cannot see any use in placing loads on the head end, in one case, and on the rear end in another. Then again there are locomotive engineers who, apparently, look at the subject in about the same way, and if asked for an expression of opinion as to the why and wherefore, they seem unable to give any satisfactory reasons.

We are, however, only interested in what the better method of making up trains of loads and empties should be. Practical experience shows that a train made up with the loads on head end, and empties on rear end, can be better handled by the locomotive. It has been noticed, that with train made up in this manner, where the engine is ascending heavy grades, and working up to its maximum effort, that with the heavy part of the train close to the source of power, and the lighter part equally distributed towards the rear end, a more advantageous run can be made, both as to time and train handling. The reverse of this proposition must be explained also. A train made up with the smaller cars next the engine, then heavier ones next these, and the loads on rear end, finally, has worked more hardship in handling long freight trains than any other method of making up trains than all the other systems of make-up.

Of course, it might be said that both methods of making up trains have their peculiarities and drawbacks. To illustrate a case under the former proposition. Presumably we have a train made up with loads next engine, then large heavy cars next these, then the lighter equipment on rear of train. The difficulty encountered in handling this kind of train is found when the air brakes are used to stop it. The 100,000 lbs. capacity cars are usually braked at 85 per cent. of their light weight, the 65,000 and 85,000 lbs. capacity cars are braked at about 70 per cent. of their light weight. Now if these cars are under load, it is fair to assume that there is 100,000 lbs. load that must be taken care of with the brake originally intended to take care of the car when light. The same being true of the smaller cars, etc. When cars are loaded the percentage of retarding force developed by the brakes is materially reduced, and instead of having 85 per cent. as in the former case and 70 per cent. in the latter case, we have about 31 per cent. and about 19 per cent. These percentages are only approximate but serve the purpose of the illustration.

Here is the detrimental feature in handling a train with empties at the rear. Suppose a train is running 12 to 14 miles an hour, and the engineer makes a 12 or 14-lbs. service reduction, not uncommon you'll find it in every-day practice, irrespective of whatever instructions may have been given for or against it. What's the result? Here's the answer and it holds good in seven cases out of ten: Draw bars and draft rigging broken and pulled out, in a few cases trucks derailed and traffic blocked for some time. What caused this trouble? Uneaven braking power, the cars on the rear end holding about three times more than those on head end, the slack taken up with a jerk from the rear end, head end is not being retarded at same time the rear end is, due to loads with decreased braking power being ahead. The result is obvious.

What part of the responsibility for such an accident is up to the engineer? If the trouble developed is due to the 12 or 14 lbs. service reduction, he would be accountable. But this will have to be proved. Rather than endeavor to hold the engineer on circumstantial evidence and on his admission that the aforesaid reduction was made, let us tell him what, in our opinion, should be done to avoid troubles of this character, as far as we are able. It's our opinion that in stopping a train made up in the way this one is, empties at the rear, an initial service reduction of say 5 or 6 lbs. should be made and sufficient time allowed in order that the slack can adjust itself. In this case the slack will stretch, due to the greater braking power on rear end, then heavier reductions may be made, as circumstances may warrant, without danger of doing, or causing damage to the draft gear of train. A locomotive engineer generally has the sense of touch and feel, so nicely and keenly developed, from practical work in the handling of the engine, the train and air brake, that he usually can work without getting into such trouble.

Suppose the train is made up in the way here mentioned, loads ahead, the only way, when possible, it should be made up. Now then if an air hose burst while the train is in motion, and running on a double track, we can better imagine the result than describe it. We know where the responsibility belongs in this connection, and it is no doubt due to a defective air hose getting by the inspectors, or due to lack of one, at some interchange point.

Speaking of the second proposition, the heavy loads on the rear, an explanation is also necessary. Usually this one draws as though the engine was always overloaded, a poorer run is made, more time consumed in getting from one terminal to the other, both trains may be of nearly equal weight, the motive power employed to do the work is equally satisfactory, but the results obtained are wide apart, more fuel and water are used, and then explanations are in order. Perhaps the engineer is quietly informed that he is not getting the work out of the engine? But still it's not his fault, but how are you to get the other fellow to see this? It's no mystery to the practical man; once he is acquainted with the circumstances, he has the answer to the question. What are the hazards accompanying the negative plan, or loads at the rear? Here are a few. Supposing the train, in going over the division, has to cross a few "hoggbacks," maybe it drifts over some of them, the heavy loads on rear end have a tendency to hold back, the engine and perhaps half the train is on the other side, and the tendency is to move ahead faster than the rear end can keep up. Is not a break-in-two likely to occur? The chances are largely in favor of it. What else? If the engineer makes the 12 or 14 lbs. service reduction, as in the former case, the brakes on head end doing about three times more effective work than those on rear end, the slack is forcibly driven up against the engine, and you have the crushing effect and the liability of damaging the train. If an air hose burst, the results are more severe, as then the undesired quick action of the brakes occur, and severe damage cannot be avoided. Is there anything the engineer can do to avoid damaging the draft gear? Yes. He can make a light service application of 5 or 6 lbs., then wait a sufficient length of time until the slack bunches against the engine, and when further and heavier reductions, as may be necessary, he can make them, thus reducing the possibility of damaging the equipment.

JAS. SPELLEN,
Road Foreman of Engines, B. R. & P. Ry.
Du Bois, Pa.

Improving Conditions.

Editor:

It may interest you to know that Mr. F. C. Pickard, assistant master mechanic at the Moorfield shops of the Cincinnati, Hamilton & Dayton, has formed a class for instruction of his shop foremen, engineers and firemen. On the 13th there was a very interesting meeting to consider where and how conditions could be bettered, economy as to care of supplies furthered, etc., and he gave a very interesting talk on the slipping or skidding of locomotive driving wheels, taken from the March number of RAILWAY AND LOCOMOTIVE ENGINEERING. The young men are taking quite an interest in these meetings. There has been a good rest room put up at this point, and your Chart No. 9, nicely framed, is on the wall. A number of magazines are to be found on table, RAILWAY AND LOCOMOTIVE ENGINEERING, of course, among them. This is quite an improvement and all look for good results to follow.

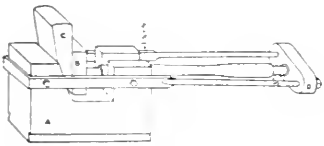
WILLIAM H. W. ROBERTS.
Cincinnati, O.

Upsetting Axle Collars.

Editor:

Enclosed is a blue print of die for upsetting collars on axles as used at the Dale street shops of the Great Northern Railway. The die block A is of cast iron and is keyed into the die block of steam hammer; the block B is recessed to the size of the collar required, the back-stop D also being recessed to receive collar. The operation is as follows:

The axles are first drawn a little each side of center to permit of wheel fit being turned to required length; after this is done they are then taken up, heated on end for 3 or 4 ins., swung in crane from fire to hammer, and lowered into position, the block B being put in place backed by the wedge C. A few blows of the steam



DEVICE FOR UPSETTING COLLARS ON AXLES.

hammer driving the wedge to place completes the operation.

Many hundreds of axles have been scrapped yearly by the different railroads after they have worn at the journal below the limit, when by upsetting a new collar on them, and using them for smaller capacity cars their life is doubled. It was no doubt considered that the old method of upsetting collars on worn axles by the ram was too slow and laborious and did not pay, hence their relegation to the scrap heap. This die does the work quickly, and eliminates the hard labor needed for the ram, making it in every sense an economical method, as it doubles the length of service of axles so treated.

John Treacy,
Master Smith Gt. Nor. Ry.
St. Paul, Minn.

Spring Floods.

Editor.

These are some views of the recent high water in Youngstown, Ohio. On March 3 the Pennsylvania Railroad tracks here were in places submerged and the movement of freight was almost at a standstill. All of our passenger trains were run over the B. & O. and the Erie for a few days.

P. J. Mahar.
Youngstown, Ohio.

HIGH WATER AT YOUNGSTOWN, PA., YARD.

The Peg Leg Railroad.

Editor.

Replying to your recent letter I have tried as far as possible to give you all the information I could secure in connection with the operation of the one-rail line railroad operated here some years ago; and which was illustrated in your April number, page 154.

The "Peg Leg Railroad" extended from Bradford up Brook Valley to Gilmour, a distance of four miles, and was built as an experiment after the plan of a single rail track used at the Centennial Exposition at Philadelphia in 1876, and if successful it was expected to revolutionize railway construction in all mountainous sections of the country.

The track consisted of a single rail spiked to a heavy timber set on piles and cars were carefully balanced on single wheels. A locomotive of equally queer construction completed a train which was one of the most interesting sights of the city of Bradford, Pa.

The road was projected in 1887, the articles of agreement between the gentlemen composing the corporation bearing the date of Oct. 2, 1887. The petition recited that the company desired to construct and maintain a railroad having a gauge not exceeding 3 ft. for public use in conveying of persons and property. Capital stock was limited to $27,000, divided into 540 shares of $50 each.

The officers of the company were as follows: Mr. A. I. Wilcox, President; Messrs. S. H. Bradley, Olean, N. Y., J. B. Brawley, Meadville, Pa., M. N. Allen, Titusvile, Pa., Roy Stone, Cuba, N. Y., George Gilmore, Titusville, Pa., E. W. Codington, Bradford, Pa., Directors. Charter was granted Oct. 4, 1877, and road opened January 1878 as far as Tarport, and on Feb. 11, 1878, it was completed.

The first locomotive cost $3,000 and was a ten ton affair, without a flue in the boiler, a piston and a driver without a crank. The road had to compete with the narrow gauge and was not a good business proposition.

On Jan. 27, 1879, a new 15 ton upright locomotive, shown in your illustration last month, built by the Baldwin people, was put on the road for an experimental trip. A short distance from Babcock the boiler exploded, five men were killed outright and one other seriously injured. The engine was tipped sideways onto the lateral timbers of road, and the two cars, one a passenger and one a flat, were hurled off the track into the creek. The railroad was subsequently sold by the sheriff to a Mr. A. J. Edgett of Bradford and abandoned.

G. R. McGraw,
Storekeeper, Erie Railroad.
Bradford, Pa.

Loco. Department Foreman's Problem.

Editor.

We, as foremen of the roundhouse, back shop and the various divisions of the mechanical department, have a great problem that we alone must solve. We are employed by the differ-

ENGINE NO. 9021. LOOKS LIKE A MONO-RAIL.

ent railway companies of the country for the purpose of solving this problem. Our work is carried on at our respective stations under vastly different conditions, with different facilities and surroundings and yet with the same object and purpose in view.

It is my understanding that the International Railway General Foremen's Association was organized for the purpose of increasing the efficiency of the mechanical foremen of the world, by bringing the foremen together in convention, at least once a year, to discuss the problem which we have, and the ways and means of solving it. Coming as we do, from the various parts of the country where we work under various conditions and discussing the vital matters with which we have to deal, promotes a more general diffusion of the knowledge we desire, than any other means.

With this knowledge we are prepared to adopt the improved methods of operation which must be used to meet the requirements of the times. It is the duty of every foreman to be equipped with as much knowledge pertaining to his work as it is possible for him to obtain. It is for his best interests as well as that of the company by which he is employed.

No industry has made the progress in development, that has been made in the science of transportation. No other influence is as vital and extensive as that of the railroads in connection with the progress and development of the business welfare of the country. What part of this progress are we to be credited with? Are we doing our share? Our opportunities and resources are in abundance. Are we prepared and prompted by a desire to present a possible, simple and consistent solution of the problem?

We should form our plans with a view of raising each individual's efficiency to the limit of his indivdual capacity. If this is obtained with the rank and file, we are progressing with the solution of the problem. We are expected to get results which can only come from men well equipped with and willing to apply knowledge pertaining to their work. Our responsibility and obligations require thought and application.

From our ranks it should be easy for our superiors to choose those who are capable of assuming more responsibility and of meeting the present needs for leadership in the shop and roundhouse. Upon our talent and ability depends the success of many of the undertakings and operations of the department and yet I feel that too few of the many foremen in this department are doing all that they should do to establish a definite, stable, systematic and self-sustaining system for conducting the operations for which we are held responsible. I fear some of us are improvident and thoughtless of the future, or fail even to appreciate the fact that there is a future to be considered. The present is very absorbing, but our plans must not end with the present. The progress of the railroads and of this generation demand that we too must be progressive and the increase in the demands made upon us can only be appreciated by those who have closely watched the growth and development of American railroading.

The position of mechanical foreman was less difficult to fill a few years ago than at the present time with its monster record-breaking locomotives and greatly increased capacity cars and the more intricate labor problems with which we have to deal. Then it was an easy matter to step from the locomotive or shop to a position at the head of some department, but to-day a different kind of ability is required, more qualifications are required and as the development progresses, a still greater ability will be necessary. Shall we be ready for the work, equal to the occasion? Is the fact appreciated by the foremen throughout the country that we must be continuously diligent if we are to be prepared to meet the conditions which will arise?

No doubt other departments have their problems, but no other position is at the same time more important and more difficult to fill than that of the mechanical department foreman, who at the same time has the labor problems and the mechanical problems to contend with. Some have large shops equipped with modern and expensive machinery to take care of, and our superior officers expect that we will render valuable assistance in the successful and economical operation of the department.

Economy is part of the problem we have before us. It is impossible for our superiors alone to so organize the system as to obtain the best results. Our assistance is necessary to produce the most satisfactory and at the same time the most economical handling of the great locomotive power which is placed under our care. We must strive to obtain a good performance of power at a reasonable cost of maintenance and handling. We must combine qualitiy of work with rapidity of handling, especialy in the roundhouse. Are we giving our superiors the assistance they need for the success of the department?

It has been said that it was more difficult to secure a good roundhouse foreman than a railway president, which is not true of course, but the fact remains that it is sufficiently difficult to secure a roundhouse foreman of the right sort and still more difficult for this foreman to secure a full complement of good men to do the work they outline. Therefore, it is necessary that we be up and doing and keep abreast of the times. It is necessary that we be able to judge our men's ability and place them where they will render us and the company we represent the greatest amount of service. It is necessary for us to so organize our forces as to promote the most perfect harmony and hearty co-operation. Efforts without harmony are most likely to prove failures. I believe we should encourage men who make extra effort to make themselves useful. Let them know that their efforts are appreciated. We must also make proper effort to maintain harmony with the members of the other departments in connection with the operation of our station as harmony with them is a very necessary requisite in the solution of our problem.

Economy must be our watchword on each hand. Time and material must not be expended uselessly and without getting results, and I say to all foremen, whether members of the International Railway General Foremen's Association or not, that unless we keep pace with the progress of the great railway systems of the country, our names are liable to be dropped from the pay rolls or placed in such obscure positions that they would better be left off entirely. Our interests are identical with the interests of our employers and our time is valued according to the ability we are able to demonstrate.

I would say in conclusion, especially to the members of the International Railway General Foremen's Association, improve every opportunity to increase your knowledge and efficiency in your work, that our superiors may look upon our organization with favor and appreciate the benefits which we and they in turn receive from our meetings, in order that our membership and usefulness may be increased and our members encouraged to attend our conventions.

J. H. OGDEN,
Pres. I. Ry. G. F. A.

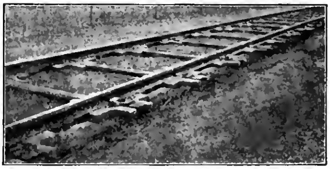
Dodge City, Kan.

Cement and Steel Tie.

Editor:

I noticed an article published in your valuable magazine written by Mr. J. F. Springer, which is not correct, and I wish to put your readers right on the subject. There is no such railway tie as the Corell tie. The cut you show is a section of track laid with the Kneedler concrete steel reinforced blocks, now in use at Sioux City, Ia.

This section of track has been in constant use under heavy traffic for four years, and it is in perfect condition today. We have secured seven patents, covering every point of construction. I claim to be the original inventor of the steel reinforced tie, constructed of blocks or pots. We shall prosecute any infringements of our patents.



SECTION OF TRACK SAID TO HAVE KNEEDLER TIES.

JOHN D. KNEEDLER,
Sioux City, Ia. Patentee.

Retained the Mason Bells.

Editor:

An incident was related to the writer while in Roanoke, Va., a short time ago by Vice-President Eddy of the Norfolk & Western Railroad. This line was built about 1860, and was entirely equipped by locomotives from the shops of the late

William Mason, in Taunton, Mass. Like all Southern roads built in ante-bellum days, it was a five-foot gauge road, and continued as such until June, 1886, when, in common with similar lines in the South, it was altered to conform to the standard gauge.

This change necessitated the withdrawal of the old Mason engines from further service on the N. & W., and word had been sent out to the various engineers on the line to report, with their locomotives at the company's repair shop in Roanoke on the day set for the commencement of operations of changing the gauge. Many of these engineers had run on their machines almost from the time they had been sent out from the Taunton shop, and had an affection for them like unto that which the Arab has for his horse.

"That Saturday afternoon," said Mr. Eddy, "witnessed one of the most pathetic sights ever seen in Roanoke, and touched everyone who beheld it away down into the cockles of his heart. One by one, at short intervals, and from all parts of the system the Mason locomotives were run in a sort of funeral procession, with engineers tolling the bells in mournful rhythm. When the shops were reached many of these old and grizzled veterans stepped down reluctantly from their cabs and patted their old companion of many a long and weary ride, by night and by day, with the affection a parent might bestow upon a loved child, from whom he was about to part. They tied, some a bit of ribbon, others a bunch of flowers, upon it, wiped, with loving care, some speck from its polished trimmings, and then, in many instances, leaned upon its grimy sides and cried like children over the parting."

President Kimball, who was a witness to this touching scene, was considerably affected, and was desirous of showing the men his regard for this manifestation of their devotion to their old engines. He consulted some of them as to what he could do in the matter, and it was the wish of all, that the bells should be transferred from the Mason locomotives to the new machines to which they were assigned. Today, although the Taunton locomotive has entirely disappeared from that section, still up and down the Roanoke Valley the mountains on either hand give back the echoes of those bells which William Mason cast in his shop here thirty years ago.

HERBERT FISHER.

Taunton, Mass.

Painting Old-Time Cars.

Editor:

I noticed in the February number Mr. Geo. H. Lloyd's criticism of my article in RAILWAY AND LOCOMOTIVE ENGINEERING of December last in regard to the "Old Colony" and "Narragansett" rivalry. I hope we shall hear further from Mr. Lloyd in this connection, as I am sure there are few, if any, better able than he to tell of that incident of long ago, when the engines of the Rhode Island and Taunton Locomotive Works struggled for supremacy on the Old Colony Railroad. I claim for my item that it is substantially correct as far as it goes, though I consider the interesting controversy is worthy of a more detailed account than I was in a position to render at the time I forwarded the picture of the "Old Colony" to you for publication.

The passenger cars of bygone days are, to me, almost as interesting and picturesque as the old locomotives themselves. I recall some which were running on the Old Colony as late as 1881, and which are said to have been in service since the opening of the road. They were built by the famous Bradley firm of Worcester in 1845, and at the time the Old Colony sold them in 1882, they had remained practically unchanged from their original appearance. As John Quincy Adams, who resided in Quincy, and Daniel Webster, whose home was in Marshfield, often traveled in these cars, they possessed historical associations worthy of more than ordinary notice. With this brief introduction, I beg to present a couple of items which I have copied from an old South Boston weekly which tell of the elaborate paintings placed upon two of these old-time cars. The glowing description of the early writer leaves little to be desired:

The South Boston *Gazette* of Dec. 30, 1848, says: "For some time past the painters employed by the Old Colony Railroad have been engaged in painting a passenger car. We had the pleasure of visiting the shop a few days ago and examining this car, and pronounce it the most splendid specimen of car painting ever produced. It is of a vermilion hue, shaded with brown and black, while either corner is ornamented with gold scrolls done in a superior manner. But by far the greater attractions are the pictures upon the sides. These were executed by Mr. Kelley, a young artist of very promising talents, and are pronounced by excellent judges worthy of a place in any drawing room. Four in number, they represent scenes in such a manner as to make it appear as if the events portrayed were transpiring before us. A lion springing upon a gazelle as it is drinking from a brook is the subject of one of the pictures. A lady riding upon a powerful charger and accompanied by a dog is also portrayed, while on the other side is a fine view of a buffalo hunt. The fourth, and by far the most beautiful, is a painting descriptive of the inhuman mother and the wolves. The almost fiendish look of the mother, the agonizing features of the children, the appearance of the hungry wolves as they surround the sleigh, and the noble bearing of the horse as he exerts himself to the utmost to escape the ferocious animals are all portrayed in a most beautiful manner. The pictures are surrounded by gilt frames, and as if to make the delusion more perfect, these frames appear to be hung by small cords upon the sides of the car. The painter of the vehicle is Mr. James Hazeltine, who has acquired an enviable reputation as a car painter."

Another clipping from the South Boston *Gazette* of April 7, 1849, reads: "Another passenger car has just passed through the paint shop of the Old Colony Railroad. This vehicle is of a vermilion hue with golden scrolls upon the corner posts, and two splendid pictures of the passenger depot, corner of South and Kneeland streets, upon the sides. The painting on this car fully sustains the reputation which Mr. James Hazeltine has justly earned. We doubt if there is a more splendid vehicle upon any railroad in New England."

W. A. HAZELBOOM.

Boston, Mass.

How a Model Was Earned.

Editor:

I would like to write a few words about your valve motion model. It came last week and every night since there has been a picnic in our house. The foreman came and explained how it worked, and now we are having regular lessons in valve-setting. Now I know all about how the steam gets into the cylinder and after it does it work, I know how, what is left of it, gets out again. I am only an apprentice, and I have no money to pay for high-priced correspondence school courses, so I thought I would try your offer and get a valve model free for 25 subscribers, so I went to work asking everybody to subscribe and showed them the paper. It was uphill work at first. I only got three the first pay day. Then I got seven others that promised, and I put their names down. The master mechanic said that he had more papers than he could read, but when I showed him the ten names I had, he said he would take it for a year because he wanted to encourage young men. I put his name at the head of the list, and when the foreman saw it, he put his name down next. Then they began coming and asking me about it. In two months I had nineteen names, and then it seemed as if I had come to a standstill.

I made another canvas among the men and did not get a single one, and I thought I would have to give it up. One day the master mechanic asked how I was getting on, and when I told him I was stuck, he advised me to see the superintendent, and in one afternoon I got nine more names, and they are still coming. There is nothing like gettting the head men on the list.

R. G. WILSON.

Paterson, N. J.

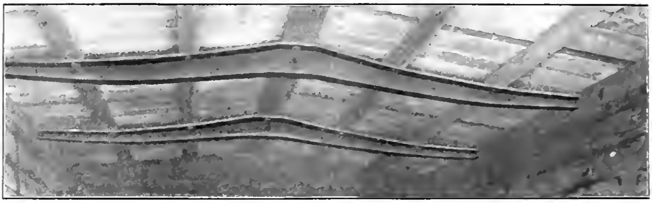
Wood and Steel Box Cars.

Some time ago the Canadian Pacific Railway placed in service 500 box cars that differed quite materially from any cars that had previously been built. Both the under frame and the superstructure are made of steel. The frames of these cars were built by the Dominion Car & Foundry Company, and the roofs, flooring, lining, etc., applied at the Angus shops of the C. P. R. at Montreal. The cars have the following dimensions: Inside length, 36 ft.; width, 8 ft. 6 ins.; height, 8 ft.; side doors, 5 ft. wide by 7 ft. 6½ ins. high. The end doors are of steel, two in number and at one end only. The upper door is for general use and the lower door is for rails. The capacity of the car is 80,000 lbs. Weight, 38,200 lbs.

The features of construction are. Framing of steel throughout; center sills, 15-in. channels; side and end sills, 8-in. channels; side and end posts and braces, 3-in. Z-bars. Corner posts and side plates are made of angles. Body bolsters, cross bearers, and carlines are pressed steel shapes.

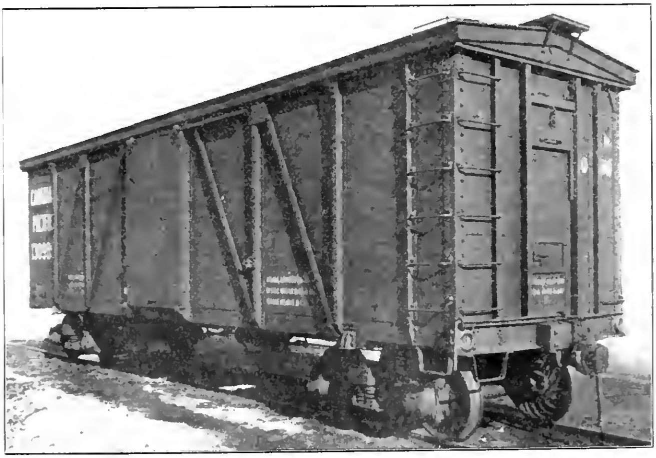
The lining for the sides and ends is one of the principal features of the design, and consists of tongued and grooved B.C. pine, 1¾ in. thick, laid horizontally and bolted to the inside of the posts and braces. The method of attaching does away with the need for outside sheathing, which has been universally used in the past and reinforces the strength of the framing. Provision is made for easy closing of the joints should the wood shrink. This is done by slacking the bolts which secure the lining to the posts and tightening the nuts under the side sills which pull down the straps, bringing with it the lining from the top. To provide for this the holes in the framing are slotted. The floor supports are 3-in. Z-bars in place of the usual wooden nailing strip. The floor is bolted to these Z-irons.

The trucks are of the arch bar type, and have McCord journal boxes, Simplex bolsters, Barber rollers, Susemihl side bearings, channel cross ties and cast steel columns, and inside-hung metal brake beams. The brakes are Westinghouse, Schedule K C 812; draw gear, Miner Tandem class "G" springs; couplers, Simplex; roof, Chicago Winslow improved, inside.



ROOF OF C. P. R. BOX CAR SHOWING STEEL CARLINES.

These cars are very easy to repair when damaged. An instance of this was shown by a car which had been sideswiped, with the result that the side posts and braces were bent considerably out of shape. The lining was removed and the framing jacked into place without heating or cutting apart. The lining was then replaced, the whole operation being done in a comparatively short time with hardly any new material used.



WOODEN BOX CAR WITH STEEL FRAMING FOR C. P. R.

The latest cars are also 80,000 lbs. capacity and weigh 36,700 lbs., which is a saving of 1,400 lbs. of dead weight over that of the first car built. We are indebted to Mr. W. R. Burnett, M. C. B. of the Canadian Pacific, for information and photographs of these cars.

Adhesion and Cohesion.

A correspondent calling herself a female reader of RAILWAY AND LOCOMOTIVE ENGINEERING, writes: The word adhesion is frequently mentioned in your paper, but I have never seen any explanation of what adhesion means. In my desire for knowledge concerning a detail of my brother's business, I have consulted Webster's unabridged dictionary, but that does not make the question clear. It says "Adhesion, to stick, like plaster," and similar meanings, cohesion being given as synonymous. My brother laughs at that and says the dictionary maker does not understand what locomotive adhesion means. What have you to say about it?

Adhesion as applied to locomotives is the weight resting upon the driving wheels to prevent them from slipping under the power transmitted to turn the wheels. It has been found that weight about four times the power transmitted to turn the wheels is necessary to prevent slipping, and that is known as the adhesion of the wheels. The mechanical use of the word adhesion had not come into use when dictionary makers finished their work, and such people abhor innovations.

Cohesion is entirely different from our adhesion, although both words are frequently employed to convey the same meaning. A good scientific authority says: "Cohesion is the force by which particles of matter are held together and makes what is known as 'strength of material.' As particles of matter are called molecules, cohesion is frequently defined as molecular attraction."

Cohesion belongs particularly to solids, and is in fact the cause of their solidity. In some it is much stronger than in others, rendering them harder or more tenacious. Extremes in degrees of cohesion are steel and putty. Liquids have so little cohesion that their weight alone overcomes it, but there is some cohesion in liquid, as may be noticed by the way drops of water cling into globules. Aeriform fluids have no cohesion. Another force, called repulsion, means tending to force the particles apart. It is to this fact that gases owe their ability to readily diffuse when not confined in a vessel.

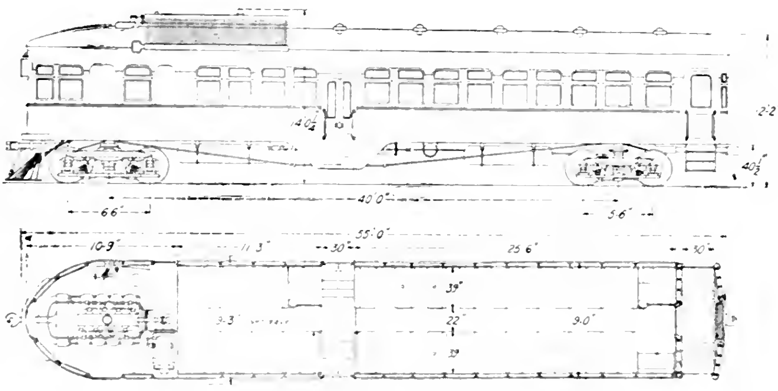
Gas-Electric Motor Cars.

The gas-electric motor cars recently purchased by the Southern Railway from the General Electric Company, as shown in the outline view, have been designed with special reference to traffic conditions in the South. The car is divided by a center entrance. The seating capacity forward of this entrance is 14 and to the rear is 38, making a total seating capacity of 52 passengers. A rear entrance is also provided, thus completely dividing the forward and rear passenger compartments.

The car body is 55 ft. long over bumpers, and of this space the engine compartment takes up 10 ft. 9 ins. The car is constructed of steel frame work and sheathed with steel plates, the interior being finished in mahogany. The truck under the engine compartment has a wheel base of 6 ft. 6 ins. and is equipped with M. C. B. 33-in. steel wheel. On each axle of this truck is mounted standard 100 h. p. 600-volt box frame, commutating pole, railway motor, type GE-205, thus giving the car a motor capacity of 200 h. p.

In the engine compartment there is a direct-driven gas engine generator set, the engine being of the 8-cylinder "Y" type, each cylinder 8 ins. in diameter by 8 ins. stroke. Direct coupled to this engine is an 8-pole 600-volt generator provided with commutating poles. The engine ignition is furnished by a low tension magnet and magnetic spark plugs. The carburetor is of the overflow type and hot-water jacketed. Compressed air is used for starting the engine, this being supplied to the several cylinders in succession through a distributing valve. Compressed air is supplied from a pump direct driven by the main crank shaft. A small auxiliary gas-engine drives an auxiliary pump to supply compressed air to the main reservoirs when necessary. This gas-engine is also direct connected to a generator for lighting the car. Combined straight and automatic air brakes are furnished together with the usual auxiliary apparatus, and in addition to these brakes an auxiliary ratchet and hand brake is part of the equipment for emergency use. A radiator is placed on the roof of the car, which provides an efficient means of cooling the engine on the thermo-siphon principle. During the cold weather hot water from the engine circulating system will be by-passed through the passenger compartments.

As there is no mechanical transmission between the engine and the axle, the speed of the engine is not a function of the speed of the car; consequently the gas-engine may be operated so as to give its maximum output irrespective of the speed of the car.



GAS ELECTRIC MOTOR CAR FOR THE SOUTHERN RAILWAY.

Heirs of All the Ages.

We who live to-day have been described as the heirs of all the ages, and by that is meant that we, being the latest production of evolution, have the result of the accumulated knowledge of all those who have gone before. This is practically true; the lost arts, if there be any, are insignificant in comparison with the discoveries which have been made and are ours. The knowledge mankind possesses today was wrested from nature by toil, patient experimenting, hard thinking, success alternating with failure. However hardly won, it belongs to the world today.

The story is told by Professor Huxley, that when a young man he worked laboriously upon a certain problem. He stated it as best he could and took it to the Royal Institution to see if he had not made the discovery of perpetual motion. He waited in the hall until a shabbily dressed man came in and the hall porter advised him to follow this man into his office and show his work. Huxley did so, full of hope. The shabby man looked the pages over carefully and handing back the manuscript said to Huxley: "Young man, do you know anything of mechanics?" Huxley admitted that all he knew was in that paper, and the shabby man, who was Michael Faraday, advised him to leave the hopeless quest, for something more likely to yield results. Huxley devoted himself to biology and wrote his name large among the world's great men.

The progress of the last few hundred years becomes apparent when we reflect that in Queen Elizabeth's time a fork at the dinner table was unknown. George Washington never had a kerosene lamp and Lincoln never saw an electric light. Hedley did not know the co-efficient of friction and could not have calculated the tractive power of one of his own engines, but it was his work that broke down the fallacy that smooth wheels and smooth rails could not be used together. Faraday discovered that a closed circuit of wire brought near a permanent magnet results in a flow of electricity through the wire, and that on drawing the wire away a reverse flow takes place. From this discovery came the dynamo.

There is not a boy beginning his career as engine cleaner who has not the chance to get for himself, by study, application and good reading as much of the world's knowledge as he needs. A college education is a good thing, but it is only one kind of a start; the getting of knowledge is almost entirely a matter of personal application and a sincere desire to know.

We not only have positive knowledge today, but we can understand where others went wrong. Hedley's contemporaries believed that smooth wheels and smooth rails would not work. They did not try to find out if it was true or not. It is not now necessary for men to perform a second time the successful experiments of the past, except for verification, or having more accurate instruments, to obtain figures more closely in accord with truth. The mechanical equivalent of heat twenty years ago was taken at 776 foot pounds, while today, owing to more careful experiments, it has been shown to be 778.3. Nevertheless, the fact that heat had any mechanical equivalent was the great discovery, and today, with our text books, our records, our histories preserving for our use the great work done by the mighty workers in past generations, we who inherit all that has gone before, who have as ours all that has been accomplished, we are the heirs of all the ages.

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances.

Published Monthly by

ANGUS SINCLAIR CO.

114 Liberty Street, New York.

Telephone, 984 Cortlandt.

Cable Address, "Loceng," N. Y. Glasgow, "Locoauto."

Business Department:
ANGUS SINCLAIR, D.E., Prest. and Treas.
JAMES KENNEDY, Vice-Prest. and Gen. Mgr.
HARRY A. KENNEY, Secretary.

Editorial Department:
ANGUS SINCLAIR, D.E., Editor.
GEORGE S. HODGINS, Managing Editor.
JAMES KENNEDY, Associate Editor.

Boston Representative:
S. I. CARPENTER, 643 Old South Building, Boston, Mass.

London Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., 3 Amen Corner, Paternoster Row, London, E. C.

Glasgow Representative:
A. F. SINCLAIR, 49 Jamaica Street, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid in the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribe in a club, state the name of the agent.

Please give prompt notice when your paper fails to reach you regularly.

Entered at the Post Office, New York, as Second-class Mail Matter.

Static and Kinetic Friction.

Friction has been defined as the resistance to motion due to contact of surfaces. The amount of friction is due to the pressure between the surfaces, the roughness or smoothness of the surfaces and to a certain extent on the adhesion existing between them, or, in other words, the material of the surfaces in contact. Friction is one of the sources of loss in a machine and is the final enemy of perpetual motion. Friction when reduced to figures is generally given as a certain proportion of the weight of the body to be moved, and this is called the co-efficient of friction.

Suppose a smooth block of steel weighing 50 lbs., when slid along smooth brass is found to require a pull of 7½ lbs., then the amount of the pull becomes the numerator of the fraction and the figure representing the weight of the block becomes the denominator of the fraction, we get 15/100 or 3/20 or 0.15 as the co-efficient of friction for steel on brass. This, for all practical purposes, may be called the static friction between these substances, as the figures are true when the steel just begins to move on the brass. As a matter of fact, when the two bodies are actually at rest it requires a little more to start them than to maintain the motion. This may be due to a slight interlocking of the adjacent particles on the surface of each.

Perhaps one may picture the meaning of static friction by supposing that we have an oak box filled with matches, resting on a smooth elm plank. The co-efficient of oak on elm with fibers parallel is 0.25, therefore if the box and matches weigh 10 lbs. it will require 2½ lbs. to draw it along the elm board. If a string is passed over a frictionless pulley at the end of the plank and a 2½-lbs. weight be suspended from the string, the oak box would be just ready to move. Theoretically, if you took a match or two out of the box, so as to give it a chance to start, you could throw the matches back after the box had begun to move. It is this starting or static friction which is ordinarily meant by the co-efficient of friction.

The curious part about the co-efficient of friction is that if you made the motion faster and faster, then after a certain speed had been reached this co-efficient would not give the ratio of resistance between the surfaces. As the speed becomes greater the co-efficient becomes less. Our box of matches would take less than 2½ lbs. to move it, if traveling very fast. One of the rules given in the text books of former days was at variance with this now well known fact, for we find in Trautwine's civil engineer's pocketbook, published in 1881, the statement that the co-efficient of moving friction is the same at all velocities. There is a footnote to the effect that there is reason to doubt this statement, as Prof. Thurston has proved it untrue with regard to axle friction, and in dealing with axle friction another footnote in the same book says that Prof. Thurston found the co-efficient of friction is much affected by velocity and by the temperature of the journal. That was in 1878. About the same time in England, the Galton-Westinghouse brake tests demonstrated beyond question the fact that the co-efficient of friction diminishes as the speed rises.

The word static comes from the Greek, meaning, "to cause to stand still," and the word which is for convenience applied to moving friction, viz., kinetic, comes from the Greek root "to move." The use made of these two forms of friction in the stopping of a railway train has its most striking application in the high-speed brake, and may be shown by taking a definite example. Suppose we have a passenger car weighing 64,000 lbs., and that it is supported on two trucks of four wheels each. There is under the car eight wheels, each carrying 8,000 lbs. In an article in our issue for March, page 107, entitled "The Factor of Adhesion," we referred to the co-efficient of friction between wheel and rail as 0.2, or under certain circumstances as 0.25. In the Westinghouse table 0.25 is taken as representing the static friction of brake shoe and wheel. Each coach wheel carries 8,000 lbs., and with a co-efficient friction taken at 0.25 it would require a force of 2,000 lbs. to skid the wheel. As a matter of fact the Westinghouse rule is to take 90 per cent. of the light weight of the car as if it was the actual weight, in order to allow a margin sufficient to make sure the car will not be over-braked. For the purposes of brake calculation this car would be supposed only to weigh 57,600 lbs. and each wheel is supposed to carry only 7,200 lbs., and with the co-efficient of friction as 0.25, it is calculated that 1,800 lbs. would skid the wheels. The Westinghouse rule amounts in this case to a margin of 200 lbs. to come and go on, for greasy rail, etc., for each wheel. The allowable static friction in this case is therefore 1,800 lbs.

When we come to kinetic friction we have to turn to the table of co-efficients obtained in the Galton-Westinghouse tests. At a speed of 60 miles an hour the co-efficient of friction is 0.072 and this would give only 518.4 lbs. This means that an air pressure in the brake cylinder which was capable of exerting a retarding pressure on the wheel of 1,800 lbs. at about 2 miles an hour could only exert a retarding force of 518.4 lbs. on the wheel spinning along at 60 miles an hour. At about 30 miles an hour the co-efficient of kinetic, or dynamic friction, as some call it, is 0.163 and this gives a pressure on the wheel of 1,173.6 lbs. There are of course like variations for other speeds, but the loss of brake power at high speed is sufficiently apparent from these figures.

The principle of the high-speed brake is to vary the pressure on the brake shoe according to the speed. At 60 miles an hour when the co-efficient of kinetic friction is low a very high brake cylinder pressure is used, indeed more than enough to skid the wheels if the speed was slow. This pressure is allowed to gradually blow down as the speed slackens, and as the speed is reduced the co-efficient of friction comes up, so that for practical purposes the high-speed brake makes up to the wheel in pressure what it lacks in effective friction at any time, and thus maintains a general average of fairly uniform retardation from the time the brakes are applied until the train comes to rest.

Science Mysteries.

Those who begin to study scientific problems after they have grown up are entitled to as much sympathy in the difficulties they encounter as the heathens, who have passed a life in religious darkness and at years of maturity have religious doctrines thrust upon them. When a young man receives scientific instruction as part of his education, the mysteries that are liable to excite heresy and unbelief are generally made clear by instructors who help to explain away obstacles to comprehension. When a grown person, however, becomes a student of scientific problems, he meets at the very portals of the study, with unproved statements given as fact, and he is in danger of giving up the pursuit of this line of knowledge and saying in his wrath, all writers on science are liars.

One of the most trying tests for the faith of a novice is the statements usually made in explaining the laws relating to matter. To be informed that matter is divisible into infinitely small particles called atoms that no human eye or magnifying device will ever be able to see, is to excite the question, How can that be proved? To be told that atoms of different substances are of certain known weights excites the question: Who was able to weigh an entity so small that no microscope can be made powerful enough to show its form?

As the student advances in the study, these and other difficult subjects become more comprehensible; but it would be well for the compilers of text books of science to distinguish a little more clearly between what are established facts and what are theories, no matter on what evidence the latter rest.

There are a great many things believed about matter and forces of nature which never will be conclusively proved; yet those who have studied their phenomena most profoundly are thoroughly convinced of the truth of the theories concerning them. Molecular motion, for instance, as an explication of heat, is one of the most trying theories to put upon the faith of a novice. Science says that heat is caused by the movement of the internal molecules forming the substance. The natural question arises: How can there be movement in the particles forming a hard piece of steel? Common sense would at the first thought call the theory absurd. Yet there are proved facts in connection with metal and other substances that seem equally absurd and can be proved by experiment to be facts, not mere theories.

If the objector who considered it absurd to say that there could be movement in the molecules inside a piece of dense steel, were asked if he thought it possible that the same steel could absorb any form of gas, he would readily answer that such an idea was as absurd as the other. Yet the power which solids and liquids possess of absorbing many times their own bulk of gases is among the most astonishing phenomena in nature, and is as true as the fact that water becomes steam when heated to a certain temperature. This is spoken of as the occulsion of gases in solids and liquids. Platinum, which is the densest of all solids, absorbs as much as five times its own volume of hydrogen without any increase in bulk, and the metal palladium absorbs 643 times its own volume of carbonic oxide and remains unchanged in volume.

Most of our readers are familiar with the operation of converting wrought iron into steel by the process of cementation. The success of that process is due to the readiness of iron to absorb a foreign substance under favorable conditions. The carbon which converts the iron into steel penetrates to the heart of the metal. Other phenomena of a similar character might be mentioned, but the instances given illustrate how readily one with elementary knowledge may make a mistake by assuming that science facts are contrary to common sense.

Overheating of the Main Rod.

As the warmer weather approaches the tendency of locomotive bearings to overheating increases. This is to be expected and extra care, if possible, should be taken that all bearings should be kept clean and well lubricated. In regard to connecting rods, the fact that many locomotives are now equipped with solid brasses the danger of heating in that particular kind of bearing is greatly diminished. There is at all times, however, a particular likelihood of the main rod bearing to become heated, partly from the fact that it is constantly the subject of treatment in the matter of tightening the key or adding new liners, and also partly from the fact that the main crank pin gradually loses its perfectly circular form. It will be noted by observing machinists that eccentrics wear most at the smallest part of the eccentric or that nearest the axle. This is owing to the fact that that part receives the shock of reversing the movement of the link at both ends and hence the metal of that part of the eccentric wears away more readily than the larger part which merely carries on the lateral motion after it has been begun.

The crank pin is subjected to similar shocks with the result that the outer side of the crank pin at both front and back centers wears away more rapidly than any other part of the crank pin. This can be readily observed by calipering the crank pin when opportunity occurs. Machines for trueing up worn crank pins are not in such common use as they should be, and the attempt to do the work by hand is far from perfect in its results. When the crank pins have become much worn at the particular part referred to, the correct fitting of the brasses becomes impossible, and the tendency to heating becomes increased from the fact that, as a rule, engineers naturally fall into the habit of keying up the brasses while the rod is on one or other of the centers, the point, of course, where the worn crank pin measures the least. The keying up while on the center should be done guardedly and the operation supplemented by trying the bearing at some other point and ascertaining whether the bearing readily moves laterally on the crank pin.

The method of leaving the brasses slightly open on the crank pin end of the main rod is not good practice. The tendency of the brasses to loosen is very great, and loose brasses are sure to bring trouble by affording ready ingress to dust and other substances that superinduce rapid wear and heating. At the front end of the main rod the brasses may be reduced so that the two brasses may remain slightly apart, care being taken not to tighten the key beyond the point of an easy bearing. In all keying up the key should not be driven with much force, as the slight taper on the key makes it a wedge of great force and brasses may readily be bent out of shape by reason of the over pressure of a key and so pave the way for endless trouble. In the case of pounding it is always time well spent to insure the careful and correct fitting of the main rod bearings. In the matter of lubrication, graphite has been found to possess great cooling qualities when used with lard oil, and when properly lubricated and care taken that the pin does not bind in the brasses at any point of the complete revolution of the crank pin, there should be little or no difficulty in regard to the overheating of the main rod.

A Mental Awakening.

An old engineer, writing about his experience nearly half a century ago in railroad shops, says: "The ambitious shopman of this generation has so many well known engineering books and publications to help him, that nothing but will is needed to obtain a knowledge of the technical part of his business. It was very different fifty years ago.

"Books and papers treating of steam and of machinery were then both scarce and expensive. I remember well the first technical book I ever saw. It was called 'The Mechanic's Calculator,' and belonged to the foreman of the shop. He kept it locked in his desk and seemed to prize it as much as if it were a precious jewel. In those days, a shop hand who was fortunate enough to know something of the principles underlying his trade, or could work out problems in screw cutting, gearing, valve motion and such like, jealously guarded his knowledge or would sell it to others at fancy prices.

"One dinner hour, while sauntering about the shop, I espied the foreman's treasured volume lying on the top of his desk. I took up the book, and glancing hurriedly through it, found a chapter devoted to steam engines. Here I paused, read and reread the rules, problems and explanations, but they were all mysteries to me. I felt for the first time that I was merely an animated machine, since I was drawing lines, describing circles and doing many other things daily without being able to give a reason why they were done. I felt abashed and humiliated. When I left school, I had a very crude knowledge of arithmetic. Greater knowledge of it I felt would unlock the mystery of the signs in 'The Mechanic's Calculator,' which I could not understand.

"There was an old Scotsman working in the shop at the time, an excellent mechanic, who made no mystery of what he knew about the technical part of the machinist art. I spoke to this man about the foreman's book, and about my own ignorance and desire to learn all that I could about the theory of the business. He advised me to attend a night school and study arithmetic and geometry. The end of it was that I took his advice. But it was not the night school alone that helped me. That impressed upon me the need for more knowledge, and my daily occupation became a school. When I saw anything done that I did not understand I did not rest until I knew the why and wherefore of the operation. When a youth once gets the thirst for knowledge he acquires what he wants from all quarters."

Compounding and Superheating.

The application of compounding and superheating to railway locomotives has for some time past aroused interest in Great Britain. The state of this case was very well put by Mr. George Hughes, chief mechanical engineer of the Lancashire & Yorkshire Railway, when speaking recently before the Institution of Mechanical Engineers. The primary aim of compounding and superheating alike is a reduction in the coal bill. In both cases also it is a matter of common knowledge that theoretically there should be a substantial economy, and in general stationary practice some such economy is realized. Hence one naturally infers that locomotives would also benefit by compounding and superheating, at least as regards fuel economy.

With regard to compounding, it is worth noting that the comparative lack of success of compound locomotives in the past has been due in large part to mechanical as well as thermal deficiencies. Thus the starting difficulty has been a pitfall to many designers. Obviously, an ordinary compound engine with only one high pressure cylinder will often find itself with the high pressure piston in such a position that it will not start; the low pressure cylinder is out of action until the engine has started, since its supply of steam comes through the high pressure cylinder. In order to overcome this condition, some means must be adopted for admitting boiler steam to the low pressure cylinders. The many detail methods of doing this fall into two broad divisions. In one are those methods which permit of a slight leakage of boiler steam into the low pressure steam chest. When the engine is running this steam is only a small proportion of the total used, and has very little influence on economy or power distribution. When the engine is standing, however, the leakage of steam accumulates in the low pressure steam chest and is sufficient to start the engine.

The other methods involve a valve for admitting boiler steam to the low pressure cylinder. The valve can be cut out of action when not needed, but, if not automatic, it is liable to be left in use when not required, thus leading to low steam economy and inferior distribution of the load between the cylinders. Mr. Hughes adopts the valve method of admitting steam to the low pressure cylinders for starting, but the valve is automatically controlled by the reversing lever so that it is only in action at full gear. Further, by adopting four cylinders, two high and two low pressure, the starting load is divided between two cylinders, and gives a lower maximum and a more equal average starting effort.

The economy of compound locomotives depends primarily upon two things. With two expansion cylinders it is easier to obtain a more complete expansion of the steam than in a single cylinder. Also the range of temperature in one cylinder is reduced by compounding, and initial condensation is decreased. As regards this last, Mr. Hughes notes the fact that at high speeds initial condensation is less than at low speeds, and hence reasons that compounding will be most economical in slow engines.

Some experiments made by Mr. Ivatt on the Great Northern Railway seem to confirm Mr. Hughes's ideas. Mr. Ivatt tested a four cylinder compound engine against a two cylinder simple engine, both being on express service between London and Doncaster under identical conditions. As regards coal the results were very slightly against the compound, and in repairs and oil the advantages also lay with the simple engine. Mr. Hughes's results, based on eleven engines of each type and covering a period of two years, showed a saving in coal effected by the compound engines over the simples of between 9 and 10 per cent., but when shunting, ballasting, and light-engine miles were deducted the saving fell to 3.2 per cent.

As regards superheating, Mr. Hughes experimented with both goods and passenger engines. The saving in coal was very marked, about 12 per cent. for the goods and 21 per cent. for the passenger locomotives. Owing to the higher speed of the latter it might be expected that the saving would be less, but the explanation seems to be that the frequent stoppages of the goods engines militate against economy by allowing the superheater to cool down, so that the first steam after restarting will be wet or low in superheat. In practice the superheater locomotives in both goods and passenger service have shown themselves able to haul loads 10 per cent. or so heavier than the non-superheating engines.

Information regarding maintenance is not given in the paper, but one would anticipate a heavier repair bill for the superheater locomotives. As a broad generalization from the results given, one may say that a well designed compound engine justifies itself for slow goods traffic, whilst a superheater locomotive shows to best advantage where the runs are long, as in express work. There is, however, no reason to think that speed is an advantage for the superheater, and, indeed, it is probably in itself a disadvantage. One thing Mr. Hughes's paper makes abundantly clear, and that is that locomotives may be classified according to their duties, and that each class requires special qualities. It is therefore impossible to say of compounding or superheating that it is or is not a failure without specifying under what conditions.

Utility of Higher Schooling.

For years education has become a sort of shibboleth used to pass all sorts of people along the highway of progress, people who are frequently devoid of all the attributes that in a fair field have pushed the select upward and onward in the race of life. Where misery exists, where vice and crime are rampant, where turbulent elements endanger the safety or even preservation of society, we are told to possess our souls in patience waiting for the good time when education will effect the regeneration of mankind, making the wolf and jackrabbit run together in harness.

Education has done so much to push certain individuals above the madding crowd, the mental training of systematic education has enabled certain nations that have nurtured school houses to outstrip in moral and physical progress nations less enlightened, that it takes much courage to move a prominent citizen of the United States to protest that the value of nearly all branches of higher education is greatly overestimated. That is what Mr. R. J. Crane, of the Crane Co., Chicago, has done, in a volume of 331 pages. The book, which carries the title "The Utility of All Kinds of Higher Schooling," can be obtained from the Crane Co., Chicago, price $1.

Mr. Crane holds that every boy and young man has a right to know exactly what higher education is prepared to give in exchange for his time and money spent upon it. The author makes a clear distinction between education and schooling, and has been at much pains to investigate the effect of college training upon the fortunes of young men who have gone into the world to earn their livelihood.

In pursuing his investigations Mr. Crane adopted the Socratic method of asking questions, and he certainly received information of a surprisingly negative character. The leading educators were first questioned, and they with one accord urge the importance of education for business men. They stood bravely, not to say unscrupulously by their class.

College graduates were then questioned, and most of them were loyal to what they considered the interests of learning, but a few admitted that a literary or scientific education did not compensate for the lack of practical knowledge. Others again confessed that among employers they found decided prejudice against college graduates.

When the investigation was extended to business men it was found that most of them were mildly favorable to college graduates for employment by their neighbors. Some of them, who wrote in the most friendly terms about college men, employed none of them, although their employees were numbered by the hundreds. This is especially true of the higher railway officials.

Want of space prevents us from discussing the book at length, but we commend it to those who are inclined to place a high estimate upon the advantages of a college education. The statements made in the following paragraphs appear to be sustained by sound arguments:

"I challenge any technical graduate to mention any idea that he got in his school that he found he could apply to advantage in the factory."

"I do not know of a good, successful, substantial manufacturer who contributes toward the support of technical schools."

Fog-Signalling in Belgium.

A new system of fog signalling is in operation in Belgium. It consists of a sufficient number of luminous relays in advance of each signal. These are located as near as possible to the track. Each signal is preceded by three luminous repeating signals, which show a yellow-orange light when the signal arm is horizontal and a green light when it is in its inclined position. The lamps of these relays are electric, fitted with powerful reflectors and furnished with yellow and green glasses. The system is said to meet with general approval.

Book Notices

Air Brake Catechism and Instruction Book. By Clinton B. Conger. 269 pages, 4 x 6½ ins. Cloth. Price $1.00.

This book is a thorough revision of a work that has been built up with the progress of the air brake to the twenty-fourth edition. This time it is practically rewritten. It is not a reprint of the instruction pamphlets issued by the Air Brake Company, as are many of the instruction books of today. It is written by a man who has lived with and grown up beside the air brake since the automatic was put into service and has kept up with its improvements. He is an engineer who can handle an air braked train and tell another man how to do it, as well as how to locate trouble and defects in the apparatus.

The facts about the operation of the Westinghouse and the New York brakes are told in definite and easily understood language. This makes the book valuable to the man who wants to learn how the air brake operates.

All the new equipment in general use up to date of both air brake companies is illustrated and explained. The book contains 269 pages, is the right size for the pocket, so that it can be a companion when on duty. Price $1. Sold by the Angus Sinclair Company, Engineering Building, Liberty Street, New York.

Bridge and Structural Design. By W. Chase Thomson. Published by the Engineering News Publishing Company, New York. 192 pages, with illustrations. Cloth. Price $2.

Mr. Thomson, a leading member of the Canadian Society of Civil Engineers, who has given much careful study to the subject of bridge and structural design, and who has delivered a series of lectures on this subject under the auspices of the Dominion Bridge Company, has given the result of his work in a book that is a valuable contribution to the engineering literature of our time. The primary object of the book is to teach the elements of bridge and structural design in a simple and practical manner. The illustrations are excellent. The analysis of stresses, the proportion of members and the details generally are worked with a degree of clearness that could not be surpassed. The book is of course designed for students and draughtsmen, but it should be of real value to practical bridge designers.

The Field Practice of Railway Location. By Willard Beahan, B. C. E. Published by the Engineering News Publishing Company, New York. 254 pages, with numerous illustrations and folding plates. Cloth. Price $3.

When the late Mr. Jay Gould began railroad operations in the West he came across a promising lad named Willard Beahan. Mr. Gould helped him to learn engineering, and in the fulness of time he became an expert in railway location. The book before us is the best proof that Mr. Gould knew the possibilities that were in the young man. Mr. Beahan has become an established authority in the field practice of railway location. Not only so, but in the twenty pages that he devotes to the locomotive there is a grasp of detail and a completeness of comprehension that bespeaks the thorough engineer. We heartily commend the book to all who are interested in the subject of constructive railroad engineering.

C. P. R. Mallet Compound.

At a recent meeting of the Canadian Railway Club in Montreal, Mr. H. H. Vaughan, assistant to the vice-president of the C. P. R., made the announcement that his company is preparing for a change in the standard type of freight locomotives. The regulation engine at present in use, of which the company has built or bought 500 since 1894, will give way to a new consolidation type of 220,000 lbs. One of these heavier engines was built at the Angus shops eighteen months ago, and has proved so satisfactory that arrangements have been made to build ten more engines of the same type. Should these prove as satisfactory as the sample, the new type will be adopted as the regulation freight locomotive. Speaking of the Mallet engine recently built by the Canadian Pacific for use on the Rocky Mountain grades, Mr. Vaughan said: "The monster engine recently built at the Angus shops, known as the Mallet articulated compound, which is the heaviest locomotive ever built in Canada, has not so far proved very satisfactory for ordinary road work. Although there was every prospect of this type proving successful in grade work, no more would be built by the C. P. R. until the present sample had been given a more extended trial than it had yet had."

The Lucin Cut-Off.

A recent press dispatch from Ogden, Utah, says that the Union Pacific are to make extensive improvements. The Lucin cut-off across Great Salt Lake is to be double tracked. As soon as the necessary material has been received between 500 and 1,000 men will be put to work on the long trestle across the lake. The work will necessitate a great deal of pile driving and practically the entire bridge will be widened. The many improvements and building mapped out for the yards and the cut-off will necessitate an expenditure of fully $1,500,000 during the coming season.

Old Time Railroaders.

By N. W. Fay.

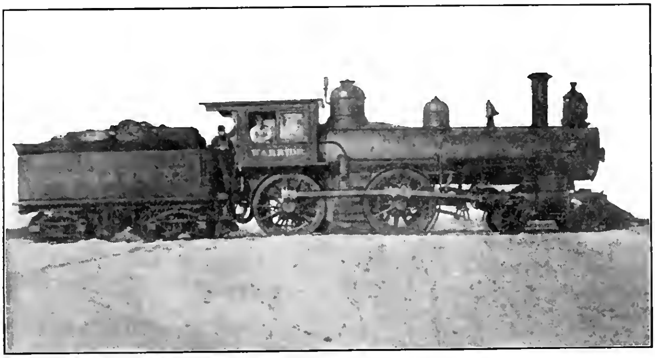
Although not a railroad man, I have taken your valuable magazine for the past six years, and have been exceedingly interested in the reproduction of old-time locomotives. I am sending photograph of the old Boston & Maine engine "Warrior," which in the winter of 1894 was hauling a passenger train between Claremont Jct. and Concord, N. H., over the Concord & Claremont branch, a part of the present Concord division.

I am unable to state when the "Warrior" was built, but am inclined to believe the engine was originally a wood-burner. She was about the last of the locomotives with a name to run on this branch. Her stack was also of a style now obsolete, and the big square headlights are no longer seen. The engineer in the cab window is John Canty of Claremont Jct., who commenced railroading 28 years ago, and has been an engineer since July 1, 1885, on this same Concord & Claremont, where he commenced firing the old wood-burner "Gen. Pierce." His engineer at that time was the late George Wright, well known along the line and yet remembered by many of the older men in the service. A roadmaster at that time was the late James Perkins of Claremont, and he used frequently to ride over the line with Engineer Wright. Both were large, heavy men, and the writer as a boy remembers hearing it said that when George Wright and Jim Perkins were in the cab together it would be impossible for the engine to tip over.

Yet, both men went into the ditch with the engine "Carroll" one morning as they were bowling down the long hill between Newbury and Bradford, March 14, 1887. A solidly packed snow drift did the trick, and although the engine, which was running about twenty miles an hour, jumped clear of the rails and rolled down a 35-ft. embankment with a portion of the train, no one in the cab was injured. A fireman by the name of Thompson was with Engineer Wright on that occasion.

In those days it was customary for trainmen to transport produce, etc., for their own convenience, and it was not unusual to see the "Gen. Pierce" or "C. W. Clark" (another wood-burner long run by Mr. Wright) roll in with boxes, bags or crates on the front footplate containing anything from vegetables to live pork.

Some of the other well remembered engines that for years did faithful work on this tortuous and mountainous branch were the "Grafton," "Crombie," "G. W. Nesmith," "James Kettell," "Contoocook" and "King Lear."



OLD B. & M. 4-4-0, "WARRIOR."

The writer, back in the '80s, got the engineer bee buzzing in his head, and went out into Nevada, where he eventually got a shop job as spare fireman in the Southern Pacific shops at Wadsworth.

But the memory remains strong, and since reading Railway and Locomotive Engineering he has looked longingly each month for some word or reminiscence of the old Truckee division of the Southern Pacific, of which Winnemucca was the eastern terminal, with Wadsworth one hundred and thirty miles westward and separated by a desolate waste of alkali, sage brush and drouth. There were brave men and grand engines in that far off desert, and some of the records for speed and pulling by the sturdy, glittering 4-4-0's stand today. Double-headers were prohibited on the desert run because of the alkali dust that persistently penetrated the boxes and valves, but going east out of Wadsworth it was necessary to help trains as far as "two-mile siding," and at White Plains a helper engine was constantly stationed to assist for the long, hard pull up White Plains Hill, a weird place abounding in railroad lore and legend.

The rule of the road was, first in first out, and every engineer was the jealous autocrat of his machine and between runs both engineers and firemen were regularly busy pottering about their beloved charges that carried a lot of brass and decorative finish and daily went out of the round house shining like suns.

The yard engine at Wadsworth was rigged with a fire hose and pump and was called "Goliath," because she was so little, I suppose. She was an exact counterpart of the one illustrated in Railway and Locomotive Engineering for December, 1900, and could start loads out of all proportion to her size. To see her racing and roaring at the tail end of a long freight up "two-mile siding" hill was an exhilarating sight.

Some of the desert crews of that time were Johnnie Smith and the 203 and generally bulletined for the "Golden Gate Special" on its bi-weekly run; Pollick on the 91, Shepley on the 222 (the three deuces), Arthur on the 62, Houston on the 149, Dorsey on the 180, old Ben Church on the 13, Burke on the 2 (the deuce), Louie Hattenhouse on the 135, Dolan on the 360, and Forrest on the 179. The last two were modern 4-4-0 Schenectadys.

The name of the division superintendent, who had an office at Wadsworth, was Whited, and the master mechanic, George Hunt. A man with white eyebrows and whom I never heard called anything but Buck, was the shop foreman, and a thin, nervous, shaggy, dark featured man by the name of George Angus was round house foreman. Mr. Angus was a Grand Army man.

I often wonder if any or all are in the land of the living, and if Wadsworth is still on the railroad map, a straggling town of shops, church, hotel, tiny homes, indolent Piutes and industrious Chinamen, lying along the green-fringed Truckee River, where the west-bound overland limited bursts above the horizon line, trailing aloft its banner of black smoke and drifting swiftly down from "two-mile siding," rolls into the terminal for a brief pause and change of engines before beginning the sixty-mile climb for Truckee, the Sierras and the snow sheds on the heights.

Telephone in Cars at Terminal.

Some of our leading railroads have installed a telephone service at passenger terminals that can be used by patrons in the Pullman car before the train starts. At the rear end of the observation platform is what electricians call a jack, and to this a wire is run from the bumping post at the end of the track. The jack has a spring shutter which closes automatically when the plug on the end of the wire is withdrawn. This protects the contacts from moisture and dust when not in use. The car itself is wired so that a telephone is on the writing desk in the car. Connection with the outer world is kept up until one minute before the train pulls out. The New York Central's famous Twentieth Century Limited is thus equipped, and the Chicago-Denver Limited on the C. B. & Q.

Applied Science Department

The Steam Indicator.

IV. READING THE DIAGRAMS.

Having briefly sketched the construction and operation of the steam indicator and presented the detail in regard to what may be called an ideal diagram, and a general method of calculating the mean effective pressure of steam as shown by the diagram, it remains to present fuller details in regard to the multitudinous variations that occur in steam indicator diagrams and to explain briefly the causes that lead to such variations and suggest the remedies that are essential to the correct construction and adjustment of the valve gearing in order that the indicator diagrams may approach as nearly as possible the ideal diagram already described, and consequently insure the most economical and effective use of the steam power required in moving the engine.

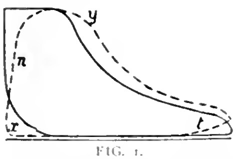


FIG. 1.

It cannot be too strongly impressed on the mind of the engineer or mechanic that the most important use of the indicator is to ascertain fully and clearly the action of the valves. The exact adjustment of the valves while the engine is in the hands of the most skilled mechanics is no proof that they will stay adjusted. When the engine is under steam many parts of the engine undergo changes, some of which materially affect the action of the valves. Apart from the expansion of some parts of the engine there is a tendency to derangement by a rapid wear or springing of some of the parts while the engine is running. This liability to change is greatest in the first week or two of service. It is rarely otherwise than that the lead or opening of the valve will have increased at one end of the stroke and diminished a corresponding amount at the other end. The variation may not be great, but when it is remembered that all of the other points are coincidently disarranged it will be easily imagined that the aggregate loss of effective pressure by the irregular action of the valve increases the cost of running as well as diminishing the power of the engine. In short, engines may be said not to be completed until the adjustment of the valve gearing has been carefully tested by the use of the indicator.

In our illustration, Fig. 1, it will be noted that while retaining the ideal or correct diagram for the purpose of comparison and marking with dotted lines the diagram which may be taken from an engine where the valve is to some extent out of its proper position, at the point *x* there is no apparent compression showing that the exhaust has remained open until the piston has completed its stroke. Following this dotted line in its upward direction, at the point *n* it shows that the piston is already moving in its path towards the other end of the stroke and the valve has not yet opened sufficiently to admit steam pressure equal to the pressure in the boiler or steam chest, and by the time that the valve has opened to admit the full pressure as shown at the top of the diagram the piston has moved a considerable distance on its path. This point could be readily measured and compared with the entire length of the stroke and the number of inches traveled by the piston before receiving the full pressure of steam could be correctly ascertained.

Following the dotted line further on its course it will be noted at *y* that the point where the dotted line begins to move downwards on the diagram, or the point of cut-off where the valve closes and the admission of steam ceases, that this point is extended some distance further than the ideal or correct point. In other words, in actual practice, supposing the cylinder to be 24 ins. in length and the point of cut-off aimed at to occur when the piston had moved 6 ins. on its path, it would be found that the piston had moved over 7 ins. on its course before the valve had closed.

Continuing further we find at the extreme end of the stroke that there is a lateness of exhaust as shown by the degree of pressure of steam remaining in the cylinder at the end of the stroke of the piston. This lateness of exhaust is further proved by following the dotted line to the point *t*, showing that the piston is meeting some amount of back pressure on its return stroke. These two defects, lateness of exhaust and back pressure, are both serious drawbacks in the economical use of steam, and assuming that the design of the valves and ports and amount of travel of the valve are correct, the remedy is a mere matter of readjustment of the position of the eccentric or eccentric rod.

It must be understood, however, that before making any changes in the adjustment of the gearing, the diagram of the return stroke of the piston should also be taken, and still keeping the ideal, or correct diagram before us, as shown in Fig. 2, and assuming that the diagram of the return stroke of the piston is indicated by the dotted line, it will be seen that in this diagram there is also a considerable variation from the ideal diagram. The compression of the steam remaining in the cylinder from the previous admission begins at the point *r*, while the piston has still about 6 ins. to travel before reaching the end of the stroke. It need hardly be stated that this early compression is a real hindrance to the working of the engine. Following the dotted line upwards it is evident that by the time the point *m* is reached the valve has already opened the port while the piston has not yet reached the end of the stroke. This, of course, adds to the resistance to piston travel. As we proceed from the highest point of pressure it will be noted at the point *p* that there is a lowering of the dotted line before the point of cut-off or closing of the valve has been reached. The lowering of the line at this point is generaly attributed to

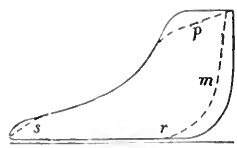


FIG. 2.

what is known as wiredrawing. It is a proof that there is a throttling of the steam in some way and may be caused by having steam pipes too small, or with pipes having sharp bends. In the case we are discussing the likely cause of the wiredrawing arises from the early closing of the valve. It is evident that the piston has already begun on its path along the cylinder when the valve has already begun closing, and hence the supply of steam does not keep pace with the space traversed by the piston. Another peculiarity will be observed at the point *s* showing an early release, that is, an opening of the exhaust at a time when the piston has still several inches to travel.

Such are some of the more common variations that may be noted on indicator diagrams, and others with even greater departures from the correct diagram will be illustrated and discussed in the near future.

Celebrated Steam Engineers.

XXIX. George S. Griggs.

The New England States have produced many clever engineers, and these fine men have had no small hand in the development of the modern locomotive. The subject of this sketch, George S. Griggs, was the first master mechanic of the Boston and Providence Railroad, and was in many ways a man of marked ability. He was at once architect, builder, machinist and engineer. He began building locomotives in 1845. His first engine, named the "Norfolk," was for many years considered the best locomotive in New England. The engine was four wheel connected, had inside cylinders, and was the first inside connected engine equipped with a swiveling truck. Several new features were also shown in the construction of the boiler. The dome, containing the throttle valve, was placed in the middle of the boiler. A manhole opened into the boiler immediately over the firebox. The frames were also of an original design, consisting of two bars, the upper bar measuring 5 x 5⅝ ins. and the lower bar 2 x 2 ins. The pedestal jaws were of cast iron, with tenons at the top. The cylinders were cast with overlapping flanges that admitted of a very secure fastening to the frames. The cylinders were held together by a central casting, the lower part of which was adapted as a circular projection upon which the truck readily turned.

Nearly all of the novel features that Mr. Griggs introduced were permanently adopted by the locomotive builders and are still retained. Indeed, few engineers have made a more indelible impression upon the science of locomotive construction than he did. The valve gear used by him, although not entirely new, also showed his ingenuity. The gearing was equipped with four drop hooks. Under these hooks a runner rested on a half round cam, so that the turning of the cam shaft lifted two of the hooks and dropped the other two in place. It was claimed by many eminent engineers to be the best valve gearing used on locomotives previous to the invention of what became known as the Stephenson shifting link. The gearing did not have the quality of a variable cut-off, but with proper adjustment it was a very reliable valve gearing.

It may be noted that at this early date the speed of Mr. Griggs' first locomotive was nearly equal to the highest speed of the modern locomotive, the distance between Boston and Providence being regularly run at that time in one hour and ten minutes; the regular run being made at the present time is rarely less than one hour.

He continued building all the locomotives required by the Boston and Providence Railroad, and when the link motion appeared he cleverly adapted it and applied it to all the older locomotives. As a proof of his fine work as a mechanic, he was the first to introduce the method of having eccentrics keyed in place before the wheels were put under the engine, and it is said that it was rarely found that a change in the eccentric keys was necessary. He experimented in placing elastic lining between the wheel centers and the tires, but as locomotives became heavier his ingenuity in this direction did not meet with the success that he anticipated.

One of his most notable improvements was the introduction of the brick arch into the fireboxes of locomotives. This was the most important step in smoke-preventing appliances hitherto accomplished, and the arch as perfected by him is still used in the same form as finally devised by him. He also made the first rocking grates and perfected the attachments whereby one or more of the grates could be moved sufficiently for dumping the fire when required. He also introduced the first diamond-topped smokestack, which was quite an improvement in the wood burning locomotives, and was universally adopted by other builders of locomotives.

Mr. Griggs' work was marked by the finest mechanical skill. This feature was the more remarkable in view of the fact that machine shop tools, and more especially the tools necessary for handling heavy work, had nearly all to be constructed in the shops where the locomotives were built. In brief, he was a fine type of the best kind of mechanic, combining inventive ability of a high order with a painstaking energy that never wearied. As a pioneer in railroading his services were of much value in the development of the locomotive.

Questions Answered

COMPOUND WITH SUPERHEATER.

35. W. G. L., New York, writes: Could you please tell me how the reheater, on the A., T. & S. F. 4-4-6-2, between the h. p. and l. p. cylinders increases the efficiency of the locomotive, since by heating the steam to a higher degree it will expand in all directions, thus increasing the back pressure on the h. p. cylinders and consequently offsetting any gain of the l. p. cylinders?—A. In a general way all compounding is a matter of compromise. The high pressure steam when exhausted certainly produces back pressure, and one may say that the efficiency of the engine is the algebraic sum of the steam pressures and the back pressure. When the high pressure exhaust is superheated it no doubt increases back pressure, but it is able to withstand greater heat losses when introduced into the low pressure cylinders than if it had not been reheated. This advantage is greater than the disadvantage of slightly increased back pressure. In correctly estimating the compound all the items on the debtor side have to be added up and all the items on the creditor side added together and the balance struck. If there is cash in the bank, so to speak, the operation is worth while; if the losses are the greater of the two, the operation is not a success. In this case the gain from the superheating outweighs the slight loss due to increased back pressure.

EXPANSION OF WATER.

36. J. W., Kenora, asks how many times its own volume does water expand under the influence of heat.—A. There is no formula by which you can at once find the increase in volume of heated water, as the expansion is not regular like mercury in the tube of a thermometer. Kent gives a table showing the volume of water at 39.1 degs. F., as unity. This temperature is the one at which water attains its maximum density, and if at that temperature its volume is taken at unity, then at 50 degs. F. the volume would be 1.00025; at 104 degs. F. it would be 1.00767; at 149 degs. F. it would be 1.01951, and at 212 degs. F. it had expanded so that its volume would be 1.04332.

BRAKES CREEPING ON.

37. K. N., Wheeling, W. Va., writes: You say that brakes creep on with the brake valve handle in running position from the same causes whether the engine is equipped with the standard "G 6" brake valve or with the No. 6 E T brake. Assuming that it is caused by brake pipe leakage and a sluggish feed valve, why is it that the No. 6 brake will apply with the handle in running position but the leakage will not set the brake when the handle is placed on lap position?—A. It means that the leak which is applying the brake is in the feed valve pipe, or in the excess pressure pipe, or from the regulating portion of the feed valve, and when the brake valve handle is placed on lap position this leakage cannot affect the brake pipe volume.

LEAKY GASKET IN DISTRIBUTING VALVES.

38. E. E., Brooklyn, writes: What is the effect of a leaking gasket 23 of the H 6 distributing valve?—A. A leak to the atmosphere from this gasket has the same effect as brake pipe leakage. If there is a leak into the port "M" the leakage will escape at the distributing valve exhaust port while the exhaust valve is in the release position. After a brake pipe reduction the effect of the leakage depends upon volume of leakage, amount of reduction, brake cylinder leakage, and brake pipe volume. If the leakage is considerable, a light re-

duction on the lone engine will result in an equalization of pressures owing to this brake pipe reduction. If coupled to a train a blow will occur at the distributing valve exhaust port after the light reduction if brake cylinder leakage is not equal in volume to the leakage through the gasket. After brake pipe pressure has been reduced below the point of equalization there will be an increase of brake pipe pressure through this gasket from the brake cylinder which will be supplied from the main reservoir. Whether this flow of air into the brake pipe will lift the equalizing discharge valve of the brake valve or merely increase brake pipe pressure, depends upon the volume of leakage from gasket, brake pipe leakage, and leakage past the brake valve piston packing ring.

INJECTOR PROBLEM.

39. K. T. W., Sutherland, Tenn., writes: I am sending a question I would like you to answer in the next paper if you can get it in. I have had quite a discussion with the officials about Sellers injectors or any other. They claim that low water in boiler will prevent injectors working. I told them that low water had nothing to do with it. I hope to have your answer so I can let them read it.—A. You are quite right about it making no difference whether the water in the boiler is high or low. As long as the steam pressure is sufficient and the flow of water to the injector adequate the injector will work. Are you sure they may not have meant low water in the tender?

BRAKES CREEPING ON.

40. E. J. K., Winona, Minn., writes: When an engine here, equipped with the "H-6" brake is coupled to a train of cars the engine and tender brake creeps on and the engineer claims he is compelled to release the brake with the independent valve, what could cause the brake to creep on when the valve handles are in running position?—A. The same thing that will cause any other type of automatic brake to creep on. It is caused by brake-pipe leakage and a defective feed valve, that is a feed valve that does not constantly maintain brake-pipe pressure at a predetermined figure. In this case, however, you say that it was necessary to use the independent valve to release the brake, and this would be termed a stuck brake and would be caused by an overcharged brake pipe or a defective distributing valve. The effect of an overcharge, that is a brake pipe pressure in excess of the adjustment of the feed valve is the same whether a distributing valve or a triple valve is used. In the event of what we would term a stuck brake, if the brake pipe has not been overcharged, and if the feed valve is working properly the distributing valve is at fault. And as it was possible to release with the independent valve, it proves that the application portion of the distributing valve is all right, but that for some reason the equalizing slide valve could not be moved to release position, which could be caused by the equalizing valve sticking or by a leak past the piston packing ring which would allow the pressure chamber to become charged without creating enough differential in pressure to move the equalizing valve.

George Stephenson's Helping Hand.

Connection with railway enterprises appears to have exercised enterprising liberality unknown among industrial capitalists of ante-railway days. The noblest monument erected for George Stephenson was reared by himself in the establishing at Clay Cross, England, of a system of education and protection for working people. That was about 1840, ten years after the first passenger-train-hauling locomotive began to sound its first note of progress.

The capitalists of those days were represented mostly by land owners and manufacturers. These people had not got over the fashion of treating workmen as animals that were fortunate if their employers gave them enough for their work to cover the expense of coarse food and homely clothing.

George Stephenson displayed a different spirit and excited the dislike of the gentry by his humane policy. He made it a condition of employment that every employee should contribute a small percentage of his income to a benevolent fund, to which the company contributed liberally. From that fund the work people's children received free education and those who were working and needed or desired more education enjoyed the privilege of attending night schools. Medical treatment was provided for the sick, a benevolent fund kept hunger away from the homes of those who were unable to work, and libraries and reading rooms were maintained. Musical societies were formed, cricket clubs encouraged, and prizes given for the best kept gardens.

Stephenson was a benevolent man, but he believed in directing his charities to the aid and encouragement of those who were willing and ready to help themselves.

Electric Night N. Y. Club.

A very significant paragraph in the report of the special committee of the New York Railroad Club is as follows:

"The electrification of large freight terminals has not as yet been attempted nor satisfactorily worked out; therefore it is necessary to proceed with caution in this matter, and the problem must be exhaustively studied and new developments made before it would be justifiable to make such an installation. The electrification of any large freight terminal would involve a number of roads, and cannot be undertaken independently without the co-operation of all the railroads affected, on account of the relations existing among the various roads in the interchange of freight traffic."

In the discussion of the report those who participated were Messrs. George Gibbs, chief engineer, and C. S. Krick, superintendent of the Pennsylvania Tunnel and Terminal Co.; W. S. Murray, electrical engineer N. Y., N. H. & H.; Calvin Townley, vice-president of the American Institute of Electrical Engineers; G. M. Basford, assistant to the president of the American Locomotive Co., and L. B. Stillwell, consulting engineer.

PASSENGER CARS IN THE GREEN MOUNT WRECK.

Air Brake Department

Conducted by G. W. Kiehm

Triple Valve Test Rack.

FUNCTIONS OF THE VALVES AND COCKS OF THE TESTING RACK.

Valve A.

Position 1. Release.
Position 2. Direct opening to brake pipe closed.
Position 3. Lap.
Position 4. Brake pipe exhaust through 1/32 opening.
Position 5. Brake pipe exhaust through 3/64 opening.
Position 6. Brake pipe exhaust through 1/16 opening.
Position 7. Brake pipe exhaust through 5/64 opening.

Cock F.

Controls communication between the main reservoir and testing rack.

Cock X.

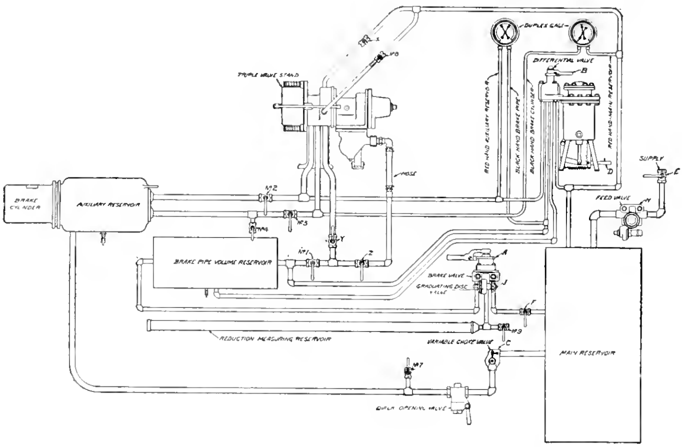
Used in clamping triple valve to triple valve stand face to admit air to and exhaust it from the clamping cylinder.

Cock Y.

To be used if triple valve is of the pipeless type, to permit brake pipe air to flow to the triple valve.

Cock Z.

To be used if triple valve has brake pipe connection to the check valve case.



PIPING DIAGRAM OF WESTINGHOUSE TEST RACK.

Position 8. Brake pipe exhaust for rapid reduction.

Valve B.

Position 1. Brake pipe pressure under diaphragm, auxiliary pressure above diaphragm.
Position 2. By-pass brake pipe air to auxiliary reservoir.
Position 3. Lap.
Position 4. Brake pipe pressure over diaphragm, auxiliary pressure under diaphragm.

Valve C.

Used for controlling air from main reservoir to the auxiliary reservoir during service port capacity test and for adjusting the safety valve.

Valve J.

Notches determine the rate of feed up of the brake pipe volume.

Cock 1.

Controls communication between brake pipe and triple valve and used to operate triple valve in quick action.

Cock 2.

Closed to obtain reduced auxiliary volume, open to obtain maximum auxiliary volume.

Cock 3.

Closed to obtain reduced brake cylinder volume, open to obtain maximum brake cylinder volume.

Cock 4.

To exhaust air from the brake cylinder.

Cock 6.

To open and close the pipe from valve C to the auxiliary reservoir.

Cock 7.

To exhaust air entirely from or reduce pressure in the auxiliary reservoir.

Cock 8.

Used when testing by-pass and graduated release feature, to cut in, or cut out, the supplementary reservoir.

Cock 9.

To close brake pipe exhaust to atmosphere from valve A, giving a predetermined brake pipe reduction.

Lever D.—The notch used determines the differential pressures acting on the triple valve piston.

Air Brake Maintenance.

IMPROPER REPAIRS.

The problem of obtaining economical air brake repair work, and work that will not come under the heading of wrong repairs, has already been referred to, and if attention was called to the problem without suggesting a remedy it was because the remedy is or should be easily recognized and applied.

When repair parts of passenger triple valves are found in freight triples and springs that were not manufactured for air brake apparatus are found in triple valves the work needs supervision and the workman needs instruction. While the workman is not required to spend any of his hours off duty in study unless he feels so inclined it is not unreasonable to expect him to know one type of triple valve from another and the repair parts of one from those of another.

It is with regret that we sometimes hear that the position of air brake instructor has been abolished or that the air brake foreman has been assigned to other duties, and believing in the maintenance of air brakes in the highest possible state of efficiency we cannot help but think that at such times not only an expensive but a serious mistake has been made because if any two men employed by a railroad company are in a position to earn their salary those two men are, and if they are not doing so it should not be a difficult matter to secure men who will, instead of paving the way for further neglect, careless workmanship and wasteful habits.

It is not necessary for an air brake man to make a tour of inspection through the average engine house and freight yard in order to be convinced that thousands of dollars are being wasted annually on air brake repair work alone, especially at points where there is little or no supervision, or where very little attention whatever is paid to air brake repair work.

Whatever is derived from the air brake, along the line of satisfactory results, is proportioned in a measure to what is put into it financially, but the method by which the expenditure becomes the most economical and effective can be determined and decided upon by air brake men only, as they are familiar to a certain extent with the most economical practices of all railroads and are assisted by the experiences of others.

If there are tricks in all trades, the air brake trade is no exception and without "giving away" any of the sharp practices or so-called tricks of the trade indulged in by some repairmen, and looking at the subject merely from a point of doing work right instead of in a way that will pass, let us consider the operation requiring about the least skill in air brake work, namely cleaning air brakes on freight cars. If anyone interested is inclined to doubt that there is any waste of time and material in present day methods of cleaning air brakes he should examine the number of worn out packing leathers and make an estimate of how much additional life the leather should have had, or how much longer each one would have given good service in the cylinder if each cleaner in his turn kept the thickest part of the leather at the bottom of the cylinder. One may also find a number of discarded triple valve body gaskets and note how many were prematurely destroyed by being placed on the reservoir instead of the triple valve when that valve was applied, how many were destroyed by improper lubrication of the brake cylinder and by being broken because one part of the gasket adhered to the reservoir and the other part to the triple valve when it was removed. While the latter was primarily no fault of the repairman that removed the triple valve it would not have been distorted or broken during the removal if the repairman who applied the new gasket had put a very small quantity of lubricant on the reservoir side of the gasket, prior to bolting the valve to the reservoir.

While calling attention to a waste of packing leathers and body gaskets that could have been avoided without taking up more than a moment of the cleaner's time, we desire to point out that he can waste leathers or rather cause them to be worn out prematurely by failing to renew, or by using an expander ring that is oblong instead of round or one that is a little large and buts tightly at the ends, rings of that kind will force their binding points into, and wear through the leather in a remarkably short time.

Quite often a stud backs out of the piston when attempting to remove the nuts in order to renew a packing leather and quite often the nut and stud are screwed into the piston at the same time instead of first removing the nut and tightening the stud in the piston, and if a packing leather slightly heavier or thicker than the one removed, is used, there may be a worse brake cylinder leak through the piston than previously existed with the old packing leather.

Removing a packing leather on a piston in a repair yard among gravel and cinders is at the best an unsatisfactory practice and the work can be better done by keeping a quantity of pistons with leathers properly put on, in stock, thus leaving the removed piston to be cleaned and leather put on at some more convenient place and at a more suitable time.

When the triple valve is removed the reservoir studs sometimes back out two or three threads before the nut loosens, and sometimes all the way. In order to get the standard stud out of the flange of the triple valve body, it is, in most cases, necessary to take the nut off, and during the operation the threads are sometimes damaged and as a result there is a reservoir leak. At times when the nut loosens after the stud backs out part way, the repairman neglects to tighten the stud first and the same reservoir leak exists and if it can be heard the triple may be taken off again and two body gaskets used, the second gasket may more effectually divert the course of leakage so that it is not so easily noticed.

This waste of time and material is not confined entirely to packing leathers and triple valve body-gaskets, but will be found to exist on about every other line of repair work, but not necessarily in all shops and yards. The writer's attention was recently directed to ordinary ⅜ in union pipe connections at the triple valve leading to the retaining valve. Among about 100 freight car brakes due to be cleaned, and which had been previously cleaned at various points throughout the country, 60 per cent. were found with no gasket whatever. If the average repairman, when removing a triple valve, finds a gasket in the union and does not lose it during the operation he will likely replace it, but if none is found, it will take up too much time to cut one.

While no account was taken of defective valves, broken and cracked pipe and crossed threads in the triple valve it showed 60 per cent. practically inoperative retaining valves from one cause alone, and while they may not be of so much importance at times, 60 per cent. inoperative on a grade may at some time cost more in about 15 minutes than a score of repairmen's wages would amount to in several years. We do not wish to insinuate that the majority of repairmen are careless or that the repair work in all freight yards is faulty, but when a repairman will spend about one hour and 30 minutes in putting up a retaining valve threading and fitting about 25 feet of ⅜-inch pipe and then, because there is a badly worn thread in the triple exhaust port, drive the nipple in with a hammer and connect the union, it is plainly evident that an improvement can be made.

It is all very well for a railroad official to spend a short time with the repairmen, look about the place, collect some data and then say and believe that "it is our practice to do thus and so," when it is done in the manner described. If any one arrives at the conclusion that the average air brake repairman requires no supervision or further instruction there is a serious mistake being made. No matter how careful or conscientious a workman may be there are times when he may become weary in well doing, and conceive the idea that he is doing something unnecessary and so devise a shorter cut to the completion of the particular piece of work, and if allowed to go on, he may gradually be led to abbreviate the work until eventually he may consider that stenciling the reservoir and cylinder will be sufficient for the present cleaning.

There is but one way to have air brake repair work done in an economical and at the same time satisfactory manner, and there is but one man in position to know whether this is being done or not, and the air brake foreman, to know this, must be an experienced and capable man himself, because if there is any inclination to deceive, it is not a hard matter to do it and furthermore we sometimes deceive ourselves.

Safety Valve Adjustment.

Several instances have come to our notice in which the safety valve of the distributing valve of the ET brake equipment has been tampered with, that is, the figure of adjustment lowered, presumably with a view of preventing an accumulation of brake cylinder pressure sufficient to slide the driving wheels. We have always tried to impress upon our readers the importance of adjusting any and all pressure governors to the figure recommended by the manufacturers, at least until local conditions or special instructions necessitate a change.

The manufacturers of modern brake equipments have spent large sums of money in developing and thoroughly testing the brake equipments and are in a position to make recommendations, and in order that our readers may not be confused concerning the proper adjustment for the E6 safety valve it is in order to make a few comments upon the braking effect of the pressure governed by this valve, and make a comparison with the effect of the brake cylinder pressure developed by what we will call the standard brake, a brake having the G6 brake valve and the combined straight air brake, schedules S. W. A. and S. W. B.

In the first place the safety valve is in communication with the application cylinder of the distributing valve during all the manipulations of either brake valve, except at such time as the equalizing valve of the distributing valve assumes service lap position, whether it be the result of the manipulation of the automatic brake valve or the result of brake pipe leakage.

The safety valve is adjusted to maintain a pressure of 68 lbs. in the application cylinder of the distributing valve, and during an emergency application of the brake the pressure will rise a few pounds higher owing to a restriction in the port connecting the application cylinder with the safety valve and to the flow of air through the "blow down timing port."

Application cylinder pressure means brake cylinder pressure, and 68 lbs. seems a very high cylinder pressure if we look no further than pounds pressure per square inch. The fact of the matter is that if two engines are properly equipped, one with the ET brake and the other with the standard, the locomotive with the ET brake will develop about 20 per cent. less braking power on the locomotive than the engine equipped with the standard brake develops, assuming of course that proper brake cylinder pressures are developed in each case.

During emergency applications when the highest possible retarding effect is desired, the rise of brake cylinder pressure made possible by additional features and a higher adjustment of the safety valve brings the braking power of the locomotive brake somewhat nearer to that of the car brakes. In order to make this clear we will consider two locomotives equipped as stated, assuming that each locomotive has 200,000 lbs. resting on the driving wheels and that two 16-in. cylinders are used. For convenience we will take round numbers and consider but one side of the locomotive and the total power exerted.

The locomotive equipped with what we will call the standard brake would be braked by what is commonly known as 75 on 50, that is 75 per cent. braking power based on 50 lbs. cylinder pressure, while the locomotive with the ET equipment would be braked at 60 on 50, or 60 per cent. braking power based on 50 lbs. cylinder pressure. On the locomotive with the standard brake each 16-in. brake cylinder would develop approximately 10,000 lbs. total pressure from a 50 lbs. cylinder pressure which must be multiplied by a leverage of 7½ to 1, to bring a total pull of 75,000 lbs. on all brake shoes on one side of the locomotive which is necessary to develop the braking power of 75 per cent. of the 100,000 lbs., which is braked by the one cylinder. On the locomotive equipped with the ET brake, the same total pressure on the brake piston is developed by the 50 lbs. cylinder pressure, which must develop but 60,000 lbs. at the shoes which requires a leverage of 6 to 1.

It is evident then that the engine with the standard brake with a cylinder pressure of 50 lbs. resulting from a service application of the brake, develops a pull of 75,000 lbs. on the brake shoes on one side of the locomotive or 18,750 lbs. on each shoe if there are four shoes. Also 45 lbs. cylinder pressure as developed by the straight air brake would give 16,785 lbs. pressure on each of four brake shoes, while with the ET brake, the 45 lbs. cylinder pressure transmitted through the 6 to 1 leverage ratio will bring a pull of but 13,500 lbs. on each of the four shoes.

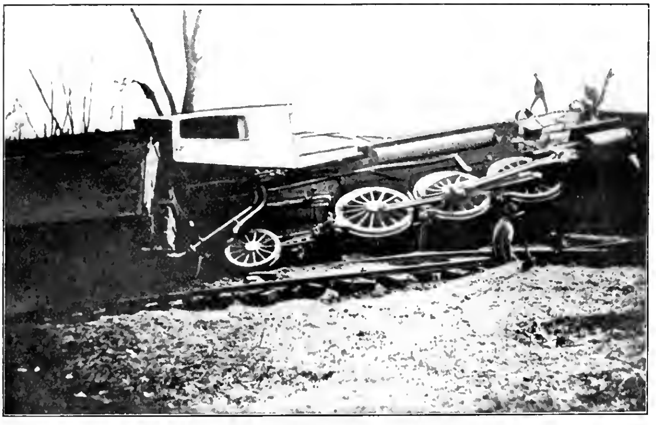
Thus it is seen that calculating from the same cylinder pressure, during ordinary service operations, the brake on the engine equipped with the ET brake is 20 per cent. less effective than the standard brake, even when regarded from a pound pressure point of view, however, during the emergency operation, the 68 lb. cylinder pressure developed by the ET brake, transmits through the 6 to 1 leverage 81,600 lbs. total braking power, or approximately 20,000 lbs. on each of four brake shoes.

It is understood that in each of these events or instances the weight on the driving wheels is 100,000 lbs. or 25,000 lbs. per wheel tending to keep it revolving. The weight assumed has been taken arbitrarily in order to obtain round numbers, for ease of calculation. It is intended to acquaint the reader with the object and relative effect of the 68 lb. cylinder pressure.

Those interested in this subject are aware that the term "percentage of braking power" is obtained when the locomotive or car is at rest, "retarding effect" when in motion, and while the terms bear some relation to each other they are entirely different when attempts are made to calculate the retarding effect from cylinder pressure only.

While investigating the cause of a slid flat wheel, the airbrake man of today is inclined to disregard brake cylinder pressure in that connection, and if caused by the automatic brake, brake cylinder pressure must have been developed with which to draw the shoe against the wheel, the amount or number of pounds being merely incidental.

Injuring the driving wheel tires of a locomotive equipped with the ET brake is almost impossible, whether the pressure on the cylinders is 68 or 100 lbs., as the independent brake can be used at all times to release and reapply the locomotive brake without disturbing the train brakes. The ET brake is an excellent protection to driving wheel tires, although it can be compelled to produce some bad results; in fact it can be made to produce many effects that it was designed to overcome. Maintenance in good order is the great requisite with air brake equipment as well as with any other of the many appliances used on locomotives.



WRECK NEAR MARSHALLTOWN, NINE PERSONS KILLED.

Electrical Department

The Interborough Repair Shops.

By W. B. Kouwenhoven.

The Interborough Rapid Transit Co. operates both the Elevated roads and the Subway in New York City. The reader is referred, for a description of the electrical equipment used by this company, to pages 545 and 546 of the 1907 volume of Railway and Locomotive Engineering and to pages 69 and 70, 163 and 164, 255 and 256 of the 1908 volume. The shops on the elevated lines take care of 1,600 motor cars, and those of the Subway 1,300 motor cars.

The motor cars are inspected after they have run 900 to 1,000 miles and are completely overhauled after 65,000 miles of travel. Formerly the Interborough inspected and repaired their equipment every three and one-half to four days. This, on the mileage basis, corresponds to only about 450 miles, and unless a car was in almost continuous service it would not make this distance. The mileage system has reduced the number of cars inspected per day on the elevated lines from 232 to 121, or 47.8 per cent. In the case of the Subway the reduction has been even larger, or 51.8 per cent. The average mileage between inspections on the elevated is now 967.6 miles, where formerly it was 484.5, and on the Subway the increase has been from 419 miles under the old system to 1,014 miles under the new. The Elevated cars are now inspected about every seven days and the Subway cars every seven and one-quarter days.

When a motor car has run 1,000 miles it comes into the barns and is run over a pit. Here the control apparatus is inspected and each control combination, corresponding to the points on the controller, is tested. The motors with their brushes and brush-holders are examined and the air brake, pump and governor are cleaned and tested. The brake rigging is gone over and the triple valve and the engineer's valve are carefully tested. At the same time the air brake piston travel is taken. The wheels are gauged and the trucks are cared for. The contact shoes are inspected and the shoe fuses tested. In the meantime, the car body is looked over for any defects, and all of the windows, doors catches and other small parts receive attention. The signal and light circuits are tested and the train line with its coupler sockets is inspected. The motor armature bearings are oiled. All the bearings are repacked with wool waste every 10,000 miles. The car body is now swept out and the windows washed.

Corresponding to each car that enters the inspection barns there is an inspection card. On this card every part of the car is listed and given its proper number. Every man in the inspection gang has certain parts of the car that it is his sole duty to look after. After he has completed the inspection of these particular parts of the car, he marks the parts on the inspection card O. K., indicates any repair work that has been necessary, and signs his pass number. This places the responsibility directly upon the repair man. If that particular part of the car that he has marked O. K. fails before the next inspection, he is held responsible. However, if a man does his work thoroughly and carefully and no failures occur, then he receives a substantial bonus for his faithfulness. This system of holding the repair men personally responsible, and of rewarding the good men, has resulted in a very marked increase in the efficiency of the repair shop force, and the incompetent man is dropped.

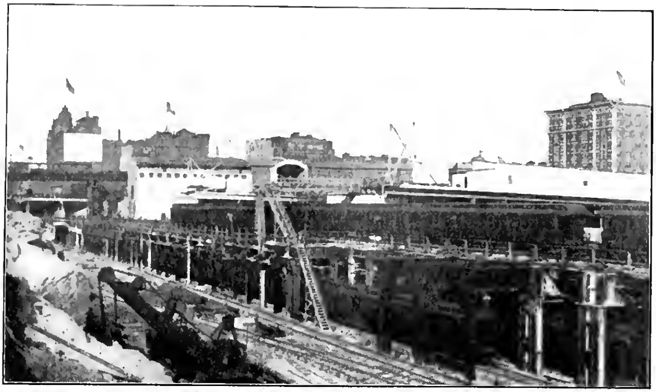
After a motor car has completed 65,000 miles of travel, it is sent to the repair shop. In the repair shop the body is jacked up and the trucks are run out from under and taken to the machine shop. The motors are taken out and sent to the armature room, where they are thoroughly cleaned and overhauled. The armatures are tested for insulation, grounds, short circuits and open coils. In the insulation test 2,000 volts are applied to the armature. This voltage is almost four times greater than the motor operates under when on the road, and an armature which can withstand this test is good for another 65,000 miles unless something unforeseen happens. If any of the armature coils are defective, the damaged part of the winding is removed and new coils are substituted. When an armature comes into the repair shop and needs rewinding the second time all of the old coils are removed, consigned to the scrap heap, and an entire new winding is put on. The field coils are cleaned and tested in the same manner as the armature, and damaged ones are replaced or repaired.

The reverser and all of the contactors are removed from underneath the car body and sent to the armature room, where they are carefully tested and the resistance of all the coils is measured. They are reinsulated and rewound if necessary, new tips are applied and the entire mechanism is carefully gone over. If a contactor is defective in any way, it is entirely rebuilt. The resistance grids and the control rheostat are removed from the car body and are sent to the armature room, where they receive a thorough testing and are repaired when necessary. The air pump compressor and the governor are removed and sent to the machine shop. In the machine shop the compressor motor is taken out and sent to the armature room. Here it receives the same treatment as that received by the main motors themselves.

The car body wiring, including the train line, bus line and the light and heater circuits, are thoroughly tested and repaired. All the switches are inspected and the defective ones are replaced. The covers are taken off all the connection boxes, the coupler sockets are examined and new springs are inserted where necessary. The master controllers are opened and given a thorough inspection and cleaning and new fingers are put in where needed. The control cylinder is removed and sent to the armature room, where it is taken apart, cleaned and reassembled in first class condition.

In the machine shop the air compressor pumps are taken apart, cleaned, repacked and put in perfect repair. The trucks receive a careful inspection. The gauge of the wheels is tested and the flanges are examined. If necessary the wheels are trued up by grinding. The contact shoes with the shoe fuses are cleaned and put in condition for service. The motors are sent back from the armature room, the motor shells mounted on the trucks and the armatures inserted. The brush holders are removed, cleaned and replaced, and new armor is placed over the motor leads to protect the insulation from chafing. This armor consists of No. 13 brass wire spirally wound, is simply slipped over the leads. The trucks are now run back under the car body and the body lowered back in place. In the meantime all of the other parts that had been removed from the car for inspection and repair are reassembled in place and all the electrical and brake rigging connections are made.

A high voltage test is now applied to the car wiring. This test consists of a 2,000 voltage insulation test corresponding to the hydrostatic test applied to the steam locomotive boiler. It is applied to every wire in the car circuits, and when successful proves that the insulation is well able to withstand the voltages to which it is subjected in practice. Tests for short circuits, ground and broken or open circuited wires are also applied to every wire. Then the cars are tested to see if they operate in the proper directions, and the contactors are put through the various combinations corresponding to the different positions of the master controller handle. Tests are also made to see that all of the metal parts of the cars make good contact with each other and with the ground.



NEW YORK CENTRAL TERMINAL WORK—STEEL WORK SUPPORTING TRACK.

Repair work on both the Elevated and Subway motor cars is similar up to this point. The Elevated cars are equipped with the manually operated style of control and the Subway with the automatic type, and here is where the first difference in the repair work occurs. The overhauling of Elevated motor cars is now considered to be complete, and the car is ready to be returned to service. The Subway motor cars have still one more operation for the repair gang to make before they are ready to be returned to service, and this is the setting of the control governor. This is accomplished by taking the car out on the track with a recording ammeter. This is an instrument that records the amount of current in amperes just as a steam gauge records steam pressure on a locomotive. This ammeter is connected in the motor circuit. The car is then run up and down and the governor is set so that it operates on 290 or 295 amperes. When this trial run is completed the car is ready for service and is turned over to the traffic department for regular work.

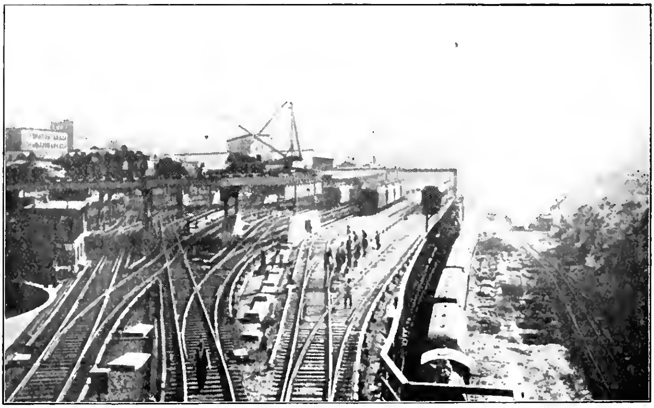
The department that has charge of the inspection and repair of the equipment maintains a complete card index system of all the various parts of a motor car that come under their care. In this system every motor, every compression motor, every contactor, and in fact almost every part of the motor car equipment has a separate card. On this card is kept a complete record of that particular motor or piece of apparatus, showing the date on which it came in for inspection and repair, the trouble, if any existed, and what was done, and by whom, is there set down. With this system it is possible to tell when any given part of the equipment fails an undue number of times.

The Interborough Rapid Transit Co. have a large foundry in which they make their own copper and brass castings and some of the smaller iron ones. They also manufacture their own armature coils, and if necessary can build and equip an entire motor car, with the exception of the trucks, as is the case in the shops of any first class steam railroad.

Not only does this company maintain a complete record of each individual piece of apparatus and hold the repair and inspection men personally responsible for the work they do, but they also have a very excellent system of keeping their shop foremen on their mettle. Each month, in the office of the superintendent of this department, a report is made out giving the costs of labor and maintenance per car-mile employed in those inspection and repair barns that are doing similar work. A copy of this report is sent to each foreman, informing him just what he has been doing in his own shop, and also what the other men have accomplished. With this system a foreman makes it his business to keep well informed as to the amount and cost of the repair parts that his shop is using, and this causes him to do his best to keep down the cost of labor and material as low as possible.

The delays that take place on the road are reported to the inspection department over the telephone. From these reports a list is made up giving the length of exact delay and the cause. These are embodied in the monthly report and each delay is charged to its proper cause. An example of the completeness and detail of this report is given below:

No. of Delays.	Length.	Cause.	Charged to
1	25 min.	Motor short circuiting.	Inspection Bars
1	10 min.	Passenger falling against side of train.	
1	15 min.	Improper motor Design.	Makers



NEW YORK CENTRAL TERMINAL WORK ON EXPRESS LEVEL.

The writer wishes to take this opportunity to thank Mr. J. S. Doyle, superintendent, Mr. Kerins and Mr. Raemer, for their kindness in furnishing him with the data for this article.

Narrow Gauge Engine for Central South African Railways

We recently published a description of a Mallet articulated compound locomotive built by the American Locomotive Company for the Central South African Railways. These same builders have just completed a Pacific type locomotive for the same road which is an interesting example of the maximum weight and power obtainable in this type within the limitations of a 3-ft. 6-ins. gauge of track. In working order it has a total weight of 155,000 lbs., of which 106,000 lbs. are carried on the driving wheels.

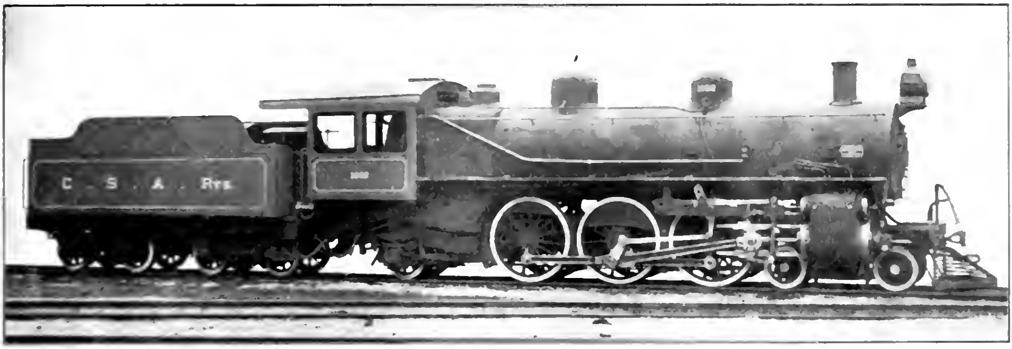
With 62-ins. driving wheels and a maximum tractive power of 28,800 lbs., the most difficult problem in connection with this design was to provide sufficient boiler capacity to meet the requirements without exceeding the height of 7 ft. 8 ins. from the top of the rail to the center of the boiler. In this case the difficulty was very satisfactorily overcome by the application of highly superheated steam. The boiler delivery factor indicates ample boiler

and following the most approved practice, both the valve and piston rods are provided with extended front rods. In this way, the valves and pistons float in their respective cylinders and friction is reduced to a minimum. An interesting detail of the design is the new arrangement of the piston-rod extension guide, which is so constructed as to be self-centering. Another interesting feature of the design is the trailing truck, which is a modification of the company's new design of outside bearing radial truck which has been successfully applied to a number of recent Pacific type locomotives. In the truck here applied the modification consists in the use of a spring yoke rigidly secured to the slab frame instead of one hinged to the frame. The advantages of this type of trailing truck, as compared with the builders' older type of outside bearing radial truck, are: Greater simplicity of construction, material reduction in the dead weight of the engine, and a more perfect main-

re[illegible]ng the load on the trailing truck.

The firebox is 78 ins. long and 65 ins. wide and provides a grate area of 35 sq. ft. This gives a ratio of grate area to equivalent heating surface of 70.6. The firebox is supported by a steel expansion plate at the back end, while the support for the front end is furnished by a steel waist plate, just back of the rear pedestal. The tender, which is of the 8-wheel type, is fitted with a U-shaped tank having a water capacity of 4,000 Imp. gals and space for 10 English tons of coal. The tender trucks are of the equalized pedestal type. Steam brakes are applied to all the drivers, and in addition the engine is equipped with a vacuum brake which acts on the tender wheels and is provided with a connection for the train line. The principal ratios and dimensions of the design are given below:

Factor of adhesion 3.68
Total evaporative heating surface ÷ grate area 56.6
Firebox heating surface ÷ total evaporative heating surface, per cent...... 6.7



PASSENGER 4-6-2 FOR THE CENTRAL SOUTH AFRICAN RAILWAYS.

R. F. Collins, Locomotive Superintendent. American Locomotive Company, Builders.

capacity to meet the requirements of the service for which the engine is intended, in which the maximum speed will not exceed 45 miles an hour. The superheater is the builders' latest design with fire tubes having side steam headers and tubes of the double loop type arranged to give a high degree of superheat. The superheater as here applied provides a heating surface of 353 sq. ft. This is 19 per cent of the tube heating surface, which approximates very closely the ratio recommended by German locomotive designers, in which country the application of superheated steam has been developed to a high degree of efficiency. Full advantage has been taken of the application of highly superheated steam to use large cylinders and a low boiler pressure. The cylinders are 21 ins. in diameter by 28 ins. stroke, and the boiler carries a working pressure of 170 lbs. to the square inch.

Ten-inch piston valves are employed,

tenance of the springs in their normal relation to the main and truck frames and in proper alignment with and full bearing on the journal boxes.

The spring seat fits freely in a central opening formed in the spring seat guide and is carried on a trunnion block which passes freely through a longitudinal opening in the spring seat, and which is provided with pivot ends carried in bearings bolted to the under side of the spring-seat guide. The trunnion block is coupled to the spring seat by means of a transverse pin passing through the trunnion and spring seat, the whole thus forming a universal joint connection.

The boiler is of the Belpaire type and is provided with a copper firebox in accordance with the usual English practice. The throat sheet and backhead are inclined so as to throw the center of gravity as far forward as possible, thereby bringing more weight on the driving wheels and

Volume of both cylinders, cu. ft........ 11.20
Total evaporative heating surface ÷ volume of cylinders 177
Grate area ÷ volume of cylinders...... 3.12
Tractive effort × diameter drivers ÷ equivalent heating surface 711
Superheater heating surface ÷ tube heating surface, per cent 19.1

Track Gauge—3 ft. 6 ins.; tractive power, 28,800.

Wheel Base—Driving, 11 ft. 2 ins.; total, 29 ft. 8 ins.; total, engine and tender, 54 ft. 11¾ ins.

Weight—In working order, 155,500; on drivers, 106,000; engine and tender, 250,800.

Heating Surface—Tubes, 1,848 sq. ft.; firebox, 133 sq. ft.; superheater, 353 sq. ft.; total, 1,981 sq. ft.

Grate Area—35 sq. ft.

Boiler—O. D. first ring, 62 ins.

Firebox—Type, wide; length, 78 ins.; width, 65 ins.; thickness of crown, ½ in.; tube, 1⅛ ins.; sides, ½ in.; back, ½ in.; water space, front, 4 ins.; sides, 3 ins.; back, 3 ins.

Tubes—No. 1[illegible]; diameter, 2¼ ins.; length, 18 ft. 2 ins.; gauge, No. 11 B. W. G.

Engine Truck—4 wheel center bearing.

Trailing Truck—Radial with outside journals.

Tank—Style, "U" shape level top; capacity, 4,000 Imperial gallons; fuel, 10 long tons.

Valves—Type, piston; travel, 5[illegible]; steam lap, [illegible] in.; exhaust, clearance, [illegible] in.

Setting—[illegible] in. lead constant.

Wheels—Driving, diameter, outside tire, 62 ins.

Items of Personal Interest

Mr. A. B. Lacy has been appointed purchasing agent of the Virginian Railway, with office at Norfolk, Va.

Mr. P. J. Archer has been appointed purchasing agent of the Arizona Eastern Railroad, vice Mr. C. E. Walker resigned.

Mr. J. T. Foley has been appointed assistant to vice-president of the Illinois Central Railroad and with office at Chicago.

Mr. L. O. Jackson has been appointed mechanical superintendent of the Beaumont & Great Northern, with office at Omalaska, Tex.

Mr. E. B. Hall has been appointed master mechanic on the Chicago & North-Western at Eagle Grove, Ia., succeeding Mr. C. Coleman.

Mr. J. W. Lowery has been appointed master mechanic of the Tombigbee Valley, with office at Calvert, Ala., vice Mr. P. P. Brooks, resigned.

Mr. John Nash has been appointed district foreman on the Oregon Short Line, with office at Kemmerer, Wyo., vice Mr. A. R. Lambert, resigned.

Mr. A. B. Pollock, assistant supervisor of signals of the Pennsylvania Railroad at West Philadelphia, Pa., has been appointed a supervisor of signals.

Mr. W. R. Smith has been appointed master mechanic on the Chicago & North-Western at the Chicago terminals, vice Mr. J. Charlton, transferred.

Mr. Albert James has been appointed roundhouse foreman at Tucker, Utah on the Denver & Rio Grande Railroad, vice Mr. R. Pickering, transferred.

Mr. F. J. Harrison has been appointed superintendent of motive power on the Buffalo, Rochester & Pittsburgh Railway, vice Mr. W. H. Wilson, resigned.

Mr. C. H. Caswell has been appointed general roundhouse foreman on the Cincinnati, Hamilton & Dayton at Cincinnati, O, vice Mr. C. L. Adair resigned.

Mr. E. W. Pratt, assistant superintendent of motive power and machinery of the Chicago & North-Western at Chicago, has been transferred to Clinton, Ia., on the same road.

Mr. F. D. Fosdick, master mechanic on the Chicago & North-Western at Madison City, has been transferred in the same capacity to Chicago, succeeding Mr. E. H. Wade.

Mr. A. C. Stevens has been appointed master mechanic of the fourth division of the Denver & Rio Grande, with office at Alamosa, Colo., vice Mr. J. H. Farmer, transferred.

Mr. Oscar Kuenzel, formerly mechanical engineer for the Pennsylvania at New Bremen, has resigned. He intends to become the editor of a mechanical paper in New York.

Mr. H. G. Huber, assistant master mechanic of the Pennsylvania at Phillipston, Pa., has been transferred to Harrisburg to succeed Mr. W. J. Rusling, promoted.

Mr. J. Charlton, master mechanic on the Chicago & North-Western, in charge of Chicago terminals, has been transferred to Mason City, vice Mr. F. D. Fosdick, transferred.

Mr. W. E. Woodhouse, master mechanic of the Canadian Pacific at Calgary, Alb., has been appointed shop superintendent at Winnipeg, Man., vice Mr. S. J. Hungerford, resigned.

Mr. C. W. Stambaugh, of York, has been appointed road foreman of engines of the Baltimore and Hanover division of the Western Maryland Railroad, vice Mr. H. K. Martz, resigned.

Mr. W. J. Rusling, formerly assistant master mechanic on the Pennsylvania Railroad at Harrisburg, Pa., has been appointed general foreman of the Enola shops of the same road.

Mr. F. B. Harriman has resigned as general manager of the Illinois Central and of the Indianapolis Southern; the duties of that position have been assumed by the vice-president.

Mr. James R. Paterson, who has been in charge of the advertising department of Railway and Locomotive Engineering, has severed his connection with the Angus Sinclair Company.

Mr. H. C. Stevens has been appointed master mechanic of the fourth division of the Denver & Rio Grande Railroad, with headquarters at Alamosa, Colo., vice Mr. J. H. Farmer, transferred.

Mr. W. J. Bingley has been appointed master mechanic of the Maryland Division of the Western Maryland Railway, with headquarters at Hagerstown, Md., vice Mr. C. M. Tritsch promoted.

Mr. J. H. Farmer, master mechanic on the fourth division of the Denver & Rio Grande at Alamosa, Colo., has been appointed master mechanic of the Rio Grande Southern, with office at Ridgway, Colo.

Mr. F. H. Green, general purchasing agent of the New York Central Lines, has had his authority extended over the Toledo & Ohio Central and over the Zanesville & Western. Office at New York.

Mr. Daniel Willard, president of the B. & O., has been elected chairman of the board of directors of the Cincinnati, Hamilton & Dayton, succeeding Mr. O. G. Murray, who continues on the executive committee.

Mr. R. B. White has been appointed superintendent of the Indianapolis & Springfield division of the Cincinnati, Hamilton & Dayton, with headquarters at Indianapolis, vice Mr. J. M. Scott promoted.

Mr. R. P. C. Sanderson, superintendent of motive power of the Virginian Railway, has resigned from that position to become general superintendent of the new plant of the Baldwin Locomotive Works at Eddystone, Pa.

Mr. G. H. Emerson, formerly superintendent of motive power of the Great Northern Railway at St. Paul, Minn., has been promoted to the position of assistant general manager of the same road, with headquarters at St. Paul.

Mr. George E. Howard has been appointed Eastern representative of the J. Rogers Flannery & Company, general sales agents for the Tate flexible staybolt, manufactured by the Flannery Bolt Company of Pittsburgh, Pa.

Mr. J. F. Deems, general superintendent of motive power, rolling stock and machinery of the New York Central Lines, has had his jurisdiction extended to the Toledo & Ohio Central, and to the Zanesville & Western Railways.

Mr. J. M. Scott, superintendent of the Indianapolis & Springfield division of the Cincinnati, Hamilton & Dayton, has been appointed superintendent of the C., H. & D. and branches, with headquarters at Dayton, Ohio.

Mr. A. C. Deverell, assistant superintendent of motive power of the Great Northern at St. Paul, has been appointed superintendent of motive power, with jurisdiction over locomotives and car shops, vice Mr. G. H. Emerson, promoted.

Mr. C. L. Adair, formerly general roundhouse foreman on the Cincinnati, Hamilton & Dayton, at Cincinnati, O., has been appointed master mechanic of the Kansas City, Mexico & Orient, with headquarters at Sweetwater, Tex.

Mr. John M. Borrowdale, formerly assistant superintendent car department, has been appointed superintendent car department of the Illinois Central, the Yazoo & Mississippi Valley, and the Indianapolis Southern Railways, with office at Chicago, Ill.

Mr. C. M. Tritsch has been appointed superintendent motive power and car departments of the Western Maryland Railway and of the Georges Creek & Cumberland Railway, with headquarters at Hagerstown, Md., vice Mr. R. E. Evans, resigned.

Mr. A. H. Westfall has been appointed general superintendent of the Toledo, St. Louis & Western and of the Chicago & Alton Railroad, with office at Bloomington, Ill. Mr. P. H. Houlahan, having resigned, the office of general manager is abolished.

Mr. R. D. Hawkins, assistant superintendent of motive power of the Great Northern at St. Paul, has been appointed superintendent of motive power, with jurisdiction over the mechanical and electrical forces, other than locomotives and car shops, vice Mr. G. H. Emerson, promoted.

Mr. Morgan K. Barnum, formerly general inspector of machinery and equipment on the C., B. & Q., has been appointed general superintenden of motive power of the Illinois Central, the Yazoo & Mississippi Valley, and the Indianapolis Southern Railroads, with headquarters in Chicago, Ill.

Mr. C. E. Walker has resigned as secretary and treasurer of the Phoenix & Eastern Railroad, the Gila River Railroad, the Aravaipa Canyon Railroad, and the Arizona Eastern Railroad. Mr. Gibson Taylor has been elected secretary, and Mr. P. J. Archer, treasurer of these roads.

Mr. H. Berlin Voorhees, son of Mr. Theodore Voorhees, vice-president of the Reading, has been appointed first assistant to Mr. Daniel Willard, president of the Baltimore & Ohio. He has been superintendent of the Philadelphia division of the Baltimore & Ohio for some time.

The International Railway Congress to be held at Berne, Switzerland, next July promises to be a most interesting meeting. Dr Angus Sinclair, inspector of technical education on the Erie Railroad, has been appointed by President F. D. Underwood to represent the railway company at the meeting. Dr. Sinclair expects to sail on June 25, and will make an extended tour in the British Isles and on the Continent.

Mr. R. C. Richards has been appointed accident inspector on the Chicago & North-Western Railway. He will bring about, as far as possible, by education and enforcement of discipline, the elimination of the causes which result in injuries to passengers and damages to freight. Mr. Richards was claim agent for many years on this road. He is to observe the causes of accidents, methods of handling trains and freight consignments, and to try to bring about the necessary co-operation between departments. Some years ago he wrote a book on the subject of railway accidents.

The position of superintendent of motive power of the Rock Island at Fort Worth has been abolished and Mr. F. W. Williams, its incumbent, transferred to Cedar Rapids, Ia. Mr. C. M. Taylor, superintendent of motive power at Shawnee, Okla., now has jurisdiction over the entire Southern district, which includes the territory heretofore covered by Mr. Williams. Mr. W. J. O'Neal, master mechanic, has been transferred to the Louisiana division, at Eldorado, Ark., and is succeeded by Mr. H. Clewer, who has been road foreman of equipment at Trenton, Mo.

Mr. Leo Pender, formerly roundhouse foreman at Tucker on the Denver & Rio Grande, has been transferred to Thistle, Utah, in the same capacity, vice Mr. W. J. Woodhead, resigned. Mr. Pender spent his youth in South America, his parents having gone there in 1882. He came back to the United States in 1898, where he worked as machinist until 1902. He spent a couple of years firing on the Northern Pacific, after which he went to Mexico. He was gang foreman, fireman, engineer and foreman on Mexican railways, and in 1909 he was employed as engineer by the D. & R. G. at Helped, Utah, and later he was made roundhouse foreman at Tucker, and now transferred to Thistle.

The Secretary of State at Washington has designated the following gentlemen to represent this country at the eighth international railway congress to be held at Berne, Switzerland, next July: The delegates are Messrs. Franklin K. Lane of California and Edgar E. Clark of Iowa, Interstate Commerce Commissioners; Fairfax Harrison, vice-president of the Southern Railway; W. A. Garrett, former general manager of the Seaboard Air Line; J. A. Brown, vice-president of the Railway Equipment Co.; Colonel H. S. Haines, former president of the American Railway Association; W. F. Schefter, Pittsburgh; Cordenio A. Severance, St Paul, Minn., and William C. Kuntz of Steelton, Pa. These gentlemen officially represent the United States at the congress. Many railways are, however, sending their own representatives.

Mr. George Karsten, a switchman on the Chicago & North Western Railroad, was recently presented with a medal of honor by President Taft under the provisions of the act of Congress governing such matters. Mr. Karsten was working at Allis Station and saw a woman attempting to cross the railroad at a point where there were twenty parallel tracks. A string of cars hid an approaching engine from her. The switchman rushed to her assistance, but she, mistaking his intention, struggled with him until the engine struck them down. The woman fell outside the track and Karsten between the rails. She had one foot crushed and died the same night. Karsten was not seriously injured, though his clothes were badly torn, and the tender and the engine as far as the pony truck passed over him. The railway company made application to the Interstate Commerce Commission, laying the facts before them, with the result that the medal of honor was awarded.

Mr. Walter McFarland, who has been associated with the Westinghouse Electric & Manufacturing Company since Jan. 1, 1899, has resigned to accept an official position with the Babcock & Wilcox Company. Mr. McFarland has occupied the office of acting vice-president for the Westinghouse Electric & Manufacturing Company for a period extending over ten years. In this capacity he has had official supervision of the large contracts of the company, as well as being the advisory head in all the co-operative movements of the company with the Associated Westinghouse Companies, involving literature, advertising and exhibition work. Mr. McFarland was born in Washington, D. C., in 1859. His education was received in the public schools of Washington, the preparatory department of Columbia University and the United States Naval Academy. He entered the latter institution as a cadet engineer in 1875, and in 1879 he graduated, being second in his class. In 1881 he was commissioned as assistant engineer; in 1891 as past assistant engineer, and in 1898 as chief engineer. He was the youngest officer for more than twenty years to have reached the latter grade. He has been a frequent contributor to the technical press, and his papers on engineering topics have won for him an enviable reputation as an engineer of broad experience and advanced ideas.

Obituary.

Frederick Mortimer Robinson, who has been connected with the Pressed Steel Car Company of Pittsburgh, Pa., for the past six years as sales agent, died of pneumonia on April 2, and was buried in Petersburg, Va., April 4. Mr. Robinson was 33 years of age, and had formerly been connected with the Chesapeake & Ohio Railway Company. He was a Knight Templar and a member of the Acca Temple of Shriners at Richmond, Va.; a member of the Commonwealth Club, Richmond, Va.; the Cleveland Coal Club; the Union Club of Pittsburgh; the Railway Club of Pittsburgh, and the Virginia Historical Society, Richmond, Va. He is survived by his parents, one brother and two sisters. Mr. Robinson has been well known in the railroad supply trade for several years and his death will be mourned by his many friend

General Foremen's Association

Punctuality Demanded.

On taking the chair at the last convention after being elected president of the association, Mr. T. H. Ogden said: "I have found a little something to say. Like the Senator from Mississippi, it is coming now. I can only say, however, that I thank you for the courtesy and will endeavor to do my best. I will say, further, that there is no officer of the association who can make it a success without the assistance of all. We have a membership of about 300, and when we stop to consider the assemblage present this morning, it is not encouraging to any officer. None of our superiors could succeed without our assistance and co-operation. While I am in this position, I shall try to call things by their right name. We will not call a meeting at 9 and commence at 10. We will use some of the system followed at home in our shops in furnishing our subordinates with what they call for. If they want it at 8 we furnish it at that time and not at 9. That is the policy we will have to begin now.

T. H. OGDEN.
President General Foremen's Association.

DISCUSSIONS TOO LONG.

"There is one thing I want to call your attention to, and that is our discussions are altogether too long; they embody too many subjects in one topic. We have too many topics which increase our subjects so. In formulating our topics for next year, I want to impress upon the members not to have so many subjects embodied in one topic. I would like to have the members have some plan by which we can know what topic we are going to take up next year, and each member write something—some article on some particular subject, and present it to the meeting, just the same as the ones who present the paper on the subject. We should talk this over among ourselves and each member come with a small paper on quick turning of power, the cost, how to obtain the best method, back shop practice and how to get the average out of the power that is required. I believe that this association has two topics that we can discuss in this meeting, and we can discuss them for two or three years; one is the quick turning of power and the other is the mileage of an engine and how to procure it. Back shop practices—how to handle the work in the round house—all such things are dependent upon us. It is a good thing to argue about air and get the different opinions about our work in the shop, but after it crosses the turntable it is of little interest to us except in the case of an engine failure. We want to discuss the best method to prevent engine failures. When we have accomplished that, reduced the cost of operation and turning the work out in good shape, we have carried out the purpose for which we are in our positions."

As that salutary advice was to a great extent given for the benefit of future conventions, we publish it now as being on time for the sixth convention.

As the most important work supervised by the men composing the General Foremen's Association is the repairing of locomotives, the most important subjects investigated and discussed are those relating to methods for facilitating the work of repairs. Nearly every shop has excellent methods peculiar to itself, and it is right that the particularly good practices should be revealed to all. In a very compact paper prepared by Mr. W. C. Stears, assisted by G. F. Dick, A. F. Bradford and F. W. Rhuarp, the association received edifying facts on the following question, which we give in full:

BEST METHOD OF GETTING WORK THROUGH THE SHOP.

"In considering this question, we will have to take into consideration the fact that there is a wide difference in the construction of the shops, and conditions of the same on the different railroads. It would therefore be impossible for us to discuss the method of handling the work in detail. But the shop organization should be such as would insure the quickest handling of the work possible. This can be done by specializing the work; such as rod work, steam chest, links, rocker boxes, crossheads, pistons, which should be handled by different gangs with working foreman. In fact, organize all the different jobs in gangs that it is possible to do so under the local conditions. The taper bolt should also be used for all engine work, using the 1/16 inch to the foot tapers, the reamers should be marked by a series of letters and numbers so that it would be possible to order bolts from machine foremen and have them fit when brought to the job. It would also facilitate the work in round house, on such rod bolts and frame splice and cylinder bolts, as well as be a great advantage in supplying material to outside points ready for use.

L. H. BRYAN,
Secretary-Treasurer General Foreman's Ass'n.

"All cross-head pins, piston fits, etc., should also be maintained as a standard of the different class engines. A stripping gang of handy men should be organized, who should do sufficient stripping to get the engine off the wheels: namely, drop pedestal binders, rods and brake rigging, all other stripping should be done by the machinist working on the engine.

"As we believe that the saving in material and time lost in looking up material will more than offset the difference in the pay of machinist and handy men, to say nothing of the time saved by getting the work distributed to the machine shop and blacksmith shop as soon as it is off the engine. the men in erecting department should also be furnished with portable tool boxes erected on wheels as a warehouse truck, which should be equipped with a full set of wrenches, pinch-bar, sledge, etc., and charged against each man. This would save a great amount of time that is usually lost in looking up and getting tools from tool room. All the taps, dies, drills, reamers and motors to be handled from regular tool room on the check system, to be drawn by an individual, kept for the purpose by each gang on erecting floor. There should also be a material man to draw all material from store room and deliver to shop (where the shop is large enough to warrant it).

"We also believe that the men should be worked on the premium system, which would be both beneficial to the company and the men; to the men by enabling them to earn in proportion to their ability; to the company by increasing the output of the shop, also by excluding the incompetent man from the shop."

Mr. Kelly thought it would pay to have the entire stripping done by the stripping gang. When the engine is ready for the machinist, the rebuilding of the engine can be started at once. The stripping gang can be trained to it, and he saw no reason why they should break or destroy anything. Besides a portion of the material stripped off an engine should go to the lye vat, and he did not think the machinist ought to do any stripping.

In regard to the portable trucks with a portable vise and tools, in some cases they are very handy, but he did not think every machinist ought to have one. In the large shops you are limited for space, and the entire shop might be taken up with boxes and trucks.

President Ogden remarked: "The individual effort system is the only true method of organization, and a method that will increase the efficiency of the back shop as well as the round house and every other foreman that works under that system. It does not only increase the earnings of the man who does the work, but the foreman's salary; his efficiency increases along with his workmen. It encourages him to take a more active part in looking after the work. It also encourages him to see whether he has too many men on one special operation. Mr. Ogden then proceeded by figures to show the benefits that the workmen derived from working under the individual effort system."

The discussion was then dropped, to be resumed later, but press of business kept it out, and the presumption is that it will be taken up at the Cincinnati convention.

Sixth Annual Convention.

Mr. Luther H. Bryan, of Two Harbors, Minn., secretary of the Foremen's Association, writes to the editor as follows:

"In connection with the International Railway General Foremen's Association, whose sixth annual convention is to be held at Grand Hotel, Cincinnati, O., May 3, 4, 5, 6 and 7, I want to state that we are going to have the best meeting we have ever had, that is, if letters from the members are any indication. Every member should make it a point to be there, as matters of vital importance are to be brought up. It took the M. M. and M. C. B. associations all of fifteen years to get firmly established and show to the 'man higher up' that they were the one important factor in the railroads of the world. Times are faster now, and the facts and information that took years of struggle for them to gather for their superiors, must be gleaned for our superiors in a much shorter time.

"The master mechanics have made it possible for your position to be created to relieve them of some of the many responsibilities that fall upon their shoulders, and their aim is to select the master minds from among the workmen, to take charge of the many duties that now fall to the lot of the foremen, and it is up to the foremen to prove the wise selection of their superiors. They depend more than you realize upon your judgment, and are trying their best, in many ways, to fit you for higher positions. The active minds are the ones picked out for advancement, the thinkers, the doers.

"The I. R. G. F. A. was formed for just this purpose, to get the thinkers and doers together, to get their opinions and thoughts on things of railroad interest that would benefit their superiors and thereby the railroads. They may not say it in so many words, but I honestly believe that the superintendents of motive power and master mechanics of today are willing and anxious for you to attend the general foremen's convention, knowing that you will return enriched in knowledge and improved physically. A trip of this kind will not only help the mind, but the body will be benefited. The old adage 'All work and no play makes Jack a dull boy,' is an axiom, pure and simple. If a week or so at the convention will benefit you, so will this bring benefit to the company which employs you, and would amply repay them for the expense incurred sending you to the convention, and your loss of time while there. Make an earnest appeal to your superior, lay the matter before him in a straightforward, honest way, and see if you cannot convince him that it will be for the company's welfare as well as your own, for him to send you there. Try it. They are all good men, and mean to do what is right, but they just haven't had time to think the matter over, and are waiting for you to ask them."

Less Romance but More Comfort.

Everything in the line of machine construction is now so thoroughly specialized that no workman or combination of mechanics thinks of building a machine tool or a locomotive to embrace valuable features that the contract shop owners refuse to build. When American machine shops were working into the making of machine tools and other concerns were trying their hands on building locomotives, the individual ideas were much more potent than they are today. There was more romance and variety in the occupation of the old-time mechanic, but his modern successor earns his wages with less effort of head and hand.

Old Things Made New.

The apprentice boy in the machine shop with a fondness for reading trade literature finds in the simplest everyday matter a subject of novelty to himself, remarked Chordal, and in the course of time his mind becomes stocked with material gathered item by item, each one as old as the hills to the world, but to him fresh as the daisies.

An apprentice boy in a machine shop sits on a block at noon reading a mechanical paper or is thoroughly interested in an article on "Lining up engine guides." An old, grayhaired fellow looks over the boy's shoulder, gets a general idea of the illustrations, and sneeringly remarks: "Pshaw! that thing's a thousand years old. Is that what you fellows read about in those papers?"

If the boy is smart, he will reply: "I am sixteen years old and this is the first I ever knew of the guide business. How old were you when you found it out?"

When the same boy gets to be fifty, he may possibly become disgusted with this same kind of shop literature, and begin to think that the editor ought to be kicked for putting old things in the paper, thinking they can be passed off as novelties. He may forget his own experience.

Professional literature forms the annals of professional progress. The artisan's literature is not and need not be consecutive. It presents a series of items which each individual arranges in his own mind for his own individual annals of progress.

We should impart to others our courage, and not our despair; our health and ease, and not our disease.—*Thoreau.*

Railroad Character Sketches

Shaw Becomes a Valve Setter

By James Kennedy.

Some people do not know when they are well off. When good fortune comes to them in an easy way they are not satisfied. It is something else that they want. Rich men are not satisfied with money; they desire to become authors or statesmen and blossom into foolishness. When Shaw was put in charge of the tool room he was practically his own master. He had long lapses of languid leisure. He could gaze out at the window and watch the pigeons describing concentric circles in the blue vault of heaven, and when some overgrown apprentice called for a twist drill, the youth had to roll up a handful of oily waste into a hard ball and hit Shaw in the back of the head with it before he could wake the tool-keeper out of his day-dream. Shaw was not altogether blind to earthly things. While he had one eye on the phenomena of nature as manifested in the winged denizens of the intangible air, the other eye swept with unwavering constancy the beaten path whereon the shop superintendent approached Shaw's secluded section of the works. If Shaw had continued his course of double observation he might have become cross-eyed. As it was, he began to assume poetic attitudes and acquired the philosophic habit of looking at his own nose.

An inspiration came to Shaw. He could set valves, or thought he could. He had sanded the rails, and pinched the wheels, and moved the eccentric rods at Macfarlane's bidding, and he knew all about it. If he had a couple of men he would tackle the job after night, and next morning the engine would be ready to go out. There was overtime and extra pay in it, and there was a dignity and mystery about it that fed the fires of vanity in the head of the ex-haddock man. He began by squaring up the old "49." It was a simple matter of dividing up the lost motion on the eccentric rods and putting a small offset in the eccentric keys, and the old engine was none the worse. This is more than can be said of the two assistants. The pinching was back-breaking. Shaw believed in long stretches of engine moving so that all of the lost motion could be taken up. Shaw explained that he would not let an engine go out of his hands unless it was exactly right if it took a part of next week. Shaw had a good conscience. That is more than some valve-setters are said to have.

The laborers became familiar with Shaw's methods. They could foresee his valve-setting a week ahead, and they evaded the superimposed sufferings with ingenious duplicity. Running over the valves was bad enough, but when it came to new saddles on the links it was something terrible. It was all night, and next day they were still at it. Shaw became introspective and uncommunicative. Importance sat upon his dark brow. From his serene altitude other men looked little. His sayings became oracular. His methods were mystical as those of an astrologer. He had great black checker boards constructed whereon he inscribed parabolic curves radiating from mysterious centers and running through a network of lines like the courses of transatlantic ships. A double row of compound fractions were inscribed on the ends of the board and men marvelled that Shaw's mind, hitherto dull and common, could blossom into such amazing mathematical efflorescence.

He was drifting either to the madhouse or a master mechanicship when a sort of valve-setting cataclysm engulfed him. It was Friday and the "42" had new axles, and key ways had to be cut in the axles for holding the eccentrics in place. Shaw was getting beyond his depth. The few engines whose valves he had been experimenting upon happened to have a keyway cut in the wheels at a point nearest to the crank pin. In the "42" the keyways in the wheels were cut at a point furthest from the crank pin. Shaw had been accustomed in his superficial experience in associating the position of the eccentrics with the key-ways in the wheels. If the key was at right angles, or where the figure three occurs on the dial of a clock, Shaw believed that the extended part of the forward eccentric should be about one o'clock, and the backward eccentric about five o'clock. In this blind belief he went on. He and his assistants had a sad night of it, but they worked mightily, and in the dim dawn of the morning the engine was ready for moving. Other new thoughts came to Shaw. The manager was to look in on Saturday and Shaw would show him something worth remembering. It had been the custom to have thirty or forty men pulling on a rope and hauling the repaired engine out preparatory to firing up. Shaw had steam up from another engine that happened to be near. When the gang assembled and the manager was looking loftily on, Shaw waved them aside and, jumping into the cab, he moved the reverse lever into the extreme forward notch, and opening the throttle, the old engine trembled for a moment as if conscious of what was going to happen, and then plunged suddenly backwards. A cry of alarm burst from the astonished crowd as the ponderous draw-bar of the engine shot through the solid brick wall, and in another instant the wall itself fell outwards with a blinding crash! Shaw shut off steam, but not before the old engine was out in the open air blocking the main line. A string of empty coal cars came lumbering along and leaped over each other as if to bury Shaw in elemental ruin!

How Shaw survived was a mystery. He was brought out in a semi-unconscious condition. Macfarlane was called upon to clear up the wreck and rectify the engine. Billy had to write a report of it, which he did with a degree of fullness that left little to be desired. In a few days Shaw's valve-setting became a fateful memory. He is back at his old job, and in his leisure moments he is finishing oil cups and cutting piston rings and cleaning injectors and the pigeons are describing their involved and convoluted circles unheeded. Macfarlane had a fit of supreme contempt for Shaw too deep for words, but Billy insists that Shaw was right, because in ancient history it is recorded that when a great man visited his native city it was customary not to admit him at the common gateway, but to pull down a portion of the city wall so that he might have the high honor of having a gateway cut for himself and so enter as became a conquering hero, amid the acclamations of the admiring multitude, and this honor Shaw had accorded to the manager.

Invention to Operate Distant Signals.

In the development of station signals means of operating a distant signal tried the ingenuity of engineers longer than any badly needed invention. About 1846, when most railway men had decided that nothing short of a man stationed beside a distant signal could operate it, so that a train standing at a station would have distant protection, a porter at an English railway station, who had charge of two signals, one at each end of the platform, devised a system of wires which enabled him to operate both signals from one point. After this invention had been in use for about a year the engineer of the road happened to see what the porter was doing, and promptly applied for a patent on the invention, which was granted and became the basis of a modest fortune in which the ingenious porter reaped no share. There are patent sharks in England as well as elsewhere.

Y. M. C. A. Work on P. R. R.

The Pennsylvania Railroad Y. M. C. A. in Philadelphia, in the annual report for 1909, shows a total attendance of 344,439 in the year. In the educational classes 320 members were enrolled, and 606 sessions were held.

Truth is to be costly to you—of labor and patience; and you are never to sell it, but to guard it and to give—*Ruskin.*

Don't Blame the Conductor.

A novel educational method was recently tried on the traveling public in Rochester, N. Y. A new and complicated system of transfers was introduced a few months ago. Mr. W. C. Callaghan, superintendent of Transportation New York State Railways, writing in the *Electric Traction Weekly*, says:

"The day the new transfer was put into effect, cards were posted on the windows of all cars headed, '*Don't blame the conductor.*' These cards informed the public that the conductors were working under rules which they could not change, and requested passengers with complaints of any kind to present their grievance to the office. This slogan, '*Don't blame the conductor,*' was undoubtedly one of the happiest thoughts that could have occurred, as it became general all over the town, and no doubt relieved the conductors from many disputes and troubles."

A Molder for the Car Shop.

The J. A. Fay & Egan Company, of Cincinnati, Ohio, have a model molder on the market that is regarded in woodworking circles as being a very satisfactory machine and particularly useful in car shops. The manufacturers call this machine their No. 182 four side molder. This machine is made in three sizes, eight, nine and ten inches wide.

In order to work very heavy moldings without vibration, the manufacturers have given special attention to the construction of the frame. It is cast in one piece, very heavy, and it is extra long to give good belt length. The feed is very powerful and positive, consisting of four geared rolls, the two upper ones being spur sections and the two lower ones solid. The upper rolls are driven down, which makes it possible for the makers to attach their patent spring hold down, giving uniform pressure on the material, and being in every way more powerful and satisfactory than the old system of weights and levers, commonly found on molders.

Sectional clamp bearings are applied to both the upper and lower cutter head spindles. The bearings consist of metal plates held in position by clamp bolts. These exert no downward pressure on the journals, and cannot be screwed tight enough to bind, a feature of the old style cap boxes that often gave trouble. By releasing the clamp bolts and simply pressing the plates down with the hand, any wear may be taken up. A cool running journal is thus insured.

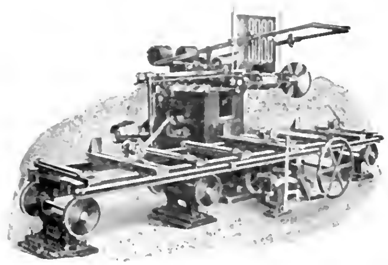
Powerful screws mounted on ball bearings raise and lower the bed, the section of which, after the lower head, swings down out of the way to give access to the knives. The side heads, which are mounted on the table, have independent vertical, lateral and angular adjustments. For further particulars, you are requested to write the manufacturers, who will be pleased to give you full information.

Let Him Cave It In.

The late Sir Daniel Wilson, president of the University of Toronto, said on one occasion when addressing the students, "I have had a lot of trouble in my life, but most of it never happened." This saying conveys the lesson that worry and fret are ninety-nine times out of a hundred entirely unnecessary. Artemus Ward, speaking one day of activity and push, said, "When an emergency comes along I like to see a man rise up and just cave in the head of that emergency."

The Gyroscope Car.

Continued experiments are being made with the gyroscope car, the latest exhibition being given in Kent, England, on a circular track of a mile in circumference. The car was run on a single rail around the track at 20 miles per hour. The stability mechanism consists of two gyroscope wheels which rotate in opposite directions, each at 3,000 revolutions per minute. The wheels are enclosed in air-exhausted cases, their axes of rotation being horizontal, while the axes of precession are vertical. While the car is standing balanced on the rail and the gyroscopes running there is no tendency to movement in the car, but when any disturbing force appears, such as the movement of the passengers, the effect of the gyroscope wheels is to cause the car to lean over to the opposite side and balance the disturbing force. Normally the action is automatic, but the driver can control the action so that the car can be made to lean over while loading and unloading and rest on adjustable platforms. The weight of the car when empty was 22 tons and a load of 10 tons was carried. The gyroscope wheels weighed together 1½ tons. The motive power was a gasoline engine. Two engines were used, one of 80-horse power for moving the car and one of 20-horse power for driving the gyroscope wheels.



FAY & EGAN FOUR SIDE MOLDER.

International Fuel Association.

The International Railway Fuel Association will hold their second annual meeting in the Hotel La Salle, Chicago, on May 23 to 26, inclusive. The secretary, Mr. D. B. Sebastian, 327 La Salle Station, Chicago, writes the editor as follows:

"The hours of session will be from 9 a. m. to 1 p. m. on the four days, and the members will be welcomed on the opening day by the mayor of Chicago, and addresses by other prominent men are expected.

"Members are particularly urged to bring their families to this convention. The hours of session were purposely arranged without intermission to permit opportunity for recreation and to establish a better acquaintance between the members. The matter of entertainment, the entire expense of which will be borne by the association, will be a distinct feature this year. Something will be done every day in connection with complimentary theater parties to members and their friends, a trip across Lake Michigan and return on a commodious passenger steamer, or a visit to one of Chicago's large amusement parks; besides automobile rides, etc., are being arranged for.

"The commodity, 'Fuel' is of more importance to railroads from a cost standpoint than anything else purchased, and with this live subject is it any wonder that all of our large and small railroads are interested as members in this association?"

A list of the papers to be presented and of the personnel of the committees is to be found in the March issue of RAILWAY LOCOMOTIVE ENGINEERING, page 102.

Lots to See.

Richard Randall had been a perfect railway manager, with charity to all and malice toward none. The time came for Richard to enter upon his reward, and a celestial messenger called to escort him upon his last run. As they were skipping through the skies a thought came to Richard, who was always compassionate, that he would like to pay a brief visit to the other place. The request was no sooner made than granted, as like a flash they were transported to the lower regions. There were many things to be seen, as the guide intimated that Richard might indulge in any enjoyment to be had from the novel sights, leaving him to select for himself. After being absent for some hours the guide returned and found Richard sitting watching intently the antics of a group of men who were squirming in a particularly hot furnace.

"What have you found there?" demanded the guide.

"I've found a furnace filled with chance-takers, and that is pleasure enough for me. I intend to stay here."

Weathering of Coal.

"The Weathering of Coal," by Messrs. S. W. Parr and W. F. Wheeler, is issued by the Engineering Experiment Station of the University of Illinois as Bulletin No. 38. This bulletin embodies the results of weathering tests conducted on car-load lots of coal for a period of one year, in the course of which, coal from various mines was exposed in covered bins, open bins and under water. The results are presented in the form of charts which show graphically the losses in heating value resulting from each condition of exposure. Copies of Bulletin No. 38 may be obtained gratis on application to Prof. W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

Silver in Lead.

It may not be generally known that old, or what may more properly be called antique, lead usually contains a considerable proportion of silver. This is readily recovered by what is known as Pattinson's process, which is an electric application used in separations of the molecules of silver from the lead. In fusing lead the greater bulk of the silver finds its way to the surface of the molten metal, but much of the silver remained in the lead previous to the application of Pattinson's electric device.

Pushing the "Get There" Idea.

Down at Dayton, Ohio, there are rival lines which compete strenuously for business. One of the managers placed some signs in cars, reading, "Direct Route to Greenwood Cemetery." Not to be outdone, his rival put up some cards which read, "Shortest Route to All Cemeteries."—*Electric Traction Weekly.*

Tractive Power.

The American Locomotive Company have just issued a very useful and convenient bulletin, No. 1002, for March. This bulletin deals with the tractive power of simple locomotives, and the tables given are the most comprehensive that we have seen on the subject. Table No. 1 is the tractive power calculated for simple engines with boiler pressure of 100 lbs. Tables Nos. 1 to 8 are for boiler pressures of from 150 to 220 lbs. In these two tables almost any combination of cylinders, driving wheels and pressures which anyone is likely to come across is covered. There are other tables giving, respectively, the number of revolutions of driving wheel per mile for different sizes of wheels. Seconds per mile with equated miles per hour. Cylinder volume. Internal area of tubes. Heating surface of tubes. Weight of tubes. Middle ordinates and tangent deflections of curves. Metric conversion tables and classification of locomotives. By means of this bulletin a great many calculations connected with locomotive design may be considerably simplified. There is a vast amount of work represented in filling the few sheets of which it is composed, but the results are so neatly tabulated and arranged that it is a pleasure to work with it. Those who would like to have a copy should apply direct to the company for one.

Employees and Pensions.

The latest government report on the number of railroad employees puts the total for the country at 1,672,074. Of these approximately 665,000, or about 40 per cent., are employed on roads which have pension systems. Among the companies that now bestow pensions on employees are the New York Central, the Rock Island, the Pennsylvania, the Buffalo, Rochester & Pittsburgh, the Chicago & North-Western, the Illinois Central, the Santa Fé, the Union Pacific, the Southern Pacific and its affiliated lines, the Lackawanna, and the Baltimore & Ohio, the Atlantic Coast Line, the Reading, Jersey Central and the Canadian Pacific and Grand Trunk in Canada.

Human Growth.

Observations regarding the growth of man have determined the following interesting facts: The most rapid growth takes places immediately after birth, the growth of an infant during the first year of its existence being about eight inches. The ratio of increase gradually decreases until the age of three years is reached, at which time the size attained is about half that which it is to become when full grown. After five years the succeeding increase is very regular until the sixteenth, being at the rate for the average man of two inches a year. Beyond sixteen the growth is feeble, being for the following two years about six-tenths of an inch a year, while from eighteen to twenty the increase in height is seldom over an inch. At the age of twenty-five the growth ceases, save in a few exceptional cases.

Tell-Tale Hole in Staybolts.

The Falls Hollow Staybolt Company, of Cuyahoga Falls, Ohio, have kept pace with the discussions concerning flexible staybolts which have taken place in the Master Mechanics' Association and in the Master Boiler Makers' conventions during the past few years. This speaks well for the enterprise and the careful examination of every phase of the important staybolt question by this well known company. It is known that the purpose of the inventors and makers of flexible staybolts has been to design a flexible stay which would, without straining or bending the metal of the outer firebox sheet, should respond freely to the slight movement caused by repeated expansion and contraction of the fire sheets, and this desirable feature has been introduced into locomotive practice. The Falls Hollow Staybolt Company are now advocating the desirability of introducing the tell-tale hole into the flexible staybolt. Their working out of this problem is interesting, and those concerned in the care of staybolts should write to the company for particulars on the subject, which they are prepared to give. The rigid hollow staybolt as made by this company is too well known to require any detailed description here. It has not only been extensively used in this country, but has been specified in foreign countries, and their further effort to include flexible staybolts is one that cannot fail to awaken interest in the minds of all those who have the care of locomotive boilers in their charge.

Might Be Something Happened.

A witness in a railroad case at Fort Worth, Tex., was asked to tell in his own way how the accident happened, said: "Well, Ole and I was walking down the track, and I heard a whistle, and I got off the track, and the train went by, and I got back on the track, and I didn't see Ole; but I walked along, and pretty soon I seen Ole's hat, and I walked on and seen one of Ole's legs, and then I seen one of Ole's arms, and then another leg, and then over on one side Ole's head, and I says to myself, 'Gee, something muster happen to Ole!'"—*Everybody's Magazine*

Increase of Pay on the P. R. R.

The boards of directors of railroads comprising the Pennsylvania System have ordered a voluntary advance of 6 per cent. in the wages of all permanent employees of the company who now receive less than $300 per month. This is the third general voluntary increase in wages granted by the Pennsylvania in the last eight years. The Pennsylvania Railroad and its affiliated lines employ about 200,000 men. Of these, approximately 195,000 will participate in the increase of wages. This will involve an addition of some $10,000,000 to the pay rolls of the various companies.

The Pennsylvania in December, 1902, awarded an increase of 10 per cent. to all employees receiving less than $200 per month. In December, 1906, another voluntary increase of 10 per cent. in wages was made by the various companies in the system, so that the present readjustment means a total addition of 28.26 per cent. to the rates paid in December, 1902. Aside from the voluntary advances that have been made, there have been granted constantly increases in wages due to promotions, as well as increases for various classes of employees, so that with the increase in wages effective April 1, 1910, the cost of labor to the Pennsylvania Railroad System for the year 1910 will be more than 33 per cent. greater than in 1902. In other words, an employee of the company will, in 1910, receive approximately one-third more salary than he was paid eight years ago.

New Era Packing.

A very handy little booklet has been issued by the New Era Manufacturing Company, of Kalamazoo, Mich. It deals in short form with their new era metallic packing, or, as they call it, self-lubricating bearing metal. We are told by the makers that "this product consists of a high grade of anti-friction alloy reduced to a sponge-like form, in which the metal portions are highly attenuated, and of irregular and interrupted surface formation, treated with lubricating oils and then coated, on all its surfaces throughout the sponge-like mass, with flaked and comminuted, friable mineral lubricating substances, which convert the whole mixture into a compound mass of metallic lubricants."

Uncertainty.

Max Adler used to tell this story about a farmer who owned a fine Alderney cow. One day a stranger, having seen, admired and coveted the cow, met the owner and asked, "What will you take for your cow?" The farmer became excited at the prospect of a sale, but suddenly reflected, and said, "Now, look ahere, you; be you the tax assessor, er hes that there cow been killed on the railroad?"—*Erie Railroad Employes Magazine.*

A Serviceable Wrench.

The Uwanta Wrench Company of Meadville, Pa., are making a first-class wrench for railroad use. The wrench is of special design and construction, having a reinforced movable jaw, made of the best quality of malleable iron. The head, bar and shank are made in one piece which is drop-forged from special high-grade steel. The hexagon nut which moves the jaw up and down is threaded its entire length and gives an extremely rigid bearing for the thrust of the wrench. The shape of this nut is such that it affords perfect grasp for the hand, and is free from any knurled surface. The iron handle is made to fit the hand, giving the best possible grasp, and its use will not tire the hand. It has a taper fit to the shank and is free from the annoyance caused by loose rivets often used to hold handles in place. This handle is made of malleable iron, and is as nearly indestructible as it is possible to make it. The makers report a wonderful demand for this wrench during the past year, in spite of the generally poor condition of business. More railroads use it than ever before. If this is true, and we see no reason to doubt the maker's claims, it is a very good illustration of the fact that there will always be a good healthy demand for a thoroughly serviceable article.

Speed of Wood-Working Machinery.

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

A properly driven circular saw has a peripheral speed of 7,000 ft. per minute—nearly a mile and a half. A band saw is run at about half that speed. Planing machine cutters have a speed at the edge of 6,000 ft. per minute, and the cutters of molding machines slice out material at about 4,000 ft. per minute. Wood-carving drills are run 5,000 revolutions per minute. Augers 1½ ins. in diameter are run 900 revolutions per minute, and those half that size are run at 1,200 revolutions per minute. Mortising machine cutters make about 300 strokes per minute.

This Rule Has Exceptions.

A religious worker gave a "Talk for Men," during the course of which he expressed his conviction that no young man should visit any place to which he would not feel justified in taking his own sister. "Is there any young man present who thinks one may safely disregard this wise rule?" asked the speaker. Whereupon a youth in the rear of the hall arose and shouted in a stentorian tone. "Yes, sir, I do." "And what, sir," demanded the angry and surprised speaker, "is the place you yourself would think of visiting to which you could not take your sister?" "The Barber shop!" replied the youth with a grin.

Record of Transportation, P. R. R.

The Pennsylvania Railroad have issued their annual Record of Transportation Lines, showing that on December 31, 1909, the road had 24,097.94 miles of track, the greatest in the history of the company. The system has in all 11,234.36

miles of line, of which 6,294.32 miles are east of Pittsburgh and Erie, and the remainder, 4,940.04, run west of Pittsburgh. There are now 11,234.36 miles of first track, 3,348.39 miles of second track, 700.10 miles of third track, and 570.20 miles of fourth track. There are also 8,184.89 miles of siding. The increase in the trackage in the year 1909 was 120.53 miles. The Pennsylvania Railroad is essentially an institution of the State of Pennsylvania, for in it are located 4,101.03 of the 11,234.36 miles of line.

Reward for Life Saving.

Mr. Robert Brendle received a medal of honor (under the provisions of the act of Congress) from President Taft, for saving the life of a woman on the Centre street crossing of the B. & O. in McKeesport, Pa. Nine parallel tracks cross the street at grade. Mr. Brendle, who was the policeman on duty at this crossing, saw a woman attempt to cross as a freight train was approaching. He shouted a warning, but the woman, being foreign, did not understand English, and he rushed to her assistance. He picked her up and carried her off the track, none too soon, for the buffer beam of the engine struck him a glancing blow. The mayor and chief of police at McKeesport made application for the medal.

Duplex Uncoupler.

A very ingenious device called the Duplex Uncoupler and Automatic Release has been brought out by the National Railway Devices Company, of Chicago, Ill. It is an uncoupling apparatus which is applicable to any car and to any kind of coupler. It consists of a round iron bar carried in suitable bearings with handle at the side of the car. This handle is an ordinary crank, and the operator in working the device rotates the round iron bar on its own axis. One of the cleverly devised features of this arrangement is that the handle is close to the step, and in the normal position, with knuckle closed, a man can step on the handle and not open the knuckle. More than that, a man may stand on the step with one foot and operate the handle with the other.

So much for the handle end; the other end is bent into what may be called a sort of right angled triangle, with the corners curved so that a short round iron rod may be moved by rotation of the triangle. In the normal position this bar lies on the base of the triangle and draw gear movement simply slides the short round iron rod along as required.

This short round iron bar has a sliding pivot motion, if one may so say, in a bracket at its outer or flattened end. The other end is attached to the coupler lock. In the lock set position this short round iron rod falls into the heel or right angle of the triangle, which by reason of its rotation has raised the bar and also the coupler lock. In the knuckle-open position the further rotation of the triangle has raised the short bar and the knuckle lock with it to its highest position, still keeping it in the heel or right angle of the triangle.

When it comes to a case of "pull out" of the draw bar, the forward movement of the coupler pulls the short bar into the smaller or acute angle of the triangle, lifting it at the same time, and with it the knuckle lock, so that the knuckle swings open and danger of accident are thus avoided.

It is not very easy to describe this device without the aid of illustrations, but our description is at least an accurate outline sketch for the mind to grasp. The best way to get the whole thing so that all its merits may be readily understood is to drop the makers a post card and ask for their folder; it is illustrated very clearly. With this brief description and their illustrations and remarks you will see what a cleverly designed arrangement it is and how well it has been thought out. Their address is 400 Old Colony Building, Chicago, Ill.

Fatigue of Metals.

It should be borne in mind that hardened tools undergo changes of temper in the course of time. This is altogether apart from the disintegration of metals which is constantly going on. Old swords, formerly the ice brook's temper, may now be readily bent and in a few hundred years more will fall to pieces of their own accord. The silver coins of the middle ages are now scarcely able to hold their own weight. The brass pillars at the door of Solomon's Temple are crumbled into dust. In the matter of hardened steel tools it may be added that the lower the temperature the longer it takes to remove the hardness from a piece of hard steel.

Incrustation of Boilers.

The following are a few of the remedies for scale in boilers recommended by various authorities. Imagination helped in making the remedies remedy: 1. Potatoes, one-fiftieth of weight of water, prevents adherence of scale. 2. Twelve parts of salt, two and one-half caustic soda, one eighth extract of oak bark, one half part of potash. 3. Pieces of oak wood suspended in a boiler and renewed monthly prevent deposits. 4. Two ounces of muriate of ammonia in a boiler twice a week prevents incrustation and decomposes scale. 5. Coating of three parts black-lead, eighteen of tallow, applied hot to the inside of a boiler every week, prevents scale. 6. Thirteen pounds of molasses fed occasionally into an eight-horse boiler prevented incrustation for six months, so the engineer said. 7. Mahogany or oak sawdust in limited quantities; the tannic acid attacks the iron, and should be used with caution. 8. Slippery elm bark has been used with some success. 9. Carbonate of soda. 10. Cloride of tin. 11. Spent tanners' bark. 12. Constant blowing off.

On to Her Calling.

Our Landlady—"It's the strangest thing in the world! Do you know, our dear old pet cat disappeared very suddenly yesterday. Excuse me, Mr. Rudolph, will you have another piece of rabbit pie?"

Mr. Rudolph (promptly)—"No, thank you!"

Our Landlady (an hour later)—"That is three more pies saved. This season will be a profitable one indeed."

Twentieth Century Outfit.

The Buker & Carr Manufacturing Company of Rochester, N. Y., makers of the Twentieth Century Outfit, have issued a folder in which every part of their machine is illustrated and numbered for ordering. This twentieth century outfit is the handy little machine used in so many railroad shops for any one of four operations connected with the handling of air brake or steam hose. With this machine one can easily cut hose clamp bolts, also pull the hose off an old coupling, and this is not an easy operation, as anybody knows who has tried to do it by hand. It will force hose on a coupling, and it will apply the clamp. The machine for doing all this is illustrated, and even the minutest part has its name and number on the folder just issued. Write to Buker & Carr and secure a copy of this folder, or ask them any question you like connected with their machine.

Water Softening.

The Germans claim that they have discovered something new in the way of water softening. The apparatus consists of a piece of thin sheet aluminum, which is bent into a series of deep corrugations, usually about 1/4 in. wide, the depth of the corrugation being about 1 inch. The dimensions vary according to the amount of water to be treated. The quantity of water is fed into a hopper and a number of holes lead into the corrugations, the supply being limited so that the corrugations will not overflow. The aluminum is set with a slight incline, so that the water flows through the corrugations into a storage tank. This is all the treatment the water receives. One would not think this would serve any purpose, but if the reports are to be depended upon something happens to the water during its contact with the aluminum. No hard scale is deposited on the plates or tubes, the precipitates from the water forming only soft mud, which can be readily washed away.

Reward for Bravery.

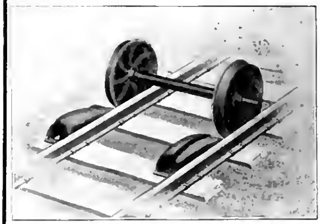
A pleasing incident occurred at the head offices of the Canadian Pacific Railway in Montreal not long ago. Conductor Thomas Reynolds, who had been in charge of the train wrecked at the Spanish river bridge, was called into the office of Sir Thomas Shaughnessy, the president of the company. Mr. Reynolds was presented by Sir Thomas with a gold watch and $500 as an appreciation of his bravery, his loyal and humane work at the wreck. Although severely injured, he worked heroically and succeeded in saving the lives of a number of passengers.

Examining a Witness.

The lawyer for the defendant was trying to cross-examine a Swede who had been subpœnaed by the other side as a witness in an accident case. "Now, Anderson, what do you do?" asked the lawyer. "Sank you. Aw ah not vara well." "I didn't ask you how your health was, but what do you do?" "Oh, yais; Aw work." "But what kind of work do you do?" "Oh, yais; Aw work in fact'ry." "Very good. What kind of a factory?" "It ees a very big fact'ry." "Your honor," said the lawyer, addressing the Court, "if he keeps on like this I think we shall have to have an interpreter." Then he turned to the witness—"Look here, Anderson, what do you do in that factory—what do you make?" he asked. "Oh, yais; Aw un'erstan': you want to know vat Aw make 'n fact'ry, eh?" "Exactly. Now tell us what you make." "Von dollar an' a half a day." An interpreter was called in.

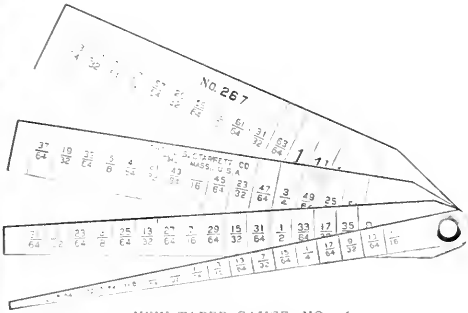
Something About Drills.

The Dunlap Engineering Company, successors to the Columbus Pneumatic Tool Company, located at Columbus, Ohio, issue at intervals finely illustrated catalogues descriptive of their products. The latest issue furnishes complete details of their close-quarter drills, central spindle and reversible type of drills. The latter is a very clever device partaking something of the nature of reversible valve gearing. It is simple and durable. The structural iron reamers are also fully described. A marked improvement in these new tools is the absence of oil as a lubricant, the bearings being bushed with graphite. These motors have a feed of 1/2 inch per minute. The chipping and caulking and riveting hammers all show evidence of recent important improvements, and these fine tools are as near perfection as can be made. Another important improvement in the sharpening of files is illustrated. With this machine two dozen files may be sharpened in one hour. All interested should send for a copy of Catalogue No. 20.



Some Small Tools.

The L. S. Starrett Company, of Athol, Mass., make a great variety of useful small tools and among them we may mention their new taper gauge No. 267. The thin leaves of this gauge are tapered, the width varying by 1-64th in. to every ¼ in. of length. They are graduated in ¼ ins. and figured to read in fractions of an inch from 1-16th up to 1 1-16th in. The gauge is very convenient for mechanics' use to measure the width of slots and size of holes in nuts drilled for tapping. It is also useful for settling calipers to sizes within its capacity.



NEW TAPER GAUGE, NO. 267.

Another small Starrett tool is what they call their telescoping inside gauge No. 229. These are instruments from which the exact size of holes or slots can be taken by an outside caliper or micrometer, so that shrink, close or loose fits, varying in thousandths, or less, can be made and measured. The ends of each telescope head are hardened and are made on a radius of the smallest hole it will enter. Ordinary leg calipers have a tendency to spring and the points to catch in blow holes or other depressions. This little tool can be used either in fitting cylinders to holes or holes to cylinders. The gauges are made in sizes to enter holes from ½ in. to 6 ins. Write to the company for further particulars about either of these articles.

TELESCOPING INSIDE GAUGES, NO. 229.

Pounding.

On his way to dinner Casey stepped into the door of his friend O'Brien's engine room and found that worthy member sitting on the tool chest eating his lunch.

"O'Brien," says he, "whaat's th' diffarance betwane yer ingin an' a lazy hobo breakin' sthone?"

"Oy giv' it up, Casey, whaat is it?"

"Whoy," says Casey, "th' hobo pounds part av th' toime, an' yer ingin pounds awl av th' toime."

And Casey got out just in time to miss connecting with a hard-boiled egg.—*Power and The Engineer.*

Railroad and Farmer.

The Pennsylvania Railroad Company have just issued a pamphlet entitled The Pennsylvania Railroad and the Farmer. This booklet tells of the various things the railroad is doing to create traffic by co-operating with the farmer. The road began an agricultural campaign three years ago; since that time it has run educational trains and steamboats on practically all of its lines. It has distributed farming literature, established experimental farms, and undertaken the education of its agents.

The pamphlet just issued, in summing up the work the company is doing, concludes as follows: "What does it all mean to the railroad? It means there will be more fertilizers to haul, more farm implements, more raw material from which these tools are made, more crops to haul, and more passengers to carry; it means that the railroad will be doing its duty to the public, to its stockholders in the intelligent exercise of its initiative, and, when reduced to a finality, that the railroad is performing its share of the work which must be done by the newly-formed partnership, railroad and farmer, if agricultural communities are to progress and prosper."

Not that Queen.

Dr. Davidson, the Archbishop of Canterbury, is a genial old gentleman, and nothing delights him more than dropping into a Sunday school unexpectedly and catechising the classes, especially if girls compose the class. He recently took in hand a class of small girls who were going over the story of Solomon. "Now," he asked, "who was the great queen who traveled so many miles and miles to see the king?" No one answered. "Why, you all know. The queen who came to see the king?" Still no one seemed to remember. "You do know, I am sure," persisted Dr. Davidson. "The name begins with S; and she was a very great queen." Just then a little hand shot up, and a shrill voice cried, "Please, I know, the Queen of Spades."

Hot Box Story.

The Joseph Dixon Crucible Company of Jersey City, N. J., when commenting on the dangers of a hot box, say: "Two years ago there occurred at a powder mill in Indiana an explosion which reduced the factory buildings to ashes, and even damaged a section of the town in which the factory was located. It was caused by a hot box.

"That's the whole story; but it resulted in a heavy loss of life and property. Fortunately, the results of hot boxes are rarely as dire as they proved to be here, but there is always the chance of loss in every case. It may be the ruining of the bearing or journal; it may be the tying up of the plant for hours; it may be a fire that destroys a portion or all of the plant.

"There is one insurance, however, against all frictional damage. It is Dixon's flake graphite. This lubricant attaches itself directly to the metal surfaces, filling in the microscopic depressions and becoming fastened upon the microscopic projections that exist on all metal surfaces. Thus direct contact of metal to metal is made impossible, and we have what may be termed a 'graphited contact' which lowers friction, reduces wear and prevents damage."

Vanadium Steel.

In addition to the numerous interesting and instructive publications got out by the Vanadium Sales Company of America, they have now issued two new ones, both treating of Vanadium steels, their classification, heat treatment, and instructions for applications. One of these publications is written in French and the other is written in German. Either or both of these may be had by those requiring them on application to the company, address Frick Building, Pittsburgh, Pa.

Hammer and Tongs.

The expression going at a thing hammer and tongs was recently the subject of some correspondence in one of the London dailies. It appears that hammer and tongs is in a way equivalent to the old adage "strike while the iron is hot," both referring to the blacksmith and his tools. The tongs was required to hold the iron and the hammer was for striking it. When the blacksmith was thus engaged his whole attention was given to his work, and he had to work hard and fast before the iron cooled. The expression has come to signify anything done with great energy.

Mr. Clement E. V. Stratton, who often writes for RAILWAY AND LOCOMOTIVE ENGINEERING, contributes to the discussion on the subject by saying that the Ancient Worshipful Society of Blacksmiths' Loriners (makers of bits, spurs, etc.), locksmiths, cutlers and bladesmiths had the motto: "By hammer and hand all trades do stand." It is no secret, he says, that after the apprentice had taken the oath on the anvil to preserve the secrets of hammermen, he was presented with a new hammer and a new pair of tongs as working tools of his trade.

Just here one is lead to remark that the modern slang expression, "I didn't do a thing," is one which is intended to convey the impression of concentrated attention and violent action, though the words themselves as they stand do not indicate it. The expression comes out in its full significance in some such sentence as this: "When the firemen turned their hose in my direction I didn't do a thing but run." There is activity of the hammer and tongs variety.

Not Deaf Yet.

"Do you know," said Mrs. Bifton Crush to the tame suburbanite whose name she bore. "Do you know I get so flustered in New York on the elevated I can't hear a word anyone says, what with the roar in the street and the noise and rattle of the cars, and all—!" "Well, that is strange," replied the man who oscillates between home and biz twice a day, as he looked at her over the top of his newspaper. "I see in the public service activity column the heading to an extensive article entitled 'Hearing on the Elevated Service Most Satisfactory.'"

Definition of Alloy.

In a paper read before the American Brass Founders' Association it is stated that according to the common understanding an alloy is a combination or mixture of two or more metals, which, after being brought to a state of fusion and cast, exhibits no objectionable segregation. In distinction between this common interpretation of the word alloy, there is a further distinction or classification, which refers to a combination of two or more metals, which when cast produce an absolutely homogeneous mass, designated by the name—true alloy. A true alloy is one in which the constituents are so merged or dissolved one in the other that they exhibit no structure whatever, one constituent cannot be discerned from the other, they are completely merged. To distinguish such a combination, beside the term true alloy, the term solid solution is also used; such alloys being analagous to compositions of matter, such as glass in which calcium oxide, silica, soda, etc., are so completely dissolved one in the other that an absolutely homogeneous and structureless product is produced. An amalgam is an alloy of mercury with another metal or metals.—*Electric Traction Magazine.*

A Grave Subject.

A good story is told of an Aberdeen gravedigger of the old fashioned type, who had a sublime indifference to the rank or wealth of those with whom he had occasion to talk. An Aberdeenshire laird had visited the burying ground with a view to selecting a spot for a family vault. He chose what he deemed to be a suitable spot, remarking that he could see his residence from it. The sentiment was pretty enough, but it had no sympathy from the gravedigger, who remarked: "Faigs! gin I get ma haun's owre ye, ye'll neither see yer hoose nor ony ither place. I'll put ye deep eneuch!"

Pitting in Boiler Plates.

Much of the cause of pitting in boiler plates and flues lies in the particles of slag and carbon which have been forced into the plate during the process of rolling. The foreign bodies are electro-negative to the boiler plate, and small galvanic cells are set up that eat away the metal surrounding the foreign substance. A remedy for general electrolytic corrosion and wasting lies in the employment of zinc plates connected to the boiler shell. Electrolytic action is set up between the two metals, with the result that the boiler is protected from the action of the acids in the water and the zinc alone suffers. Where this remedy is used a sufficient number of slabs of zinc should be attached securely to the boiler so that there should be at least one per cent. of zinc surface as compared with the entire heating surface of the boiler.

Railroading Is Healthful.

Compilations have been made, from government reports, showing the relative liability to disease of the employees in various trades. According to the returns so far tabulated by the Census Bureau, the occupation of the steam railroad employee is the healthiest of all. In a long list of maladies, the only one to which the railroad employee is more liable than workers in manufacturing or agricultural trades is typhoid fever, and to this he is far less liable than the workers classed as laborers. The figures show that the railroad man is far less liable to consumption than the workers in the manufacturing and chemical industries. He is less apt to commit suicide than any other wage earner, and suffers less from rheumatism and malarial fever. His nervous system, according to the statistics, is in excellent shape. Heart disease and pneumonia, the Census reports say, are rarer among railroad employees than among any other working men.

New Form of Legal Tender.

"I want a ticket to B——," said a lady just before train-time. "Twenty-four cents," responded the ticket agent, working his sausage-machine. She laid down a silver quarter. Being well acquainted and a practical joker, the agent drew from his pocket a glittering pants button and passed it over with the ticket and scooped up the quarter.

"Is this legal tender?" asked the lady, gravely.

"Oh, yes," he answered, with mock gravity, "they are the mainstay of the republic."

She pocketed it, and got aboard, leaving the agent's face corrugated with smiles. A few days after he told it to a brigade of runners buying tickets for B——, and while he was enjoying the encore the lady appeared with:

"Ticket for B——, please."

"Twenty-four cents," with a sly wink at the runners. He laid down the ticket. She scooped it and laid down twenty-four dazzling pants buttons, exactly like the first.

"You said they were legal tender. They go a long way in supporting the family," she chirped sweetly, as she bowed from the presence of the more than presidential prerogative.—*Erie Railroad Employees' Magazine.*

How Tinfoil Is Made.

Tinfoil, that useful substance, which is extensively used for wrapping tobacco, certain food products and other articles of commerce, is a combination of lead with a thin coating of tin on each side. Not one man in a hundred who throws a piece of tinfoil away after it has served his purpose, knows how it is made. The method of making the foil is ingenious, and in a sense very simple. A small pipe of pure tin is made, and into this pipe of tin molten lead is poured until the whole is solid. It is then rolled flat like a pancake, the lead remaining in a thin sheet in the center between two films of tin. In this way the tin coating spreads simultaneously with the lead core, even though it may be reduced to a thickness of less than 0.001 of an inch.

A Permanent Resting Place.

A High Church curate was once summoned to a hospital to console a man who had been injured fatally. The clergyman was delayed, and when he reached the hospital the man had died. "Too bad, sir," explained the dead man's friend. "Bill's dead, sir; but I think it's all right, sir. I gave him consolation." "You did?" inquired the clergyman, in astonishment. "How did you give him consolation?" "Ah," replied the man, "Bill says to me, says he—'Jim, I'm goin' to die.' 'I reckon you are,' says I. 'I've been a very bad man, Jim,' says he. 'That's what you have been, Bill,' says I. 'I reckon, Jim,' says he, 'I'll not go up there,' says he, pointing up. 'Ah, Bill, you won't,' says I. 'Jim,' says he, 'I reckon—I reckon I'll go down—down there,' says he, pointing down. 'Yes, Bill,' says I. 'I reckon that's where you'll go, and you're lucky that you've got some place to go to at all."

The Splash of a Drop.

The researches of A. M. Worthington, F. R. S., headmaster and professor of physics in the Royal Naval Engineering College at Devonport, England, have taken what to many would appear to be a unique direction. Prof. Worthington has minutely studied the splash of a drop, and his work appeals to the serious student of physics who is interested in the unexpected phenomena of fluid motion.

Prof. Worthington has taken a series of what may be truly called instantaneous photographs of a drop of water falling into a bowl containing the same liquid. In order to do this work he has had to abandon the shutter over the lens of his camera, marvelously rapid as its mechanical action undoubtedly is. He has had recourse to an electric spark the flash of which endures for the almost inconceivably short interval of the one three-millionth of a second. This is a period so exceedingly brief that it stands to one whole second in about the same proportion as one day stands to a thousand years, yet in this short interval of time, during which his photographic plates run the chance of being somewhat under-exposed, a ray of light a little less than 3,000 ft. long dashes in on the sensitive plate and prints the minute picture of the splash.

Oil in Waste.

The amount of oil that can be absorbed by cotton waste in journal boxes has been ascertained by repeated experiment, and it amounts to about four pints of oil to 1 lb. of waste. Any amount in excess of this will not remain in the waste, but will run down through the waste into the bottom of the box.

Quality of Work.

There are grades of skill in all occupations. Andrew Carnegie tells a story about hearing a group of street sweepers discussing the skill of their companions. One was said to be expert on plain work, but he was no good on the refinements of nooks and the surroundings of lamp posts.

The cynic only knows no heroes. The dullest routine practice finds unknown somebodies who by bold originality have entitled themselves to that highest expression of praise, "better than I."

Expert or Technical.

There are so many vague impressions among people about the meaning of the terms "expert" and "technical" persons that we reproduce the definition given by Mr. R. T. Crane. He says:

"An 'expert' is one who has become skilled and thorough in any line of handicraft or calling.

"A 'technical' man is who who has learned the science or theory of some calling or handicraft."

Not Feminine.

In former days it was customary to speak of a locomotive as "she," thereby gallantly implying some feminine attributes to the machine of steel and steam. Now that dresses which sweep the ground have gone out of fashion, at least in cities, we cannot liken an engine to a woman because she draws a train after her. Nor would the smoke-abatement people allow us to refer to her as scattering the sparks, and those who object to the postoffice deficit year by year do not enthusiastically refer to her as transporting the mails (males). A woman probably considers she is doing the greatest volume of business when she is out shopping, while a locomotive does business entirely between shoppings.

Air Brake Presentation.

As a memento of the most notable air brake test held in recent years and in token of the kindly feelings of the various air brake and mechanical representatives present from railroads all over the country, Mr. C. H. Weaver, supervisor of air brakes for the Lake Shore & Michigan Southern and in direct charge of the entire series of tests, has recently been presented with a solid gold watch beautifully and appropriately engraved as follows: "To Mr. C. H. Weaver from his associates at the Lake Shore Railroad air brake tests, 1909, in recognition of the able manner in which the tests were conducted and his good fellowship to all.

P. C. Riley (Penna. R. R.),
Mark Purcell (Nor. Pac. R. R.),
W. W. White (Mich. Cent. R. R.).
Committee."

Personal Mention.

Mr. Le Grand Parish, formerly superintendent of motive power of the Lake Shore & Michigan Southern Railway, has resigned from that road and has accepted the position of president of the Arch Company of Chicago.

The canny Scot has taken fast hold of American railway life. There are 36 Scotts on the Railroad Official List, and no less than 655 Mcs. The latter names are fairly divided between Scots and Irish, but all may be considered of Celtic origin.

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances

Vol. XXIII. 114 Liberty Street, New York, June, 1910. No. 6

New York Terminal of the P. R. R.

Our frontispiece and following illustrations this month show views of the New York Terminal of the Pennsylvania Railroad. The building of this station in the heart of New York City was, if one may say so, an incident in the larger project of boring under the Bergen Hill in New Jersey, tunneling under the Hudson River, tunneling the island of Manhattan and again diving beneath the East River and so reaching Long Island City. The whole project practically involved the construction of two under land and water tubes each about 13 miles long. The whole of this vast project was conceived by the late A. J. Cassatt, when president of the Pennsylvania.

The Pennsylvania Station is a granite building of imposing dimensions, occupying eight acres, bounded by Seventh and Eighth avenues and 31st and 33rd streets. The architects, Messrs. McKim, Mead & White, have endeavored to express in its design the idea that the station is the gateway of a great city.

The station is in three levels. On the first is the general waiting room, flanked by two subsidiary waiting rooms of ample dimensions. Connected with the main waiting room is the main baggage room, covering the same area as the arcade, and the restaurants on the plane above. Parallel to it is the concourse, 200 ft. wide and extending the entire width of the station; under which is a sub-concourse 60 ft. wide, to be used for exits only.

VIEW OF THE PENNSYLVANIA RAILROAD STATION IN THE HEART OF NEW YORK CITY

On the third level is the train platform, 36 ft. below the level of the street. There are eleven passenger platforms, with twenty-one standing tracks and a trackage of sixteen miles. It is estimated that about 1,000 trains will be run daily from these tracks by the Pennsylvania and Long Island roads. In the main waiting room there are above the windows six huge panels upon which maps will be placed showing Long Island, P. R. R. lines east of Pittsburgh, P. R. R. lines west, the United States, Pennsylvania, and steamship lines from New York to Europe.

CORNER IN P. R. R. WAITING ROOM.

In a little pamphlet issued by the railroad we are told that "From Harrison the line extends across the Hackensack Meadows on an embankment to Bergen Hill, an abrupt eminence on the western bank of the Hudson.

THE CONCOURSE, P. R. R. STATION IN NEW YORK.

Through the solid rock of this hill, and under the towns built on its surface, two single track tunnels have been bored from its eastern border and two single track tube tunnels extend under the Hudson River to the New York side and thence under 32nd street to the passenger station. The railroad continues across the island east of the station under 33rd street and under 32nd street, first in two tunnels of three tracks each, then in two single track twin tunnels, and finally into four single track tube tunnels running under the East River to Long Island City, thence still by tunnel to the portals of the Sunnyside Yard.

"The construction of these tunnels exemplifies the skill and daring of modern engineering. The tubes under the river were bored by the shield method. An iron tube over 23 ft. in diameter was driven through the mud and sand, 70 ft. below the surface of the river, by hydraulic jacks, compressed air being used to keep out the water, and as the shield progressed the rings of the tubes were fitted in place. By this process the steel tube was gradually built from one bank of the river through to the other, and as the shield bit its way through the rock, gravel, or sand it left in its wake the outer rim of the iron tunnel ready for the interior work. Then came the concrete workers to line the sides of the tube with a solid mass of concrete two feet thick, and to lay on its bottom a still more solid foundation for the tracks, and to build along its sides the conduits for wires, the top of which serves as a pathway through the tunnel from end to end.

"Every known scientific appliance was utilized in the construction work, both in implements and for the safeguarding of the lives and health of the workmen, and although the work extended through several years and thousands of men were engaged in it from time to time, the percentage of the loss of life or even injury was small. The boring was started from the sides and progressed until the shields met near the

P. R. R. WAITING ROOM.

center of the river, and in every case when the western shield met its eastern counterpart the calculations were so accurate and exact that there was only a discrepancy of a fraction of an inch in the alignment.

"Some idea of the size of the station building may be realized by the statement that Trinity Church could be placed in the center of the structure and be entirely lost to sight. The new United States Post-Office, under construction at Eighth Avenue, 31st and 33d Streets above the Pennsylvania Railroad tracks, will greatly facilitate the prompt delivery of mail in the hotel and residential district of Manhattan Borough."

Old Time Railroad Reminiscences.

By S. J. Kidder.

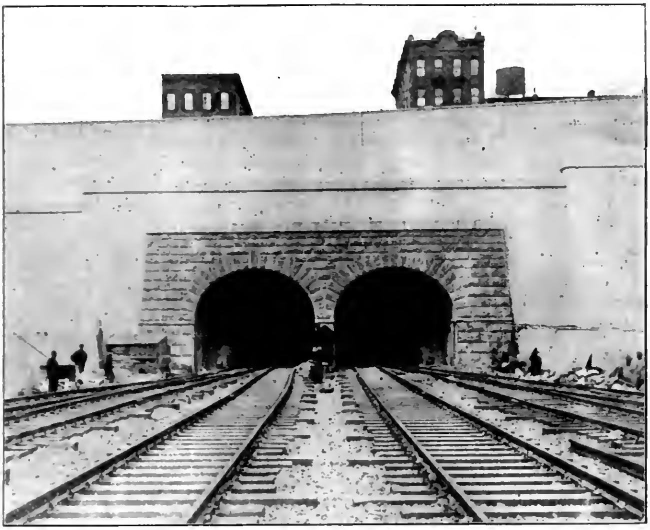
Like many of the young men born and raised in New England at a somewhat early age the writer was stricken with western fever. The longer this diseased state of the system continued the more acute it became, and when an opportunity presented itself to go west I was not slow in taking advantage of it.

It was a period when a Yankee looked upon Chicago as the jumping off place of the West, and when I announced to my friends the intention of going beyond the Missouri river their countenances assumed an expression such as would be expected when one departs for that bourne from whence no traveler returns. At the time I thought myself extremely fortunate to be the possessor of transportation from Boston to Chicago, though subsequent events somewhat dampened my ardor, and I was quite impressed that to put up railroad fare through the States might have been more conducive to comfort than a free ride through the Provinces of Canada. Sleeping cars at this time were not common and were considered a luxury which few could afford, regardless of the fact that a night's ride in a passenger car bore none of the fruits of comfort.

A day and night ride from Boston to Ogdensburg with a brass strap, having sundry screw heads projecting above it, extending along the top of the somewhat low seat back, for a pillow was not conducive to peaceful sleep, and the monotony was further contributed to by the train, known as the fast, through express, stopping at all stations with a long tarry here and there to "wood up" the locomotive tender, or partake of refreshments. The changes of engineers, too, were quite frequent, the division being from seventeen to eighty miles. In fact, eighteen engines were required to haul the train from Boston to Chicago, the average for each run being about sixty-four miles. We reached Ogdensburg about daybreak and transferred to a ferry boat, where the custom house officers compelled every one to unlock their trunks and look on while they dug to the bottom in search of contraband articles, turning the contents topsy-turvy, and finally, when closing the receptacle, one officer sat upon the lid while another turned the key.

Reaching the Canadian side of the St. Lawrence river another transfer was made from the boat to a train, many of the window panes of which were broken out, and a ride of a few miles took us to Prescott Junction where, after a wait of some two hours, we again boarded a train. The track was laid with U-rails, in section similar to an inverted letter U, and from excessive wear in many places the top was worn through, making the track extremely rough. The engines hauling us, built in Kingston, Canada, were much of the type of American engines of that period. The steaming qualities of those hauling our train were not of the best, and with the bad track, which made reasonable speed dangerous, the average was perhaps fifteen miles an hour. After a long day's ride Toronto was reached at 8 o'clock, the train being some four hours late. At this point it was abandoned and the hundred or more passengers were compelled to bivouac in the station for the night.

Preparations were under way to construct a new station and the old one had been moved back and stood mounted on cribbing some feet above the ground. In raising the building much of the window glass had been broken and numerous cracks were well developed in the floor. The waiting room, in dimension perhaps 30 by 40 feet, had a large cylindrical stove in the center, round which the passengers, men, women and children, stood in a circle, and while they toasted on one side the other was exposed to the chilling blasts which came from the lake and freely floated through the numerous apertures in the building. At 4:30 the following morning the train was again put in commission and an eight hours' ride took us to Port Sarnia. Here we were ferried across the river and our trunks again subjected to the tender mercies of the custom house officers. Reaching the Michigan side of the river a train was boarded for Detroit Junction, 62 miles, where in the evening we transferred to a Michigan Central train for Chicago. Another night was spent on the road and late the following morning the "Windy City" was reached.



NEW YORK PORTALS OF TUNNELS UNDER THE HUDSON. P. R. R.

The Chicago of today bears but few of the earmarks seen during that early visit. At that time the streets in the business district were all below grade, the wooden sidewalks being built upon stilts, and to cross a street one had to descend a flight of stairs and on the opposite side ascend another. The railroad station, in most instances, stood on their present locations. The railroad shops, round houses, passenger and freight yards were in what is now the business district and all street and railway crossings were at grade.

With boyish ardor two days were spent in Chicago visiting the various depots, shops and roundhouses, bent on seeing everything having to do with railroads. Most of the sights were new to me, for within the prescribed limits of Northern New England but few locomotives built outside of that bailiwick were in service, while here, in almost endless variety it seemed, were to be seen the Rogers, Ketchum & Grosvenors, Danforth & Cooke, New Jersey Locomotive & Machine Co., Baldwin's, Richard Norris & Son, Schenectady (known as Dutch wagons), Amoskeag, Detroit, Cuyahoga and other builds, the shops in which many of these locomotives were constructed having then gone out of existence. It was at this time, on the C. B. & Q. R. R., I saw the first ten wheelers. They were inside connected, weighed perhaps thirty to thirty five tons and were built at the Amoskeag Machine Shop. These engines had the appearance of leviathans and found little favor among the enginemen, being in their estimation too big for safety.

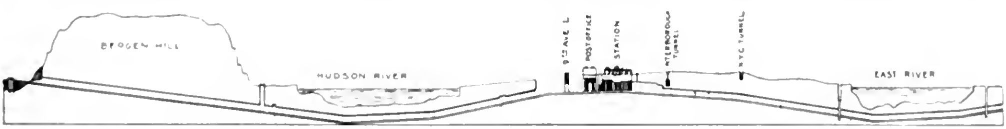


DIAGRAM OF P. R. R. TUNNEL SYSTEM FROM BERGEN HILL TO LONG ISLAND.

Having done the Chicago railroad terminals pretty thoroughly, for at that time, while it was considered a great railroad city, it did not take long to cover the railroad field. I prepared to resume my journey westward, but with serious misgivings as to whether I was not departing from the last vintage of civilization. It was well along in the forenoon when the train rolled out of the Chicago & North-Western station and hardly a mile had been covered before we were fairly out of the city on the wide, open prairies of Illinois, and for the first time I saw the broad expanse devoid of hills and timber. Here, too, was my first experience in a Pullman car, and shortly after crossing the Mississippi river I crawled into an upper berth and was soon oblivious of all surroundings. The following morning I was awakened by the strains of sweet music, but from whence it came I could not imagine until later, upon reaching the ground floor, I discovered a young lady playing a cabinet organ which was built into the car and occupying a center section.

Our train was a heavy one for the little engine pulling it and occasionally it seemed an open question whether we were going to reach the summit of a grade without stalling. The day's ride was a most pleasant one through western Iowa, at times over what appeared an almost boundless prairie entirely devoid of trees, then among bluffs or across valleys and streams, the banks heavily fringed with timber. Very few farm houses were in sight, but here and there was a struggling village at which the train stopped, nearly all of them having come into existence with the advent of the railroad, yet in its swaddling clothes, for it had been completed to Council Bluffs but a few months when I first passed over it. The Chicago & North-Western was the first Chicago railroad to reach the Missouri river valley and at this time Council Bluffs could hardly be called a railroad center, the North-Western being the only railroad then entering the town.

The train arrived at the "Bluffs" about 3 p. m. and such of the passengers as held through tickets to Omaha mounted a Concord stage coach, the others walking to the Missouri river ferry, three miles away, where all boarded a boat and crossed the river. A short drive from the levee, up a sharp hill, took us into Omaha, which was the goal my youthful anticipations were seeking. Omaha was a town of some twelve thousand people and had one railroad, the Union Pacific, then under construction, the "front" or end of the track being some five hundred miles west of the city. The river front, or levee as it was known, was a very busy place, all of the material for constructing the road, rails, ties, building material and food being brought up the river or ferried across, as, at this time, the supplies in large quantities were coming in over the North-Western railway. With the advent of railroads into Council Bluffs and Omaha began the decline of steamboating on the river, and a few years later the numerous boats which plied on the "Big Muddy" and lined the levee, some of them running 1,700 miles above Omaha to Fort Benton, slowly but surely disappeared.

The Union Pacific had 53 engines, practically new with the exception of a few old ones purchased for construction work, all having been brought to Omaha up the river from St. Joseph. The product of nearly every locomotive builder of that time was represented on the U. P., each type of engine bearing the distinctive design of the maker in every respect and gaudily bedecked with polished brass, gold leaf and paint. Among them were the Hinkley, Rogers, Danforth & Cooke, Lancaster, Norris, McQueen, Manchester, Taunton, Smith & Jackson and the Lawrence Machine Works. With the advent of the C. & N.-W. Ry. into Council Bluffs active efforts were instituted to make a connection between the Union Pacific and this road by bridging the Missouri river, something which up to this time had been looked upon as utterly impracticable owing to the frequently shifting course of the river and great depth through quicksand to reach a solid foundation. An engineering outfit was organized to locate the most suitable site for such a structure and it fell to the good fortune of the writer to be one of the party. Several months were consumed in making the surveys from the main lines to various points along the river and finally a location was selected where the U. P. bridge as it is known now stands. As above suggested this was the first bridge to span the Missouri river. The Nebraska end rested on the face of a high bluff, much of which has, with the expansion of railway facilities, been removed, while an extensive fill was made on the Iowa side to bring the track up to the bridge. In surveying the three mile line from the river to Council Bluffs a clearing had to be made through the woods. The trees were straight as a telegraph pole, from six to nine feet in height, of small diameter and stood so thick as to be almost impenetrable. The survey was completed late in the fall and the following summer the building of the bridge foundations began.

"IN THE SWIM" AT YOUNGSTOWN, PA.

That winter the river was heavily covered with ice and to facilitate the movement of material across, a pile railroad bridge was constructed and used for several months, but with a sudden rise of the water the ice went out, taking the bridge with it and again the ferry boats were resorted to. During these early days of the Union Pacific the yards, shops, depots, etc., were located on or adjacent to the levee, far below the table land on which Omaha was situated and outside of the city proper. The depot was a one-story affair, built of wood and of a character such as is usually seen in a country town. Quite large and substantial brick shops and a round house had already been built, but during the winter, from some lack of stationary engine power, a Taunton locomotive had been jacked up, raising the driving wheels from the rails, and with a belt over one of the drivers, the other end of the belt on a shaft pulley, the necessary motive power was furnished to operate the shop tools. With the completion of the work of locating the bridge my thoughts turned to a job out on the road, for many were the tales I had heard of Indians on their native heath, buffaloes and a strenuous frontier life generally along the line, and I longed to get to or near the "front" where all these exciting things were to be seen.

The general master mechanic was approached for work in the locomotive department, but day after day I was told to call again as there would be something to do as soon as a lot of new engines, then at Council Bluffs, could be got across the river. Several weeks elapsed, then came the good news to be ready to go to North Platte on the first train, and report to the master mechanic there. What I saw up the line and some of my experiences while there will be related in a future number of RAILWAY AND LOCOMOTIVE ENGINEERING.

New Railroad in Canada.

It is stated that charters and subsidies having been obtained, English and French capitalists will soon be asked for financial support in behalf of a new railroad, the Montreal, Kapatchawan & Rupert Bay, capitalized at $3,000,000, which is designed to link Montreal with the Grand Trunk Pacific which is now being built in Canada. The new road will bring Winnipeg within 1,260 miles of Montreal.

Mallet Articulated Compound for the Delaware and Hudson

The Schenectady works of the American Locomotive Company have recently turned out six very heavy articulated compound engines for the Delaware & Hudson Company. They are intended for pusher service on the Wilkes-Barre and Susquehanna division of that road, between Carbondale, Pa., and Oneonta, N. Y., a distance of 95 miles.

In working order they have a total weight of 445,000 lbs., all of which is carried on the driving wheels. The high-pressure cylinders are 26 x 28 ins., and the low-pressure cylinders are 41 x 28 ins. With the boiler pressure of 220 lbs. and driving wheels 51 ins. in diameter, the theoretical maximum tractive power, working compound, calculated by the American Locomotive Company's formula, is 105,000 lbs. The normal maximum tractive power, working compound, can be increased about 20 per cent. by changing the engine to simple. The maximum tractive power of these engines working simple is thus 126,000 lbs. The six articulated locomotives in this order will, therefore, relieve 12 of the consolidations from pusher service without sacrificing any tonnage, and with a saving in operating expenses due to handling fewer units.

Owing to the large diameter of the boiler, it was necessary in this instance to locate the high pressure steam pipes underneath the running boards. Steam is led from the throttle through a dry pipe to the smoke box, where it is divided in a tee head and passes into two branch pipes, one in either side of the smoke box, in the same manner as in a single expansion engine. From these branch pipes, two wrought iron steam pipes, connected through elbows with ball joints, extend back underneath the running board, one on either side of the boiler, to the high pressure cylinders. An elbow covers the steam passage in the cylinders, to which the steam pipe is joined by means of a specially designed connection having a ball joint at either end and fitted with a slip joint. This construction permits of the expansion and contraction of the steam pipe, due to variations in temperature, and also facilitates removing and putting it up when repairs are necessary. With this arrangement of steam pipes, the engineman is afforded an unobstructed view ahead.

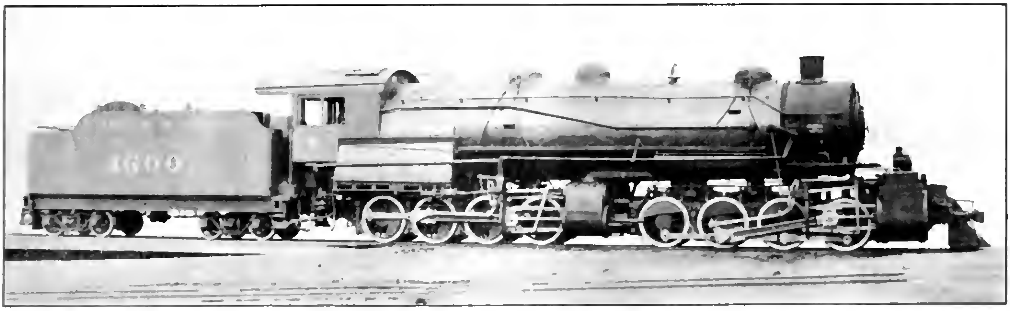
The low-pressure cylinders are the largest ever applied by the builders, being 41 x 28 ins. Steam is distributed to the high pressure cylinders by 14-in. piston valves, having inside admission and ample port area. The low pressure cylinders are equipped with Mellin double ported balanced slide valves. Special provision has been made for strengthening the valve yoke. This is stayed by two longitudinal bolts which pass through cored passages in the valve. The bolts, which are 1 in. in diameter, are fitted with 1-in. wrought iron pipe thimbles, which act as spacers. By-pass valves of the builder's standard pattern are provided for the low-pressure cylinders. These are located in chambers in the side of the cylinder castings, and automatically establish communication between the two ends of the cylinder when the throttle is closed. The valve gear, which is the Walschaerts type, is reversed by the builder's hydro-pneumatic reversing gear.

The frames throughout are of Vanadium cast steel, and of large section. The frames of the rear engine have a single front rail cast integral with the main frame, while those of the front system are provided with double front rails, the lower one of which is in one casting with the main frame.

A single articulated connection is used between the front and rear systems. This is formed by a cast steel radius arm rigidly bolted to a cast steel cross-tie between the rear ends of the front frames. This radius arm fits in a steel pocket casting securely bolted to the bottom rails of the rear frames, and which also extends back underneath the high pressure cylinder saddle, to which it is bolted. The coupling is made by means of a vertical pin 6 ins. in diameter, inserted from the top.

Two features which have proved very successful in the articulated locomotives built for the Erie Railroad have been incorporated in this design. These are the floating balance device and the side spring buffers at the frame union. The floating balance device which is located between the second and third pair of drivers of the front system immediately back of the boiler bearing, which carries the spring centering device, consists of a pair of spring supported columns. These have ball and socket connection at their upper ends with the saddle casting of the boiler bearing and a similar connection at their lower ends, with two castings hinged at one end to the bottom of the cast steel cross tie between the lower rails of the frames. The outer ends of these hinged castings rest in U-bolts, and are supported by coil springs seated on the cross tie. These columns serve to support a portion of the weight which would otherwise come on the main boiler bearing, thus relieving that bearing of excessive pressure. In this instance, the total initial compression of the springs is about 30,000 lbs.

With this arrangement that part of the weight of the boiler which is carried by the front system is divided between three points of support, namely, the self adjusting sliding bearing, located between the third and fourth pair of driving wheels, the spring supported columns and the pair of adjustable hinged bolts which connect the frames of the two systems.



MALLET ARTICULATED COMPOUND FOR THE DELAWARE & HUDSON

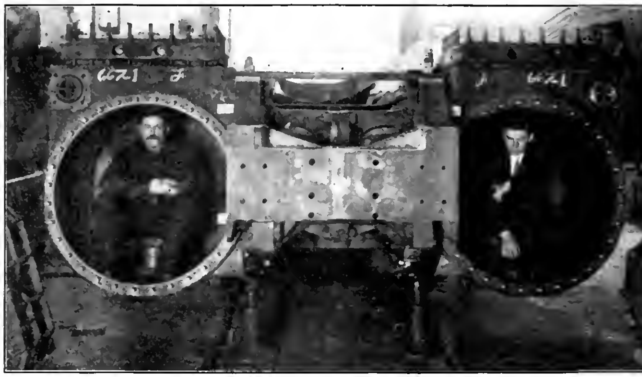
J. H. Manning, Superintendent of Motive Power. American Locomotive Company, Builders.

The surfaces of the boiler bearing, which is located between the second and third pair of driving wheels, are not normally in contact, so that this bearing does not support any weight except under unusual conditions.

The side spring buffers are placed in the pocket casting of the articulated connection, one on either side, and as far apart as possible. They are so designed that when the engine is on a tangent the buffers just touch the bumper castings bolted to the cast steel cross tie at the ends of the rear frames. Thus, when the engine enters a curve one or the other of the buffer springs is compressed. When the engine is curving, these buffers serve to direct the pushing force through the center of the wheel base of the front engine instead of through the flange of the outside forward driving wheel, as it would be were they not applied. In pushing, the resistance of the head load tends to swing the front system about the center of its wheel base when the engine is passing through a curve, thereby increasing the flange friction of the front driving wheels. The action of the spring buffer is to counteract this side push of the load ahead and thus reduce the resistance.

The boiler is of the radial stayed type with conical connection sheet. At the first course the barrel measures 90 ins. in diameter outside, while the outside diameter of the largest course is 102 ins. The barrel is fitted with 446 tubes, 2¼ ins. in diameter and 24 ft. long. There is a liberal width of bridge between the tubes, which are spaced 3⅛ ins. between centers. The boiler has a 4-foot combustion chamber, which is radially stayed to the shell of the boiler. The width of the water space is not less than 8½ ins. at any point and increases to 11¼ ins. at the bottom.

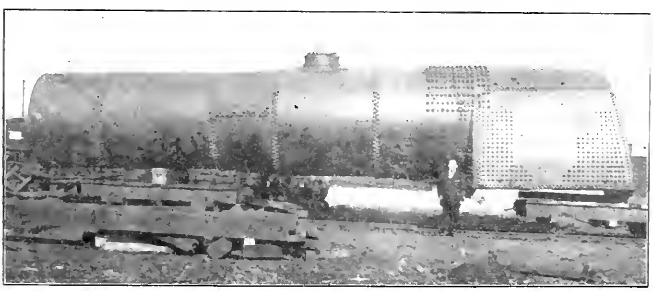
All the plates of the boiler shell are, of course, very thick, the heaviest plate being 1 3/16 ins. thick, and the lightest 1 in. The firebox is 114 ins. wide and 126⅛ ins. long, and provides a grate area of 100 sq. ft. Two Chicago sight feed flange oilers are provided for oiling the flanges of the front and back wheels of each system when the engine is passing through a curve. These are located on the back head of the boiler and oil is fed to them by steam pressure through a pipe line, from which there are leads to the above mentioned wheels. A single firedoor is provided in the firebox, equipped with a Franklin automatic opener. Iron doors are provided at the back of the cab, which may be closed when the engine is backing.



LOW PRESSURE CYLINDERS FOR D. & H. MALLET.

The tender is fitted with a water bottom tank which carries 9,000 gallons of water and the fuel space holds 14 tons of coal.

In the design of the tender frame special care was taken to provide a strong and rigid construction. The longitudinal sills are composed of 15-in. steel channels weighing 33 lbs. to the foot; and top and bottom cover plates are used. Both the front and rear bumpers are of cast steel. The tender trucks are of the four wheel arch bar type, the design following the Delaware & Hudson Company's standard practice, and have a carrying capacity of 100,000 lbs. each.



BOILER OF D. & H. MALLET COMPOUND.

Some of the principal dimensions are given below:

Wheel Base.—Rigid, 14 ft. 9 ins.; total, 40 ft. 2 ins.; total, engine and tender, 75 ft. 7¼ ins.

Weight.—In working order, 445,000; on drivers, 445,000; engine and tender, 611,800.

Heating Surface.—Tubes, 6,276 sq. ft.; firebox, 353 sq. ft.; total 6,629 sq. ft.

Grate Area, 100 sq. ft.

Axles.—Driving journals, 10 x 12 ins.; tender, 5½ by 10 ins.

Firebox.—Thickness of crown, ⅜ in.; tube, 9-16 in.; sides, ⅜ in.; back, ⅜ in.; water space, front, 5 ins.; sides, 4 ins.; back, 4½ ins.

Smoke Stack.—Diameter, 18 ins.; top above rail, 16 ft. 0 ins.

Valves.—L. P. double ported h. p. piston type; travel, 6 ins.; steam lap, slide h. p. 1 1-16, l. p., 1 in.; ex. lap, b. p. 5-16—l. p., 7-16.

Setting—3-16 in. lead.

Locomotive, Man and Car.

One of the papers over in Philadelphia, the *Record* by name, has poked a bit of harmless fun at a big engineer on a little engine. Our contemporary says: "Frank Seidler is the biggest engineer on the Williamsport end of the Philadelphia & Reading system, and he has the "littlest" engine. The engine looks like a toy alongside the monsters that handle coal trains or that go pounding along with general freight. It is an engine that was once considered "some pumpkins" on the road, but it has got down to pulling a work train. The big engineer on this tiny old-fashioned engine weighs 320 lbs."

The remarks about how this engine has dwindled in size by comparison reminds us of the couplet indicating the growth of the box car:

"Dear little box car, don't you cry,
You'll be a freight house by and by."

Whether or not we get heavier box cars or locomotives in the future, we wish Frank Seidler good health and good luck.

King Rode on Locomotive.

The late King Edward, of Great Britain, displayed much courtesy towards Andrew Carnegie. The friendship of the two dated from the time Edward, as Prince of Wales visited this country in 1859. At that time Andrew Carnegie was superintendent of the middle division of the Pennsylvania Railroad, and he took the future king riding on the locomotive of different trains, among them a trip over the horseshoe curve.

General Correspondence

Source of Information.

Editor:

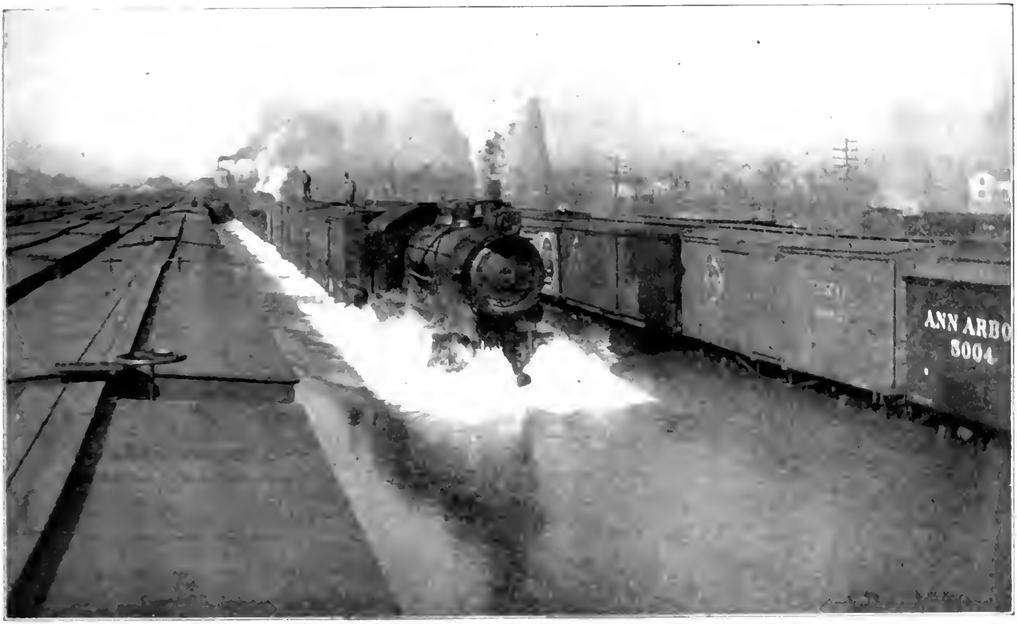
I have been a reader and subscriber of your valuable paper since its inception, and have always found it interesting, absorbing, and helpful, but never more so, than at present, and the engineer, fireman and shop man of today should consider themselves fortunate in having such a valuable source of information as it furnishes.

Your articles in the March number, "Reading Indicator Diagrams" and "The Factor of Adhesion" are most explicit, and no doubt have been eagerly read and digested by scores and hundreds of your readers. Not only to the three classes of workmen mentioned above, the "Factor of Adhesion" will appeal, but also to a great number of transportation officials who in the latter day railroading are eager to read and keep abreast of any knowledge and information they can get relative to the hauling power of locomotives.

I say the railroad men of today are fortunate in having such a source of information on subjects so closely pertaining to their calling as compared with those of the late 70's and early 80's of the last century, when the writer did his firing and was promoted to the position of engineer. In those days there were very few publications or in fact anything printed that set forth the problems of practical railroading such as your magazine does today. Any engineer can readily consult the different formulas that you furnish and know exactly whether or not his engine is being over-loaded, or in fact he can get any other information he may desire that [illegible] pertains to his calling.

In the period I speak of, when I was getting my experience and knowledge mostly by observation, it was the custom among railroad superintendents to rate an engine's hauling capacity by the number of cars or loads it could haul, and if the engine stalled and doubled three trips in five it was considered good enough, and the rating stood as good and regular practice until more enlightened officials saw there was a dead loss in overloading engines. The system of rating now almost everywhere in vogue, the tonnage basis, was established, and lots of grief to the train hands and more to the railroad companies was saved in the less frequent cases of doubling hills. The adoption of the tonnage rating for locomotives was certainly a long step in the right direction.

The writer believes that the tonnage rating system originated with Mr. Frank S. Gannon who, in 1881, while superintendent of New York City & Northern Railroad, now the Putnam division of the N. Y. C. He issued instructions to conductors and engineers that thereafter engine hauling capacity would be rated by tonnage instead of cars, and he indicated the number of tons each of the different sizes of engines would be required to haul over the various portions of the road. After this the doubling of hills was reduced to a minimum and occurred only on especially wet and greasy rails or when the train consisted of cars that had an especially large proportion of bad side bearings, for those were the days when wooden body and truck bolsters were in use, and you could seldom see daylight between the top and bottom side bearings on an empty, let alone on a load, and this often resulted in stalling, because the side bearings pre-



SWIMMING THROUGH MEADVILLE YARD UNDER DIFFICULTIES DURING THE MARCH FLOOD

(Courtesy of the [illegible] Employes' Magazine.)

vented the trucks from adjusting themselves to the rails.

Possibly other engineers have knowledge of the adoption, earlier than 1881, of the ton unit instead of the car for rating locomotives, but the writer thinks if Mr. Gannon did not originate the system, he was one of the pioneers in adopting it.

ENGINEER.

Mount Pleasant, N. J.

Bay State Limited.

Editor:

Here is the photograph of the Bay State Limited on the New York, New Haven & Hartford, hauled by engine No. 1109. It is in the act of picking up water from a track trough when this picture was snapped. This train is one of the three 5-hour trains between New York and Boston which are perhaps the finest trains in New England. I am a constant reader of your magazine and was very much interested in the pictures you had in the February and March issues.

R. C. PALMER.

New Haven, Conn.

THE BAY STATE LIMITED ON THE N. Y., N. H. & H.

Wear of Eccentrics.

Editor:

In the May issue of your magazine I saw an article, as I have in previous issues on the wear of eccentrics, about the wear being all on the small half of the eccentric or the part nearest to the axle. All the explanations of this that I have seen are wrong, according to my views, which I will give.

The wear of eccentrics or gain in throw has been a difficult question to answer, and has been answered a number of ways, but with a little thought is an easy problem to solve. The eccentric and strap being out of center is governed by centrifugal force and after any momentum or speed is attained its tendency is to pull away from its center, which brings all the wear on the small half or the point closest to the center of the axle. Where momentum or speed is enough the weight of the revolving parts are driving the motion, and consequently will bring all the wear on the point of the eccentric closest to the center of the axle. The heavier the eccentric and motion rods, and the higher the speed the more wear on the small half or part of eccentric nearest the center of the axle. It is simply a question of centrifugal force.

E. J. BRENSTER,
Genl Foreman, C. & N. W. Ry.

Chicago Shops.

Flange Lubrication.

Editor:

On page 90 of the March issue of RAILWAY AND LOCOMOTIVE ENGINEERING I notice a reply to my letter in the January issue, by Mr. C. A. Poland, of Atchison, Kan. When I spoke of flange lubrication I only had reference to lubricating the front wheel of an engine on the high side of a curve while the engine was on same. Lubrication is shut off while engine is on straight track. From the way Mr. Poland wrote I imagine he must have thought I was going to open a valve and let oil run in a stream as large as your finger, and from one end of the road to the other. I have designed and patented a lubricator which works automatically, lubricating the high side of the curve and cutting off when the engine is on level or straight track, preventing the tires from cutting, increasing the life of rail, and reducing friction of long trains rounding curves, and the best of all, lessening wrecks, for it is impossible for a flange to climb a rail when it is lubricated.

On page 144 of the April issue of your valuable magazine, I noticed an article from Mr. C. H. Voges, general foreman of the Big Four at Bellefontaine, Ohio, headed "Good Record." Mr. Voges says that engine No. 6416 made 200,581 miles between shoppings with only a few roundhouse repairs. No tires were turned or changed. This is indeed a good record, especially on tires, and Mr. Voges should be congratulated on turning out such work. What do you suppose these same tires would have made equipped with the wheel flange lubricator? We have 50 and 60-ton engines here making 30,000 to 50,000 miles and consider this excellent mileage. We can't exceed this on account of tread wear, as we do not have any more flange wear since applying the above mentioned lubricators. Mr. Voges calls special attention to this being the Railway Steel Spring Co.'s tires; why should there be so much difference in tires? We are using the Latrobe and Midvale and they seem to be as hard as could be handled. Reragding my flange lubricators, I may say the Tennessee Copper Company is using my lubricators and will be glad to recommend them to any one interested in flange lubrication. My occupation is that of a roundhouse foreman with the above mentioned company. Mr. W. T. Foster is superintendent of this road.

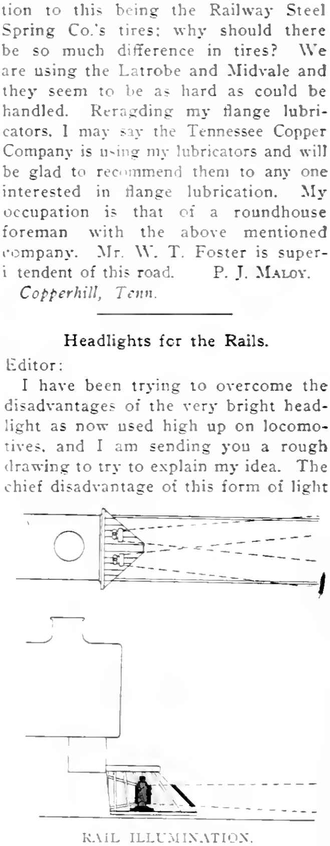
P. J. MALOY.

Copperhill, Tenn.

Headlights for the Rails.

Editor:

I have been trying to overcome the disadvantages of the very bright headlight as now used high up on locomotives, and I am sending you a rough drawing to try to explain my idea. The chief disadvantage of this form of light



RAIL ILLUMINATION.

to my mind is that the glare blinds the engineer of an oncoming train.

My idea is to place two small electric or gas lamps on the inside of the pilot of the locomotive, similar to the lights on an automobile, only the light to stream through pilot onto the rail.

The intention is to have each small beam of light flash on each separate rail, the lights being placed low down so that the engineer will have a clear view of his block signals or of an approaching train, and the light being almost parallel with the rail will carry a good way ahead.

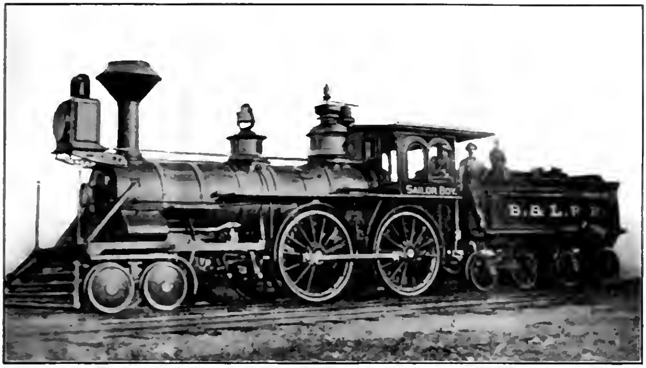
THOMAS J. PRATT.

Paterson, N. J.

Some Old Ones on the B. & M.

Editor:

I am sending you some photographs of several old "mills" that once ran in this neck o' woods. The "Sailor Boy" was one of the engines of the Salem and Lowell Railroad, of which there were three, viz: the "Transport," "Factory Girl," and the one named above. Sailor Boy and Factory Girl were names given as appropriate to the leading industrial life at the railroad's terminals.



BOSTON & LOWELL ENGINE "SAILOR BOY."

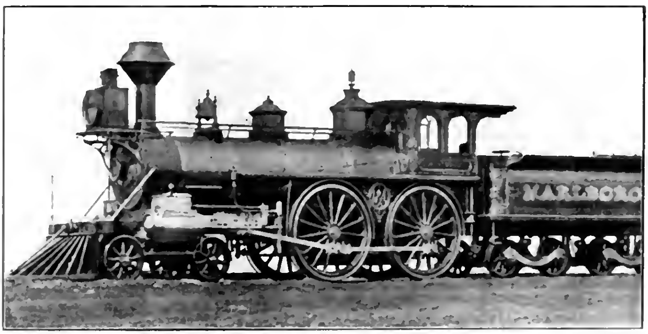
Mr. E. T. Summer, the present master mechanic of the Southern division of Boston & Maine, is a native of Salem and remembers these engines, having seen them when he was a boy more than 60 years ago. At that time they were drop-hook Hinckley engines and the frames were outside the wheels. Later the frames were cut off ahead of the drivers. He tells a story concerning these engines with the facility of an eye-witness.

The Sailor Boy and the Factory Girl put up in Salem over night. The inhabitants of this town held to their Puritan ideas and thought the engines should be married, so a local preacher named Clark was found, and told about it. He came down to the yard one day and the engines were coupled together and were married. This was about 1850.

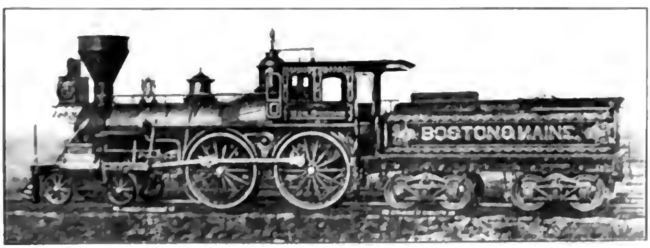
The "Marlboro" was a Fitchburg Railroad engine, built by McKay and Alders at East Boston, in 1868. Mr. B. W. Healey, late of the Rhode Island Works, was foreman. The "Gen. Sherman" was built by Hinckley and Drury in 1866, for the Boston & Maine, at the same time Aretus Blood of the Manchester Works built the "Gen. Grant" for the same road. Both of these engines were scrapped within a year. The other photograph, if you will notice, is one with three drivers gone. This engine came in under its own steam, fixed up by Mr. Summer and was run by Mr. W. P. Steele, now of the American Locomotive Company. The tender carried the weight at the back.

D. F. Cassidy.

Somerville, Mass.



FITCHBURG RAILROAD ENGINE "MARLBORO."



BOSTON & MAINE ENGINE "GENERAL SHERMAN."

Loads and Empties in a Train.

Editor:

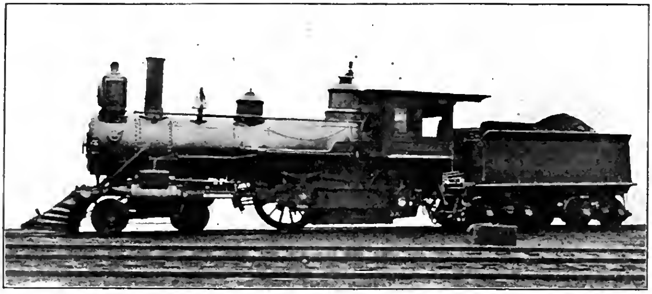
In reading the April number I noticed a letter describing the most desirable manner of making up freight trains relative to the placing of loads and empties in a train. A few years back it was considered good practice to place the loaded cars ahead in a train, some claiming that where a train is made up in this manner it handled much better and there was less trouble due to damaged draft-rigging. Also you can find plenty of engineers at the present who will assert that a train, say, of 700 tons, on a grade of 1½ per cent., will pull easier if the loaded cars are placed next the engine.

I might say that I have handled freight trains on a grade of this kind where a dynamometer car was placed behind the engine, and that the registered draw-bar pull did not show that there was any gain owing to the manner of placing the loaded cars in the train. If you have an equal number of tons and the resistance is equal it will require an equal draw-bar pull to move the train over the grade. The resistance in a long train should run much higher on a track where the curves are sharp and close together than on a short train of an equal number of tons.

My opinion as to the manner in which a train should be made up is this. The loaded cars should be distributed through the train. Of course I do not mean that it would be practicable to make up a train of, say eighty cars, consisting of forty loads and forty empties, first load then empty throughout the train, but if they are divided into groups of say three, four or five loads or empties, the train will handle much better over any kind of a grade. And when it comes to stopping the conditions are all to the good where a train is made up in this way. It must be remembered that the brake on a loaded car is no better than the brake on an empty car, and that the unbraked weight of the loaded car is away in advance of the unbraked weight of the empty car.

Suppose the empty cars are all on the rear of the train and the brakes are applied, the unbraked weight of the loaded cars on the forward portion of the train will carry this part of train much farther than the rear of train unless the draft-rigging is strong enough to hold it. I have seen many cases where it was not strong enough, especially in cases of emergency, some of them being undesired emergency. My experience has taught me that there is nothing to be gained by placing loaded or heavy cars ahead in a train except that the train will start better than were the heavy cars all behind. There is less liability to damaged draft-rigging when starting. Tests have been made to show that where freight trains are handled in excess of forty cars in length it is a decided advantage to distribute the loaded cars throughout the train. F. W. BEAIRD.

Grand Rapids, Mich.



ENGINE WITH ONLY DRIVER LEFT RIDING ON TENDER.

Locomotive Inspection.

Editor:

In reading RAILWAY AND LOCOMOTIVE ENGINEERING as I do, I fail to see anything in regard to the subject of locomotive inspection. Some time ago I did see an article where an official of some system said he had inspection of locomotives down to about three minutes. Did he mean the small engines of ten years ago, or the engines of the present, articulated compounds for example.

Locomotive inspection in my judgment is an important feature for a railroad company for safety, economy, and the maintenance of power. There are a great many things for the inspector of today to give attention to. Tires, flanges, scoops, safety devices on both ends of the engine and tender. None of us are infallible. Overlooking any part or parts may cause detention, accident or worse, which means reprimand, sometimes not in choice language, or it may be suspension.

Now, Mr. Editor, I would like you to take up this matter of inspection in your "best railroad magazine published" and see what others have to say in regard to this matter.

INN SPECTRE.

[Our correspondent has touched upon a most important matter. We would like to hear from others who do the work of inspection and from those who are in any way affected by the work of the locomotive inspector—such as locomotive engineers, firemen and shopmen.—Editor.]

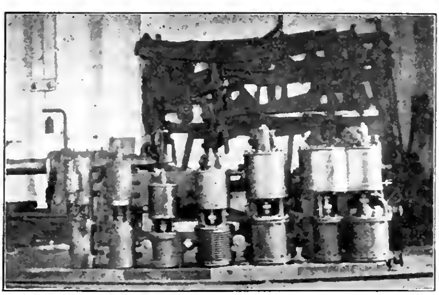
Ancient and Modern Air Pumps.

Editor:

You will find enclosed a photograph showing the past and present of air pumps used on locomotives. The one on the left is a Gardner & Ranson pump, which was one of the first air pumps used. The other five are Westinghouse, as follows: 6-in., 8, 9½, 11 and 8½-in. cross-compound. The 6-in. Westinghouse was first used on the Big Four about 30 years ago. The 8½-in. cross-compound pump is one of the Westinghouse Company's latest products, and will pump about the same amount of air as the other five combined. C. H. VOGES,

General Foreman, Big Four.

Bellefontaine, Ohio.



ANCIENT AND MODERN AIR PUMPS.

A Tenderfoot of the 80's.

Editor:

"Old Time Railroaders," by Mr. N. W. Fay, in your May number was a very interesting reminiscence to me, especially the reference the Truckee division of the Southern Pacific, where I was employed a few years ago as machinist and fireman, and possibly my memories will be of interest to your readers and the remaining Old Guard.

It's been over twenty years since leaving that part of the world, but I have been more fortunate than Mr. Fay, as an occasional friend informs me of some happening, and a few years ago an article appeared in RAILWAY AND LOCOMOTIVE ENGINEERING, in which it was stated that the division was changed to Sparks, close to Reno, the line straightened and Wadsworth abandoned. So I presume if Wadsworth is of any importance, it must be inhabited by different commercial enterprises than existed in Mr. Fay's time, when the yard engine "Goliath" was run and fired by Huston and later by Cunningham, and could be heard for miles, pushing trains up to two-mile siding.

Those were the days when if a man did a dishonorable act the community administered punishment from which there was no appeal. One case I may mention was of a brakeman suspected of being a spotter; he was escorted to the river bridge, where a can of front-end paint and one of Bill Donaldson's largest pillows had preceded him. After the ceremonies he was headed East, admonished never to return, but later reported his troubles to headquarters, causing several dismissals.

Upon another occasion a cow puncher, color blind from excessive indulgence with Charley Lewis' "sperits of fomento," got the wrong cayuse out of Tom Herman's corral and took to the foothills with constable and blacksmith foreman Crosby and three deputy Piutes in pursuit in an all-day chase, returning to camp with their prisoner bound with a lasso to the back of the mustang he had stolen. Judge Angus, our general foreman, held court that evening with postmaster Taylor acting as prosecutor and shoemaker McGuire representing the defendant, but the poor fellow was bound over to the criminal court, as he was found guilty of a crime which had no precedence in that country that was pardonable. Whatever happened, everyone butted in like a free roll at a poker game.

Constable Martin, shop foreman, was unanimously elected a limb of the law at a meeting held at the Opera House, and about his first case of note was a prisoner who escaped from the sheriff at Carson, and $100 reward was offered for his capture dead or alive. This news soon spread, and every stranger was spotted by the town sleuths, which was the entire population. Finally the constable saw a stranger in the shop and put him under arrest. He proved to be the man wanted, and after some difficulty was placed in the "jug" back of Scotty Lee's store. I was not working that day and was told to watch him while the sheriff was notified to come for his man.

The jail was an 8 x 10 frame shack with two cells lined with sheet iron, and a corridor in front and large padlocks. I took a look at this fellow, who was small and about twenty-two years of age. Thinking everything secure, I went to the hotel for breakfast and was gone possibly thirty minutes when some one yelled "He is out!" and upon my return I found he had cut his way out of the cell and picked the lock, leaving a large quid of tobacco in the keyhole as a memento. Our bird had flown and I was in disgrace, as some one had to be blamed. Finally Gigerie Bob and two other Piute bucks were rounded up and put on the scent, which led to the river and which he waded for a few hundred rods and did not cross, but gained a few hours before the Indians found his footprints in the sand; and then for at least five hours they held a regular dog trot until the older buck and myself lay down along the railroad and were counted out, while the two Piutes trailed their man to Reno, where he made his "getaway," only to be captured at Truckee, being identified by some of the railroad boys; and upon searching his clothes they found all kinds of burglar tools sewed in the lining, and even in his shoes.

Buck, mentioned by Mr. Fay, was a big-hearted Englishman by the name of Bucklen, and still an employe of the company at San Francisco. Shorty Hyde, whom the boys were convinced had drawn the grand prize in the old Louisiana Lottery, was at Sparks, last report. Johnnie Smith, George Hunt, Superintendent Whitehead and Jem Gesford are in California. Dorsey is running on the Santa Fe. Bert Keys is in Mexico in locomotive department service. Charley Kamm is in the distillery business. Frank Walstrom, who was the only fireman to suit Louie Hattenhouse, is on a farm in Nebraska. Mike Martin is running a machine shop in Chicago, and Peter Maher, who was on the rod job, is superintendent of motive power on the C. & A. Judge Angus, Tom Clark, Bill Nichols, Bill Dunlap, Andy Russle, Bob Richie and several whom I am unable to recall by name have passed away, and let us hope to a better land than where the baying of the coyote, the hymn of the Piute, the sage brush and sand hills abound.

W. D. Martin,
Genl. Foreman N. Y. C. Lines.
South Bend, Ind.

Four-Cylinder Balanced Compound.

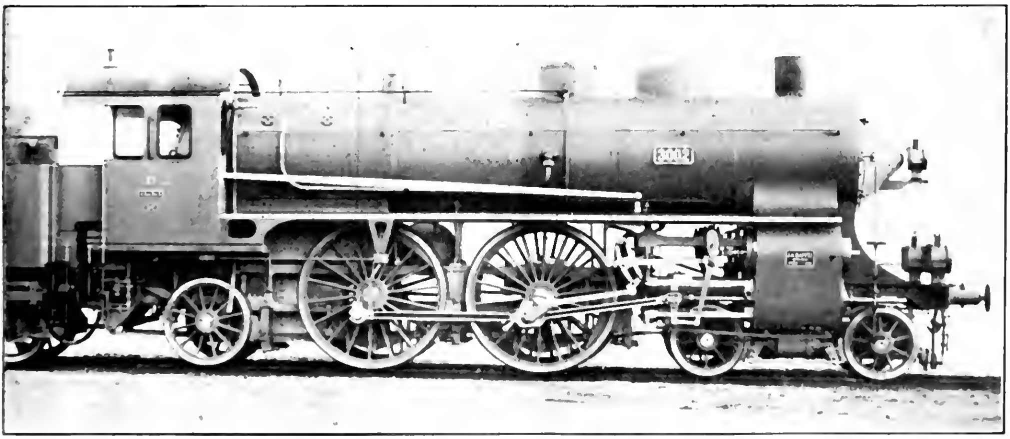
The locomotive here illustrated is built by J. A. Maffei, of Munich, Germany, for the Royal Bavarian State Railways. The engine is finished in the neat and compact fashion characteristic of this builder, and with the high polish of the continental mechanic. The engine has cylinders 13.6 and 22.8 by 25.6 ins. The steam pressure is 235.2 lbs., and with driving wheels 80 ins. in diameter, a tractive effort of 10,000 lbs. can be developed.

The valves are of the piston type, actuated by Walschaerts gear. The two high pressure cylinders are on the outside and the low pressure ones are below the smoke box. All pistons drive on the front pair of driving wheels and on the crank axle. The counterweights in the driving wheels are necessarily light and in the front wheel they are so disposed as to counterbalance crank axle weights.

The heating surface of the boiler is in all 2,212 sq. ft. This is made up of 150 sq. ft. in the fire box and 2,050 sq. ft. in the tubes. The grate area is about 35¼ sq. ft., which gives a ratio of grate area to total heating surface as 1 is to 64. The number of tubes in this boiler is 283.

The type of locomotive is what we call a 4-4-2 or Atlantic type and is of very symmetrical proportions and graceful design. The engine truck wheels are 38 ins. in diameter and the carrying wheels at the rear are 48 ins. in diameter. The total wheel base of this machine measures 35 ft. 4 ins. The weight in working order is 68.5 metric tons.

The tender is mounted on 40-in. wheels, weighs in working order 50 metric tons. It carries about 8 tons of coal and about 5,785 gallons of water.



FOUR-CYLINDER BALANCED COMPOUND FOR THE ROYAL BAVARIAN STATE RAILWAY.

Without Foundation.

We have before now referred to the so-called railroad news which the ordinary daily newspaper gives to its readers. The possession of a wide sheet of white paper, a soft lead pencil and a fertile imagination are after all the ground-work for a good deal of what is called railroad news. The ordinary daily paper which has become in many instances, especially on the front page, merely the record of death, disaster, foolishness and crime, occasionally increases its efforts, by printing an account of something that did not happen.

We recently saw a statement in a prominent New York daily to the effect that an officer of one of our leading railways, in making a so-called surprise test of signal observance, had been arrested and only liberated on giving heavy bail. By direct inquiry, addressed to the vice-president of the road in question, we learned that the statement, as printed, was without any foundation.

Victorian Railway Shops at Newport

By J. H. Boyd

The Victorian Government Railway Shops, located at Newport, a suburb of Melbourne, possess many features of special interest. The rolling stock for the whole of this railway is built for 5 ft. 3 ins. gauge. The original workshops were situated at Williamstown, which is three miles further from the Victorian metropolis and better known as Point Gellibrand.

In 1884-5 the authorities decided to build an up-to-date workshop, and an area of about 732 acres at Newport was secured and designs obtained from their consulting engineer in London.

GENERAL VIEW OF NEWPORT SHOPS OF VICTORIAN GOVERNMENT RAILWAYS

The workshops generally cover twelve acres, some 2,300 workpeople being employed there. The adjoining yard occupies 120 acres. The works which run from west to east are divided into three blocks. Commencing at the eastern end, the first is a large timber store, containing some £60,000 worth of timber. This timber comes from all parts of Australasia. The woodworking machinery employed in the manufacture and repair of carriage and trucks is well arranged and is representative of the best woodworking machinery makers of Great Britain and the United States. Australians, in general, have an open mind in regard to the purchase of machinery; the cost, design and general adaptability of the machine required, being the principal factors in making their decision in favor of any particular machine, rather than favoring any particular maker or country.

The whole of the eastern block is devoted to the manufacture and repair of carriages or cars and freight or goods wagons. The carriages are of two distinct types—suburban and for long distance traveling. Australian railways generally have adopted the compartment system and have two classes—first and second. The carriages for long distance traffic are provided with corridors, generally at one side. The method of coupling carriages is the same as in England, and the method of fastening rails to ties is the same as in America. It should be mentioned that the driving gear for the wood machine shop is under the floor. Sawdust and refuse are drawn away for fuel in the boilers by the most approved method. Spray painting machines worked by compressed air are used for painting the outside of freight cars. Many other details that were often painted by brush are now painted or varnished by this method.

Passing on to the central block which is devoted to the offices, including that of Mr. T. Smith, the workshop manager, are the stores department, the pattern shop, the coppersmith's shop, and the foundry. The iron foundry is well provided with molding machines, sand sifting and coremaking machines.

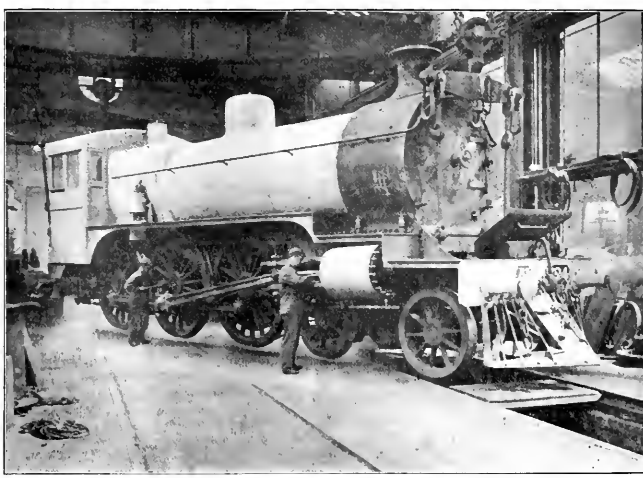
ERECTING SHOP, BOILER SHOP BEYOND.

In front of the central block is a large lawn and flower garden in which the men can spend, if they desire, their lunch hour. Attached is a large dining room recently erected by the commissioners, which provides accommodation for about 600 men. The catering and management are done by a committee of the men, and a good meal can be had for 6d. (or 12 cents).

The west block, containing boiler shop, fitting and erecting shop, machine shop, smithy, etc., is devoted entirely to the construction and repair of locomotives.

The boiler shop, which alone covers nearly 57,000 sq. ft., is well equipped. The plant includes the usual punching, drilling, rolling, pressing and straightening machinery and all other devices used in the construction and repair of boilers.

The fitting, erecting and machine shops cover in the aggregate nearly 100,000 sq. ft. The erecting and fitting shops are capable of turning out over 20 new engines of various types per annum in addition to the repairs to existing engines and rolling stock which is always going on.



THE "A-2" TYPE OF ENGINE BEING LIFTED ON TO OUTGOING TRACK.

An impression of the capacity of the works can be gained from the fact that 36 new locomotives are in hand and some 50 others are undergoing repairs.

Of the several types of engines the A-2

MACHINE DEPARTMENT—SLOTTING MACHINES AT WORK.

type, which is designed for express passenger traffic, ten of which have recently been built, is of special interest. Ten others are well advanced; they have 6-ft. driving wheels, weight 110 tons. The estimated cost of each is £3,700. The side view, showing the engine being lifted from the building track or pit to the central rails gives a good idea of proportions of the machine. The general effect is of a combination of an American and British built engine. The outside cylinders, pilot and style of cab suggesting the American, the lack of bell and headlight combined with other features of design, suggesting the British type.

Another class of locomotive built at Newport is the "D D" type, which weighs 92 tons and costs about £2,900. This class of engine is used on suburban

ONE OF THE SUBURBAN CLASS.

or country lines, principally for passenger, goods and mixed trains.

The D D 1 or tank engines, are also constructed at the works at a cost of about £2,700 and weight 68 tons with water tanks full. They are used for suburban lines. When the lines are electrified the engines will be converted into regular road locomotives.

The machine shop is well designed generally with good machines and tools. As already stated, the machines are of

GENERAL VIEW OF THE MACHINE SHOP.

many different types and makes, Great Britain, the United States and Germany being represented.

High speed steel is being used with advantage, and it was observed by Mr. R. Ferguson, foreman of this department, that the stronger machines of British make stood up well to the increased output now demanded of them.

It is admitted generally by those who are qualified to give an opinion in Australia, that America is well ahead on design and ingenious development of machines and tools, but their machines are often on the light side, and in many cases not sufficiently rigid.

One of the special features in the manufacture of the locomotives is the built up crank shaft. This method was adopted in the first place because of the lack of facilities for forging the shaft. The method of building up the shafts under pressure is most successful and gives entire satisfaction.

The forge shop is generally well equipped, and among other appliances has a 5-ton steam hammer for forging axles, connecting rods, etc., other features are the bolt and nut forging machines.

The smithy is also well equipped with steam hammers and necessary tools, and which, including the forge, covers an area of over 60,000 sq. ft.

Approximately the capital value of the works is £350,000; wages paid, £640,000; value of material used annually, £355,000; work at present in hand, locomotives, 36; carriages and vans, 90; freight trucks or cars, 667.

Apprentices are expected to serve six years, and during that time are expected to attend the Workmen's College in Melbourne and show proficiency in their technical training. The results or marks obtained at the various examinations are posted up in the works from time to time that progress is noted by all concerned.

The writer is indebted to Mr. T. H. Woodroffe, chief mechanical engineer, for kindness and courtesy, both in allowing him to visit the works under such favorable conditions and also for several of the photographs, blue-prints, etc. Mr. T. Smith, works manager, was also very attentive.

Steam Turbine and Reduction Gear.

The Westinghouse marine steam turbine made by the Westinghouse Machine Company of Pittsburgh, Pa., is too well known to require detailed description here. The Melville-MacAlpine reduction gear, as applied to the Westinghouse marine turbine, is a very successful combination of high speed turbine and low speed propelling shaft. In an article contributed to *Applied Science* by Mr. J. A. MacMurphy, chief draughtsman of the turbine department Westinghouse Machine Company, he says, among other things:

GEORGE WESTINGHOUSE,
President, The Westinghouse Companies.
President American Society of Mechanical Engineers.

REAR-ADMIRAL GEORGE W. MELVILLE,
Ex-Engineer-in-Chief U. S. Navy.

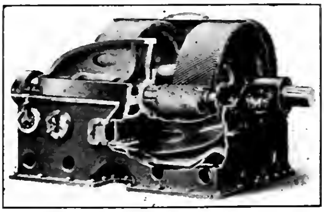
JOHN H. MACALPINE,
Member Institute of Naval Architects.

"It has been generally admitted that properly cut gears will transmit power with extremely small loss, but the use of gears for large work has heretofore been limited, owing to mechanical difficulties involved. It, therefore, remained for Messrs. Melville and MacAlpine to invent a gear which would transmit the enormous powers necessary for the propulsion of large, fast ships at a speed of revolution of pinion which would permit of a design of turbine giving the lowest possible steam consumption, and would reduce the speed of revolution to that required for best propeller efficiency. Ordinary gears will not do this: that is, they cannot be operated successfully with wide gear faces working with several hundred pounds' pressure per inch of width of tooth, while revolving at a velocity of over a mile a minute at the pitch line. And this for the manifest reason that if it were humanly possible to accurately cut and align the gears so that there would be a line contact to begin with, this condition would not be maintained for any length of time because of the natural wear of the bearings.

"The novel feature of this reduction gear consists in carrying the pinion shaft in what the inventors call a "floating" frame. The floating frame is extremely stiff in itself and supported half-way between the end bearings in such a manner that it is free to oscillate in the vertical plane passing through the axis of the pinion shaft, while it is prevented from moving in other directions. The result of this arrangement is that any minute irregularity in the pitch of the teeth (which would tend to concentrate the load) will merely cause the floating frame to change its position about its central support and in this way equalize the pressure. The pinions automatically adjust themselves to divide the load and so avoid abnormal stresses. In order to transmit the enormous power required in marine work, it is not necessary to have very wide gears, and it is found advantageous to divide this into two gears on the same shaft. Helical teeth are employed so that they will roll into contact without shock and thus reduce wear and noise.

"In this connection it will be interesting to note that Mr. George Westinghouse has developed a modification of this gear which differs from the "floating frame" type in that both the pinion shaft and the gear shaft are carried in fixed bearings, the connection between the gear rim and the shaft being made through a thin diaphragm, which while amply strong to transmit torque, is sufficiently flexible to permit of the gears aligning themselves by interaction of the tooth pressure. The flexible support of the pinion frame consists of an I-beam so arranged that the web is free to bend back and forth as required.

"The effect of this increased efficiency of both turbine and propeller in a marine installation has an even farther reaching effect, as a large reduction in coal bunker capacity is also brought about and moreover the boiler H. P. required is reduced about one-

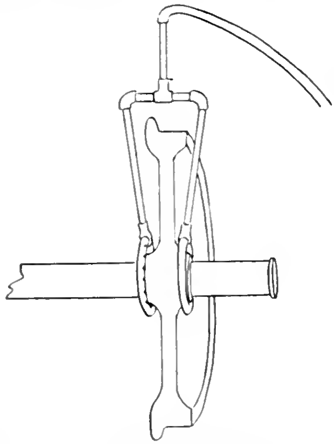


REDUCTION GEAR WITH FLOATING FRAME.

third. On the *Lusitania* there are twenty-three double-ended and two single-ended boilers, the double-ended boilers being 17 1-2 ft. in diameter by 22 ft. long, the saving of one-third of the space occupied by these boilers will be seen to be a very large item. As each of these ships carry 192 firemen and 123 trimmers, the reduction of the number of boilers to be fired would effect a very material reduction in the expense for this part of the crew."

Wheel Hub Expander.

Writing to the *Electric Traction Weekly*, Mr. J. O. Harrison, superintendent of motive power of the Fort Dodge,



GAS HUB EXPANDER FOR WHEELS.

Des Moines & Southern Railroad, at Boone, Ia., says:

"I have in my shop a little device which ought to draw a better salary than some mechanics. It is as you can see from the accompanying sketch a straight pipe, screwed into a T from which a pipe runs each way dropping down on either side of the wheel to the hub where it again connects to another T. From each of these two T's two curved pipes encircle the hub of the wheel, both inside and outside the hub. These circular pipes are perforated with small holes. We attach a hose to the straight pipe at top. This hose connects through one branch to an air tank and through another to our gas supply. Air and gas being turned on and lighted at small holes in the circular pipes, form a hot, blue flame around the hub of the wheel. This wheel is put in the press and given about 80 tons of pressure. In a very few minutes, seldom more than ten, the heat has expanded the wheel sufficiently to allow the press to move it off the axle. Heretofore I have never heard of any one pressing steel wheels off steel axles. It has been customary to drill two or three holes through hub of wheel parallel with the axle in order to allow the metal in hub of wheel to yield its grip on the axle. This method requires several hours' labor while, with the gas jets as we use them, a pair of steel wheels can be removed in twenty minutes."

[In writing us on the subject Mr. Harrison says he also uses this heater when putting wheels on axles. The expanded hub lets the axle pass in quickly and the adjustment is made as the hub cools. The actual shape of the circular burners is probably each like a hook, so as to permit of their being put around the axle on the hubs of the wheel. The drawing does not show the burner very clearly.—EDITOR.]

Reminiscent.

A valued correspondent who delights not in seeing his name in print has sent us the following notes:

I was much pleased with Mr. Ricksecker's autobiography and hope to see more of the like from his fellow veterans. Am sorry that he had forgotten the No. 64 Rogers. She had cylinders 16 x 24 ins., not 18 x 20 ins. The first engines having larger than 16 x 24-in. cylinders were built in Jersey City Locomotive Works, with 5½-ft. driving wheels. I think the first engine with that size of wheel was No. 80, named Frank Cummings, which had 16 x 24-in. cylinders.

The first engine on the Atlantic & Great Western with an 18x24-in. cylinder was a Mogul built at Jersey City.

I note your editor's answer to Mr. Merrill about the Mallet compound exhaust. If he is correct in that, I do not understand the Mallet engine. I had always before thought that it had four exhausts for each turn of the drivers, and if not, why? [It has four exhausts for each turn of the drivers and is practically two cross compounds coupled together, the valves being set to make the exhausts synchronous.—EDITOR.]

Railways in Madagascar.

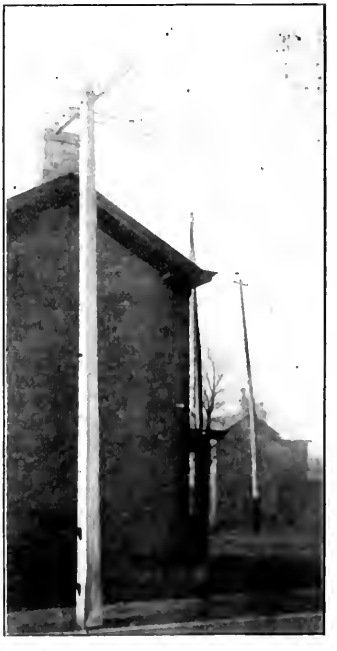
A comprehensive scheme is being formulated by the French Government to establish a complete railway system in the island of Madagascar. There is at present a narrow gauge line about 150 miles in length. The new project comprises standard gauge railways through the most fertile valleys in the island, that will open up to commerce this hitherto almost entirely unexplored region. The mineral wealth of the country is reported to be great, while the vegetation is said to resemble more the luxuriance of Brazilian forests than the jungles of the near continent of Africa.

Concrete Telegraph Poles.

The Pennsylvania Railroad system, in order to provide against timber scarcity, have on the lines west of Pittsburgh placed in experimental service a number of concrete telegraph poles through New Brighton, Pa. The construction of the poles has followed a series of elaborate experiments which have been conducted during the past two years.

Owing to the fact that wooden poles are becoming more and more expensive as they become more difficult to obtain, the Pennsylvania, in 1906, began to test the value of concrete as a substitute for wood. Fifty-three reinforced concrete poles were set up in the line along the Pittsburgh, Fort Wayne and Chicago Railway, near Maples, Ind. A year later they were found to be giving entire satisfaction and showed no evidences of decay.

According to the experiments made so far it is thought that a concrete telegraph pole will last for many generations, thereby doing away with the frequent renewals necessary with wooden poles. Much importance is also attached to the increased strength of the new poles, which hold the strain of the line, even on curves, without braces.



CONCRETE TELEGRAPH POLE.

The poles at New Brighton are of graceful proportions, being about 30 ft. high, 14 ins. in diameter at the bottom and 6 ins. at the top. Their general appearance is pleasing to the eye on account of the uniformity in size, shape and color.

Railway & Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances.

Published Monthly by

ANGUS SINCLAIR CO.

114 Liberty Street, New York.

Telephone, 984 Cortlandt.

Cable Address, "Loceng," N. Y.
Glasgow, "Locoauto."

Business Department:
ANGUS SINCLAIR, D.E., Prest. and Treas.
JAMES KENNEDY, Vice-Prest. and Gen. Mgr.
HARRY A. KENNEY, Secretary.

Editorial Department:
ANGUS SINCLAIR, D.E., Editor.
GEORGE S. HODGINS, Managing Editor.
JAMES KENNEDY, Associate Editor.

Boston Representative:
S. I. CARPENTER, 643 Old South Building, Boston, Mass.

London Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., 3 Amen Corner, Paternoster Row, London, E. C.

Glasgow Representative:
A. F. SINCLAIR, 15 Manor Road, Bellahouston, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid in the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribe in a club, state the name of the agent.

Please give prompt notice when your paper fails to reach you regularly.

Entered at the Post Office, New York, as Second-class Mail Matter.

The Chancetaker Must Go.

The words at the head of this article, we believe, form the headline for some remarks attributed to a master mechanic in Texas. We recently saw some exception taken by a writer in a contemporary magazine to the word chancetaker as applied to a railroad man who is guilty of bad judgment. RAILWAY AND LOCOMOTIVE ENGINEERING first applied this word to the railroad man who did not play the game according to the rules. It originated in the contemplation of a man who ran at full speed past a caution signal in the hope that the home signal would be clear before he got to it. That act may be called bad judgment by those who prefer the word, but to us he is a chancetaker.

There are degrees of bad judgment, but in nearly all cases of bad judgment there is the chancetaking element. Habitual bad judgment is incompetency. One may say that the rules of the road provide means of safely getting out of difficulty, as, for example, flagging to a siding if you get on the time of a superior train. The fact that you know what the antidote to a poison is is no excuse for taking the poison. Even if you have the antidote handy, you take a grave risk if you swallow the poison. The serious and the deadly thing about the chancetaker is that he may with his bad judgment, or what ever you like to call it, kill good, careful, first class men in some fool accident. How would you like to go into the beyond that way?

There has been a great deal of discussion about signal observance records—surprise checking, some call it—now we want to get the honest opinion about the matter from the locomotive engineers and others who are subject to these signal observance tests. If you write us your views, with name and address and your road, we will use your pen name only if you wish, and respect your confidence to the full. We want to print the views of those who have experience in the matter. Engineers, firemen, road foremen and men who make the tests, officials, anybody may write us who is concerned in the business, and we will give them an opportunity to express their views without giving their names to the public.

Our opinion about the signal observance test is that if properly conducted it is all right. We do not approve of an official sneaking out from behind a hedge to catch some one man or men he may not like. But we believe the fair, impartial test of all is perfectly legitimate. Such tests are not poorly disguised attempts to look for trouble, they should be like the examination at a college, made to see where the whole class stands. The signal observance test should carry with it no more imputation of untrustworthiness to the railway man than the presence of a National cash register carries the imputation of dishonesty to the employee in a store. If the cash register was only to be used by John Jones and the rest of the employees simply gave their word as to the number and amount of sales, then the cash register would be objectionable. Where all use it, it keeps a legitimate record and there is no discrimination.

Some of our important roads have made signal observance tests in such numbers that they clearly must apply to all engineers alike, and the setting of the signal at danger or extinguishing a light is only the artificial production of a condition that may at any time confront enginemen, and be brought about by failure of track circuit or signal mechanism or other sufficient cause. Several roads report as high as 98 per cent. efficiency of the men so tested, and that is an honorable record for the men and a proof of their care, their watchfulness, and their conscientious performance of duty, which it is not possible to obtain in any other way. Under this system a man is able to establish a positive reputation for good work. Not that he merely kept out of trouble, but that he did the right thing at the right time and the fact was known and recorded.

A man in a railway repair shop does not have to explain to some official that he worked ten hours, where the brass check system is in vogue. The check proves that he was present on the day in question and at the hours specified, and no imputation of dishonesty is ever intended by the use of the check system at the gate or by the presence of the timekeeper in charge.

We have not much sympathy for oversensitive persons in a big working concern like a modern railway. There must be a definite system to keep up efficiency and maintain discipline. The trouble about the chancetaker is that by getting outside the rules of the game he may injure or kill those men who, doing the square thing themselves, believe that the others on the road are doing the same thing, and that the company is guaranteeing their safety by enforcing the rules.

Send us a letter and state your views. You have a right to your opinion, and if you do not agree with us, let us know where and why. We will respect your nom-de-plume, but give us your name and address and road as a guarantee of good faith and not for publication. What do you think of signal observance tests, and what about the chancetaker?

Cracks, Pitting and Grooving.

Some interesting facts with regard to cracks, pitting, grooving and general surface corrosion of boilers have been brought out in a report prepared by Messrs. H. Fowler and L. Archbitt, of the Midland Railway of England, for the eighth International Railway Congress.

These defects though known under various names, say the reporters, are so closely related that it is difficult to decide under which head a particular defect shall be classed. The conditions which result in cracking may if corrosion be also present result in grooving.

A groove is primarily due to oxide of iron (rust) having formed as a thin scale on a portion of a plate which is subject to slight movement. This movement causes the scale to crack off. Scale is again produced under suitable conditions. The repetition of the formation and removal of this scale in time produces a groove. This may not explain every case, but is in general the theory of how grooves are produced. Cracking is, strictly speaking a different phenomenon and occurs principally in the firebox, where there is radii of outer and inner plates. Cracks are probably more often found between the tube holes; round the outside of the plate, especially in the upper part; and sometimes between the stays on the copper or inside sheet of the firebox. In all cases where copper fire-plates are used, there is a liability to crack inside of any flanged portion.

It is possible that these cracks, generally found as a series, may be started in an incipient form when the plate is bent, but they develop only under continually repeated stresses as the boiler "breathes" in working. They develop in places where slight movement can take place and do not appear in stiff portions of the box.

Pitting as apart from the tubes is nearly always confined to the lower parts of the barrel and in some cases it has been found to be worst at the smoke-box end. The Lancashire and Yorkshire Railway are mentioned as finding pitting worst in small boilers, where the tubes are close to the bottom of the barrel. The Natal Government Railways find the same result with engines having shallow fireboxes. Both these cases may be due to the want of free circulation of water, and the consequent tendency of corrosive matter to lie on the bottom of the boiler in contact with plates.

In the matter of grooving there are four principal places at which grooving generally takes place. 1, At the bottom of the smoke-box tube plate; 2, just above the mud ring in the outer casing sheet, especially near the corner; 3, at the bottom of the circumferential lap joints in the interior of the barrel; 4, at the throat plate flanges, near the position where the flange joins the bottom of the barrel. There are several other places where occasionally grooving is found such as near the edge of the fire-hole door ring, and at the flange of those in which the fire hole is formed by flanging the plate. In some cases the grooving occurs on the inside of the vertical flanged portion of the door plate and sometimes may be found between vertical rows of stays in the lower portion of the throat sheet in the water side.

With regard to general surface corrosion, this is stated as taking place principally over the bottom of the boiler barrel and smoke-box tube-plate. The Eastern Bengal State and East Indian Railways find that these plates corrode inside the smoke box owing to the corrosive effect of the smoke-box gases, but several locomotive departments including that of the Eastern Bengal State Railway, find that these plates also corrode on the water side. The Lancashire and Yorkshire Railway find that corrosion of the boiler plates takes place near the feed-water delivery.

In reading this necessarily brief synopsis of the report, the American reader is reminded that in some of the cases mentioned the plan of construction is different from what is common in this country, but the definition of the terms used and the probable causes for the conditions observed make the report a valuable contribution on the subject with which it deals.

Wheel Failures.

During a recent tour the Editor had occasion to discuss with an unusually bright master mechanic the subject of wheel failures, which continue to be alarmingly common under heavily loaded cars, also under tenders and among engine truck wheels. The failures are in fact common in every position where the wheel has to endure hard usage under heavy loads. Since returning to the office we have received a letter from the master mechanic, part of which reads:

"I find that steel tired wheels shell out a great deal worse under tenders than under cars. In fact, those under cars are the exception. This leads me to believe that the short wheel base may be partly responsible, for I have never seen shelled spots develop to any noticeable degree on drivers or on trailers, but have seen it very pronounced on four wheel engine trucks and that without brakes. My experience has been mostly with very crooked tracks and I consider this responsible for the frequency and severity of this scaling propensity.

"The outside wheel on a sharp curve must, in addition to revolving, be dragged over the rail, describing a circle from the inner wheel, or the inner wheel must stop and hunch backward. Either of these actions or a combination of both will cause tire to burn and induce shelling. In order to prevent this, recourse must be had to make one wheel independent of the other. Experiments which were made along these lines between 1870 and 1890, while showing that such could be done, never led to the adoption of the independent wheel; but it may be possible that at that time the demand for better conditions was not so urgent as it is now. I am not sufficiently advanced in scientific or practical engineering to urge changes; but present conditions for your consideration."

We agree with our correspondent that something ought to be done to avert the danger which is every day becoming more alarming through failure of wheels. Several remedies might be proposed, among them the independent wheel, but that would entail complications that might prove worse than an occasional wheel fracture. When the excessively heavy cars came into vogue and with them increasing loads on tenders and engine trucks, the obvious remedy proposed to provide against breakage of wheels was stronger wheels, which meant the abandoning of the time honored cast iron wheel in favor of steel tired wheels. That change was largely carried out, but breakages or failures have not been stopped. The shelling of steel tired wheels is no doubt caused by the overloaded wheel undergoing severe lateral shocks, as in rounding curves, but that cannot be avoided. A little more cone to the tread of the wheel might help and is worthy of being tried. First-class cast iron wheels display less tendency to shell than steel tired wheels, and the cause may be that the chilled tread has more cone than the steel tired wheel.

It falls upon the motive power department of railways to search for remedies to prevent breakage of the weak members of the rolling stock family; but the fact is, that weight has been added to the running gear of locomotives and cars until in some instances the safe limit has been exceeded. Axles and other parts have been enlarged to withstand the added stresses, but wheels do not admit of the simple strengthening process of adding material. There is upon the market extraordinarily strong material, such as vanadium and nickel steels, but railway companies cannot afford to purchase such material for tires in these days, when politicians great and small are working so zealously to reduce railway revenues. It may be that the interests of safety will require transportation companies to return to the practice of imposing lighter loads upon their rolling stock.

Remedy for Defective Sheets and Stays

The designing of a steam boiler light enough to be carried on a wheeled vehicle and equipped with an engine that used the steam generated by the boiler to propel the vehicle and pull other vehicles behind it, was one of the greatest inventive triumps the world has ever seen. That happened a little more than one hundred years ago and marked the beginning of a revolution in the methods of land transportation.

But the rose is generally garnished by thorns and every good and useful thing bring drawbacks along with the advantages, so it was with the steam boiler that gave vitality to the locomotive engine. Several essential features of this form of boiler made its care and management a burden to the people responsible for the safety of its operation. The boiler had to be light; strong enough to withstand high pressure; it required to have the capacity for generating steam with immense rapidity; it needed to be so designed that repairs could be done without tearing the vessel apart, and it had to be so constructed that cleaning could be easily accomplished. Ever since Richard Travethick built a locomotive boiler in 1802 embracing part of these requirements, his successors in this line of enterprise have been striving to improve the boiler so that it should possess all the attributes named. But the road to success has been paved with obstacles that have been almost insurmountable.

While the engines continued to be small, and the steam pressure low, the difficulties encountered in maintaining a boiler in good working order were comparatively small; but when the steam approached 200 lbs. gauge pressure then arose a fierce conflict between the forces working for the destruction of the boiler and the skillful labors of those having the duty of maintaining the boiler safe and free from the defects of broken staybolts, leaky seams and leaky flues. The firebox has always been the embarrassing part of the boiler. An oblong box of sheet steel secured to the outside shell as strongly as science and the teaching mature experience could devise, the expectations naturally were that the furnace would act in harmony with its surroundings; but instead of that no sooner was a fire started on the grate than the boiler began tearing itself away from the bonds applied to hold it secure. The expansion and contraction of the inside firebox sheets would be different in degree from the expansion and contraction of the outside shell. Every change of temperature due to fire intensity and to change of steam pressure would cause movement that ended in fracture of sheet or of staybolts.

Ever since high steam pressures came into fashion, there has been an incessant struggle maintained to overcome the movement that has proved so disastrous to boilers and fireboxes. It has been a struggle to resist the irresistible and had no more chance of success than would be an effort to stem the rising tide.

This question of trying to resist the movement of firebox sheets has come into unusual prominence lately through a paper by Mr. Donald R. MacBain, superintendent of motive power of the Lake Shore Railway, read at the May meeting of the New York Railroad Club. The paper illustrates many failures of sheets and of staybolts and gives particulars of investigations made to ascertain the causes of the failures. The experiments and investigations carried out for this purpose were the most thorough and far reaching of anything done in this line since boiler failures began to attract attention, and an illuminating feature of the work was that it was conducted by a practical boiler maker who sought for information without preconceived notions of what he was seeking to find out. For details of the work done and of the discoveries made we must refer our readers to the paper read by Mr. MacBain. A digest of the paper is to be found on page 259 of this issue. It is enough for us to say that they found breakage of staybolts and cracking of sheets at certain spots well known to locomotive men; that strengthening the parts to resist movement proved useless and that finally by providing for movement by means of flexible staybolts an effectual remedy was found.

In connection with one firebox illustrated the paper says: "This installation of flexible staybolts, including radial stays, was made in January of 1907, and the engine was put into heavy passenger service. It was our intention to have made this firebox of one piece but, owing to a defect developing in one of the side sheets, a half side sheet had to be applied, and up to Feb. 1, of this year, at which time the last examination was made, the engine had made 243,000 miles without one broken staybolt, without any vertical cracks in the side sheets, without any trace of a crack in the back head, or throat sheet, and without any cracks, or any sign of a crack, leading away from the arch tube holes in the back flue sheet, nor has there ever been a tool on the side sheet seam; in fact, the engine has never been held one moment for boiler work, other than that of expanding the flues, since it went into service in February of 1907."

Master Mechanics' Convention.

The leading business for the coming convention of the American Railway Master Mechanics' Association will be introduced by thirteen committees' reports, which include that of the standing committee on mechanical stokers, of which Mr. J. Rumney is chairman. Some progress has been made in the application of mechanical stokers since the last convention, but the interest in the subject seems to have abated to some extent, but it is well for the members to be informed on the present state of the art.

Revision of standards will be reported on by a committee, of which Mr. W. W. V. Rosing is chairman. Standards that were established years ago have become obsolete and others require changing, so it is high time this work was done. Mr. Rosing may be depended upon to recommend the changes which will bring up standards to meet prevailing practice.

Motive Power Development comes next, with Mr. Robert Quayle chairman of the committee. We do not remember any year wherein greater development of motive power has taken place than during the year that has elapsed since last convention. The story of the progress made will form a valuable and interesting report. One visiting the various locomotive building works is certain to be amazed with the increase in the power of recent locomotives and the variety of novelties that have been applied to increase the power and the efficiency of this form of engine.

Increase in the weight and rigid wheel base of locomotives have called for widening track gauge on curves and that subject has been referred to a committee of which Mr. F. M. Whyte is chairman. Mr. Whyte may be depended upon to see that the proper change is recommended.

One of the most vital of living subjects before the railway world at present is superheaters, which will be reported on by a committee, of which Mr. L. R. Johnson, of the Canadian Pacific, is chairman. No better selection could have been made, for the Canadian Pacific has taken a lead in the introduction of superheaters, and Mr. Johnson has enjoyed acquaintance with the working of superheaters in marine service as well as on locomotives. There is still some conflict of opinion concerning the economy and utility of superheaters, so it is well for the association to receive a report on the subject from an engineer whose good judgment and experience guarantees a true statement of the merits and shortcomings of the various steam heating appliances.

Locomotive and shop operating costs, is an important subject that has been a little neglected of late years and it is now before a committee of which Mr. H. H. Vaughan is chairman. The wide shop experience that Mr. Vaughan has enjoyed in Great Britain, in the United States and in Canada, makes him peculiarly well fitted to report on this subject, and we look forward for something that will set motive power men discussing the cost of the work performed under that supervision. Discussions of locomotive and shop operating costs have at various times raised the temperature of convention halls and we should not be surprised to witness some excitement when this subject is called.

Reporting on the design, construction and inspection of locomotive boilers has been assigned to a committee, of which Mr. T. H. Curtis is chairman. The subject of locomotive boilers has been before the conventions more than any other and Mr. Curtis will distinguish himself if he adds anything of value to the immense accumulation of literature on boilers now to be found in past annual reports. The contents of a paper read by Mr. Donald R. MacBain, at the New York Railroad Club last month, attracted so much attention that Mr. Curtis may be able to submit valuable information on lines that have remained unventilated.

The remaining subjects to be reported on are steel tires, Mr. A. Stewart, chairman; safety appliances, Mr. C. A. Seley, chairman; timber specifications, Mr. R. E. Smith, chairman; and train brake and signal equipment, Mr. A. J. Cota, chairman.

When to these reports are added a variety of topical subjects the convention will be kept remarkably busy during the three days the sessions last.

Agricultural Specials.

We have all heard of president's specials or millionaire's specials or opera company flyers or circus trains, but there is in actual operation on the Erie a train which may well be called an agricultural special. The officials of that road, believing in the spread of useful information for the farmer, went to the Cornell University and offered the State Agricultural College a free train to carry the professors, and have them give lectures at the various stations along the line. The college accepted the offer.

The first and indeed all subsequent trains of this kind have been an immense success. Milk, potatoes, beans, poultry, fruit, corn, grain, alfalfa, etc., were the topics discussed by the lecturers and suitable exhibits were carried in the cars. The Erie furnishes the train and crew, the college furnishes the lecturers, the exhibits and the literature. The whole thing was carried out with the enthusiasm which means and wins success.

Later the Erie put on the milk production special, with sample cows, if we may say so, as part of the traveling equipment. After a lecture of about thirty minutes' duration had been delivered the farmers were asked to adjourn from the lecture car to what we must, for want of a better name, call the bovine annex. This was a baggage car fitted up for the accommodation of kine. Two Jersey cows were then shown at the door of the car. The lecturer explained that the first of these took $50 a year to feed, and gave $58 worth of milk, profit $8. The second, also, at $50 worth of food but gave $66 worth of milk. These facts were the results of careful record, each cow having, as you might say, a debit and credit side.

These unequally sided cows were metaphorically thrown into the shade by one of Holstein breed. This animal ate the equivalent of $60 in the year but gave $191 worth of milk. The milk from the Jersey cow contains a larger percentage of butter fat, but the Holstein is a fresh milk producer par excellence. The cow exhibited by the Erie produced 11,966 lbs. of milk in the year, which is close to six tons, and that is about ten times the weight of the producer. The reasons for the difference in the cows exhibited was fully explained and set forth by the lecturers.

The work done by these agricultural specials is beneficial in every way. The instruction given enables the farmers to produce more on their farms. This puts more business into the hands of the railroad, and cows and other producers are rated on a strictly dollar and cents' basis, which would no doubt astonish them if they became aware of the fact. If a pennant should at any time be awarded for milk production we make bold to mention the Erie's Holstein in this connection.

Signal Efficiency Tests.

Some 300,000 efficiency tests were made last year by the Pennsylvania Railroad and practically a perfect record was made by the employes. These figures are shown in a report issued by the railroad. The average number of tests made each day was 820 and of the total for the year 99.75 per cent. were perfect. In the twenty-five one-hundredths of one per cent. of failures are included the cases where enginemen passed signals by a few feet before stopping their trains, and similar cases, which, though violations, were not such as would make possible an accident to a train. Efficiency tests are conducted by officials of the Pennsylvania Railroad who, at unusual times and places, set signals at caution or danger, display fusees, or place torpedoes on the track, with a view to keeping all employes constantly on the alert for any and all signals. Failure to observe any of the rules regarding the operation of trains is considered cause for discipline.

The tests made in 1909 were divided into four classes, in which the following records were made by the men: Block signal rules, 47,384, of which 99.6 per cent. showed perfect observance on the part of the employes. Rules governing flagmen, and the use of fusees, torpedoes, and other signals, 45,887 tests, with 99.6 per cent perfect. Trains ahead of schedule time, 92,370 tests, with 99.8 per cent. perfect. Signalmen relieving each other, 99.9 per cent. perfect out of 112,901 tests. Eight of the twenty-six divisions of the Pennsylvania Railroad showed perfect records in all signal tests made during the year. On the Sunbury and Shamokin divisions a total of 12,539 block signal rule tests were made and in only nine cases was the observance imperfect. Twelve divisions had over 99 per cent. of efficiency tests perfect, 10 divisions had perfect records in trains checked for running ahead of schedule time, and 9 divisions had perfect records in signalmen relieving each other on time.

In 1906 the Pennsylvania Railroad first made public the results of efficiency tests. Since that time these tests have been conducted regularly and the results have been given to the public from time to time. The percentage of failures has been gradually decreasing and at the same time the number of accidents on the Pennsylvania system has shown a far greater percentage of decrease.

Book Notices

Practice and Theory of the Injector. By Strickland L. Kneass, C. E. Third Edition. Revised and Enlarged. Publishers, John Wiley & Sons, New York. 1910. Price, $1.50.

The book before us is one of 175 pages and has eleven chapters and an index. The author tells us that it has been his object to present solutions of some of the more interesting injector problems with illustrations drawn from practical tests, and to describe in detail the function of the various parts.

Since the publication of the previous edition, there have been changes in the construction of locomotives which have affected the method of feeding boilers and of injector design. Many of the articulated types have no room in the cab for an injector of the required capacity, so that the non-lifting form is coming into vogue again. Motive power officials are recognizing the advantage of utilizing waste products for heating the feed water, of purifying it of scale-bearing salts, and are giving more attention to the details of boiler feeding accessories which make for economy of operation. Two additional chapters have been added on these important subjects. The arrangement of the contents of the book is good. After the history and development of the injector, Chapter III gives a definition of the terms, and a description of the parts; this is followed in order by a chapter on the delivery tube; one on the combining tube; another on the steam nozzle. The action of the injector follows, succeeded by four other chapters on the application, sizes and tests and the two on modern practice, to which we have alluded.

A History of the Logarithmic Slide Rule and Allied Instruments. By Floridan Cajori, Ph. D. Published by the Engineering News Company, New York. 136 pages, cloth. Price One Dollar.

The slide rule has been adapted to almost every branch of the arts in which calculation is required, and few instruments offer a more attractive field for historical study. Dr. Cajori, the accomplished professor of mathematics of Colorado College, has added a valuable contribution to the engineering literature of our time in presenting not only the most complete history of the instrument and its uses, but also giving in historical detail the growth of the instrument, if we may use the expression, to its present high degree of utility. The book should meet much popular favor among all kinds of practical engineers and carpenters, as well as mathematicians and all writers and instructors in arithmetic. It need hardly be added that excise officers and indeed all interested or engaged in exact calculations should have a copy of Dr. Cajori's valuable book.

Trip in Canadian Scenes.

The New York Central Railroad have issued for free distribution an illustrated pamphlet descriptive of the Thousand Islands, and the trip through the Rideau Canal and down the St. Lawrence River to Montreal, Quebec, and up the famous Saguenay River, with the wonderful rock-ribbed entrance towering thousands of feet above the water, Cape Trinity and Cape Eternity.

The folder contains a map of the territory, a list of hotels and boarding houses and detailed information that will aid in the enjoyment of the trip.

Mallet Articulated Compound for the Canadian Pacific

A very interesting form of Mallet articulated compound engine was recently built by the Canadian Pacific Railway at their Angus Shops in Montreal. Mr. H. H. Vaughan, assistant to the vice-president, designed the engine. The engine is of the 0-6-6-0 type, all wheels are driving wheels and the adhesive weight is therefore a maximum.

Our illustration shows the right side of engine No. 1950. Next to the cab are the safety valves, further along is the back sand box, then the whistle, next is the throttledome, then the dry-pipe dome, then the superheater, next the forward sand box and bell. The dry pipe originates in the dry-pipe dome, and runs back to the throttle valve, which is enclosed in its dome. Steam passing through the throttle goes to the superheater, after passing through which it enters outside pipes leading to the high pressure steam chests. This outside piping is heavily lagged and does not move, as the high pressure engine, which forms the rear group, is rigidly connected to the boiler.

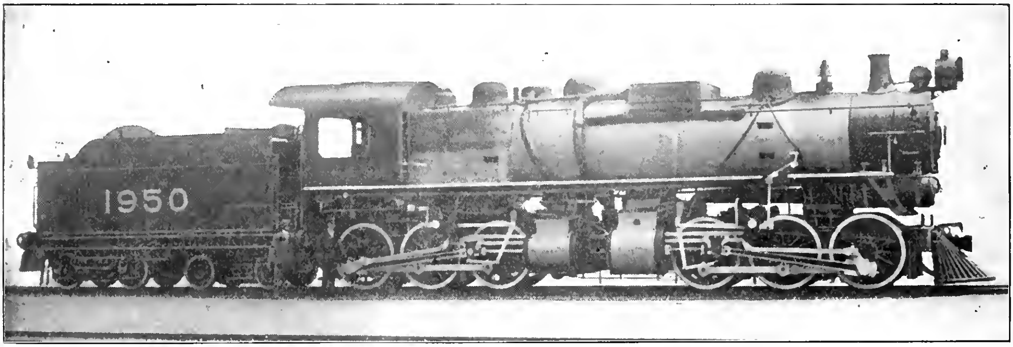
The high pressure exhaust from both cylinders enters a common receiver. This receiver pipe between the two headers extends up beside the boiler about 6 ft. and curves down again under the boiler to a point exactly over the pivot pin of the locomotive frame and at this point a flexible joint is interposed. The receiver is here attached to a header which supplies the low pressure steam chests.

The cylinders are placed front to front so that as the locomotive moves ahead the leading or low pressure engine is backing, as it were, while the high pressure group at the rear is running forward. The high pressure cylinders are 23¼ x 26 ins. and the low pressure cylinders are 34 ins. in diameter, with same length of stroke. The valves are of the inside admission piston type H. P. 11 ins. in diameter and the L. P. is 12 ins. The driving wheels are 58 ins. in diameter, and with 200 lbs. steam pressure the engine develops a tractive effort of 57,400 lbs. The high pressure cylinders have a cast steel saddle which is bolted to the boiler. The boiler at this point is of course under pressure and the saddle is secured by 1¼ in bolts having a taper of 1/16 in. in 12 ins. The holes are reamed to this taper from the inside and the bolts are driven from the inside, their shape making them act like plugs in their own holes. The low pressure cylinders have no saddle, but a small casting is attached to the under side of the superheater chamber. The flat surface on top of the cylinders slides on this casting, but no weight is transmitted here to the low pressure group, the weight being transmitted through a heavy casting back of the smoke box. Walschaerts valve gearing is used on both high and low pressure groups.

The guiding of the locomotive by the front or low pressure group is very cleverly managed. As we said before, the rear group are attached directly to the bailer. The front group swings about the pivot pin in the frame which is in the center of the engine between the high and the low pressure cylinders. The weight-bearing casting at the front is securely bolted to and mounted on the frames, and may be seen in our half-tone illustration between the leading and the second wheel. The upper casting is bolted to the boiler close to the smoke box. This casting is made with three approximately radial paths on it. The two outside paths are provided with friction plates and these have oil grooves connected with an oil receptacle on the top casting. These friction paths are therefore constantly lubricated.

The space between the two radial friction plate paths is 8¾ ins. wide. In this path, which may be called the roller path, there are two wedge shaped blocks having a taper of ¾ in. in 12 ins., and these are set with the thin ends together at the center. These inclined blocks rest on what we have called a roller, but it is in reality about one-quarter of a heavy cast wheel fastened to a shaft at the hub. The rocking of this wheel or roller, turns the shaft upon which it is fastened and the movement of the shaft causes the arms of an equalizer to press down upon a pair of coil springs at one side, and ease up somewhat on the springs on the other side. This roller has a series of teeth which mesh into appropriately spaced holes in the wedge blocks.

In entering a curve if the leading truck was carried over to the left the boiler would endeavor to move straight ahead, but the movement of the wedge blocks to the left would slightly raise the engine on the right side on the incline of the right wedge. The wedge block movement would carry the roller wheel to the left, the equalizers would compress the coil springs on the left side and the sum total of the action of wedge blocks and roller wheel would tend to cause the boiler to come back to the center line of the truck and in this way the guiding of the engine around curves would be effected.



MALLET ARTICULATED COMPOUND FOR ROCKY MOUNTAIN SERIVCE C. P. R.

H. H. Vaughan, Assistant to the Vice-President. Canadian Pacific Railway, Builders.
L. R. Johnson, Assistant Superintendent Motive Power, Angus Shops. Angus Shops, Montreal.

Weight in Working Order—Drivers, 262,000 lbs.; engine and tender, 391,000 lbs.
Wheel Base—Front engine, 10 ft. 4 ins. rear engine, 10 ft. 4 ins.; total engine, 35 ft. 2 ins.; engine and tender, 60 ft. 7 ins.
Firebox—Length and width, 120 x 69⅞ ins.; water spaces, sides, 4½; throat, 5; back, 3½ ins.; thickness of sheets, 5/16, ⅜, ½ and 7/16 in.
Heating Surface—Tubes, 2,605 sq. ft.; firebox, 180 sq. ft.; total, 2,785 sq. ft.; superheating surface, 420 sq. ft.; equivalent heating surface,* 3,415 sq. ft.; grate area, 58 sq. ft.
Tank—Kind, semi-water bottom; frame, sills, center, 13 ins.; sides, 10 ins.; trucks, kind, equalizer; wheel, diameter, 34 ins.; axles, 5½ x 10 ins.; water capacity, 5,000 imp. gallons; coal capacity, 12 tons.

Applied Science Department

The Steam Indicator.

V. Peculiarities in Diagrams.

Diagrams taken from the cylinders of locomotives that are running with the reverse lever near the center and consequently with a short valve stroke and an early cut-off of steam, are subject to irregularities that are apt to be misleading. An example of this kind may be seen in Fig. 3. Generally speaking a diagram of this kind, showing an extra high point indicated by the pencil followed by a sudden dropping, may be safely taken as proof that there is an excessive degree of compression. By compression it will be understood that when the valve closes the exhaust port, a certain amount of steam has been left in the steam port and also in that part of the cylinder not yet traversed by the piston in its approach to the extreme end of the cylinder. This pent up steam may have a pressure of twenty pounds per square inch or even more while the piston may have three or even four inches more to travel before completing its stroke. As the remaining steam that we have referred to is being crushed into smaller bulk by the moving piston, the pressure of the steam so confined increases until in some cases it is higher than the pressure of the steam in the boiler. The indicator, of course, is affected by this extra pressure, and also by the sudden decrease of pressure when the valve opens and allows the pent up steam to expend its extra degree of pressure in mixing with the steam at a lower pressure. In such cases there is usually a tendency to lift the valve from its seat, that is in engines equipped with the sliding valve. In locomotives equipped with piston valves there is a tendency to compress the rings of the piston valves. In both kinds of valves this extra pressure on the valve face has a pernicious effect, the tendency being to injure the valve seat and lead to a breaking or collapsing of the rings.

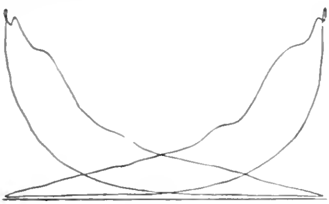


FIG. 3

With locomotives running at high speeds and with a short travel of the valve and an early cut off, it is a physical impossibility to avoid an extra degree of compression. This is caused by the fact that valves when confined to a short stroke necessarily travel at a slower speed, and as we have already stated when the exhaust port is closed that portion of the valve which overlaps the port has to be moved to the point where the valve opens before any release of the pent-up steam can occur. A larger valve stroke and a consequent increased speed of valve movement renders this compressed steam period of shorter duration, that is in comparison with the distance which is being traversed by the piston.

While, as stated, the indicator diagram that we have referred to may be taken as a proof of excessive compression, it is well to remember that the high point on the diagram may arise from the momentum given to the piston and moving parts of the indicator whereby the marking pencil may be raised beyond the real amount of pressure actually at work in the cylinder. This is readily the case if the spring is too light or is weak, or by frequent use has lost much of its original resiliency. The marked improvement in the manufacture of the steam indicators has however given a reliability to the instrument that leaves little to be desired. It remains with those who are interested with the care and management of these fine instruments to see that they are kept in the very best condition. After using, they should be taken apart and carefully cleaned and oiled with a fine quality of oil, after which the parts should be assembled, leaving out the spring, which should be placed in the box separately.

In concluding these brief articles on the steam indicator it may be stated that it is largely by the careful use of this instrument that many of the improvements in valve gearing have been effected. The importance of the lessons that its intelligent use teaches cannot be overestimated. It immediately points out faults in construction and adjustment in valve gearing. To the thoughtful engineer many suggestions have come by carefully scanning the indicator diagrams. Inventors have profited by its use. We close with an illustration, Fig. 4, showing a diagram taken from a locomotive equipped with the Baker-Pilliod valve gear. This diagram comes as near the ideal diagram as can be expected and in view of the fact that the gearing is so constructed that its rigidity remains undisturbed after many months of constant service, it can be readily understood that a locomotive from which indicator diagrams like these may be taken after a lengthened period of service has reached a degree of perfection that it would be extremely difficult to surpass.

Celebrated Steam Engineers.

Wilson Eddy.

As we have already said that the New England States produced many clever mechanics who helped greatly in the development of the locomotive engine, and many of whom are still well remembered by their successors. The Lowell Machine Shops furnished many of these accomplished mechanics with their early training, and all of them took pride in acknowledging the debt of gratitude they owed to the instructors who seemed to possess the happy faculty of giving the young mechanics the right kind of a beginning.

Among these New Englanders Wilson Eddy was long and favorably known as an accomplished machinist and engineer of marked ability. In 1840 he was foreman of the Springfield shops of the Boston and Albany Railroad. His keen, mechanical ingenuity suggested many improvements in the locomotives of his time. These locomotives were mostly modelled on the early English type, and about 1840 he began the construction of new locomotives from his own designs. In 1851, he produced his first locomotive. It was named the "Addison Gilmore," in compliment to the president of the railroad. While the locomotive had much of the English design, there were a number of features peculiarly its own, some of which were afterwards copied by all locomotive builders. The engine had a four wheel truck in front, with a single pair of driving wheels, 6 feet 9 inches in diameter, and a single pair of trailing wheels under the foot plate.

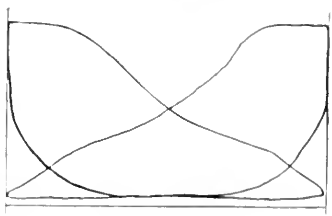


FIG. 4

The most notable improvements were the placing of the horizontal cylinders outside of the frames. It was the first engine constructed in this way. It was also furnished with the first frames in two sections; these were spliced, thereby greatly facilitating the repairing of frames when necessary. His arrangements for placing the cylinders high enough to clear the truck wheels necessitated the raising of the boiler, and while the first appearance of his locomotive created alarm among railway men it was soon discovered that the raising of the center of gravity was a step in the right direction. It effected a considerable saving both in wheel flanges and rails, besides reducing the tendency to spread the rails and jump the track, which were among the worst troubles of the early locomotive builders. Eddy afterwards favored the adoption of two pair of high driving wheels, similar to what is known as the American type of locomotive of our own time.

He introduced a system of oil cups on the boiler head for lubricating the cylinders, and arranged pipes leading to the top of the steam chests to convey the lubricant. These simple contrivances look common enough to us, but Mr. Eddy was the first to introduce such effective conveniences. When he began building locomotives there was a strong prejudice against equipping the locomotives with cabs, but the "Addison Gilmore" gave the cab question its final settlement. It appeared in elegant form, at once a thing of beauty as well as a covering for the enginemen. The boiler was not furnished with a dome, the steam being admitted to the dry pipe through a series of holes. The throttle was a plain slide valve placed in the T-pipe in the smoke box, and was actuated by a rod extending through the dry pipe to the back boiler head.

During a period of nearly forty years Mr. Eddy built many locomotives for the Boston and Albany railroad. A marked feature of his locomotives was the large increase of heating surface. The ratio established by him of cylinder contents to heating surface has been universally adopted, and is a proof of how carefully his experiments along that line had been conducted. In brief, the changes made by him were nearly all in the right direction and have stood the test of time. His locomotives were easy of operation, convenient and comparatively easy of repair, and so properly proportioned that the maximum amount of wear was obtained before any considerable degree of repairs were necessary. In the March, 1898, issue of LOCOMOTIVE ENGINEERING, page 151, we gave a brief account of what was probably the last of the Eddy "clocks," as these old engines were called. This engine was No. 39 on the Boston & Albany and was, when our correspondent saw it, in the Worcester roundhouse of the B. & A.

Questions Answered

WEIGHT ON DRIVERS.

41. E. H., Morton, Pa., writes: I often see in your valuable magazine such expressions as adhesive weight, and weight carried on drivers. Are these the same thing? You seem to treat them as if they were.—A. For all practical purposes they are the same; the expression "weight on drivers" is not exactly correct, for that looks as if the weight of the wheels and rods were not taken into account, which they are. A better form of expresssion than weight on drivers would be "weight on track under drivers," but adhesive weight covers this fully. If you want to get the ratio of adhesive weight to tractive effort, you have to use the weight on the rails below the drivers and this takes in everything not carried by the engine truck or the trailing truck if an Atlantic or Pacific type engine. We admit that the meaning of weight on drivers is better expressed by the expression adhesive weight, because the weight of the wheels, axles and rods counts in such a case.

WRONGLY CONNECTED AIR PIPES.

42. K. N., Wheeling, W. Va., writes: What could be wrong with an H6 brake that works all right with the lone engine, or when coupled to a train, but when the engine is the second one in double-heading, the brake will not apply on this engine, but instead there is a blow at the brake valve exhaust port when the head engineer applies the brakes?—A. As the air pressure escapes at the brake valve only during the reduction of brake pipe pressure originating on the first engine, it is evident that the application cylinder of the distributing valve is open to the atmosphere through the brake valves at this time. The only way in which an opening from the application cylinder to the brake valve exhaust could exist at such a time would be through wrongly connected or crossed application cylinder and release pipes, that is the application cylinder pipe connected to the distributing valve at the connection at which the release pipe should be. To test for this without tracing up the pipes, apply the automatic brake on the lone engine until the cylinder hand on the small gauge shows 8 or 10 lbs., then return handle to lap position and place independent brake valve in application position, and if pipes are wrongly connected, application cylinder pressure cannot be increased and the hand will not show any more pressure than was developed by the automatic application.

CONCERNING TRACTIVE EFFORT.

43. J. E. G., McGehee, Ark., asks: Is there any difference in the tractive effort of two engines each built to the same specification throughout, except one is a ten-wheel engine and the other a consolidated, both having the same mean effective steam pressure?—A. The name of the 2-8-0 type is consolidation, not consolidated as you wrote it. If these engines have the same mean effective pressure, the same sized wheels, and the same sized cylinders, the calculated tractive effort of each will be alike. See article on "Tractive Effort Analyzed" by Mr. Geo. S. Hodgins, page 136 of our April issue. You will see that the tractive effort formula takes no note of the number of wheels an engine has. It is concerned only with size of drivers, mean effective pressure and cylinders. As a matter of fact it is not likely that a ten-wheeler and a consolidation would be designed so as to be exactly alike in these respects. The 2-8-0 type is usually designed with large cylinders and small wheels, because this gives high tractive power, and the total weight on the drivers can be and usually is heavier than that on the drivers of the 4-6-0. In this connection see, also, article on "Factor of Adhesion," page 107 of our March paper. In that article you will see that when a designer has decided upon the tractive effort necessary for the work his engine will have to do, he fixes the sizes of cylinders, and wheels and boiler pressure. The factor of adhesion practically indicates to him the kind of engine he should build. If a ten-wheeler was properly designed and the same tractive effort given to a consolidation, it is probable that the 2-8-0 would not work up to her full capacity. If the 2-8-0 engine was properly designed and same tractive effort given to a ten-wheeler, it is quite possible the ten-wheeler might be over-cylindered.

LEAKAGE INTO BRAKE PIPE.

44. K. N., Wheeling, W. Va., asks: On an engine equipped with the H6 brake the gauge shows 70 and 90 lbs. with the handle in running position, but after a service application of the brake on the lone engine, the black hand slowly rises to 70 lbs. If this rise in brake pipe pressure is caused by main reservoir pressure leaking into the brake pipe, how is it that the hand goes no higher than 70 lbs.?—A. Sometimes the inner mechanism of the gauge gets in such condition that the hands will not move higher than a certain figure, regardless of the pressure that happens to be in the reservoir or brake pipe. If the gauge is correct and the action you mention occurs, there must be a leak into the brake pipe while the handle is on lap position and the leak must be from a source that contains but 70 lbs. pressure, and as the feed valve maintains 70 lbs. in the feed valve pipe, while the valve handle is on lap position, it is evident that the leak must be

from the feed valve pipe into the brake pipe, which could occur through the rotary valve seat gasket, or through a cut on the face of the rotary valve seat where it forms the bridge between the feed valve pipe and brake pipe ports.

TRAIN RESISTANCE.

45. F. T. S., Loyalton, Cal., writes: I would like to ask you how to figure the tonnage that a locomotive will haul. Knowing the grade, degree of curvature, what is the rule for calculating the tonnage?—A. First find the tractive effort of the engine, take off about 10 per cent for internal friction of the engine itself. This gives the effective pull on the train, which in this case includes the tender. The rule for train resistance as quoted by Dr. Sinclair, in "Locomotive Engine Running and Management" is about 6 pounds per ton to move a car along level track on a calm day at between 10 to 20 miles an hour. Divide the effective pull delivered by the engine by 6 and the quotient is the number of tons weight in the train. If ascending a grade take this weight of train and multiply it by the vertical rise of the grade and divide by the horizontal length. If the grade is 1 in 100 multiply by 1 and divide by 100. Deduct this result from the weight of the train previously found, and that gives weight of train this engine can haul up a 1 per cent grade. If the train is on a curve ascertain how many degrees of curvature the train occupies and deduct one per cent for each degree. In this sense each degree is the 1/360 part of a circle. If the train occupies 4 such parts or four degrees, deduct 4 per cent. Most of the calculations from which the foregoing figures are derived were made many years ago on the track and with the cars of that time, so that one can hardly expect more than an approximation to present day results. No wind resistance is here taken into account

Potential Energy.

By George S. Hodgins.

The other day I bought what is known as a dollar watch. It is a stem winder and a stem setter and I intended to use it on my office desk. As I wound it up the thought occurred to me, it only takes about six or seven seconds to wind up the watch and it will then run for a day. The slight resistance offered to the rotation of the stem is easily overcome, yet in those few seconds the watch is given the power which will move the hands during the succeeding hours.

As a matter of fact the main spring has been coiled closely, and this has slightly altered the position of the small particles of steel of which this spring is composed, and they are now arranged in a new order with reference to one another, some exerting a compressive strain, others one of tension. The molecules of the spring have undergone some distortion. This new arrangement of particles is not stable and would not last, even as long as it had taken to coil the spring, if it was not forcibly held by the escapement. This is so designed that by the rhythmic swing and sway of the tiny balance wheel only a minute amount of uncoil is permitted each second to the tense spring. Thus the second-hand ticks round its small circle, and the larger hands count out the minutes and the hours.

The forcible rearrangement of the particles composing the spring, caused in winding the watch, endowed that spring with energy, or the power to do work. This energy was for the most part in the stored up state and it is then spoken of as potential energy as distinguished from the moving form in which the work is actually being done. The moving form is called kinetic energy, while the stored up power is energy in the waiting-to-be-used, or potential form. The energy which was stored in the spring may be called the potential energy of molecular distortion.

Another and equally familiar exhibition of potential energy is when the hammer of a drop-forging machine is drawn up to the top of the guides against the ever present force of gravity. The hauling up of the hammer is work pure and simple, as it is weight moving through distance, and can be calculated in foot-pounds as soon as the distance traversed and the avoirdupois of the hammer is known. While the hammer is high in air waiting to descend, it has the potential energy of position with reference to the dies below, and as soon as the detent lets it fall it slides down with great swiftness, giving back with slight friction on the guides and in the blow, the kinetic energy consumed in raising it. The blow on the dies shows the work done in the forming of the piece and in the flow of hot metal as it takes the desired shape.

In another column of this issue we have referred to a railroad collision by which one engine and part of another was loaded on a tank frame and a flat car. This loading was the expression in the kinetic form of the energy which had been stored up in the moving trains, and unless this potential energy had become active in the lifting of the engines and the breaking up of many cars, it is certain that it would have developed an enormous amount of heat.

This very principle was made use of in the design of what was known as the Palliser shell, used in warfare. This projectile was made of cast iron with a chilled point. The interior of the shell was hollow and filled with the bursting charge. The Palliser shell was not provided with any fuse, but when fired at high velocity at the solid armour plate of a battle-ship, it was believed that the sudden stoppage of the projectile would develop sufficient heat to ignite the bursting charge and so explode the shell.

We have briefly considered potential energy under the names of molecular distortion and of position, but there is another form of potential energy which perhaps comes nearer to us as railroad men than either of the others. The coal on the tender of a locomotive possesses energy in the potential form, for it is the coal from which the heat comes which generates the steam, which drives the engine and pulls the train. Coal is the result of natural processes which have gone on in the world thousands of years ago. For all practical purposes we may say that the plant life of the long by-gone ages did what plant life does to-day. In the process of growth, plants, by means of their leaves, in the presence of the warm and actinic rays of the sun, take up the carbon from the carbonic acid of the air and in doing so liberate oxygen. This is briefly the barest outline of the process, but it gives us the key to the apparent mystery of the energy contained in the coal. The plant life which flourished long ago in surpassing luxuriance was in many quarters of the globe not permitted to rot and be destroyed. It was buried under tons of mineral matter which held it compressed and crushed together for countless ages, but unaltered in its fundamental chemical composition. The oxygen of the air was, in all the intervening years, ready to reunite with the carbon of the coal and in such chemical union to give back in the form of heat, the energy expended in separating them in the days when the earth was young.

The coal on the tender of a locomotive has the potential energy of chemical separation and this energy is liberated when the appropriate temperature conditions for the union of the carbon and oxygen are present in the firebox. Coal has this energy in very concentrated form. The heat and light and violet rays of the sun poured lavishly upon the plant life of a remote past, and which was then slowly stored up in fiber, twig and leaf, overthrown and sunk beneath clay and rock, buried and preserved for our use, is now liberated and changed from the potential to the active form in the few short hours that it takes a modern train to rush from New York to Albany or speed from Philadelphia to Pittsburgh.

A very satisfactory form of luminous paint is made from a mixture of ground oyster shells and sulphur. When in use this paint absorbs light during the day time and gives it out in the dark. Paint of this kind is useful for many purposes.

Air Brake Department

Conducted by G. W. Kiehm

The seventeenth annual convention of the Air Brake Association was called to order at the Hotel Denison, Indianapolis, Ind., Tuesday, May 10, 1910, by the presiding officer, Mr. J. R. Alexander. After the usual routine of business had been transacted, the reading of technical papers was taken up, the first of which was "Tests to determine the effect of low temperature on air-brake hose and coupling gaskets," by Mr. W. J. Hatch.

The object of the tests was to decide on a specification of air hose and air hose gaskets that would reduce the tendency of the hose to stiffen and the gaskets to become hard and create excessive brake pipe leakage, during extremely cold weather. While the subject is not of so much interest to Southern railroads, it is a very serious one on Northern lines, where extremely cold weather prevails during the winter months. Very often brake pipe leakage resulting from frozen hose and couplings becomes so excessive that the number of cars to be hauled per train must be reduced in order that the train may become charged with air and at such times the earning capacity of the locomotive is reduced by this leakage from frozen hose.

The principal object of the tests was to secure hose that would not freeze or if they did freeze would not freeze so stiff as to create the amount of leakage caused by ordinary hose freezing. Special hose were submitted by the manufacturers for these tests and apparently some very satisfactory hose were secured and as a result some very rigid specifications for air brake hose were adopted.

The second paper presented was "Air pump and main reservoir capacity for freight service," by Mr. P. J. Langan. It is a well known fact that some very strange ideas concerning main reservoir capacity are prevalent and it is also a fact that in some instances this matter has been given no consideration whatever when a locomotive was equipped with its main reservoir.

In some instances main reservoir capacity is too small and in some instances it is too large, and it is evident that some locomotive builders or designers are laboring under the impression that it is impossible to have too much main reservoir capacity, while on some locomotives there does not seem to be enough available space for main reservoirs of sufficient capacity.

Mr. Langan has by a series of tests determined to his own satisfaction the proper main reservoir capacity to meet the conditions he is confronted with personally, and they can be generally applied. At the same time it was recognized that air pump capacity bears some relation to main reservoir capacity, and having fixed upon sufficient main reservoir capacity, tests were also conducted to determine the air pump capacity necessary to handle different lengths of trains on descending grades.

By a series of tests conducted under normal or average conditions it is shown very clearly that any of the different sized pumps can perform but a certain amount of work in a given length of time and no more, and the tables and diagrams show exactly the length of time required for the 9½-in. pump, two 9½-in. pumps, the 11-in. and two 11-in. pumps to charge different lengths of trains, or rather charge different numbers of car-brakes. There is a great deal of information concerning the time required to charge and recharge trains of different lengths when the pump and main reservoir capacity are sufficient to meet present operating conditions.

SECOND DAY'S PROCEEDINGS.

The first paper presented at the second day's session was on the subject of "Air Pump Piping," and had particular reference to size of air pump steam pipe, back pressure on air pump piston, and the disposition of exhaust steam from air pump. Recommendations relating to the size and installation of steam pipes were derived from shop tests and back pressure on the air pump exhaust due to pipe friction alone was determined by means of indicator cards taken from the exhaust pipe at the same time.

Tests to determine the back pressure on the air pump piston resulting from piping the air pump exhaust into the engine cylinders exhaust cavity were derived by means of gauges attached to exhaust pipes while locomotives were in service, hauling various sized trains. The paper also contains suggestions concerning the arrangement of steam pipes with a view of obtaining an equal distribution of steam and oil when two pumps are used per locomotive.

A unique feature in connection with the paper is that a member of the committee, Mr. John S. Barner, New York Central Lines, has designed an air pump exhaust nozzle for use in the front end of a locomotive that will entirely eliminate the back pressure on the pump exhaust and at the same time muffle the annoying thump of the pump exhaust, while another member of the committee, Mr. F. F. Coggin, has designed and perfected a by-pass valve for obtaining air-pump exhaust steam for car-heating purposes without creating any additional back pressure on the air pump piston, beyond that due to pipe friction. The paper illustrates this valve and contains a sketch of the air pump exhaust nozzle used during road tests and also gives excellent reasons for discontinuing some of the present-day practices concerning air pump piping. During the laboratory tests, the number of strokes obtained per minute and the resultant capacity of the pump was noted, also the capacity of two pumps per locomotive under different steam pipe arrangements.

During the discussion there appeared to be some sentiment in favor of a restricted flow of steam, for the sole purpose of preventing the pump or pumps from being run at an excessive rate of speed, and even at this late day it is not generally recognized that there is any such thing as a recommended speed or a maximum permissible number of strokes per minute during ordinary service conditions. The second paper of the day was "Air Brake Instruction," by a committee composed of Messrs. T. T. Clegg, chairman; T. F. Lyons, H. A. Wahlert, H. H. Burns, G. A. Wyman. The paper deals with air-brake instruction car equipment, methods of instruction, examination and rating, length of time between visits of instruction cars and road work of air-brake instructors. During the discussion all the air brake instructors present felt it their duty to outline their own individual systems of instruction and as a result the discussion was not closed. The paper afforded an opportunity for comparing the methods of instruction employed by the various instructors.

The paper, while enumerating some of the qualifications the instructor must possess, ventures the assertion that an air-brake instructor may be secured either from shop or road service; however, attention was also called to the fact if anything jarred upon a gray-haired engineer's nerves it was receiving instructions from a shop man, and if anything would jar a mechanic it would be to have a locomotive engineer tell him how to fit up and repair air-brake apparatus.

When the hour set for the topical discussion arrived, Mr. George Christensen, of the Johns-Manville Company, was permitted to read a paper entitled, "Brake cylinder leakage, causes and remedies," which was a very hearty endorsement of the J.-M. brake cylinder expander ring. While dwelling upon the problem of brake cylinder leakage in general, the chief aim of the paper was to show an increased brake cylinder efficiency as derived from the use of the J.-M. ring.

At 3 p. m. Mr. Walter V. Turner, chief engineer of the Westinghouse Air Brake Company, delivered an illustrated lecture upon the subject of "Brake operation and manipulation in general freight service." Mr. Turner received the same affectionate greeting that is always accorded him by the Air Brake Association. The members always anticipate something new in the line of air brake information when he speaks, and he never disappoints his audience. He is always able to prove any assertion he may make, and a remark made by Mr. Turner is never questioned by the members of the association.

This lecture was illustrated by slides thrown on a screen; diagrams and charts were used to convey the ideas Mr. Turner wished to impress upon the minds of his hearers. The first part of the lecture referred to brake cylinder and retaining valve leakage and the brake cylinders on cars sent to the shops at Wilmerding to be loaded or unloaded were tested in an effort to find the general conditions of brake cylinders. The cars were those of various roads and were tested just as they arrived regardless of whether they were new or old. The charts taken from the recording gauge used on those brake cylinders show an alarming state of affairs in connection with brake cylinder leakage.

At this time the old method of testing for cylinder leakage by noting the receding movement of the brake piston, is shown to be worthless. The charts make it plain that brake cylinder leakage can be accurately noted only by the use of a gauge and that the only correct way to test for cylinder and retaining pipe leakage is to use a gauge at the retaining valve. Retaining valves to which air gauges can be attached are being manufactured, and two railroads are equipping all their cars with them. After calling attention to the fact that air brake men are dealing too much with the effect instead of the cause, Mr. Turner passed on to the handling of freight trains.

This subject was handled in a general but in a very complete way and nearly all the information given is printed in a special publication No. 9015, issued by the Westinghouse Air Brake Company, which is a copy of a paper read before the Chicago Railway Club, in December, 1909.

Mr. Turner read a portion of this paper and explained the causes and conditions which produce shocks and break-in-twos during brake manipulation. Attention was called to practically every difficulty that is encountered in stopping and starting a freight train and in all cases the most practical remedy was given. Like all other papers prepared by him, this one is so complete that there is no room left for any discussion and at the conclusion of the address his audience arose to their feet and vigorously applauded.

THIRD DAY'S SESSION.

After the conclusion of the discussion on "air brake instruction," Mr. T. L. Burton read by far the most technical paper that has ever been presented before the Air Brake Association.

Under the title of "Stopping Passenger Trains through the Medium of an Emergency Application of Air Brakes." Mr. Burton has given a complete analysis of the factors entering into the problem of stopping a moving train of cars.

There is given the thorough definitions of the terms, work, power, energy, inertia, motion and force after which gravity and velocity are treated, there are about 50 formulas submitted for use in calculating the effect of the forces considered. While the paper is of a theoretical nature, it illustrates a practical application of the formulas in determining time and distance in stopping trains.

The paper was endorsed and commented upon by Messrs. Turner, Nellis, Dudley, Owens and Kelly, and it will add greatly to the interest of the printed proceedings of the meeting and those who wish to learn the finer points and get to the bottom of the air brake business will find material for a full year of hard study in this paper. The members in discussing the paper pronounced it complete in detail and that the formulas will be accepted as correct for some years to come. Mr. Burton was given a vote of thanks by the association for his excellent paper.

Mr. C. P. McGinnis next read a paper entitled "Maintenance of Brakes in the Northwestern Territory." He outlined the methods employed and the results obtained while caring for triple valves and brake cylinders under the extraordinary conditions encountered by the railroads in this territory. It appears that instead of repairing cars and car brakes at shops the repairmen are compelled to rig up repair cars and go out on the line at certain seasons of the year and repair cars that are temporarily stored on side tracks and look after the brake equipments at the same time.

The afternoon session consisted of a smoker or the informal meeting which originated at the St. Paul convention in 1908. Those meetings are the most interesting and to some members the most instructive feature of the annual conventions. It is a meeting in which the new members feel free to get up and tell their troubles, and at the same time learn what some one else has discovered along the same lines.

The first topic of this session was prearranged because of some slight misunderstanding on the subject of train handling. Mr. Turner very kindly arranged to be present at this meeting and Mr. P. J. Langan, who has made a series of tests with a dynamometer car in order to obtain some information along the line of slack action and shocks to trains, was the first speaker. He requested that Mr. Turner take notes of his statements and those of the members and sum up the conclusions and clear up any differences of opinion that might arise.

Mr. Langan stated as his reason for asking Mr. Turner to arbitrate, that Mr. Turner is the greatest of the air-brake experts in this country and is considered the one perfect instructor.

There is a reason for the association's sentiment regarding Mr. Turner and it is not what might be termed hero worship, but the facts in the case are that he lives a few years in advance of the railroad air-brake experts, consequently, when the air-brake man discovers a new problem and presents it, Mr. Turner has already anticipated it and solved the problem by elaborate tests and as he derives his explanations from chronograph, dynamometer car, and recording gauge records naturally his answer is final and unquestioned by air-brake men.

There is no stenographic record of what was said during this session so that it will not appear in the printed proceedings of the convention, but we are able to present our readers with the general sense of the meeting in the discussion on train handling. What we give here on this subject has been agreed upon by the members as being the best practice.

Air-brake men realize that train handling is one of the broadest subjects and one of the most important and is always governed to a great extent by local conditions, but some general instructions are applicable to most ordinary conditions, and in laying down rules to be adhered to in train handling, the worst possible condition and make-up of trains are taken as a basis. About the most difficult train to handle successfully with the air-brake is the long mixed trains of loads and empties with the empties on the rear end.

The first of the rules that should be adhered to under all conditions is, "When it is desired to apply the brakes the brake valve handle should be moved from running to service position promptly without any hesitating on lap position." Second is "the initial reduction of brake pipe pressure should be what is termed a light one, or, one that will move all the brake pistons it is possible to move without building up sufficient brake cylinder pressure to create enough retarding effect anywhere to part the train."

With loads ahead and empties in the rear, brakes should be applied while engine is using steam, the object being to keep the the train stretched. When the speed of a train has been reduced to about 8 miles an hour following the first reduction, a heavy reduction should then be made with a view of bringing the train to a halt while the brake pipe exhaust port is open and discharging brake pipe air. In the event of loads in the rear and empties on the head end, the throttle should be closed before the brakes are applied, and, after a reduction just sufficient to run through the train, time should be allowed for the slack to adjust itself. In a case of loads and empties indiscriminately mixed the direction the slack will run should be observed and the brake used accordingly.

As light a reduction as possible means, one just sufficient to move the brake pistons, on a 25-car train it would be 4 or 5 lbs., on a 50-car train, 6 or 8 lbs., and on a 75-car train about 10 or 11 lbs.

With mixed trains at speeds of 18 or 20 miles an hour or more the reduction should not be heavy as it is undesirable to produce an equalization of auxiliary and brake cylinder pressures at such speeds during service stops as there would be no object in bringing the train to rest while the brake exhaust port is open, if the pressure has been reduced beyond the point of equalization.

In handling solid trains of all loads or all empties it is plain that if the rules laid down cover the worst conditions they will suffice for the better conditions or if a certain method of braking can be successfully employed in stopping trains that are hard to handle the same method could be used in handling a better make up of trains.

In the case of undesired quick action emanating from a triple valve, the "dynamiter" should of course be cut out, but if for any reason whatever it cannot be found, the speed of the train should be kept up until near the stopping point and the brake valve handle used in emergency position. The object of such a method is to start the emergency application on the head end of the train in case it is known that a triple will work in quick action and it may be termed as "beating the triple valve to it."

Under modern operating conditions the method of releasing brakes is of almost as much importance as the application and with certain make up of trains more so. We have reference to the release of brakes while the train is in motion.

The first recommendation is intended to cover the worst cases of long trains and the throttle should not be opened until one minute after the valve handle has been moved to release position. With modern locomotive pump and main reservoir capacity the brake valve handle should not be allowed to remain in release position for a period of over 15 seconds. After this release the handle should be returned to running position and again moved to release position for a few seconds as the overcharge causes the re-application of the head brakes or at about the time it should occur. It is absolutely essential that this be adhered to in handling long trains and under no circumstances should the valve handle be brought to running position at a period of from 25 to 60 seconds after the handle is first placed in release position.

If the brakes are to be recharged with the handle in release position on descending grades it does not conflict with the 15 seconds time in release position as the handle will not be moved from release position until the application is desired. The sole object in placing a time limit on the handle in release position is to prevent so far as possible an excessive overcharge on the head end of the train.

We would remind our readers that the improper release on long trains can produce undesired quick action. It is possible to overcharge the forward portion of a long train to such an extent that when the brake pipe supply is temporarily cut off by a return to running position, the rear cars in recharging will sometimes absorb the brake pipe pressure on the forward cars rapidly enough to cause undesired quick action. It is understood that long trains are here being considered, the methods for handling short trains having been agreed upon some years ago. It is also understood that brakes should not be released at very low speeds and the handle of the brake valve should not be placed in release position while brake pipe air is still flowing forward and escaping at the brake pipe exhaust port.

While it is to be regretted that the remarks made at this time were not recorded Mr. Turner has covered the subject thoroughly in his lecture on "Brake Manipulation" which will appear in the proceedings. After a discussion upon freight brake maintenance the smoker was adjourned.

FOURTH DAY.

The fourth day's session opened with the Association's recommended practice by the standing committee of which Mr. S. G. Down is chairman. This was the concluding paper of the session and at its close the Association was confronted with an unusual order of business.

An application for membership in the Air Brake Association, bearing the name of Mrs. J. A. Parkins, was presented. It was endorsed by the names of Messrs. W. V. Turner, J. R. Alexander and T. F. Lyons. Mrs. Parkins was examined with a view of ascertaining her knowledge of air-brakes by Mr. Turner and Mr. Alexander.

The examination covered the subjects of car brake equipment, triple valve operation, construction and leverage, and Mrs. Parkins answered correctly every question asked her. Mrs. Parkins, being prepared, answered a series of questions on the subject of leverage and foundation brake gear that would have caused many a member considerable uneasiness and the vote to admit her to membership was unanimous, and to the seventeenth annual convention belongs the honor of admitting the first lady to membership. Mrs. Parkins is the wife of Mr. J. A. Parkins, air-brake instructor, Santa Fe system, and has derived her knowledge of air-brakes from assisting her husband in the instruction car and working out problems in leverage and car equipment. Mrs. Parkins is a student of the air-brake and a constant reader of RAILWAY AND LOCOMOTIVE ENGINEERING and passed through her examination with the same degree of confidence that is manifested by all of "R. & L. E." students of the locomotive when up for examinations for promotion.

OFFICERS ELECTED.

The following officers were elected for the ensuing year: President, T. L. Burton, C. R. R. of N. J., and P. & R.; first vice-president, W. J. Huntly, C. & O. R. R.; second vice-president, H. R. Wahlert, Tex. Pacific; third vice-president, J. F. Slattery, Denver & Rio Grande; secretary, F. M. Nellis, W. A. B. Co.; treasurer, Otto Best, N. C. & St. L.

Question About Excess Pressure.

W. R. B., Tottenville, N. Y., writes: Where is the excess pressure of the brake system stored and what is its use?—A. The pressure that is referred to as the excess, is stored in the main reservoir on the locomotive. It is a pressure, a number of pounds in excess of that with which the brakes are being operated and it is used as a driving head to promptly release brakes and recharge the brake system.

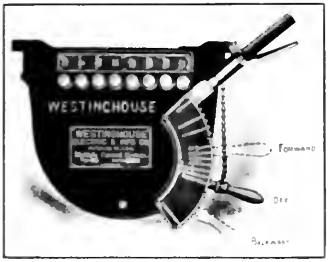
There are some curious phenomena noticeable in connection with revolving bodies. For instance, an emery wheel out of true will make violent vibrations when revolving at slow speed. As the speed rises the wheel revolves smoothly. At 300 revolutions the heavy part will lurch out as may be proved by holding a piece of chalk within touching distance.

Electrical Department

Running a N. Y., N. H. & H. Electric.

By W. B. Kouwenhoven.

The New York, New Haven and Hartford Railroad, which connects many of the New England cities and towns with New York City, does not possess a terminal of its own in New York, but shares the N. Y. C. terminal known as the "Grand Central Station." The New Haven also uses the Central tracks as far as Woodlawn, where its own begin. In 1905 the New Haven changed the motive power of the road from steam to electricity as far as Stamford, installing an 11,000 volt, 25 cycle, single phase alternating current system. Prior to this, however, the New York Central had installed a 600 volt direct current system on their lines. The New Haven was therefore compelled to not only run on alternating current but on direct current as well. The reader is referred to pages 137 and 138, and pages 401 and 402 of the 1909 volume of Railway and Locomotive Engineering for a description of the New Haven installation and equipment. At present the road is continuing the electric installation to New Haven.



PLAN OF MASTER CONTROLLER.

The New Haven electric locomotives are equipped with four motors, connected permanently in pairs, each pair operating as a unit. The crew of one of these locomotives consists of two men, the engineer and his helper, or fireman. Wherever electric locomotives are used to replace the steam locomotives the same number of men in the crew is necessary. It has been the experience of the New Haven Road that many of the engineers who ran steam locomotives in passenger service have had no difficulty in adapting themselves to the changed conditions.

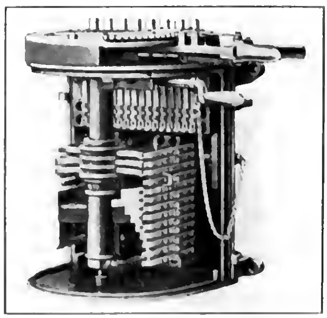
Before describing the operation of one of these New Haven electric locomotives, and the duties that fall to its crew, it is necessary that the reader should first form a mental picture of the equipment. The equipment naturally separates itself into two parts, one, the motor control apparatus for making the various steps in the application of power to the motors, and the other, the master control apparatus for handling the motor control. Each of these divisions can be further divided into those parts that are used only when running on direct current, those used only on alternating current, and those that are common to both.

The equipment of the motor control for running on direct current comprises four third rail shoes and a trolley that is located on the roof at the center of the locomotive, for collecting the current. From the collecting devices the current passes through a main switch and a circuit breaker. Then it passes through the contactors, or unit switches, which are divided into three groups, through a set of resistance grids to the motors and down to the track. There are six switch groups, three to each motor unit. Besides the apparatus mentioned there are also two direct ammeters, one to each pair of motors and a direct current wattmeter which gives the total direct current power consumed by the locomotive.

The alternating current collecting devices consist of two pantagraph trolleys located on top of the cab at either end of the locomotive. From the trolleys a high-tension cable is led down in an iron pipe to two oil circuit breakers or switches. From the oil switches the current passes to two auto-transformers which are simply transformers provided with nine taps, which are connected to the windings at intervals, thereby providing a series of voltage steps, for accelerating the motors. The alternating current from a transformer goes through three preventive coils; small transformers, which are used in making the connections to the transformer taps. The same three switch groups that were mentioned above serve to make the connections of the preventive coils to the transformer taps in the proper sequence. One oil switch, one auto transformer, three preventive coils and three switch groups belong to each motor unit; there being an exact duplicate for the other motor unit. There is also provided an alternating current ammeter to each unit for registering the rate at which current is taken by the locomotive and one wattmeter for recording the total amount used by both units.

The same master controller serves to run the motor on both alternating and direct current, with the aid of what is known as a change-over switch for changing the connections from direct to alternating currect and vice versa. The master controller is provided with two handles, a control lever and a reversing lever, which is removable. A plug, which must be inserted in a socket in the master controller before the locomotive can be run, is attached to the reverser handle by a chain.

A set of relays is also provided for interlocking the control circuits so that it is impossible simultaneously to throw both direct and alternating current into the motors or any apparatus. There are three relays in the set, one for direct current and two for alternating; one for each transformer. When the current is off the armatures the relays fall to their lower positions. If direct current is thrown into the locomotive the direct current relay (the large one) raises its armature, and the control circuit for direct current finds its way through the upper contacts of this relay and through the lower contacts of the other two. On alternating current the two other relays raise their armatures while the direct current one remains down, and the control circuit for alternating current finds its



MASTER CONTROLLER WITH COVER REMOVED.

way through the upper contacts of the first two and through the lower contacts of the third. If, by any means whatever, alternating current should enter the locomotive while running on direct current, one or both of the alternating current relays would become excited and raise its armature, thereby opening the direct current control circuit, cutting off the current from the contactors, causing them to drop and to cut off the current from the motors. The same conditions would result if direct current found its way into the locomotive when operating on alternating current.

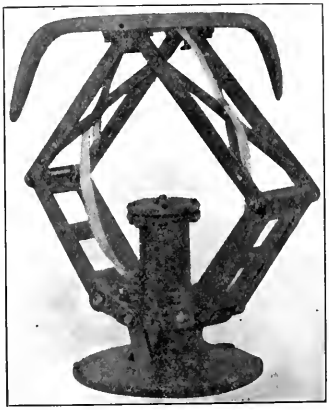
All of the switches or contactors in the switch groups, and a number of other switches, besides the third rail shoes, direct, and alternating current trolleys are worked by compressed air, controlled by electro-magnet valves, some of which are in turn operated by the master controller and the others by a set of push buttons or small switches provided for the purpose. The compressed air for this purpose is taken from a control reservoir, in which a pressure of from 70 to 80 lbs. is maintained, and which receives its supply from the main reservoir through a pressure reducing valve. The current for operating the electro-magnet valves is drawn from two 20-volt storage batteries, one of which is in use while the other is charging. Storage batteries require direct current for charging purposes, and because, for the major part of the run the locomotives operate on alternating current, a small motor-generator set is installed to provide direct current for the batteries. The motor-generator set consists of a small alternating current motor driving a small direct current generator, which provides the necessary current.

The control circuit wires are grouped in a train line and brought out in coupler sockets at each end of the locomotives. Jumpers fitting these sockets are provided which make it possible to connect two or more electric locomotives together and to run them as a single unit in charge of the engineer in the cab of the first one.

One of the novel features of the equipment is that each motor unit is provided with a blower which consists of a motor driven fan. The purpose of these blowers is to drive a strong current of air through the motors and transformers and resistance grids, in order to keep them cool. This artificial cooling results in a marked increase of the hauling capacity of the locomotive. Electric thermometers are placed in the motors and at any time that the engineer desires he can tell exactly what the temperature of any motor is by pressing the button for this purpose. Another feature is the arrangement of the equipment, this with the exception of the driving motors, is all placed inside the cab, even the air compressors, the blowers, the main and control reservoirs are to be found there. The apparatus that belongs to each motor unit is arranged on separate sides of the cab, where it is readily accessible and can be closely watched by the engineer and his fireman.

Whenever the electric locomotives are standing idle in the roundhouse in the alternating current zone the reverser handle with its plug should be removed from the controller by the engineer and returned at the terminal office. It should never under any circumstances be permitted to remain on the locomotive. The operating handle should be left in the off position. When the engineer leaves his charge for the night in the roundhouse, he should see that both the alternating and the direct current trolleys are locked down, that the third rail shoes are folded up out of the way, and that both oil switches and the direct current main switch, and all other switches are open and that the hand brake is set. If the locomotive is standing idle in the direct current zone everything should be left in the same way except that the third rail shoes should be down in contact with the third rail.

In preparing to leave the roundhouse in the morning the engineer must first make sure that the safety chains are unhooked from the alternating current trolleys. These chains make dead grounds with the trolleys and are used to protect the engineer and his helper if they should be



DIRECT CURRENT TROLLEY RAISER.

required to go on top of the locomotive. He enters the cab, makes sure that both the oil switches are open, and proceeds to test the two sets of storage batteries, by use of a 20-volt lamp supplied for this purpose. This is done by holding one wire from the lamp on one blade of the double pole battery switch, and the other wire on the other blade; if the lamp lights up to full brightness the engineer knows that the battery is all right, but if it burns dull he knows that the battery needs charging. If both batteries are in good condition the engineer throws the battery switches so as to use No. 1 battery on the odds days of the month and No. 2 on the even days, otherwise he throws the switches so as to use the stronger battery and charge the weaker one.

After the engineer has completed his battery test, he inserts the controller plug and the reverser handle in the master controller and proceeds to raise the alternating current trolleys. This is done by pressing the buttons marked "A. C. Trolley Down" and "Shoe and Trolley Unlock," releasing the "A. C. Trolley Down" button first. The trolleys are raised by spring pressure and are held locked down by air pressure. If, when the engineer presses the buttons, the trolleys fail to rise it indicates that there is not sufficient air pressure to unlock the trolleys, and the engineer must use the hand pump provided to unlock and raise trolley No. 2.

As soon as the trolley makes contact with the overhead wire, the engineer closes both alternating current circuit breakers, energizes both transformers, and sees that the change-over switches are thrown to the alternating current position. Then he starts the air compressor and watches the gauge, to see that the compressor automatically cuts off when 130 lbs. pressure is secured in the main reservoir, and that the compressors start up again when the pressure falls to 120 lbs. He next tests the bell, sanders and lights by pressing the buttons actuating each and closing the proper switches, and he also lowers and raises the alternating and direct current trolleys and the third rail shoes several times to make sure that they operate properly.

Next the engineer must test the control for alternating current. Before proceeding with the test, however, he must first see that there is at least 70 lbs. on the control reservoir, and then open both circuit breakers, throw the reverser handle to the forward position and proceed to notch up the operating handle, meanwhile his helper watches the switch groups to make sure that the proper contactors come in at each notch. When this is completed the engineer should return the operating handle to the off position, throw the reverse lever to the backward position and repeat. The test should also be made using the other controller.

If everything is satisfactory he should return the handles to the off position and close both oil circuit breakers again. Then either the engineer or his helper should see that the sand boxes are filled, and that there is the proper complement of spare fuses, tools, etc., on the locomotives. The engineer starts the motor-generator set by closing the snap switch provided for the purpose, and closes the knife switch for charging the proper storage battery. He inspects all fuses and makes sure that the direct current main switch is open and that the short circuiting switch, whose use will be explained later, is also open. He tries the brakes on the locomotive to see if they set and release properly, and is then ready to proceed. These tests must all be carefully and intelligently made in time to remedy defects if any are found to exist. This guards against engine failures.

Pacific Type Engine for the Chicago, Burlington & Quincy

The most extensive use of superheaters in the United States, is at present found in the middle West, especially on passenger locomotives. The policy of the Chicago, Burlington & Quincy Railroad with regard to the use of superheated steam, is shown by the fact that this road has recently received from the Baldwin Locomotive Works fifty Pacific type locomotives equipped with Emerson superheaters. These engines are designated by the railroad company as class S-2, and are the latest development of a series of Pacific type locomotives which have been highly successful.

With 69-inch wheels, a tractive force of 34,500 lbs., and a liberal factor of adhesion, the new engines are well fitted for handling the heaviest class of passenger traffic.

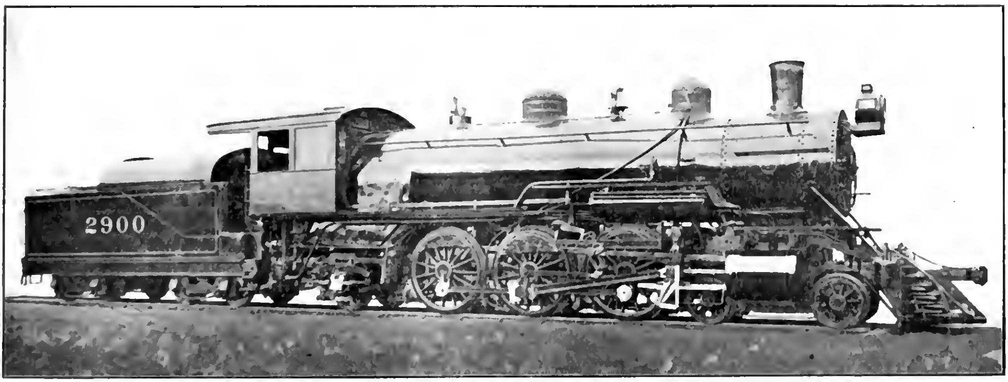
The boiler is of the extended wagon-top type, and its design presents several features of interest. The barrel is composed of three rings, the first of which is tapered, while the dome is placed on the middle ring. The longitudinal seams are butt jointed, with eight rows of rivets. The outside welt strips cover four rows. In accordance with the practice of the builders, the seams are welded at the ends; and on the middle ring the seam is welded throughout its entire length on either side of the dome opening. The firebox is radially stayed with four rows of expansion links supporting the front end of the crown. The side water legs taper in width at the mud ring from 6 ins. at the front to 4 ins. at the back. The fire door opening is formed by flanging both sheets outward and riveting them directly together. The back head is vertical to a point immediately above the fire door; thence it slopes forward. This plan is intended to facilitate a convenient arrangement of cab fittings. The superheater elements are in 24 tubes, each 5½ ins. in diameter.

The boiler pressure is 160 lbs., and to secure the desired tractive force the cylinder diameter is made 24 ins. Piston valves 12 ins. in diameter, control the steam distribution. These valves have a steam lap of 1⅛ ins. and an exhaust clearance of ⅛ in.; they are set with a maximum travel of 5¾ ins., and a constant lead of ¼ in. The valves are placed between the upper and lower frame rails, and are 43 ins. apart transversely. This location allows very direct steam and exhaust passages, but when used with the Walschaerts gear a long rocker is required. In the present instance this rocker is of cast steel, and is keyed to a shaft 41¼ ins. long. This shaft is supported in suitable bearings which are bolted to the guide-yoke. The links are carried on longitudinal bearers, outside the leading drivers.

The frames are of cast steel, 5 ins. in width. The lower rails are extended to the forward end of the cylinder saddle, while the upper front rails are of forged iron, and are bolted to the main frames in the usual manner. The front bumper is further braced by short supplemental rails, which are bolted to the under side of the cylinder saddle. The trailing wheels have outside journals, and the rear frames are bolted to a transverse steel casting which constitutes a tail for the main frames, and is placed immediately back of the rear driving pedestals. The trailing wheels are allowed a limited amount of lateral motion, and the weight is transferred from the trailing equalizers to the journal boxes through inclined friction plates. The frames are supported, back of the trailing wheels, on short elliptic springs. This arrangement of trailing wheels is standard on the Burlington, and has been successfully employed on a large number of locomotives. The leading truck and trailing wheels are steel tired with cast iron spoke centers, and were manufactured by the Standard Steel Works Co.

The tender has a water bottom tank, with a low center of gravity. The longitudinal frame sills are composed of 12-in. channels; the front bumper is of oak, and the back bumper of steel, built up. The fuel space is partially covered by a hood, which prevents coal spilling over the sides. The trucks are of the equalized pedestal type, with cast steel bolsters. The wheels are similar to those used under the engine, and were supplied by the same makers.

The building of these locomotives indicates a growing confidence in the use of superheated steam, especially in heavy passenger service. The builders in writing to us on the subject say: "In work of this character the demands made upon the boiler are most exacting, and the superheater provides a means for increasing the capacity of the locomotive per ton of weight. It is along these lines that the improvement of the locomotive should progress, and the superheater promises to be an important aid in effecting such improvement." Some of the principal dimensions are given below.



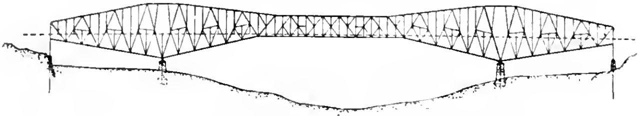
HEAVY 4-6-2 FOR THE CHICAGO, BURLINGTON & QUINCY RAILROAD.
F. H. Clark, General Superintendent of Motive Power. Baldwin Locomotive Works, Builders.

Cylinders, 25 x 28 ins.
Boiler—Diameter, 70 ins.; working pressure, 160 lbs.
Firebox—Material, steel; length, 108⅛ ins.; width, 72¼ ins; depth, front, 73½ ins.; back, 61½ ins.
Tubes—Material, iron; wire gauge, superheater tubes No. 8; 2¼ in. tubes No. 11, number, 170; length, 21 feet.
Heating Surface—Firebox, 194 sq. ft.; tubes, 2,816 sq. ft.; total, 3,010 sq. ft.; Emerson superheater, 925 sq. ft.; grate area, 55 sq. ft.
Weight—On driving wheels, 153,100 lbs.; on truck, front, 41,950 lbs.; on truck, back, 39,050 lbs.; total engine, 236,100 lbs.; total, engine and tender, about 390,000 lbs.
Tender—Tank cap., 8,000 gals., fuel, 21 tons.

The New Bridge at Quebec.

Our illustration shows an outline of the proposed bridge over the St. Lawrence River joining Point Levis with Quebec. The design has been commented on as the ugliest that has been got out for a long time for any large structure of its kind, as it presents only a series of triangles and straight lines. Whether or not the charge of want of beauty is so very serious if in other respects the design is good, will always remain a matter of opinion.

The bridge commission appointed by the Dominion Government have invited competitive plans which were filed last month, and it may be that the design here shown will not be used. The specifications call for a height of 200 ft. of tower above the masonry. In the famous Forth bridge in Scotland this height is 330 ft. This feature of the specifications has also been criticised.



OUTLINE OF PROPOSED BRIDGE OVER THE ST. LAWRENCE RIVER AT QUEBEC.

Wireless for Trains.

A recent press dispatch from Omaha, Neb., says the Union Pacific Railroad not long ago issued orders to install wireless telegraphy over the main lines of that system and announced that as soon as completed all trains will be dispatched by wireless.

For three years Dr. Frederick H. Millener has been experimenting with wireless on the Union Pacific system and has now perfected his apparatus so that the railroad believes it practical.

Sending stations will be erected at all division points and receiving stations at every high point as well as on all trains. Train orders will be sent to stations as well as directly to moving trains.

Whitewashing Coal.

A curious example of how people do not always want the truth is afforded by the fact that some years ago the vice-president of a coal company, subsidiary to the C., R. I. & P., adopted the practice of spraying car load lots of coal with whitewash. Under this white mantle the black diamonds were hauled to destination and if any coal had been stolen en route it was at once visible and detection was more or less easily accomplished.

While this plan was eminently satisfactory as far as revealing the extent of depredations it was finally abandoned because of the opposition of consumers who were anxious to claim a destination loss, and also on account of objections made by other dealers. Salesmen complained that when coal had been whitewashed and was subject to the action of rain, critical buyers objected to the appearance of the coal.

There is no doubt that the whitewashing plan would materially help in tracing coal losses, especially if supplemented by inspection and careful checking at arrival and departure at certain intermediate points. The arrangement would have to be worked out in detail by the road adopting it. As a matter of fact the whitewash has no effect on the quality of the coal, though its appearance if streaked by rain would be altered. We understand some such plan as this is used in foreign countries.

Waste in the Ashpan.

In a test recently made at eighteen points on the Erie Railroad, on ninety-five samples of ashes taken from the ash-pans, an average of 33% of carbon was found in the ashes. This is the most valuable heat producing element of fuel. Anything which will materially reduce this waste of carbon will prove a paying investment for any railroad company. It is safely to be presumed that the ash dropped from all the locomotives in the country contains as much carbon as that analyzed from the Erie ash pans. These apparently small losses aggregate into fortunes when the whole country is taken into account.

Red Lights Are Stop Lights.

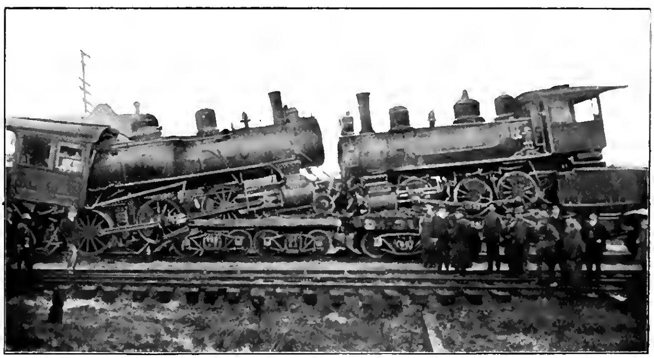
It is stated that it is the Pennsylvania's intention to have red lights exclusively as stop lights along the road. This company we understand has substituted green for red lights as a night warning on crossing gates. The object is to eliminate all red lights not intended to serve as stop signals for locomotive engineers.

Automatic Loading.

A curious railway wreck occurred some time ago and one of our numerous correspondents sent us in the photograph from which our engraving is made. A six-coupled yard engine was hauling a train composed of twenty-four loads and one empty flat car. This flat was immediately behind the tender and came in very handy when the automatic loading of the power began.

The road engine, of the 4-6-0 type, was pulling a fast freight train. When the engines came together they stopped, doing comparatively little damage to each other, but the moving train behind each, did not stop pushing until considerable damage to the cars in both trains had been done, many empties being reduced to kindling wood. The result at the front end, as shown in our illustration, reveals the fact that the tank of the yard engine pushed under the foot-plate of and heaved the yard engine up at the back. The push of the train behind forced the tender frame of the yard engine under the engine, and in this condition and without leaving the rails the yard engine tender frame passed completely under the yard engine and against the front of the road engine, which it raised up in front and partly carried.

The one flat car in the yard engine's train just behind followed the fortunes of the yard engine tank frame and pushed in under the switcher as its own tank frame went on to lift the road engine out of the way. The yard engine was thus so successfully loaded on the flat car that in clearing away the wreck the flat was coupled on to, and flat and engine taken away to a siding about a quarter of a mile away. No one was hurt in this collision.



ACCIDENTAL BUT SUCCESSFUL LOADING.

General Foremen's Association

The sixth annual convention of the International Railway General Foremen's Association opened in the Grand Hotel, Cincinnati.

President Ogden welcomed the members and congratulated the association upon the prosperous condition of the organization. He adverted to the pressure put upon the mechanical department to exercise rigid economy owing to the depression of business and urged members of the association to do all in their power to effect economies wherever possible.

Another vital matter that had been directed to his attention was the co-operation which should exist between general foremen, subordinate foremen and their men. He regretted that it is a fact that many foremen lost sight of the little leaks which tend to increase operating expenses.

He had been informed that many foremen displayed indifference to the work reported by the enginemen or conductor that demanded immediate remedy. Maintaining harmony with enginemen tended to strengthen the General Foremen's Association as self-interest alone ought to convince all concerned that it is good policy to create harmonious feeling with all in the company's employ, from superiors to the workmen under our charge.

We are striving to qualify ourselves for leaders and to infuse enthusiasm into our subordinates that they may perform that work to the satisfaction of all concerned.

The secretary read the secretary's and treasurer's reports, which were highly satisfactory.

The president then in a few complimentary words introduced their honorary member, Dr. Angus Sinclair, who delivered an address which traced the development of railroad mechanical industries on the American continent. He said that when railroad operation began among us most of the people were engaged in agricultural pursuits, which thousands of young men left to enter machine shops and engine houses. Millwrights, blacksmiths and handy men by natural selection filled the positions of general shop foremen and drilled the rustics into mechanics as Kipling makes Sergeant Mulvaney by hard drilling convert raw recruits into efficient soldiers of the British army.

Dr. Sinclair concluded: It seems to me that your association has been particularly fortunate in selecting Cincinnati as a place of meeting. This city is an old railway center with many interesting memories. Here in the early days thrived the Niles Locomotive Works, which put a progressive stamp upon the locomotive of that day. Several engines were equipped in these works with what is now known as the Walschaerts valve motion, before Walschaerts had reached the breeches age.

Here have grown up makers of machinery that are household words to every railway general foreman. I need only mention the Fay & Egan makers of wood working machinery to make you feel at home. A few miles out of the city are the Niles Tool Works that has placed more machine tools in railway shops than any tool maker in the business. There are other machine tool making works within the city limits with whose product you are all familiar, such as the Bickford Tool Works. Those among you who enjoy punching and shearing operations can find Long & Alstater establishment out at Hamilton, not far from the Niles Tool Works.

It would be highly edifying to visit all these works, and if you feel like extending your investigations and professional enjoyment, you might take in Barney & Smith Car Works at Dayton, also the Dayton Malleable Iron Works whose product you are all familiar with.

In conclusion I would express the hope that the toils of the convention may be brightened by social enjoyment and by harmonious intercourse with old and new friends. (Applause.)

REPORT OF SECRETARY-TREASURER.

The report of Secretary-Treasurer Bryan shows that the Association was in a prosperous condition, 207 members being on the roll. The members accorded much credit to Mr. Bryan for the energy and ability he had displayed in changing a burden of debt to a substantial credit balance.

It may be the proper time now to mention that Mr. Bryan wished to retire from the position of Secretary-Treasurer when the election came round, but the members were so enthusiastic in urging him to continue holding the important office that he consented to continue giving his services for another year.

TO SHORTEN CONVENTIONS.

After the reading of the Secretary-Treasurer's report a discussion arose concerning the dispatch of business and some of the members expressed the opinion that the interest of the association would be promoted by confining the convention to three days instead of spreading the business out five days which had been the practice adopted. The belief was expressed that more general foremen would be able to attend if the time was reduced to three days. After the subject had been discussed at some length a motion was made to change the constitution to provide for the annual convention extending over three days.

THE FOREMAN AND HIS MEN.

Address by Mr. W. L. Kellogg.

An interesting address on the above subject was delivered by Mr. W. L. Kellogg, superintendent of motive power of the Cincinnati, Hamilton & Dayton, on the above subject. The real text of the address was found in the sentence: "Intelligent co-operation between the foreman and his men spells success by the shortest method possible." He referred to the difficulty of inducing workmen to take a living interest in their work when the product turned out consists of pieces whose ultimate use the maker knows little about. He regarded as the duty of foremen to instil into workmen facts concerning details of their work and the purpose of every detail of production. If that practice were followed generally the workmen would have more to think about than the mere consideration of wages and how much every job was going to pass to their credit. Spreading information among workmen concerning the work they are engaged upon has a tendency to make the men better artisans and more contented citizens. The most salient paragraphs of the address read:

"Your foreman has lost his most valuable asset if he is not able to keep in sufficiently close touch with his men, to act as their counselor or adviser, and exert his influence at all times toward peace and harmony, counseling the men to uniform activity and energy, pointing out to them the possibilities of their future success through the success of their employes, encouraging them in habits of temperance and morality, in the establishment of savings accounts and the building of homes, and counseling them when selecting representatives and leaders to pick conservative men, men qualified to appear for them when meeting their superior officers on matters of mutual interest.

"The success of their craft can well be likened to the success of a nation, our own great country having been built up as the result of physical application of the energies given us. The most successful labor organizations of this country today should be pointed out to the men as the ones which have had the most conservative leaders and in which the men have lent themselves to their surroundings and endeavored to advance with their employers, and to the advantage of their employers, and who have not brought disaster on their employers through their endeavors to advance solely at their expense.

"I believe the personal interest feature of your work should be enlarged on at all times. The highest importance should at all times be attached to having foremen keep in closest personal touch with the men under them, displaying an interest in their personal welfare with solicitude for them in sickness and organizing relief for them in case of need; helping the indifferent workman by endeavoring to get him up to the standard of his more successful associates; singling out the men who will not, or cannot, fit in harmoniously with the balance of the crew and dropping them from the service."

PAPERS AND DISCUSSIONS, LATER.

This necessarily brief synopsis of the opening of the General Foreman's Convention will be followed in later issues of RAILWAY AND LOCOMOTIVE ENGINEERING with the more extended accounts of the proceedings of the association.

OFFICERS ELECTED.

The gentlemen elected as officers of the International Railway General Foreman's Association for 1910-11, were: President, Mr. C. H. Voges; general foreman of the Bellefontain, O., shops of the Cleveland, Cincinnati, Chicago & St. Louis Railway; first vice-president, Mr. T. F. Griffin, general foreman of the Indianapolis, Ind., shops of the Cleveland, Cincinnati, Chicago & St. Louis Railway; secretary-treasurer, Mr. L. H. Bryan, general foreman of the Two Harbors, Minn., shops of the Duluth & Iron Range Railroad.

CONVENTION EXHIBITS.

The following railway supply concerns had exhibits at the convention: Armstrong Bros. Tool Co., Chicago, Ill.; Ashton Valve Co., Boston, Mass.; Celfor Tool Co., Buchanan, Mich.; Chicago Pneumatic Tool Co., Chicago, Ill.; Crane Company, Chicago, Ill.; Crucible Steel Company of America, Pittsburgh, Pa.; Curtain Supply Co., Chicago, Ill.; Dearborn Drug & Chemical Works, Chicago, Ill.; Detroit Lubricator Co., Detroit, Mich.; Joseph Dixon Crucible Co., Jersey City, N. J.; Fairbanks, Morse & Co., Chicago, Ill.; J. A. Fay & Egan Co., Cincinnati, O.; Franklin Railway Supply Co., New York City; Garlock Packing Co., Palmyra, N. Y.; Gold Car Heating & Lighting Co., New York City; Goldschmidt Thermit Co., New York City; Green, Tweed & Co., New York City; Hunt-Spiller Mfg. Co., Boston, Mass.; Jenkins Bros., New York City; H. W. Johns-Manville Co., New York City; the E. A. Kinsey Co., Cincinnati, O.; Nathan Mfg. Co., New York City; Otley Mfg. Co., Chicago, Ill.; Storrs Mica Co., Owego, N. Y.; Strong, Carlisle & Hammond Co., Cleveland, O.; Talmage Mfg. Co., Cleveland, O.; West Disinfecting Co., Cincinnati, O.; Westinghouse Air Brake Co., Pittsburgh, Pa.

The Care of Boilers.

A leaky seam in a boiler should not be caulked under pressure, as the jar caused by the blows of the hammer has a tendency to start new leaks and may cause a rupture in the seam. The location and extent of the leak should be carefully marked and the necessary repairs effected when the boiler is cold. Sudden openings of valves are also pernicious, particularly if there is water in the pipes. Water hammer, or the sudden rush of a body of water impelled by steam pressure, has a very bad effect on pipes, and is the cause of many leaking joints. Boilers should not be emptied while under steam pressure. If there is not time to wait until the boiler is cooled, it is good practice to draw the fire, open the furnace door, then turn on feed water and blow out from time to time until the steam gauge shows no pressure.

Railway Wage Advances.

The railway wage advances, already made or to be made before the end of the year, are now estimated at $100,000,000 for the entire country. This is the figure given by President Brown of the New York Central. It includes, of course, many advances the details of which have not yet been settled.

Calculated on the Interstate Commerce Commission statistics as a basis, the wages paid to railway employes, under the new scale, will amount to $1,227,233,000 a year. This is arrived at by estimating the operating expenses of the present fiscal year from the monthly reports now available; applying the percentage of labor cost to total operating expenses in 1908, the latest year for which wage figures have been published; and adding the $100,000,000 estimated advance in wages this year.

The $1,227,233,000 which, it is estimated will be paid out to employees annually under the new scale, is thus compared with $1,072,386,000 in the fiscal year 1907, which was the year which holds the record for the volume of railway business. Wages on the railroads were not reduced after the 1907 panic, so that this year's advances are on top of those which were made in 1906 and the early part of 1907. The proportion of labor cost to total operating expenses has increased steadily for several years.

The Rewards of Engineering.

It is gratifying to observe that there is a tendency in the age in which we live, more and more to recognize the important position that engineering should occupy in the estimate of civilized humanity. It seems remarkable that we should hear so little of the eminent engineers who have done so much to advance what is known as human progress, especially during the last half century, while we are being constantly startled by the clamorous calls for recognition by alleged statesmen and embryo authors, whose works, if we may so dignify their babblings, pass out of remembrance in a short time and are heard of no more forever.

Is it not a fact that all of what we call modern civilization is practically the work of the engineer and should be so credited? The human mind has become so accustomed to the contemplation of mere words that it would seem as if work, however stupendous in its magnitude and however beneficial in its results, is taken by us as a mere matter of course. True it is that the work of the engineer may be said to speak for itself, and that like the silent majesty of the Pyramids it is at once the creation of the mighty builders and their monument. This is true only in an abstract or general way, but the proper recognition of individual effort and accomplishment is by no means what it should be.

To our thinking there is an element lacking in the engineering mind. There is a tendency among them to consider only the engineering side of their profession and to lose sight, in a great measure, of their proper relations with the world at large. The engineering fraternity is perhaps more modest than need be. Engineering should be recognized as the chief force by which civilization has been advanced and established and on which it largely depends. To this end it is well that all engaged in engineering work should interest themselves in something more than mere engineering. The mind trained to harnessing the elemental forces of nature would, if more widely directed, impress itself more largely upon the popular mind and lead to a fuller recognition and, doubtless, to a higher reward.

Order for 1,000 Gondolas.

A Pittsburgh press dispatch of recent date says: An order was placed by the New York Central with the Pressed Steel Car Company of Pittsburgh for 1,000 additional freight cars, of the 50-ton capacity gondola type, for use on the New York Central Lines. All of the 1,000 car order will be made in the lower North Side plant of the car company. This class of cars is of course made of steel and is spoken of as the steel hopper-bottom high side gondola coal or ore car. It is ideal for rough freight.

Items of Personal Interest

Mr. J. F. Holzemer has been appointed purchasing agent of the Kanawha & Michigan, with office at Columbus, Ohio.

Mr. Ross Brown has been appointed district passenger agent of the Iowa Central Railway with headquarters at Oskaloosa, Iowa.

C. E. FULLER,
(Vice President, M. M. Ass'n).

Mr. J. J. Conn has been appointed assistant general purchasing agent of the Atchison, Topeka & Santa Fe, with office in Chicago, Ill.

D. F. CRAWFORD,
(Vice-President, M. M. Ass'n).

Mr. James S. Sheafe has been appointed engineer of tests at the Burnside shops of the Illinois Central Railroad at Chicago, Ill.

Mr. J. R. Scott has been appointed road foreman of equipment on the eastern district of the Frisco System with headquarters at Springfield, Mo.

Mr. L. M. Jacobs has been appointed general foreman of the Trinity & Brazos Valley Railway at Eros, La., vice Mr. J. D. Maupin, promoted.

Mr. J. W. Johnson has been appointed master mechanic of the Western division of the Chicago Great Western, with headquarters at Clarion, Iowa.

Mr. G. A. Brown has been appointed superintendent of car service on the Chicago & Great Western, with office at the Grand Central Station, Chicago.

Mr. F. X. LaPrairie, heretofore car inspector at Kenora, Ont., on the Canadian Pacific, has been appointed wrecking foreman at Vancouver, B. C.

G. W. WILDIN,
(President, Mast. Mech. Ass'n).

Mr. W. J. Laird has been appointed general agent of the freight department of the Chicago Great Western, with office at 103 Adams street, Chicago.

Mr. J. I. [illegible], general sales manager of the Harbison-Walker Refractories Company, at Pittsburgh, has been elected one of the directors of the company.

Mr. A. T. Hollenbeck has been appointed superintendent of telegraph on the Chicago Great Western, with headquarters at Chicago, Ill., Grand Central Station.

Mr. W. J. Harrison, superintendent of motive power of the Northern district, Rock Island Lines, at Cedar Rapids, Iowa, has resigned to go into other business.

Mr. J. D. Maupin has been appointed master mechanic of the Trinity & Brazos Valley Railway at Eros, La.

H. T. BENTLEY,
(Vice-President, M. M. Ass'n).

Mr. Thomas Sweeney has been appointed road foreman of engines on the Shamokin division of the Philadelphia & Reading with headquarters at Tamaqua, Pa.

ANGUS SINCLAIR,
(Treasurer, M. M. Ass'n).

Mr. C. Adez has been appointed acting traveling fireman on the Canadian Pacific Railway, district No. 2, Pacific division, with headquarters at Vancouver, B. C.

Mr. E. H. Wade, master mechanic on the Chicago & North-Western at Chicago, has been appointed supervisor of locomotives at Green Bay, Wis., on the same road.

T. H. CURTIS,
(Vice-President, M. C. B. Ass'n).

Mr. R. N. Begien, formerly division engineer of the Philadelphia division on the Baltimore & Ohio, has been appointed assistant to the chief engineer, with offices at Baltimore.

Mr. Charles Coleman, master mechanic of the Chicago & North Western at Eagle Grove, Iowa, has been

[illegible] W. TAYLOR,
(Joint Secretary, M. M. & M. C. B. Ass'n).

transferred as master mechanic to Winona, Minn.

Mr. H. C. Gritt[illegible], general shop inspector, on the Lake Shore & Michigan Southern, has been promoted to be supervisor of materials and coal, vice Mr. J. W. Senger, promoted.

Mr. R. E. Darby, assistant engineer of motive power of the Lake Shore &

F. H. CLARK,
(President, M. C. B. Ass'n).

Michigan Southern, at Cleveland, Ohio, has resigned to go to the Pilliod Company, New York.

Mr. R. Brown, heretofore assistant boiler foreman, Winnipeg shops of the Canadian Pacific, has been appointed locomotive foreman, Cranbrook, B. C., vice D. T. Main, promoted.

Mr. E. Y. Brake, heretofore car foreman on the Canadian Pacific at Lethbridge,

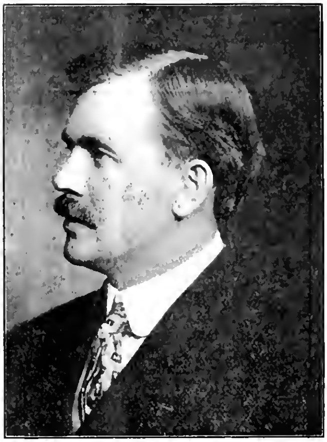
A. STEWART,
(Vice President, M. C. B. Ass'n).

bridge, Alta., has been appointed car foreman at Cranbrook, B. C., vice Mr. A. McCowan, resigned.

Mr. I. W. Marshall, heretofore assistant car foreman on the Canadian Pacific at Winnipeg, has been appointed car foreman at Lethbridge, Alta., vice Mr. E. Y. Brake, transferred.

Mr. A. R. Ayers, assistant master mechanic of the Lake Shore and Michigan Southern, at Elkhart, Ind., has been promoted to mechanical engineer, vice Mr. R. B. Kendig, promoted.

Mr. Le Grande Parish, formerly superintendent of motive power of the Lake Shore & Michigan Southern Railway at Cleveland, Ohio, has, as previously announced, become president of the American Arch Company



LE GRANDE PARISH,
(Vice-President, M. C. B. Ass'n).

of New York. The office of this company is in the Hudson Terminal Building, 30 Church street, New York.

Mr. B. H. Montgomery, assistant general foreman on the Lake Shore & Michigan Southern Railway at Collinwood shops, has been promoted to succeed Mr. B. F. Kuhn, as general foreman.

JOHN KIRBY,
(Treasurer, M. C. B. Ass'n).

Mr. J. A. Coopers has been appointed traveling engineer on the Missouri, Kansas & Texas Railway with jurisdiction from Wagoner, Okla., to Hillsboro, Tex., vice Mr. W. P. Danforth, promoted.

Mr. T. H. Goodnow, master car builder on the Lake Shore & Michigan Southern of Englewood, Ill., has been transferred to assistant master mechanic at Elkhart, Ind., vice Mr. A. R. Ayers, promoted.

Mr. Harry L. Wyand has been appointed district passenger agent of the Chicago Great Western, at Cleveland, Ohio, with office at 315 Williamson Building, vice Mr. Frank R. Mosier, resigned.

Mr. W. P. Hobson, formerly master mechanic on the Chesapeake & Ohio at Lexington, Ky., has been transferred to the Cincinnati division of the same road, vice Mr. W. T. Smith, promoted.

Mr. R. A. Pyne, district master mechanic of the Canadian Pacific at Nelson, B. C., has been appointed master mechanic, with office at Calgary, Alta., vice Mr. W. E. Woodhouse, promoted.

Mr. P. A. Crysler, heretofore general car inspector Eastern Lines of the Canadian Pacific Railway, has been appointed assistant general foreman of passenger car repair work at Angus shops, Montreal.

Mr. J. R. Gould, formerly master mechanic of the Chesapeake & Ohio at Richmond, Va., has been appointed superintendent of motive power of the Virginia general division of the same road.

Mr. W. T. Smith, formerly master mechanic on the Chesapeake & Ohio at Covington, Ky., has been appointed superintendent of motive power of the Kentucky general division of the same road.

Mr. A. A. Mavor, master mechanic, on the Grand Trunk Railway system, in charge of the company's locomotive shops at Point St. Charles, Montreal, has been elected president of the Canadian Railway Club.

Mr. J. H. Nash, master mechanic on the Illinois Central Railroad at Paducah, Ky., has been promoted to the position of superintendent of the Burnside shops of the same company at Chicago.

Mr. J. Rutley, heretofore locomotive engineer on the Canadian Pacific, has been appointed road foreman of engines, district 4, western division, Macleod, Alta., vice Mr. L. E. W. Bailey, resigned.

Mr. J. J. Connors, district master mechanic of the Chicago, Milwaukee & St. Paul at Dubuque, Ia., has been appointed assistant superintendent of motive power for the lines west of the Mississippi River.

Mr. F. J. Harrison, division master mechanic of the Buffalo, Rochester & Pittsburgh, has been appointed superintendent of motive power, with office at Du Bois, Pa., vice Mr. W. H. Wilson, resigned.

Mr. C. H. Terrell, formerly master mechanic on the Chesapeake & Ohio at Huntington, W. Va., has been appointed superintendent of motive power of the West Virginia general division of the same road.

Mr. J. T. Carroll, master mechanic on the Lake Erie & Western Railroad, has resigned, to accept the position of superintendent of motive power of the Baltimore & Ohio Railroad, with headquarters at Pittsburgh, Pa.

As announced last month, Mr. Morgan K. Barnum, formerly general inspector of machinery and equipment on the Chicago, Burlington & Quincy Railroad, has been appointed general superintendent of motive power of the Illinois Central, the Yazoo & Mississippi Valley, and the Indianapolis Southern Railroads, with headquarters in Chicago, Ill. Mr. Morgan was born April 6, 1861. He graduated from Syracuse University, 1884, with degree of A. B., and later received degree of A. M. He entered railway service in 1884 as special apprentice in the shops of the New York, Lake Erie & Western at Susquehanna, Pa., since which he has been consecutively, to September, 1887, machinist and mechanical inspector; September, 1887 to 1889, general foreman same road at Salamanca, N. Y.; January to September, 1889, general foreman, Louisville & Nashville shops at New Decatur, Ala.; September, 1889, to September, 1890, assistant master mechanic, Atchison, Topeka & Santa Fe at Argentine, Kan.; September, 1890, to June, 1891, superintendent of shops on the Union Pacific at Cheyenne, Wyo., June, 1891, to December, 1898, district foreman on the same road at North Platte, Neb.; December, 1898, to December, 1902, master mechanic, Nebraska division same road at Omaha, Neb., Dec. 15, 1902, to February, 1903, assistant mechanical superintendent Southern Railway, February, 1903, to April, 1904, superintendent motive power, Chicago, Rock Island & Pacific; June, 1904, to date, mechanical expert or more correctly, general inspector of machinery and equipment—Chicago, Burlington & Quincy Railroad. Mr. Barnum has won his way up by hard work and ability, and his many friends are pleased to see the high position in the railroad world to which he has now attained.

M. K. BARNUM.

Mr. J. T. Carroll, formerly master mechanic of the Lake Erie & Western, has been appointed superintendent of motive power of the Baltimore & Ohio with office at Pittsburgh, Pa.

Mr. J. W. Senger, supervisor of materials and coal, on the Lake Shore & Michigan Southern, has been promoted to be master car builder, with headquarters at Englewood, Ill., vice Mr. T. H. Goodnow, promoted.

Mr. W. P. Danforth, heretofore traveling engineer on the Missouri, Kansas & Texas Railway, has been promoted to the position of master mechanic of the Trinity division of the same road with headquarters at Trinity, Texas.

Mr. J. F. Walsh, superintendent of motive power of the Chesapeake & Ohio Railroad at Richmond, Va., has been given the title of general superintendent of the same road. His office remains in Richmond, Va.

Mr. B. F. Kuhn, general foreman locomotive shops on the Lake Shore & Michigan Southern Railway at Collinwood, Ohio, has been promoted to be assistant superintendent Collinwood shops, vice Mr. F. H. Reagan, promoted.

Mr. T. J. Hamilton has been appointed district master mechanic of the Chicago, Milwaukee & Puget Sound, with office at Deer Lodge, Mont. He will have charge of the line between Harlowton, Mont., and Avery, Idaho.

Mr. H. B. Voorhees has been appointed additional assistant to Mr. Daniel Willard, president of the Baltimore & Ohio Railroad. Mr. Voorhees' headquarters are in the company's general office building in Baltimore.

Mr. R. B. Kendig, mechanical engineer, of the Lake Shore & Michigan Southern, has been promoted to general mechanical engineer of the New York Central Lines, with headquarters at Grand Central Station, New York, vice Mr. F. M. White, resigned.

Mr. John T. Wilson, former assistant engineer at Baltimore, on the Baltimore & Ohio, has been promoted to be district engineer, with jurisdiction between Philadelphia and the Ohio River at Parkersburg and Wheeling, with headquarters at Baltimore.

Mr. E. A. Murray, foreman of the machine department of the Covington, Ky., shops of the Chesapeake & Ohio, has been appointed master mechanic on the same road, with headquarters at

Lexington, Ky., vice Mr. W. P. Hobson, promoted.

Mr. F. H. Reagan, assistant superintendent on the Lake Shore & Michigan Southern Railway at Collinwood shops, has been promoted to be master mechanic of the Lake Erie & Western, with headquarters at Tipton, Ind., vice Mr. J. T. Carroll, promoted.

Mr. A. J. Isaacks has been appointed master mechanic of the Southern division of the Chicago Great Western Railroad with headquarters at Des Moines, Iowa, vice Mr. T. H. Yorke, resigned. Mr. Isaacks was formerly connected with the Chicago & Alton.

Mr. William Wibel, acting assistant purchasing agent of the National Railways of Mexico, the Mexican International and the Interoceanic, at New York, has been appointed assistant purchasing agent of these companies, with office at New York.

Mr. J. H. Waterman, storekeeper of the Chicago, Burlington & Quincy at Lincoln, Neb., has been appointed superintendent of timber preservation, with office at Galesburg, Ill., succeeding Mr. F. J. Angier, resigned. Mr. J. H. Ellis succeeds Mr. Waterman.

The employes of the Mobile & Ohio motive power and car departments have presented Mr. George S. McKee, consulting mechanical engineer, who retired last month, with a gold watch, and Mrs. McKee was presented with a chest of silver and a diamond ring.

Mr. W. J. Rusling, assistant master mechanic of the Pennsylvania Railroad at Harrisburg, Pa., has been appointed foreman of the Enola, Pa., shops, vice Mr. H. T. Coates, Jr., promoted. Mr. H. G. Huber, assistant master mechanic at Phillipston, succeeds Mr. Rusling.

Mr. Theodore Voorhees, first vice-president of the Philadelphia & Reading, has been elected president of the bureau for the safe transportation of explosives, vice Dr. Charles B. Dudley, deceased. Mr. Voorhees is also chairman of the committee on transportation of explosives of the American Railway Association.

Mr. W. H. Williams, master mechanic of the Buffalo, Rochester & Pittsburgh, at East Salamanca, N. Y., has been appointed master mechanic of the Middle and Pittsburgh divisions, with office at DuBois, Pa., and Mr. Harry Sneck has been appointed master mechanic of the Buffalo and Rochester divisions, with office at East Salamanca.

Mr. J. W. Adams has been appointed inspector of passenger service on the Baltimore & Ohio, with headquarters at Baltimore, Md. Mr. Adams entered the B. & O. service as assistant yardmaster at Philadelphia, in 1888, and on June 1, 1890, was promoted to station master at Baltimore, which position he has filled until promoted to the position of inspector.

Mr. D. B. MacBain, formerly assistant superintendent of motive power of the New York Central Railroad at Albany, N. Y., has been appointed superintendent of motive power of the Lake Shore & Michigan Southern Railway at Cleveland, Ohio, to succeed Mr. Le Grand Parish, who resigned to become president of the American Arch Co. Mr. MacBain's selection for the position is a promotion. As a motive power man he has made a fine record on New York Central Lines.

Mr. Frederick M. Whyte, general mechanical engineer of the New York Central Lines, has been appointed general manager of the New York Air Brake Co., with headquarters at Watertown, N. Y. To accept this position, he resigns the position to which he was promoted soon after Mr. W. C. Brown became president. Mr. Whyte's record and career furnish one of the unusual examples of how a young man can advance steadily on his own merits, and his many friends wish him every success in his new field of labors.

The Department of State has delegated Dr. W. H. Tolman, Director of the American Museum of Safety, to represent the United States at the Ninth International Housing Congress. Mr. Robert W. DeForest is the president of the American Section of the International Housing Committee, of which Dr. Tolman is the executive secretary. Mr. R. W. Gilder is vice-president, and Messrs. T. C. Martin and Arthur Williams are the other members. The report from the United States summarizes the progress of the movement in this country.

Mr. J. B. Comstock, who for six years has been with the Westinghouse Electric & Manufacturing Company at its East Pittsburgh works, and for four years manager of their publication department and printing plant, has severed his connection with that company to accept a similar position with the P. & F. Corbin Company of New Britain, Conn. Prior to Mr. Comstock's connection with the Westinghouse Company, he filled the same position with the Corbin Company, which he has recently been asked to assume again.

Mr. James F. DeVoy, mechanical engineer of the Chicago, Milwaukee & St. Paul at Milwaukee, Wis., has been appointed an assistant superintendent of motive power, with office at Milwaukee, and Mr. J. J. Connors, district master mechanic at Dubuque, Iowa, has been appointed an assistant superintendent of motive power, with office at Dubuque. Mr. Charles H. Bilty, draftsman, succeeds Mr. DeVoy as mechanical engineer. Mr. Walter Liddell, general foreman in the locomotive department at Dubuque, succeeds Mr. Connors as district master mechanic.

Mr. David Brown, assistant superintendent of motive power of the Delaware, Lackawanna & Western Railroad at Scranton, Pa., has recently been compelled to undergo an operation, from the effects of which, we are informed, he has almost quite recovered. It is a well known fact that all the machinists of the D., L. & W. system hold Mr. Brown in great esteem for the many loveable traits of character which he possesses. Mr. Brown has been untiring in his efforts to make the new machine shops second to none, and those in the mechanical department of the Lackawanna know how well he has succeeded. His many friends most heartily wish him continued good health for many years to come.

Mr. Lewis B. Rhodes has been appointed superintendent of motive power of the Virginian Railway, with office at Norfolk, Va. He was born in 1864 at Macon, Ga., and received his education in the high schools at Macon and began railway work in the latter part of 1880 on the Central of Georgia. He was at first a machinist, and was later appointed foreman on the same road. In 1889 he left that company to go to the Georgia, Southern & Florida, since which time he has been consecutively to 1900, locomotive engineer, shop foreman, general foreman and foreman of locomotive repairs. He was appointed master mechanic on the same road in 1900, which position he held at the time of his recent appointment as superintendent of motive power of the Virginian Railway.

Mr. Alfred Beamer, superintendent of the Idaho division of the Northern Pacific Railroad, stationed at Spokane, Wash., has resigned and will be succeeded by Mr. J. M. Rapelje, of Glendive, Mont., now superintendent of the Yellowstone division. Mr. Beamer will devote his time to extending the use of the A B C block system of train dispatching, of which he and T. H. Langtry, trainmaster of the Northern Pacific in Spokane, are inventors and patentees. Mr. Beamer has arranged for a thorough demonstration of his system at the national convention of Train Dispatchers of North America in Spokane, June 21 to 24, when 500 delegates from roads in the United States, Canada and Mexico will be in attendance. Special wires will be run into the convention hall so that the dispatchers can become familiar with the working of the system, which is designed to prevent collisions. It has been in satisfactory operation on the Idaho division of the Northers Pacific road the last three years. A very full description of the A, B, C system was given in RAILWAY AND LOCOMOTIVE ENGINEERING on page 537 of the December, 1908, issue.

Sir William Van Horne has resigned the chairmanship of the Canadian Pacific directorate, but will remain a member of the board. In explanation of his action Sir William says that the position was merely nominal, not as in Great Britain where the chairman is the active head of the company. "Such a concern as the Canadian Pacific," he said, "can have but one active head, and there should be no room for doubt anywhere as to who that head is, but judging from the number of applications I get for passes or places on the road there are yet some people who do not seem to know Sir Thomas Shaughnessy is and has been for a long time the real head of the C. P. R., and I need not tell anybody in Canada what a competent head the company has in him, nor how abundantly able he is to manage its affairs without the help of anybody." Sir William's connection with the Canadian Pacific began in 1881, when he became general manager. Three years later he was made also vice-president, and in 1884 he succeeded Lord Mount Stephen as president, resigning in 1898, when he became chairman of the board and was succeeded in the presidency by Sir Thomas Shaughnessy.

Obituary.

Isaac Bond, well known to men connected with the mechanical departments of railroads, and who for many years was a master mechanic on the Erie, at Susquehanna, Rochester and Hornell, died recently at his home in Hornell. Mr. Bond was seventy years old and has had an honorable record of useful work.

John I. Kinsey, for over forty years master mechanic on the Lehigh Valley Railroad, passed away at his home, in Easton, Pa., at the age of 83. He entered the service of the Lehigh Valley in the South Easton shops in 1856. In 1897 he was appointed superintendent of the Morris canal. He was an honorary member of the Master Mechanics' Association.

James Hedley, formerly superintendent of two English railways and third of a line of noted railroad men, died last May at the age of eighty-seven. He leaves a widow and seven sons, two of whom are in the railroad business. One is Mr. Frank Hedley, vice-president and general manager of the Interborough Rapid Transit Co., and another is Mr. E. M. Hedley of the Galena Signal Oil Company.

William Wait Snow died at his home in Hillburn, N. Y., last April at the age of 81. He was born in Heath, Mass., in 1828. His parents wished him to become a minister, but his tastes lay in other directions. He eventually went into the foundry business with his brother at Woonsocket, R. I. In 1857 he moved to Newburgh, N. Y., on the advice and with the help of Holmer Ramsdell, then president of the Erie. At Newburgh he went into partnership with Isaac Stanton for the manufacture of car wheels. The firm of Snow and Stanton suffered in the panic of that year and later we find Mr. Snow at Ramapo, N. Y., engaged in makign cast iron car wheels. His wheels were high priced, but were most satisfactory in service. Mr. Snow was not only a manufacturer of great ability, but he had the qualities which go to make up the successful salesman. He liked his fellow men, and he was eminently truthful. These characteristics opened every door for him and contributed to his splendid success. His relations with his many employees were perfect, and he was the recipient of many confidences from his men. He was at all times ready to give that help and sympathy that brought hope and compelled manly effort in others. In later years he founded the Ramapo Iron Works, the Steel Tired Wheel Company and lastly the American Brake Shoe & Foundry Company.

John H. Converse, president of the Baldwin Locomotive Works, Inc., Philadelphia, Pa., died at his home in Rosemont, Pa., last month, after a brief illness. Mr. Converse was born in Burlington, Vt., in 1840. His early education was received in the public schools of that town and he entered the University of Vermont in 1857, from which he graduated in 1861. His first work was on the editorial staff of the Burlington (Vt.) Daily and Weekly Times. He took up railroad work in 1864 and was employed on the Chicago & North-Western. In 1866 he went to the Pennsylvania Railroad at Altoona, Pa., under Edward H. Williams, then general superintendent. In 1870 he secured a position with the Baldwin Locomotive Works through Mr. Williams, who had become one of the proprietors, and three years later he became a member of the firm. Mr. Converse handled the business and financial management. He had for many years held directorships and taken an active part in the management of numerous other institutions. Among these may be mentioned The Philadelphia Trust Co., the Philadelphia National Bank, the Philadelphia Savings Fund and the Real Estate Trust Co. Since 1890 he has been a member of the board of directors of City Trusts. He was also a member of the Philadelphia Board of Public Education, trustee of the Presbyterian Hospital, president of the Fairmont Park Art Association and of the Pennsylvania Academy of Fine Arts. During the war with Spain, Mr. Converse served as president of the National Relief Commission organized in Philadelphia.

Unequal Expansion of Boiler Sheets.

A very interesting paper on the inequality of expansion in locomotive boilers and the possibility of eliminating the bad effects thereof was recently read at a meeting of the New York Railroad Club by Mr. D. R. MacBain, superintendent of motive power of the Lake Shore & Michigan Southern Railway. The speaker presented a series of lantern slides which very clearly illustrated his remarks.

The first showed the back head of a modern locomotive cracked on each side along the outer row of staybolts. This is a common form of failure with rigid staybolt setting. The second slide showed a similar failure of a throat sheet. In all cases the cracks began on the inside or water side of the sheet. Another form of failure shown was that of a side sheet cracking vertically along a line of staybolts. An example was given of a firebox flue sheet cracked from the arch flue holes up and down. This is a common form of failure and Mr. MacBain attributed it to there being probably more expansion transversely in the outer sheet than in the flue sheet across the bottom where the cracks occur. Another example was given of a back flue sheet cracked from the top flue holes, the cracks extending up around the flange. Mr. MacBain explained that a larger radius of flange had been tried, but the ¾-in. radius was found to be the most satisfactory.

In a diagram he gave the result of an investigation to determine the direction and extent of expansion in a flue sheet caused by putting in a set of new flues. A circle was drawn upon the tube sheet before the flues were set and this circle was carefully measured after the setting had been completed. The distortion of the circle was found to be 1/32 of an inch at the bottom and 3/32 of an inch at the top. The sides each showed a distortion of 1/32 of an inch. The part of the flue sheet where the tubes are placed became larger. Fig. 8 showed a seam on a side sheet near the top. Considerable trouble is often experienced by a leak of this kind, but Mr. MacBain spoke of having at last found an effective remedy for the trouble. Fig. 9 showed three rows of radial stays where breakages most frequently occur. They are just above the last row of short or horizontal bolts. The speaker believes that the same agency is responsible for all these various boiler troubles.

Some very careful measurements were shown as made on a number of boilers with a view of ascertaining the amount and position of the distortion of boiler plates in service, and upon the gaining of this information the application of flexible staybolts began; at first they were used in certain areas, but later were applied intirely to one firebox with the most satisfactory results. Mr. MacBain brought out the important point that it is not only necessary to use flexible staybolts, but it is essential to know how to put them in. For example, in the throat sheet he said the first row above the mud ring were set tight, the second above the mud ring were 1/32 of an inch loose. All others were 1/16 of an inch loose. The back flue sheet braces were left 3/32 of an inch loose. Taking this throat sheet as an example he believes such an installation will increase the life of a modern firebox from 50 to 75 per cent.

Some interesting information was given concerning the relative expansion of flues and boiler barrel. In placing a set of flues in one of their boilers a sag of 1 3/16 ins. was purposely given to the flues and an indicator was attached to one of the top ones, by means of which a pencil moving on a card traced a graphic record of the movement of the tube. When the boiler was cold and a fire started it was found that the artificial sag of the tube was increased as it became hot and expanded. Later as the water became hot the expansion of the barrel sheets carried the flue sheets farther apart and so reduced the sag in the tubes. Two graphic records of road tests were taken in the same way and it was found that when the engine was worked hard, the rush of heated gas into the flues caused them to expand, but when the engine was drifting or was worked lightly the tubes shortened and showed less sag in the center, according to the indicator.

The most interesting feature of the paper was on a point, the importance of which it would be impossible to overestimate. He said: "Slide No. 14 shows the side view of the previously mentioned firebox, showing a full installation of flexible staybolts, including radial stays. This installation of flexible staybolts was made in January of 1907, and the engine was put into heavy passenger service. Up to Feb. 1, of this year, at which time the last examination was made, the engine had made 243,000 miles without one broken staybolt, without any vertical cracks in the side sheets, without any trace of a crack in the back head, or throat sheet, and without any cracks, or any sign of a crack, leading away from the arch tube holes in the back flue sheet, nor has there ever been a tool on the side sheet seam; in fact, the engine has never been held one moment for boiler work, other than that of expanding the flues, since it went into service in February of 1907."

This record of mileage is just about equal to the average distance of the moon from the earth, and that fact enables one, in a sense, to appreciate the performance of the all-flexible staybolt engine.

Railroad Character Sketches

Shaw Attends a Convention

By James Kennedy.

This is the age of conventions. The leading spirits in almost every field of human endeavor are meeting semi-occasionally, and comparing notes, and shaping their energies, and molding their methods, and setting the seal of approval on ideas and individuals. Hence cometh standardization and classification, and hence departeth complex confusion and ancient usage. Then there is a blessed relief that is experienced at these meetings. The pent-up feelings of the associated members, like compressed air in metallic reservoirs, rush noisily into the intangible air, passing, of course, through the ears of willing or unwilling listeners. Whatever may be the feelings of the hearers, the speakers feel better. Let it is strange that in spite of the pains taken to gather such assemblages together, nothing seems so welcome—morning, noon or night—as a motion to adjourn. Doubts might arise in inquiring minds as to what is the real motive of such meetings. Are they exhibitions of goods that may be brought to the eyes of prospective purchasers, or is it mere holiday-making, or both? Do the members come back wiser and better? Certain it is, that they come back sunburned and blistered and bitten by poisonous insects, and full, it may be of malted milk, and also of repentance.

Shaw went to the convention of the International Tool Keepers. The proper tool-room had not yet been established. It lay somewhere in the undiscovered future, in the airy realms of unimagined ideality. The present condition of the craft was chaotic. The idea of a mechanic coming to the tool-room and asking for a tool, and the tool-keeper giving it to him without any further ado was behind the age. A feeling of unquiet gradually grew in the masterful minds of the tool-keepers and hence the convention. Some simple thinkers favored the idea of a mechanic having a string around his neck on which would be hung a certain number of copper checks, like Chinese coins. These would be exchangeable for tools. Others had a card system in their mind's eye whereon every kind of tool had a history peculiarly its own, inscribed in characters only known to the tool-keeper. A more profound coterie had a system of signals full of meaning, like the deaf and dumb alphabet. Another class ran into formality. Shelves for holding tools should be made, they claimed, at a certain degree of angularity. The earth was their model—twenty-three and a half degrees leaning away from the perpendicular. Still others claimed irregular formation of tool receptacles according to size and distance apart, each in its proper orbit, like the planetary system, the tool-keeper, of course, being the central sun, around which the tools radiated according to the centripetal forces of attraction or repulsion. Then the question of contiguity had its apostles. Wrenches, they claimed, should not be hung up and taps laid down. They should dwell together in unity, like brethren. Drills should not be thrown together carelessly. They should stand on their heads, all numbered in arithmetical succession, like the multiplication table. Full of these and other conflicting opinions the convention assembled.

When the committee on credentials had their report accepted and the house was ready for business, a tall, dark-haired man stood up. He had flowing whiskers and was robed in a long coat that nearly reached his frying-pan-shaped feet. He leaned forward at an angle of eighty-five degrees, and extended his right hand. A hush fell upon the Associated Tool-Keepers. It was Shaw, clothed and in his right mind. Billy had prepared a speech for him and Shaw had carefully learned it. Looking solemnly at the chair, Shaw began by stating that he rejoiced to have lived to witness the occasion of such a meeting. It was something he had long hoped for. "In what respect do we differ from the lower animals," queried Shaw, "but in the use of tools." ("Hear, hear.") "Tools are the instruments through and by which thought is transmitted into action." ("Right you are.") "Tools are the tangible and crystallized expression of the aims and objects of humanity. The higher we go in the scale of civilization the more intricate in form and the more marvelous in execution tools become." ("That's what knocks.") "From the stone-hammer to the steam-hammer is a wide step." ("You bet it is.") "Tools mark the progress of events. Tools make possible the visions of seers, and the dreams of poets and romancers assume a form and a meaning when the proper tools are skilfully used toward the object aimed at." ("Now you're shouting.") "By the use of tools we remove mountains and make the desert places blossom. But why expatiate?" ("Go on, go on.") "Without tools we would lapse into beast-like barbarism. What then is the province of the tool-keeper? He is the guardian of the highest expression of the best thoughts of intelligent humanity." ("Sure's you're born.")

"I would therefore move," continued Shaw, glancing at one of Billy's notes, "that the chair appoint a committee on the housing and handling of tools, a committee on the cleaning and keeping of tools, a committee on the distributing and collecting of tools, a committee on the borrowing and lending of tools and a committee on the classification and segregation of tools. These five separate committees to consist of five members each, and to present their reports at five o'clock this afternoon." ("That's business," chorused the nameless interrupters.)

Shaw sat down amid a storm of applause. His motion was carried by acclamation. Of course there was an immediate adjournment. The chair must consult with the members on such important appointments. In the triumph of the hour Shaw wandered out among the exhibits that had blossomed into being on the occasion of the convention. Souvenirs and buttons and badges were thrust upon him and the elemental habit of collecting things that he had no use for came back to him in all its pristine eagerness. The gradation from memento-gathering to petty larceny was swift. His capacious pockets were soon stuffed with articles never meant as gifts. Of course this was too good to last. The climax came after Shaw had left the Toolmakers' restaurant where he had not only ate mightily, but had also in a moment of forgetfulness gathered up several forks and knives and other equipment. This habit is said to be quite common and can only be accounted for on the ground that there is a growing opinion that spoons and table articles generally should be taken after meals, like medicine.

There was a police station near the Grand Pavilion and a little court house, and a pair of stern looking detectives laid their hands on Shaw. The prisoner was searched. Besides the domestic articles referred to there was found on Shaw one screw-jack (miniature), two screw-drivers, three watches (nickel plate), two monkey wrenches (silver plated), four pocket knives (pearl handles), three sets of dice, two packs of playing cards, with instructions on bridge whist, eleven books (leather bindings), twelve badges of unique and varied designs, six paper weights (metallic), two thermometers (with mirrors), four paper cutters (scimitars), two busts of Abraham Lincoln (stucco), one rat trap and thirty-nine other unassorted articles, the whole forming a collection of one hundred and seventeen separate pieces.

The members of the Associated Tool-Keepers thronged around, and pleaded ably and eloquently for Shaw's release. Some restitution there was, but Shaw was dismissed with a heavy reprimand that seemed to sit lightly upon him, and although his collection was somewhat shorn of its full proportions by the stern hand of justice, the exhibit made quite a sensation when Shaw reached his old boarding house and spread his multiform curiosities on the table. Billy and Macfarlane had the first choice and made sad havoc. The boarding mistress took the rat trap and Shaw's popularity was further enhanced by a presentation of one of the Lincoln busts, which now fills a high niche in Clark's parlors.

It need hardly be added that the various committees of the Tool-Keepers' Association merely reported progress, although no real progress seemed to have been made.

Where the New D. & H. Mallets Work.

The division over which the new articulated compounds for the Delaware & Hudson will be operated has some very heavy grades. The engines are, in the opinion of the builders, probably the most powerful locomotives ever constructed. They have just been completed by the American Locomotive Company, and are designed for pusher service on the Wilkes-Barre & Susquehanna division of the D. & H., between Carbondale, Pa., and Oneonta, N. Y. On these divisions there is a heavy movement of freight traffic, consisting mostly of loaded coal trains. The grade conditions on this portion of the road are severe, and sharp curves are numerous. Against northbound traffic, in which direction practically all the movement of loaded freight trains takes place, there is a six-mile grade of 1.36 per cent. from Carbondale to Forest City. From the latter point to Ararat, the summit of the rise, a distance of 14 miles, the road is on a grade averaging 0.81 per cent. Going down the other side of the mountain it is practically a continuous grade of 51.7 ft. per mile, for 75 miles into Oneonta.

Hitherto the freight traffic on this division has been handled by consolidation locomotives, known on the D. & H. as Class E-5, having a theoretical maximum tractive power of 49,690 lbs., a total weight of 252,000 lbs., and a weight on driving wheels of 223,000 lbs. A single Class E-5 engine can very satisfactorily handle a 2,000-ton train from Ararat to Oneonta, but it requires the assistance of two locomotives of the same class, as pushers, to haul this load up the 20 mile grade to Ararat, at which point the pushers cut loose. With this power a speed of about 10 miles per hour can be maintained on the six miles of ruling grade from Carbondale to Forest City, and a speed of 15 miles per hour over the remaining 14 miles of the ascent.

In the fall of last year one of the heavy Mallet engines built by the American Locomotive Company for the Erie Railroad was borrowed and put into pusher service on the 20-mile Ararat grade. A number of test runs were made, which proved that a single Erie Mallet engine easily did the work of two of the D. & H. Class E-5 consolidation locomotives. Following these tests six Mallet engines were ordered from the American Locomotive Company, one of which is illustrated in this issue on page 227.

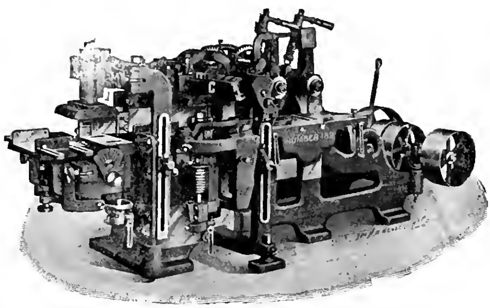
HYDRAULIC ENGINEERING AT MEADVILLE ON THE ERIE, DURING THE FLOOD.
(Courtesy of the Erie Railroad Employes' Magazine.)

The wheel arrangement is of the 0-8-8-0 type, and the design is based on the articulated locomotives built for the Erie Railroad in 1907, but with 35,000 lbs. increase in weight, and 10 per cent. more power, thus giving a good margin of power to meet the varying conditions of service on the Delaware & Hudson Railroad. With the same average weight per driving axle, and a rigid wheel base 2 ft. 3 ins. shorter than the E-5 class, the new articulated engines, under normal working conditions, have over twice the power of the E-5 consolidation engines, and in case of emergency they can exert a tractive power more than two and one-half times as great as the latter. One of these engines as a pusher and a Class E-5 locomotive in the lead, will easily take a 2,000 ton train up the grade where it previously took three Class E-5 locomotives. The saving of an engine is the result.

Fay & Egan Car Shop Molder.

The J. A. Fay & Egan Company, of Cincinnati, Ohio, have a model molder on the market that is regarded in woodworking circles as being a very satisfactory machine and particularly useful in car shops. The manufacturers call this machine their No. 182 four side molder. It is made in three sizes, eight, nine and ten inches wide. The accompanying illustration gives a very good idea of the appearance of this well designed car shop tool.

In order to work very heavy moldings without vibration, the manufacturers have given special attention to the construction of the frame. It is cast in one piece, very heavy, and it is extra long to give good belt length. The feed is very powerful and positive, consisting of four geared rolls, the two upper ones being spur sections and the two lower ones solid. The upper rolls are driven down, which makes it possible for the makers to attach their patent spring hold down, giving uniform pressure on the material, and being in every way more powerful and satisfactory than the old system of weights and levers, commonly found on molders.



FAY & EGAN CAR SHOP MOLDER NO. 182.

Sectional clamp bearings are applied to both the upper and lower cutter head spindles. The bearings consist of metal plates held in position by clamp bolts. These exert no downward pressure on the journals, and cannot be screwed tight enough to bind, a feature of the old style cap boxes that often gave trouble. By releasing the clamp bolts and simply pressing the plates down with the hand, any wear may be taken up. A cool running journal is thus insured.

Powerful screws mounted on ball bearings raise and lower the bed, the section of which, after the lower head, swings down out of the way to give access to the knives. The side heads, which are mounted on a table, have independent vertical, lateral and angular adjustments. For further particulars, you are requested to write the manufacturers, who will be pleased to give you full information.

The Kindly Kind of Porter.

"What numbah, lady?" asked the pleasant looking porter, addressing the woman who came on board his Pullman an hour before train time.

"Upper 16," answered the mild passenger.

"Upper 16!" The porter's exclamation was almost a shriek, and his face screwed itself into wrinkles of concern.

"I know it's hard," sighed the woman, as, with a softening of her heart, she felt that this menial was expressing for her the indignation she would have liked to voice herself.

"I don't b'lieve this ca-a'h's all sold out like that!" he scolded. "You just have a seat theah, lady, while I goes into the office; I kin suah git you somethin' bettah!"

The world was not so bad after all. There was a goodness in human nature which exceeded her most optimistic dreams. For here was this man, belonging to a department of service not noted for its eagerness to coddle patrons, taking such a kindly interest in her comfort.

The porter returned, with a lag in his step and a discouraged shake of his head.

"Best we kin do, lady; got an awful crowd comin' on heah to-night."

"Well, it's too bad; but thank you, just the same, for your trouble," beamed the recipient of this unusual attention.

"Ya-as'm, suah it's too bad!" muttered the porter, as he started for the linen cupboard. "I was goin' to sleep in uppah 16 myself."—*Puck.*

B. of L. E. Souvenir.

The Ninth Biennial Convention of the Brotherhood of Locomotive Engineers have marked their visit to Detroit in May by a very elaborate souvenir in book form. The pages measure 9 x 12 ins. so that there is ample room for the fine engravings which they have had made of scenes in Detroit, where the convention was held, and of the neighboring city of Windsor on the Canadian side of the river. No more beautiful park is to be found in any city than that at Belle Isle with its many attractions, natural and artificial. The souvenir book also contains views of the city of Jackson, Mich., one of the principal cities of the State. Those who attended the convention in Detroit last May will be able at any future time to refresh the memory by a glance at this most artistic, tasteful and elegant souvenir.

Early Opposition to Railways.

In a speech delivered by the chancellor of the University of Syracuse, Mr. James R. Day, before the New York Traffic Club some interesting reminiscences were given. Speaking of railways as he remembers them, the chancellor says: "My acquaintance with railways began as a boy in Maine when my father shipped lumber over a road with wooden rails upon which were nailed iron straps. The little locomotives had fierce names. They were the 'Lion' and 'Tiger.' I remember riding on that road one day when the engineer saw a spike sticking up through the iron. He ordered the fireman to run ahead and drive it down, which he easily did before the engine reached it!

"But the old road has gone and the little old engines, as they were called, repose in museums, I am told. But it was a great railway to my boyish fancy, and none has ever interested me more nor been invested with greater dignity and glory. 'Con' Sullivan, the engineer, was the greatest man of the village.

"My next acquaintance with a railway was of what is now the Maine Central, a locomotive with red driving wheels and a vast umbrella-shaped smokestack—the greatest engine of the State, weighing twenty-five tons, burning, I have forgotten how many cords of wood, and running twenty-five miles an hour.

"I recall that these roads were not without unfriendly criticism and opposition. The first had crowded out ox and horse teams which for years had enjoyed the monopoly of drawing lumber over to the seaport town. The other had displaced the stage coach and closed the country inns along its route. This opposition recalled to mind the violent attacks made upon railway promoters in early days.

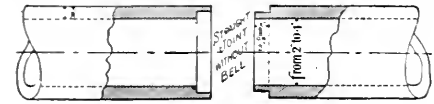
George Stephenson was accused of interfering with the farmers' sale of oats and hay. He was told that the noxious gases from his engines would kill the pheasants and the screech of his whistles would scare away the foxes, making hunting impossible, and the noise and confusion would prevent the hens from laying. This all seems very ridiculous now. Certain railway legislation of today will appear equally ridiculous less than a century from now."

Pennsylvania Railway Relief Fund.

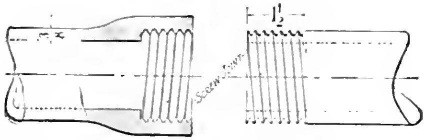
The monthly report of the Relief Department of the Pennsylvania Railroad system shows that nearly $230,000 was paid to members during the month of March, 1910. On the united lines east and west of Pittsburgh during March the payment for the families of members who died amounted to nearly $75,000, while to the members who were incapacitated from work during the same period nearly $75,000 was paid. Since 1886, a total of more than $28,000,000 has been paid out. The work of this department is most laudable.

New Cable Conduit.

A new cable conduit has recently been placed on the market by the H. W. Johns-Manville Co. of New York, known as J-M Fibre Conduit. It is noteworthy because of some features new in the manufacture of conduits. It is made of indurated fibre, a material which has been extensively used for insulating purposes. In making the conduit the fibre is moulded into shape under high temperature and immense pressure, and is thus without grain or laminations. This process gives each length of conduit a solid, ⅜-in. one-piece wall quite homogeneous, with a tensile strength that is remarkable when compared with the light weight of the conduit.

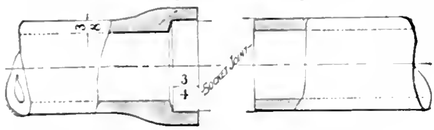


J-M. CONDUIT STRAIGHT JOINT.



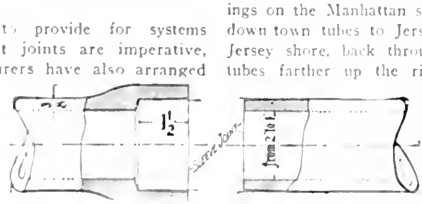
J-M CONDUIT SCREW JOINT.

Perhaps the most interesting feature of this new conduit are the bell joints. One end of each section is moulded to an enlarged size, with an opening as large as the outside diameter of the opposite end of the next section. Thus, any two sections fit together without any reduction in the wall thickness of either section at the joint. This makes a stronger and more rigid connection than is possible with other kinds of joints.



J-M CONDUIT SOCKET JOINT.

In order to provide for systems where straight joints are imperative, the manufacturers have also arranged to make this new conduit with straight line joints. These are perfectly smooth inside, with no offset. Each length of the conduit is also smooth throughout its bore. This greatly facilitates the work of inserting cables. The manufacturers claim that by reason of there being no seams or roughness at the joints, a No. 6 wire can be pushed through each duct from manhole to manhole, thus doing away with the use of any ropes or rods. A very attractive booklet has been got out by the manufacturers, and a copy can be obtained by writing to the H. W. Johns-Manville Co., New York.



J-M CONDUIT SLEEVE JOINT.

"Tunnel Drill" for Lehigh Agents.

Seventy passenger agents, from all the local offices of the Lehigh Valley Railroad, some time ago were brought to New York by squads to receive visual and oral instruction in regard to the Hudson River tunnels. At the time of the formal opening of the tubes descriptive literature was sent to all the Lehigh passenger agents, but experience showed the railroad officials that no amount of reading compares with actual experience. Mr. C. S. Lee, General Passenger Agent of the Lehigh, decided that every man who came in contact with the ticket-buying public should actually ride through the tubes, so as to be able to readily answer any questions asked.

The seventy passenger agents received a thorough drill in the Terminal Buildings on the Manhattan side, through the down town tubes to Jersey City, up the Jersey shore, back through the pair of tubes farther up the river, and under Sixth avenue to Twenty-third street. Now they know just where the tunnels run, and can give graphic descriptions to inquirers of just where the arrows on the walls of the stations point to, and whether to turn to the right or the left at the bottom of the elevators in the Jersey terminal.

Hearing at Fault.

A well-known railway general manager on one of the Western lines was rather deaf in his old age, and although a venerable looking gentleman, had not entirely abandoned a habit of profanity, which he had acquired as trainman in his youth.

Mr. G. M. happened to be in Detroit one time when there was a Methodist conference going on, with headquarters at the Cadillac Hotel. When Mr. G. M. walked into the dining room, the head waiter, thinking that he belonged to the clericals, seated him at a table reserved for the ministers. Presently one of the brethren looking at Mr. G. M. remarked, "Perhaps our strange brother will say grace?"

Mr. G. M., having an idea that he was addressed, shouted: "If you are saying anything to me speak louder, for I'm so d—— deaf, I can't hear ordinary talk."

Electric Signal Lamps. B. & O.

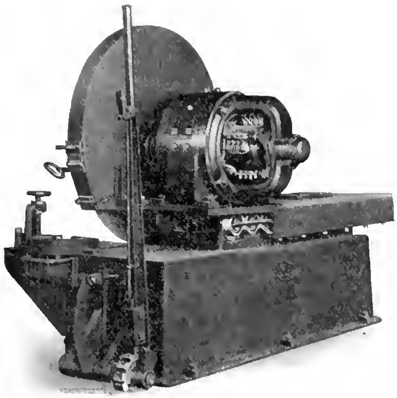
Statistics of the performance of the Baltimore & Ohio Railroad's electric signal system for 1909, just compiled by Mr. F. P. Patenall, signal engineer of the road, show a marvelous percentage of efficiency, and, compared with oil-burning signals, great economy in operation. On the Washington Branch, between Baltimore and Washington, the 69 lamps were lighted and extinguished 1,259,250 times, while on the Metropolitan Branch, between Washington and Gormantown, Md., the 38 lamps were lighted and extinguished 208,050 times, and during the year there were but 9 failures, 4 being caused by lightning and 5 by films burning out. The Baltimore & Ohio has had in operation since 1907 the system of electric lightning for signal lamps patented by Messrs. F. P. Patenall and G. H. Dryden and the results have been very satisfactory.

On the Washington Branch 69 of these lamps are in service and 38 between Washington and Gormantown, on the Metropolitan Branch. When burning the lamps consume approximately one-half an ampere of current, and on the Washington Branch, where fifty trains are run each direction daily, this results in each lamp burning one hour and forty minutes each twenty-four hours. The lamps light upon approach of the trains both day and night. The territory covered by these 107 signals is divided into five sections, the signal appliances and batteries on each section being maintained by one repairman and one batteryman, no lampman being required.

Thimbles were first made in Amsterdam, Holland, about 250 years ago. Cupid inspired the move that caused a young goldsmith to devise a thimble to protect the fingers of his lady love from the punching of the needle.

High Speed Friction Saw.

Joseph T. Ryerson & Son, of Chicago, have just completed a high speed friction saw particularly adapted to car shop work. Since steel has now entered so extensively into car work, there has been a great demand for some quick method of cutting up steel sections, small bars, rails, etc., and the machine illustrated was designed to answer that purpose. In this design the makers were prompted by the advice of a number of railroad mechanical department men, who suggested the remodeling of the saw previously manufactured for this purpose.



HIGH SPEED FRICTION SAW.

The Ryerson high speed friction saw has a capacity to cut continuously, 15-in. 80-lb. beams, and this without turning the beam. Other sections of smaller or equivalent cross sectional area can also be cut. We are told that a 15-in. beam may be cut in from 28 to 38 seconds and smaller sections in less time. The machine is self contained and has no bolts, gears or other driving mechanism that consume power or are apt to get out of order. All parts of the machine are designed as simply as they can be made without sacrificing strength and efficiency. The machine complete occupies floor space approximately 7 ft. long by 4 ft. wide. No foundation other than a good floor is necessary.

The saw discs are made from ordinary flanged steel, and two are furnished with each machine. Additional blades can be made in the railroad shop when required. The only sharpening necessary is occasionally to renick the blades on the edge, which operation can be done in about fifteen minutes with a special chisel which is furnished with each machine. A very full description of this saw may be had from a circular issued by the makers. The circular will be sent free on request.

Who Gets the Difference?

In these days of high prices much blame is placed upon the railways by people who take no trouble to investigate. Here is a sample. Potatoes are sold by the farmers in the upper part of New York State for 20 cents per bushel. The freight charge from Rochester to New York is 9 cents per bushel. The potatoes are then sold at $1.50 per bushel, and when sold in small quantities to consumers the price is $2.56 per bushel.

The same ratio applies to nearly every other commodity. Eggs are bought from the farmers at less than 20 cents per dozen, and are carried by rail over 300 miles for less than half a cent per dozen. The eggs are then sold in New York at prices ranging from 40 to 60 cents according to the locality where the purchase is made.

The increase in prices between the producer and the retailer is without a parallel in the history of the world, except in a few cases of prolonged sieges when lines of communication were threatened or entirely cut off. Wherever the fault lies it is well to know that the railway companies have no share in it.

Sufficient Excuse.

"Now, guard," said an eminent novelist, "remember if I have this compartment all to myself for the entire journey you will receive half-a-crown from me." "Very good, sir!" replied the guard, and he locked the door. All went well till they got to a certain station where an irascible gentleman pulled at the door of a locked compartment. "Guard! Guard!" he called. "Open this door! I've got the same right to travel in this carriage as anybody else, and I mean to do it!" The guard hurried up, whispered a few words to the irascible gentleman, who went quietly away to seek room elsewhere. "How did you manage it?" asked the author at the end of the journey, as he pressed the promised half-crown into the guard's hand. "How did you manage to get that bad-tempered old chap to go away so quietly?" "Oh, that was easy, sir!" replied the guard. "I told 'm you were a bit wrong in the 'ead!"

Egg Specials in England.

The movement for the co-operation of railroads, with farms has reached the other side of the Atlantic, and in England they are running what are called "egg trains" with lectures on how to conduct the poultry business on a profitable basis.

Railroad Necessities.

The preservation of air-brake hose and the prevention of leaks in pipes, etc., is one of the most important items in railroad car maintenance. For example: The shifting of the main 1¼-inch pipe breaks and loosens the connections at the cross-over pipe, causing them to leak. As a result of experience, the M. C. B. Association established standards for the location of brakes, pipes and their application and maintenance, designed to meet all of the requirements of the service. One of the most common defects in brake equipment is leaky train pipes, due to insecure fastenings and to the shifting of the pipes when cars are bumped in switching. The Monogram Bracket manufactured by Guilford S. Wood, of Chicago, makes shifting impossible. All of the M. C. B. requirements are obtained and maintained. The bracket is designed for strength with a liberal factor for safety, and its use reduces the cost of maintenance.

Another of the devices made by Mr. Wood is the flexible nipple and protector for air hose. About half the discarded air hose are found to be damaged at the nipple end. A photograph of an air-brake hose having a sheet iron protector at the nipple end, which was in use twenty-eight months, shows the result, and one might almost say the abnormally, hard usage air hose gets at the nipple end. With a view of protecting the hose and so increasing its life, Mr. Wood, whose address is Great-Northern Building, Chicago, has got out the flexible nipple end hose protector made of coiled wire. The protector is removable, for its upper end is held by the hose clamp. It is flexible because made of coiled wire and it is practically indestructible because it is heavy steel wire placed over rubber. Mr. Wood has issued several folders on the subject of the bracket and of the protector. All are so well illustrated that the letterpress is hardly required, though the use of each device is fully explained. The folders are quite interesting and can be had free on application to Mr. Guilford S. Wood, Chicago.

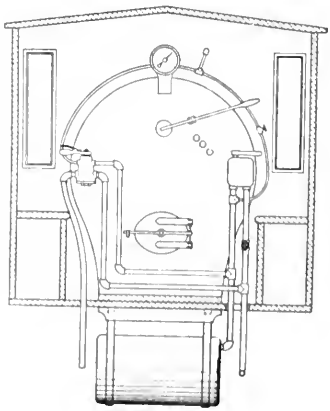
Paid for Repartee.

The foreman and his gang were clearing up a wreck on the day after a heavy rain storm had visited the country, and the superintendent, who had brought some men from the other end of the division to help, came up to the foreman and said: "Bucknell, do you see that lazy, good-for-nothing lout over there; give him a day's pay and get him out of here. I'll get you a refund but I don't want him here." Bucknell looked in the direction the super's eyes had taken and saw a fellow in workman's garb watching men resetting a pair of jacks under the buffer beam of the derailed engine.

The foreman went up to him and said, sharply: "Look here, my man, how much do you get a day?" "One twenty-five," he replied. Bucknell handed him the money and said: "Now, then, you get out of here quick. You haven't rendered much assistance." "No," he said, slowly and reflectively. "I wouldn't render any assistance to thick skulls like you. If you made an honest effort to raise that engine it wouldn't be so bad, but you've done nothing but jack down a couple of ties into the ballast and left the engine where it was. You'll have them in China some day if you keep at it." The foreman, not very pleased at this kind of talk from one of the "men," jerked out: "Be off with you, and keep your brilliant repartee for someone who appreciates it." The man moved off slowly and Bucknell went up to the super with, "I got rid of your man, sir." "My man," said the super in surprise. "Bucknell, you ought to be ashamed of yourself having a fellow like that around." "Well, Mr. Blakely, if he isn't one of the men you fetched here, he isn't one of mine, and I've taken a lot of his impudent back talk and paid him $1.25 for it."

Auxiliary Brake Valve.

Our illustration shows an invention of Mr. S. N. Stevens of Fitchburg, Mass. It is an additional brake valve or emergency valve and is placed on the fireman's side of the locomotive and is intended to be used by him in



AUXILIARY BRAKE VALE.

the event of a disability to the engineer, or the engineer's brake valve or in case the fireman observes a stop signal or an obstruction on the track that cannot be seen by the engineer. It accomplishes its purpose by taking air pressure directly from the brake pipe, and the reservoir connection is for the purpose of operating the track sanding device with the application of the brake. It is covered by patent No. 955,611. The inventor tells us the valve can be applied at small cost and that the maintenance charge is practically nothing.

A Study of Bells.

Quite an interesting folder has been issued by the Vanadium Metals Company of Pittsburgh, Pa., on the subject of the use of their Victor Vanadium Bronze in the manufacture of locomotive bells. A test was made by a company that makes annually thousands of large bells. It was a comparative test between Vanadium bronze and the standard bell which is an alloy of 82 per cent. copper and 18 per cent. tin. The Vanadium bell was judged to have the better tone, to be much lighter, and its physical endurance was far beyond that of the standard bell. This whole question of Vanadium as one of the ingredients of steel or other metals is one of interest and importance to the mechanical engineering world. The circular about the bells is illustrated. Send to the company if you would like to know something about the matter.

One on the Foreman.

A blacksmith took a day off, and his newly hired helper was improving the shining hour by trying his hand at forging something himself. It had looked simple enough folding a bar of heated iron over a square mandril with a welding heat where the two edges of the bar met. When the job was finished the foreman came around to look at it. It was burned here and hammer-marked there. It was neither square nor three-cornered. It partook more of a combination of a trapezium and rhombus. It was so warped it would hardly lie still on the floor. When set on end it tumbled over to the heavy side. It was so indented by erratic blows of an unmanaged hammer that it looked as if it came through a shower of grape shot.

"What do you call that?" said the foreman. "Spring-band," said the helper.

"You do? I'll tell you what I'll do," said the foreman. "If you show me another thing like that I'll give you two dollars."

The helper dug among the coal for a few minutes and produced the exact counterpart of his creation in metal, the result of a previous effort he had made in the same direction.

Borne down by the weight of popular opinion, and the convincing resemblance of the two distorted metallic miracles, the foreman handed over the money.

When not engaged in hammer swinging the helper is now assisting the white-washing gang, and wheeling coal, and sweeping the floor, and carrying planks from place to place, and lifting bundles of iron hither and thither. He is hesitating as to whether he will join the army or navy. He will do something desperate soon.

Liquid Finish.

Two men who had the earmarks of the "tramp" were riding on a Germantown car during the Philadelphia strike. One of them was poorly clad and dirty, and his companion was of the same stamp. His companion was reading a piece of newspaper, and now and then leaned forword to comment on the news. "'What do you think of this,' he was heard to exclaim. 'Fellow drowned in a beer vat in Milwaukee yesterday.' The other rubbed his eyes and said: "Poor fellow, floating on his watery bier."

Air Brake Hose Renewals.

The M. C. B. arbitration committee have issued the following notice to members intended to make clear a point in connection with the renewal of air brake hose:

"It has been brought to the attention of the Arbitration Committee that a great deal of trouble is being experienced at interchange points as to the proper interpretation of the words 'Name of Railroad,' on the label for M. C. B. Standard 1⅜-inch air-brake hose, and that hose which meets every requirement of the specifications, except that it does not bear the name of a railroad company, is being removed from cars. In order that there may be no delay to traffic and to avoid any further trouble, the Arbitration Committee recommends that where the label bears either the name of the road or the name of the purchaser in the location shown for the name of the road and meets the M. C. B. hose specification in all other respects, that it be considered standard hose."

Collision with Geese.

The night express on the Intercolonial Railway between St. John and Moncton encountered a large flock of wild geese near Salisbury. The result was disastrous to the birds. When the train reached Salisbury station the driver found five dead ones on the pilot of the engine. The birds were flying low in a dense fog and were probably confused by the glare of the headlight. Although it is not uncommon to hear numerous flocks of geese in nocturnal flight at this season of the year the birds were unusually plentiful around the city the previous night and at times the air resounded with their discordant honking.—*Montreal Herald.*

Superheated Steam.

The subject of the efficiency of superheated steam is always an interesting subject, but it is particularly so at the present time when there is a tendency to substitute it with lower boiler pressure, for the high pressures introduced a few years ago. In this connection there has just been published a report of superheater tests of the Jacobs high and low pressure superheaters as applied to tandem compound locomotives on the Atchison, Topeka & Santa Fé.

The report which occupies 116 pages is signed by Mr. H. B. MacFarland, engineer of tests. The report also gives the record of road tests made on a simple engine of the 2-8-2 type, fitted with the Jacobs smoke-box superheater. Altogether this book is probably one of the most complete and exhaustive reports on the subject that has ever been brought out and the Santa Fe is to be congratulated on having gone so thoroughly into this important subject.

Grim Industry.

The wandering master mechanic sat in this office all afternoon relating his out of the way experiences. Among the many curious things he told was this anecdote. He said:

"About five years ago I was appointed master mechanic of a railway in Central America. On arriving at headquarters I found the most desolate shops I had ever seen. I walked through the machine shop and found the men slumbering over the most ancient machine tools that ever escaped the scrap heap. Then I entered the car shop and found decided activity there. All the men were busy making coffins."

Corrugated Fireboxes.

The W. H. Wood Loco. Firebox Company, of Media, Pa., have issued a small publication of the catalogue variety giving information concerning the corrugated firebox made by this concern. In it Mr. William Wood, the engineer of the company, answers several very pertinent questions about expansion and contraction. He gives the opinions of many other engineers and boilermakers on the form of construction adopted by the Wood Company. The pamphlet is clearly illustrated and should prove of interest to all those who have to do with the care or maintenance of boilers. Write to the company for a copy of the pamphlet if you are desirous of learning something about the corrugated firebox. The pamphlet is for free distribution.

The Good Old Times on the Erie.

Mr. C. F. Stickles, an old time conductor on the Erie Railroad, writing to the Erie Railroad Employes' Magazine, draws a picture of a trainman's duties in the good old times, that tells graphically the hardships the men had to endure in the days when the operating of railroads was under development. Mr. Stickels writes:

"Conductors were their own secretaries and kept their own accounts and had hard work to keep their cash straight, as cash fares would get mixed up with their own money and it was hard to separate it from the company's.

"In those days the brake boys had to keep the coaches warm with wood stoves, one in each end of the coach with a large wood box which had to be kept full by bringing in the wood by the armful from stations where the train stopped. When the train stopped they would have to get out and hold it by hand brakes at all stations, also. If you had a hot journal you had to crawl under the car to pack it, as there were inside bearings.

"The freight boys had to ride on top most of the time, help wood up the engine several times over the division, string a bell rope over the train and pull it in again at terminals. All trains stopped for meals somewhere between Adrian and Binghamton.

"Such a thing as overtime was never heard of in those days. A day and a half was the time allowed from Hornell to Susquehanna, no matter if it took a week to do it in. However, special time was allowed for work done on the division when being held for some purpose or other.

"I believe there is one brakeman left on the Susquehanna division who registers back to 1865—forty-five years ago. There are three who have 40 years to their credit; two who have 39 years; three who have 38 years; one who has 37 years; two who have 36 years; two who have 32 years; one who has 31 years, and there are twenty-three who, I think, have from 21 to 27 years, all good and faithful employees."

The Very Acme.

The Acme Machinery Company never do things by halves. Their latest illustrated catalogue of bolt, nut and forging machinery, is one of the most complete publications of its kind that we have ever seen. It contains over 160 pages and over 100 illustrations and presents an elaborate variety of machines, comprising the newest and finest equipment in both cutters and threaders, nut forging and tapping, bolt and rivet heading machines. Some of the machines, especially the upsetting and forging machines, have all the ponderous massiveness of heavy artillery, some of them weighing as much as 25 tons. The six spindled nut tappers are models of elegance and lightness. The bolt cutters have several new features that must be seen to be appreciated. All interested in the tools we have alluded to, should have a copy of this fine catalogue, which may be had on application at the main office of the company at Cleveland, Ohio.

The Commercial Acetylene Company have moved their Western office to the Peoples' Gas Building, at the corner of Michigan and Adams streets, Chicago.

By Rail Across Australia.

A transcontinental Australian railway is one of the probabilities of the near future. A survey of the proposed line was provided for in 1907. This has been completed and a report made to the Federal Government (of the Australian States). The line will be 1,063 miles in length, and its estimated cost $20,000,000. There is at present no rail connection between the eastern and western sections of the continent.

Kalgoorlie, the western terminus of the new line, is the great western gold field of the country. It is at present connected with Perth, on the western coast, by a railroad some 350 miles in length. Railways in both Victoria and New South Wales are fairly well developed, and Port Augusta is connected with the Victoria lines by a road through Adelaide to Melbourne. Lord Kitchener is a strong advocate of the transcontinental for strategic reasons, connected with the defense of the Commonwealth in case of military need.

The Prime Minister is reported to have said apropos of Lord Kitchener's remarks: "We have appealed to Cæsar and mean to follow his judgment." All of which seems to indicate an early breaking of ground for the new line. Another fact likely to hasten the project is the discovery that much of the country surveyed is capable of agricultural, or at least pastoral, development—the soil fertile and the only need water.

A rather unfortunate feature of the railway situation in Australia is the multiplicity of gages. These vary on the present lines from 2 feet 6 inches through 3 feet 6 inches, and 4 feet 8½ inches to 5 feet 3 inches. At a "gauge conference," held several years ago, it was decided that in case any formal unification of track width was ever adopted the gauge should be 4 feet 8½ inches. This is the width adopted for the new line.—*Collier's.*

Valves and Wrenches.

A descriptive pamphlet finely illustrated and extending over 40 pages has just been issued by the Walworth Manufacturing Company, Boston. The valves and fittings of the company have a world wide reputation and in many respects their output is the highest standard of design and workmanship. Their boiler blow-off valve has become deservedly popular, while the boiler trimmings and mountings generally could not be surpassed in elegance or utility. As makers of tools also their Stillson wrenches have long held a place in the front rank. Their heavy pipe and bench vises are established favorites. The same may be said of their dies and pipe cutters and chain tongs and other small tools. All interested should obtain a copy of the catalogue, which may be had free on application.

Very Fast Going.

When the average American drummer finds himself among strangers of a boasting town he generally manages to hold his own. Sam Short, who travels for Minor, of Chicago, was enjoying an evening cigar in the smoking room of the Kinton, in London, when one of the company began to boast about fast trains. He had come in from Aberdeen last week, and, by Jove, they came through in eight hours, some stretches being made at 100 miles an hour.

"That's nothing," remarked Short. "You know that in the West we have hitched the power of the Mississippi River to train hauling, and the way those electric driven cars hum along is a caution. One hundred miles an hour is crawling.

"Why, last month, when I was leaving home in Omaha, my wife came to see me off. Just as the train was starting I leaned down to kiss my wife, and the train went off so sudden that I kissed a cow fifty miles east in Iowa."

Traveling Engineer's Subjects.

Mr. J. A. Talty, chairman of the committee on subjects for the next convention of the Traveling Engineers' Association, has issued a circular to the members in which he says:

"The undersigned having been appointed by the president as chairman on 'Subjects for 1911,' your committee would appreciate any suggestions that you have to offer in the way of subjects that you would like to have discussed in our 1911 meeting. J. A. Talty, chairman, Committee: Messrs. W. G. Wallace, J. P. Kelley, J. F. Roddy, Ed. M. Sawyer.

The Traveling Engineers' convention is to be held next September, and, although 1911 is a good way off yet, it is to be hoped that Mr. Talty's request will meet with a full and prompt response.

The Art of Metal Spinning.

"Metal Spinning" is the title of a pamphlet recently issued by the Industrial Press. It is written by Mr. C. Tuells and William A. Painter, and its thirty-eight pages contain numerous illustrations. The price is 25 cents. Metal spinning is an art which was practically perfected long before press working of metals acquired commercial importance. As press working developed metal spinning declined relatively as a manufacturing method, being a process requiring a certain amount of manual dexterity and skill. It has never been superseded, however, especially for making fine brass, copper and aluminum ornamental hollow ware. The art is now being revived in modern lines for other than ornamental work because of the advantages it offers in many respects.

Some Fast Runs.

McCord and Company have issued an elegant folder giving an interesting description of the runs made by trains on the Philadelphia & Reading Railway and the Pennsylvania Railroad between New York and Philadelphia. The average speed of both trains is about 50 miles an hour, but there are several stretches where the speed approaches 90 miles an hour. The McCord Force Feed Lubricator was at work on both trains besides other of the McCord specialties, including the McCord Journal Box, the McCord Draft Gear and McKim Gasket. Send for copy of the Folder to the company's office at 50 Church street, New York.

Capacious.

Miss Pollie Juggle's mouth was exceedingly well developed. She sat in blissful contentment on the sea beach at Long Branch, watching the restless sea, and something of its grandeur shed its light upon her soul. "Oh, Harry," she said to the young man by her side, "how grand it all is, ain't it? I feel as though—as though I could open my mouth and take it all in." A small boy who was near by looked up, a startled gleam in his eye. "But I say," he remarked, "you won't do it will you? We only came down here yesterday."

Activity on the B. & O.

The output of the Mount Clare shops of the Baltimore & Ohio Railroad for the month of April was the largest in their history, exceeding the record for March, when 45 locomotives underwent heavy repairs and were rebuilt. About 2,200 men are employed by the B. & O. at Mt. Clare, 1,600 being in the locomotive shops, and the steady increase of traffic on the system has necessitated overtime work by many of them in order to keep the equipment in condition to handle the business. Mount Clare is the principal shop on the B. & O., and most of the heavy repair and rebuilding of equipment is done there.

In order that the shops might be run to their full capacity the B. & O. recently placed a large order for new machinery; practically all of this has been put in place. Eight modern engine lathes, a quadruple multiple drilling machine, a steam hammer for the blacksmith shop, numerous wood working machines for the cabinet shop, an automatic turret lathe and various special machines have been installed. The lathes and drilling machines are driven by electricity.

The new equipment orders are being filled and placed in service. Up to the present time more than 100 consolidation freight engines and 20 Atlantic type express engines have been received. The entire order was for 230 freight and 26 passenger engines. Of the order for 10,000 freight cars, more than 3,000 have been delivered and put in use.

Railway Men Honored.

A press from Montreal recently printed in the Toronto *News*, says: Mr. D. McNicoll, vice-president of the C. P. R., has been made an Esquire of the Order of St. John of Jerusalem, and Messrs. Lacy R. Johnson and S. A. Gidlow, of the same company, honorary associates of the order, of which Sir Thomas Shaughnessy was recently created a knight. These honors have been conferred in recognition of the work of the railway in the organization of the St. John's Ambulance Association of the Angus shops. Mr. Johnson is assistant superintendent of motive power of the C. P. R. and Mr. Gidlow is secretary of the First Aid Department of that road.

Radial Trailing Truck.

The American Locomotive Company have recently issued Bulletin No. 1003, in which the radial trailing truck for locomotives as made by that company is very fully described and illustrated. In addition to the details of the truck which are illustrated by line engravings, examples from a number of types of engines using this truck are given in the bulletin. Those who desire to understand the construction of this truck should write to the company, 30 Church street, New York, for a copy of the bulletin.

The Standard Coupler Company announces the removal of their Chicago office from the Fisher Building to 1005 Peoples' Gas Building, corner Michigan avenue and Adams street, Chicago. This well-known company are makers of Standard Steel Platforms, Sessions-Standard friction draw gear and Standard couplers. Mr. Geo. A. Post is the president of the company.

Hate to Experiment.

Railway officials hate to experiment with novel devices on the locomotive, a sentiment which sometimes leads improvements of real merit to be rejected. We do not remember of any improvement worthy of notice that came into use without opposition. One of the greatest causes of annoying labor to engineers in the old times was packing the stuffing boxes of piston rods and valve stems. Yet the introduction of metallic packing was fiercely opposed by the forces of ignorance and prejudice.

Signal Instruction Cars.

To increase the efficiency of operating employees the Pennsylvania have decided on signal instruction cars on all divisions. The main line divisions between Philadelphia and Pittsburgh have been equipped.

Explicit personal instructions are to be given frequently to enginemen, firemen, conductors and trainmen. These are to be given in the signal car and will include not only block and interlocking signals but all others used.

These signal instruction cars are 60 feet long, divided into two compartments. One room will be for examinations, the other has a table upon which is placed under a glass cover a large track chart of the railroad, which can be rolled back and forth by means of rollers placed at each end. It shows all main running tracks, switches, cross-overs, all signals, track troughs, stations and mile posts. The men will be given an opportunity to study this chart prior to passing an examination. Each car is provided with a set of model signals, which can be manipulated so as to show the signal indications that the men receive when on the road.

The cars are in charge of examiners, each with an assistant. They will conduct the examinations, with the exception of those on machinery and air brakes. The cars may also be used for examination of employes on other subjects beside the signals, such as train rules, etc.

Independent Air.

The high degree of perfection to which the manufacture of air tools has reached is finely illustrated in the latest circular issued by the Independent Pneumatic Tool Company, Chicago, Ill., a copy of which may be had on application. Their Thor air tools embrace hammers equipped with duplex valves combining strength with lightness, piston air drills and reamers, long stroke rivetting hammers, stay-bolt drivers. A new feature is introduced in what is known as Thor No. 9, close-quarters piston air drill. This drill is well suited for locomotive work, particularly where spaces for machine work is limited. Any of this enterprising company's machines will be sent on trial at the company's expense.

Electric Locomotives for P. R. R.

The Pennsylvania Railroad Shops are working on 43 new electric locomotives for use in the Hudson River tunnels, at New York. The trucks are being built at the Juniata shops while the cabs are being turned out at the car shops, and the keen rivalry between the two departments has resulted in the machines being completed at the rate of six a week. They are then sent to the Westinghouse Electric Company at East Pittsburgh to be electrically equipped.

The Cleveland Twist Drill Company, of Cleveland, Ohio, have moved their Chicago branch to No. 9 North Jefferson street. In their new location, greatly improved facilities for the prompt handling of their steadily increasing business are afforded.

Terra Cotta Stations.

Three terra cotta railroad stations have been built by the Lehigh Valley Railroad, and plans for a fourth are now being considered. The structural material is the hollow tile block of the kind used for fireproofing skyscrapers in New York and other cities. The exterior surface of the walls is covered with stucco, so that the terra cotta tile itself is not visible when once a building is complete. Tests of the material have shown that it is strong enough to stand any strain put upon it and will be as serviceable as stone or brick.

The new style stations of the Lehigh Valley are at Honeyoye Falls, Freeville and Interlaken, N. Y.

In addition to being fireproof, the stations have the advantage of being warmer in winter and cooler in summer than stations of the ordinary type. This is due to the hollow spaces, or what some call the dead air spaces, which make the blocks non-conductors of heat. The New York, New Haven & Hartford Railroad recently built a hollow tile station at Rowayton, Conn. The Delaware, Lackawanna & Western have been making investigation with a view of using terra cotta in some of the new stations on that road.

Re-rolling Old Rails.

About four or five thousand tons of steel rails are being re-rolled by the Provincial Steel Company at Cobourg, Ont., for the Intercolonial Railway, and at the present time from fifty to one hundred tons of rails are being turned out daily.

These rails were purchased by the Intercolonial Railway from the old Ship Railway between Fort Lawrence and Baie Verte. They were then placed in use on the I. R. C., and since have been torn up and sent to Cobourg to be re-rolled. The rails formerly were of the one hundred and ten pound variety, and are being reduced to eighty pounds. They were laid on the road a few years ago, and becoming somewhat worn were taken up and sent to the Provincial Steel Company, who are now engaged re-rolling them. The Provincial Steel Company is a new industry started in Canada, and this is the first work they have done for the Government road. The process used is called the McKenna process. Used rails are heated and then put through the rolls, thus making the rails practically new, but reduced in weight and size.

In the suit of the Simplex Railway Appliance Company against the Pressed Steel Car Company for infringement of Simplex bolster patents, the United States Circuit Court for the Southern District of New York, has decided in favor of the Simplex company.

Railroad Fish Planting.

The Lehigh Valley Railroad are helping the fish commissioners of New York and Pennsylvania stock the streams in these two States with fish. The Pennsylvania commissioner, Mr. W. E. Meehan, has already sent out three hundred cans of trout fry, from the Harrisburg hatcheries, for spring "planting" along the line of the road. The company is also co-operating with the New York commissioner in his efforts to stock the up-State streams with trout and bass. A corps of trained attendants accompanies each consignment of fish, to see that they are fed at regular intervals and planted scientifically. Every effort is made to transport them with the least possible delay. The railroad company arranges with outing clubs and individuals to be on hand the minute the fish arrive, so that no time will be lost in getting them to the water.

The baby trout or bass, known as "fry," are hatched during the winter at the State hatcheries. In the spring they are distributed. More than two dozen streams in Pennsylvania, tributary to the Lehigh and Susquehanna rivers, have been stocked with fish year after year. Many parties spend the summer months in house boats on these rivers, fishing directly from their dwellings, or rowing up the tributaries in small boats.

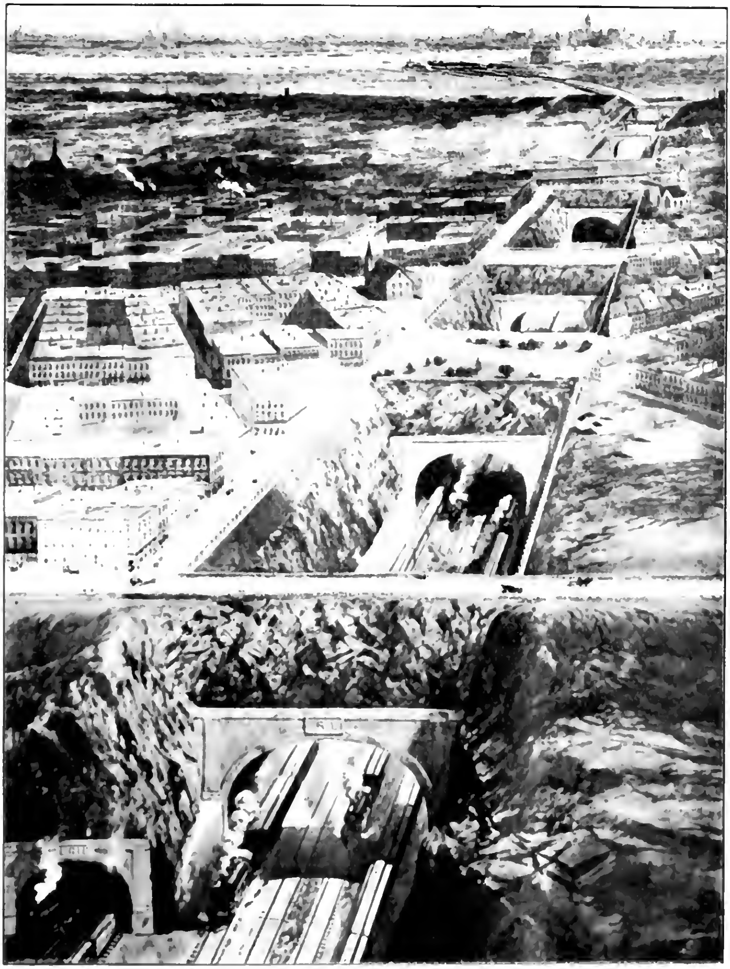
Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances

Vol. XXIII. 114 Liberty Street, New York, July, 1910. No. 7

Erie's Four-Track Open Cut.

The Erie Railroad Company has so far completed the task of constructing an open cut through Jersey City Heights, as to have finished two tracks all the way through and connected them, so that about the middle of June last passenger trains of the main line, New Jersey & New York and the Greenwood Lake branches began to use the new line, both east and westbound. The Northern Railroad and Susquehanna [illegible] direction have [illegible] finished [illegible] Bergen tunnel, which [illegible] that [illegible] for traffic to and from Jersey City, will now be used only for the movement of freight trains. The two tracks now completed are known as numbers 2 and 3, they being the two middle ones of a prospective four track line through the cut. The value to the patrons of the Erie of the new open



OPEN CUT ON THE ERIE [illegible] THROUGH THE BERGEN HILL.

cut, particularly the commuting passengers, is too great to be measured in words; to the entire passenger service, it means no more tunnel delays, no more

VIEW OF OPEN CUT FROM ABOVE.

closed windows, stifling atmosphere or artificial light—but a clean, wholesome ride for everybody and the elimination of the only passenger tunnel on the Erie Railroad between New York and Chicago.

VIEW SHOWING PROGRESS OF THE WORK, TAKEN AT TRACK LEVEL.

The banks of earth sloping to the surface of the rock walls, on either side of the open cut, have been sodded, and a force of men for several weeks has been assigned to the work of testing the walls for loose rock. Wherever such has been found, it has been removed so as to preclude the possibility of accidents to passing trains. A wall, surmounted by a high metal fence, will be built along both sides of the cut for the protection of life and to prevent the possibility of anything rolling down.

The practical completion of this engineering feat is one of the greatest in the history of the Erie Railroad and is of great importance, because it will afford the relief that has been needed for years. Passenger traffic has developed and continues to develop within 50 miles of New York, in what is termed "commuting territory." A few years ago so many trains became necessary that both tracks in the Bergen tunnel had to be used in the morning for inbound traffic.

The new cut will be used by the six principal lines which carry the passenger traffic, much of which is suburban. These are the Main Line, New Jersey & New York Railroad, Northern Railroad of New Jersey, the New York & Greenwood Lake Railroad, Newark branch, and the New York, Susquehanna & Western, the latter at present running into the Jersey City terminal of the Pennsylvania Railroad. These six lines converge, and from three main stems some distance west of the new open cut, each main stem carrying the traffic of two branches, and are known as the main line, Newark branch and Susquehanna line. The point of divergence of the New Jersey and New York Railroad from the main line is 5.5 miles west of the west end of the open cut; the junction of Newark branch and Greenwood Lake line is 2.4 miles and connection between the New York, Susquehanna & Western Railroad and the Northern Railroad of New Jersey will be three miles west of the entrance.

The approach to the open cut from the east end is over a massive steel trestle which reaches the level at Grove street, Jersey City, and which spans Erie street, Jersey avenue, and Coles street, rising above the tracks of the New Jersey Junction Railroad, which runs north and south near the base of the Heights. The maximum grade is 35 feet to the mile. Concrete arch bridges carry Palisade avenue and Baldwin avenue over the cut. There are four short tunnels extending between a point west of Baldwin avenue and east of Central avenue, east of Summit avenue to St. Paul's avenue, east of St. Paul's avenue to east of the Hudson County boulevard and between the boulevard and the west portal, but none is long enough to affect the atmospheric conditions, the greatest being 571 ft. and the shortest 220 ft. in length, or a total of 1,288 ft. of tunnels. The total length of the cut is 4,400 ft. and width of roadbed 58 ft. The minimum depth is 45 ft.; maximum depth, 85 ft. In order to produce this deep canyon, it was necessary to blast 500,000 cubic yards of blue trap rock and excavate 100,000 cubic yards of earth. The rock represents 750,000 lineal feet of drilling, and it took 250,000 lbs. of dynamite to rend it. No fatal accident happened in making the cut.

Basing the operation of trains on a four-track line, which will be a fact by autumn, an ingenious method will be adopted in handling them. The traffic being practically all inbound during the early morning hours and outbound in the evening hours, the direction of traffic on the four tracks through the open cut will vary according to conditions. During the morning rush, a separate track will be assigned to each group inbound, leaving one track to handle the outbound business of all the groups. In the evening, the conditions will be reversed, while in the middle of the day, the normal movement will be two tracks for inbound business and two for outbound.

Trains of the main line and New Jersey & New York Railroad will be brought in on one track, those of the Greenwood Lake division and Newark branch on another, and those of the Northern Railroad of New Jersey and New York, Susquehanna & Western on the third track, so that there will be three distinct leads to and from the Jersey City terminal, whereas there are but two at present, as a result of the two-track line through the tunnel, and one of these must be used for trains running in the opposite direction. Freight trains will not use any of the tracks assigned to the four-track open cut line in the Jersey City yard, because the ascent over the trestle begins at Grove street, which is at least

OPEN CUT WITH TEMPORARY FOOT BRIDGE.

four city blocks from the tunnel. This is another distinct advantage which will tend to eliminate delay in the handling of passenger traffic.

Railway Guards in England.

Not long ago the Railway Guards' Universal Friendly Society celebrated their diamond jubilee. The London *Globe* commenting on the occasion says: "The guard occupies, under changed conditions the same post as did the stage coach guard of years gone by. The coming of railways caused great distress among those dependent upon the coaching system for their livelihood. Drivers, guards, horse-keepers, ostlers, etc., suddenly found themselves stranded, just as the London cab drivers are suffering today owing to the introduction of the motor vehicle. Generally speaking, the guards were the only coaching officials able to continue their calling with the new means of locomotion, but as guards of railway trains the older men among them soon dropped out, owing to the harder life which the latter service entailed.

VIEW SHOWING PROGRESS OF WORK.

"To begin with, the railway guard occupied a kind of 'dickey' overlooking the tops of the carriages, where he was utterly unprotected from the weather, and from the smoke and fiery particles emitted by the engines. Two guards were allotted to each passenger train, the upper and an under one. The upper sat on the last carriage with his face to the engine, and was furnished with wire spectacles or a begoggled face mask to protect his eyes from the ashes. The under guard sat on the carriage next to the engine with his back to the engine. By this vis-a-vis arrangement each guard had constantly before him all the carriages in the train except the one he was riding upon, and they could both communicate with each other by signal. The coaches upon which the guards rode were always, and usually, the only braked vehicles on the train, the retarding agency being hand-operated screw brakes; but if the train was very heavy, additional brake vans and guards were sent out with it.

"The oldtime upper guard had multifarious duties to perform. He notified the engine driver through his under guard when the train was traveling too quick or too slow, and when to stop, and after applying the brakes both men hurriedly descended to see that the wooden brake shoes had not caught fire. The upper guard superintended the stowing of the luggage on the roofs of the vehicles after the 'strapper' had inspected, cleaned, shampooed and refreshed with cold drawn neat's foot oil the iron wire lined luggage straps. But notwithstanding careful stowing, the luggage often got displaced by the oscillation of the train, whence it ran the risk of falling off or striking an overbridge, and despite tarpaulin covers it was frequently set on fire by the sparks from the engine, while if packed too tight it excluded the air from and extinguished the roof lamps. In case of serious accident both guards were expected to render first aid, being instructed in the use of the tourniquet and carrying bandages for the purpose. They were instructed not to allow passengers to stand up in the open coaches while in motion, nor in any other manner to endanger themselves by improper exposure, and not to permit them to alight for the purpose of rebooking by the same train. Guards were forbidden to pass over the tops of carriages when in motion, but they might clamber along the footboards to collect ticket, etc., as is still done on Continental railways, though the increasing speed of trains soon led to this latter practice being discontinued. The upper guard was entrusted with bills and passes of every kind, carried in a portfolio, and kept a journal recording the running of the train.

"In 1847, owing to the great speed of the broad gauge trains, the Great Western Company transferred the under guard to an iron 'dickey' at the back of the locomotive tender, where he could more easily communicate with the engineman, and rechristened him 'traveling porter.' The exponents of the narrow gauge, however, at once claimed this innovation as a confession of weakness regarding the safety of the broad gauge trains and nicknamed the porter the 'man in the iron coffin.'

"After a while the discomforts and hardships suffered by guards were alleviated by giving the roof seat a box shaped shelter glazed in front. The next steps in advance were regular shut in vans for them to travel by, and for storing the luggage in safety, while in order that they might still keep a good lookout along the top of the train the roof of the new van was furnished with a raised glazed lookout. An interesting feature of the North London Company's rolling stock consists of the retention of the raised guards' lookouts, which are seldom to be met with now on any other line, as their utility pretty well vanished with the introduction of automatic continuous brakes, whereby the control of the train was transferred from the guards' manipulating handbrakes to the engine driver primarily. Lastly, the guards' accommodation assumed its present form of thoroughly well sheltered and brilliantly lighted vehicles, with padded seats and apparatus for warming food while traveling."

CONCRETE BRIDGE CARRYING STREET ACROSS THE OPEN CUT.

The Public Drinking Cup.

The State Board of Health in Kansas last year did away with the public drinking cup. The order affected the railroads as well as other corporations which provide drinking water for the thirsty. When the law, for such it is, went into effect there was much adverse comment for the principal reason that no cup or cups of any kind were provided in railroad cars. The health regulation expressly prohibited the providing of a cup.

We recently saw in a dentist's surgery, an individual cup made of paraffine paper, which was held in a thimble of light nickel-plated ware or aluminum. When the cup had been used by a patient, it was emptied and thrown into a suitable receptacle. The thimble and paper cup were tapered so as to fit together very neatly, and when standing on the table the bottom of the cup did not reach quite down to the lower edge of the metal thimble. As the thimble had no bottom it could not be used to drink out of, and the clean, white paraffine cup when holding filtered water had a cool and refreshing appearance.

Mallet Articulated Compound for the Chicago & Alton

A recent order from the Chicago & Alton Railroad to the American Locomotive Company has resulted in the building of three engines of the Mallet articulated compound type, and a number of 2-8-2 engines, these Mallet engines have a 2-6-6-2 wheel arrangement and the low-pressure cylinders are in front. The Mikado or 2-8-2 type engines are now being used in road service between the Girard coal district and Chicago, a distance of about 210 miles. Except on the grade between Lawndale and Atlanta, which is 0.85 per cent., these engines can handle a 4,000-ton train over this division. The Mallet type locomotives are intended for pusher service on the Atlanta hill, and with their assistance the road engine can take the above-mentioned tonnage through to Chicago.

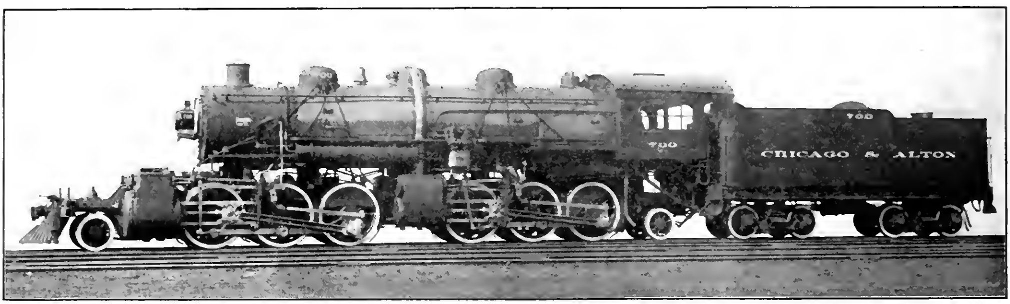
The cylinders of the Mallet are 22 and 35 by 30 ins. and with 62-in. driving wheels and a working pressure of 200 lbs., the engine can exert a tractive force of 61,500 lbs. Both the high and low-pressure engines use Walschaerts valve gear, the high-pressure valve being a 14-in. piston valve, while the low pressure has a double-ported valve. All having 6-in. travel. The high-pressure steam lap is 1 in., while that of the low pressure is 7/8 in. The lead in all cases is 3/16 in. constant. The exhaust clearance is 5/16 in.

The articulation or jointing of the frame follows the builders' practice and is placed just in front of the high pressure cylinders, a ball-jointed receiver pipe, with slip joint at the front end, takes steam from the high to the low-pressure cylinders. The high-pressure engine is attached to the frames and boiler in the usual way, and in taking a curve the low-pressure engine moves under the boiler to one side. The main slide bearing for the boiler on the jointed front frame is immediately below the forward sand box as shown in our half-tone illustration. This bearing is bolted to the boiler before the tubes are set.

The boiler is of the extended wagon-top type, the front ring of which is 74 1/8 ins. in diameter. The crown staying is radial and the tubes are 406 in number, each 2 ins. in diameter, outside, and are each 21 ft. long. The total heating surface amounts to 4,766 sq. ft., made up 300 in the firebox and 4,466 sq. ft. in the tubes. The total amount of heating surface in this boiler is a little more than half the space enclosed between the bags on a baseball field. The grate area is 49.7 sq. ft., which gives a ratio between grate and heating surface as 1 is to 96.

The wheel base of this engine is 48 ft. 1 in.; with the tender it is 76 ft. 8 ins. The driving wheel bases are in each case 11 ft. and the total adhesive weight is 286,300 lbs. The total weight amounts to 327,300 lbs. The engine truck and trailing wheels are each 33 ins. in diameter, and the tender is carried on eight wheels, each 36 ins. in diameter. The tender has the ordinary U-shaped tank, holding 8,500 gallons and carrying 14 tons of bituminous coal. The tender frame is made of steel channels, and steel trucks are used. The total weight of the engine and tender is 498,300 lbs. A few of the principal dimensions are appended for reference.

Axles—Driving journals, main, 10 x 12 ins.; others, 9 x 12 ins.; engine truck journals, diameter, 6 1/2 ins.; length, 12 1/4 ins.; trailing truck journals, diameter, 6 1/2 ins.; length, 12 1/4 ins.; tender truck journals, diameter, 5 1/2 ins.; length, 10 ins.
Firebox—Type, wide; length, 108 1/8 ins.; width, 66 1/4 ins.; thickness of crown, 3/8 in.; tube, 1/2 in.; sides, 3/8 in.; back, 3/8 in.; water space, front, 6 ins.; sides, 5 ins.; back, 5 ins.
Tubes—Gauge, No. 11 B. W. G.
Boxes—Driving, cast steel.
Brake—Driver, New York automatic; tender, New York; air signal, New York; pumps, 2 No. 5; 2 reservoirs.
Engine truck—Swing center bearing.
Trailing truck—Radius bar type.
Piston—Rod diameter, 4 3/16 ins.; piston packing, C. Ir. rings.
Smoke stack—Diameter, 18 ins.; top above rail, 15 ft. 1/16 in.



MALLET ARTICULATED FOR THE CHICAGO & ALTON.

Peter Maher, Superintendent of Motive Power and Equipment. American Locomotive Company, Builders.

The persistence of an advertisement is strikingly illustrated in the experience of Angus Sinclair with a small company he organized in 1887. The concern was called the Engineering Literature Company, and its purpose was to sell books that Dr. Sinclair controlled. The affairs of the Engineering Literature Company were wound up in 1890, but railway men wanting to purchase books still keep sending orders to the company, which has been defunct for twenty years.

The Highland Park Home.

A very fine sentiment was expressed by Mr. P. H. Morrissey, formerly the grand master of the Brotherhood of Railroad Trainmen, on the occasion of the opening of the Highland Park Home for disabled railroad employees, a short time ago. The needs of helpless men who have at some time labored in the railroad field, has been very fully and substantially realized and Mr. Morrissey has put the whole undertaking on a high ethical plane when he said:

"We have not provided this home for aged and disabled railroad employees as a matter of charity. It has been and will be a matter of duty with us. The railroad men of the country owe to their less fortunate brothers a duty that is greater than charity."

The home represents the investment of about $120,000, with a debt of only $40,000 upon it, which there is every reason to believe will soon be provided for.

Wireless for the U. P.

The Union Pacific Railway management have arranged to introduce the use of wireless telegraphy in its regular work. They are equipping two stations for the work, one at Cheyenne and the other at Sydney, 103 miles distant.

Traveling Engineers' Association.

The eighteenth annual convention of The Traveling Engineers' Association will be held at the Clifton Hotel, Niagara Falls, Canada, commencing at 10 a. m., Aug. 16, 1910, and continuing for four days.

The following is the list of subjects to be discussed at this convention:

1—Fuel economy, under the following heads:

(a) Value of present draft appliances. Can they be improved to effect fuel economy?

(b) Firing practices, including the prevention of black smoke.

(c) Roundhouse practices; whether it is more economical to knock or bank fires at terminals.

(d) Whether it is more economical to buy a cheap fuel of a low heat value, or a higher priced fuel of a greater heat value.

(e) Devices and appliances for use on engines and tenders to prevent waste en route.

2—Superheat as applied to locomotives.

3—How can the traveling engineer best educate the present-day fireman to become the successful engineer of the future?

4—Latest developments in air brake equipment and its effect on train handling.

5—What progress has been made in reducing the cost of locomotive lubrication, and is it advisable to place this item entirely under the control of the road foreman or traveling engineer?

6—New valve gears as compared with the Stephenson link motion, referring particularly to economy of operation and maintenance, and also necessary procedure in case of break-downs.

Mr. C. F. Richardson (La Salle Street Station, Chicago) is president of the association, and Mr. W. O. Thompson (New York Central car shops, East Buffalo, N. Y.) is the secretary, to whom any communication concerning the convention should be addressed.

Superheater Questions.

The Traveling Engineers' committee on superheat have prepared a comprehensive list of questions on this very important subject. The committee consists of Mr. M. H. Haig, mechanical engineer of the A. T. & S. F., Topeka, Kan., chairman, and Messrs. Max Toltz, C. W. Carey, E. Salley and Geo. Cooper. The subject is "Superheat as Applied to Locomotives."

The questions asked are: What type of superheaters are in service on your road? How many of each type? How many in freight service? In passenger service? How many degrees of superheat are obtained in superheater? Have tests been made to determine temperature of steam at steam chest? If so, give the temperature. What is the boiler pressure of locomotives equipped with superheaters? What is the boiler pressure of locomotives of same class operating with saturated steam? Where boiler pressure has been reduced and superheater applied, what has been your experience in lessened boiler troubles? What per cent greater tonnage is hauled by locomotives using superheated steam than by locomotives of same class using saturated steam? What per cent of fuel is saved by use of superheated steam? What per cent of water? What change in front end apparatus and difference in size of nozzle is necessary upon application of superheater? Do you find any difference in steaming quality of locomotives using superheated or saturated steam? Which is the more free steamer? Can a locomotive equipped with a superheater operate better with foaming water than a locomotive not so equipped? Has the reduction in the amount of water consumed, resulting from the use of the superheater, been sufficient to increase the possible mileage between boiler washings? If so, to what extent? Do you experience any trouble in lubricating with superheated steam. If so, at what temperature? Do you lubricate cylinder as well as valve chamber? Do you use force-feed or ordinary lubricators with saturated steam; with superheated steam? Do you use slide valves or piston valves with superheated steam? Which gives the better results? Has the use of superheated steam caused any trouble or expense in maintaining piston rod and valve stem packing? If any trouble, explain changes required. Have you had any trouble in leaking joints in the superheater, or in the steam connections? Do you use gaskets or ground joints with superheated steam? If gaskets are used, what kind and make? What is the nature of questions on subject of superheat asked by your enginemen? What questions on the subject of superheat are included in your examinations of engineers and firemen? Has your road ever applied superheaters to locomotives and later discarded them? If so, what types, and for what reason?

The Making of Good Engineers.

One of the subjects which will be taken up at the coming convention of the Traveling Engineers' Association is "How can the traveling engineer best educate the present-day fireman to become the successful engineer of the future?" This is not only a live subject but it is one of the utmost importance, and the successful solution of the problem would mean much to railroads. The committee of which Mr. J. C. Petty is chairman and which includes Messrs. W. J. Anthony, R. Collett, J. F. Cosgrove and H. F. Bentley, have issued a circular addressed to members in which they have asked ten questions.

Among these questions, one of them is, "Would you recommend the best standard books on machinery for the education of engineers and firemen to be in railway libraries, or would it be best, in your opinion, for each man to have these books at his home?" Again, "If possible to do so, do you not believe it would be best for each engineer to have a regular fireman?" The ninth question is, "Do you not believe a man with shop experience as machinist's helper would make a better man for the position of engineer if it could be arranged with railway companies to start them in this way, with the intention of promoting them as fast as possible to do so?"

The circular containing these questions is addressed to all members. We would like to hear from any of our readers, firemen, engineers, road foremen and others on the questions we have quoted.

Telephone Apparatus for Trains.

All trains on the Lehigh Valley are to be equipped with telephone apparatus by means of which immediate communication can be established. This announcement is the result of successful experiments with apparatus on the car of Mr. J. F. Maguire, general manager.

The device is an extension pole, similar to a trolley pole on a street car, which can be hooked over the telephone wires beside the track. In this way train crews will be able to communicate with train dispatchers from any point on the road.

On the other hand, to reach any person on a train, the operator at the nearest station will be informed, the train stopped and the telephone connected by means of the pole. The new apparatus is expected to be particularly effective in the handling of freight trains. The breaking or pulling out of draw heads causes delays, and the ability to rapidly communicate with headquarters will be most satisfactory to all concerned.

Silver "Brasses."

In what would now be termed olden times, some curious methods were employed to effect temporary repairs on locomotives, such as making brasses and glands of hard wood. That material would hardly stand a trip with a modern Mallet engine. We remember hearing about one form of substitute that would stand all the shocks and strains put upon our most powerful locomotives.

A mining railway under construction in Brazil purchased a locomotive from Baldwin's and it was shipped in parts. A box containing part of the engine was mislaid, among them rod brasses and piston glands. A silver smelting plant belonged to the mines and they made castings of silver to replace the missing parts.

B. of L. E. Convention.

The Grand Convention of the International Brotherhood of Locomotive Engineers was held in Detroit in May last. The report of the proceedings reached us too late to appear in our June number, but we are pleased to publish some particulars of the interesting meeting even at this late date.

It was very fitting that Detroit should be selected for holding the convention of 1910, the largest meeting held by the order, with over 700 delegates in attendance, for Detroit was the birthplace of the order when in 1863 a few locomotive engineers, mostly in the employ of the Michigan Central Railroad, came together and organized the Brotherhood of the Footplate, which a year later became the Brotherhood of Locomotive Engineers. At that time the conditions of employment on the Michigan Central were of a character to make men desperate and ready to resort to any fair means for preserving self-respect. There was an official in high authority at that time who had a peculiar hatred to locomotive engineers, and lost no opportunity of tyrannizing over that class. The writer once applied to that man for a position as machinist and was promised a job, when he incidently mentioned that he was a locomotive engineer. "An engineer are you?" exclaimed that official ruffian in a fury. "Get out of here you son of a ——. I wish all locomotive engineers were in hell." That kind of language was familiar to the men who formed the Brotherhood of the Footplate, and, no doubt strengthened the resolution to establish a means of defense by union.

The conditions of railroad employment in the days when the Brotherhood of Locomotive Engineers was formed were eloquently described by Grand Chief Stone in his opening address at Detroit when he said:

"We of today can hardly realize what is meant in the early days to be known as a member of a labor union. The railroad man was an Ishmaelite, every man's hand was against him. No city wanted a railroad headquarters established there, because of the objectionable class of men it brought in. No company wanted their men to organize because they could see the handwriting on the wall, and the petty official who had played favorites and sold jobs, and collected his percentage from their pay, who had discharged men without cause whenever the spirit moved him, and had been a Czar in his little world, awoke to find a new order of things, and to realize there was a new power in the world that in future would have to be respected."

These sad conditions were wide spread and stimulated the men who established the Brotherhood to stand fast and to invite engineers generally to join the order The invitation met with hearty response for during the first year of its existence forty-four subdivisions were organized. In August, 1864, the first convention of the Brotherhood of the Footplate was held in Indianapolis with all the forty-four subdivisions represented, and earnest enthusiasm prevailed that promised a prosperous future for the brotherhood and decided amelioration of the condition of railroad employees. Mottoes selected for the order were: "Sobriety, Truth, Justice, Vigilance not Violence, and do unto others as ye would that they should do unto you, and so fulfill the law. "These mottoes constituted the foundation stone of the order and no organization has ever adhered more loyally to the principles professed.

A notable characteristic of the order has been the attention paid to elevating and conferring benefits upon the individual members. While other labor organizations were contented so long as members paid their dues regularly, the Brotherhood of Locomotive Engineers were always bringing out schemes for making the membership more valuable. In 1866 a monthly journal devoted to the interests of the members was started. A year later an insurance system was formed which has proved a precious boon to many sufferers. In 1887 a Ladies' Auxiliary was organized which has been wonderfully successful and has an insurance department that has done much good in cases that the ordinary insurance benefit do not reach. A large number of the divisions have a weekly indemnity insurance that gives members comfortable incomes when they are disabled or during sickness.

Commenting in his opening address on the work of the Brotherhood, Grand Chief Stone said: "The B. of L. E. has improved the conditions of the locomotive engineer, increased his wages, secured for him better treatment, elevated his home life and his standing as a man, made him a steady, sober, reliable engineer, a good neighbor and citizen, a credit to the community and to the country.

"It has furnished insurance for him at cost and is today carrying over 117 millions of dollars, and has paid into the homes of deceased members over 21 millions of dollars, besides creating a fund to care for old and indigent members who otherwise would become objects of charity. . . .

"In addition to that the organization has given away in charity over $3,000,000 to the families of deceased and disabled members. . . . If the B. of L. E. never did anything else, the one fact that it has scattered this vast sum of money broadcast on its mission of mercy will stand as a monument to it throughout all time."

Many railroad officials opposed the Brotherhood for years, but the better class of men soon reorganized the elevating and beneficent tendencies of the organization and it has gradually grown into high favor, and is now constantly pointed to as the best kind of a labor union. The Brotherhood of Locomotive Engineers had not long been in existence when railroad officials came to perceive that its influence stemmed the downward trend of wages that under speculative influence used to follow every slight depression of business. The Brotherhood had adopted the policy of forming contracts with railroad companies to maintain a certain scale of pay which could not be broken every time business was dull. The obstacle to cutting down engineers' wages had the best kind of influence upon the whole pay roll.

The Brotherhood of Locomotive Engineers has been singularly fortunate in the selection of its managing officials, who are known as engineers of various grades, the highest being Grand Chief, who performs very important duties. The first Grand Chief William D. Robinson served only a few years and was succeeded by Peter M. Arthur, who held the command with remarkable ability for over thirty years. The present incumbent, Warren S. Stone, is an excellent business man, besides being an exceptionally able executive officer who has already indicated that the order will grow rapidly in strength and prosperity under his management.

The B. of L. E. New Building.

May 14 last was a celebrated day for the Brotherhood of Locomotive Engineers, for on that day a vast concourse of the order with their friends assembled at Cleveland, O., to take part in ceremonies arranged to dedicate the opening of the new building erected by the Brotherhood and recently finished. The Grand International Convention in Session at Detroit was transported by the railroad companies in three trains.

The building has been erected at a cost of one million dollars. It contains 500 offices, with 132,000 square feet of floor space. It is a modern up-to-date fireproof building, with all modern improvements and has an auditorium seating 1,400 persons.

First Grand Engineer Prenter presided at the opening and introduced a number of eminent speakers, among them being the Governor of Ohio and the Mayor of Cleveland.

An attractive part of the meeting was the unveiling of a bust of the late Grand Chief Arthur. In connection with this was a humorous and eloquent address delivered by Shandy Maguire, the celebrated poet of the Brotherhood, and the reading of a poem prepared for the occasion.

General Correspondence

Efficiency Tests.

Editor:

The subject of making efficiency tests is one that has produced vast discussion. For sometime after the practice had its inception, it was found that a large majority of the employees held a hostile feeling against it, but after it was understood, there came a change, and now the majority look on the tests as a necessary part of the training to which employees of the motive power and transportation departments are subjected.

Our method is to make every test simple, and in line with every day practice, and to scatter them each day through the month, and in this way to keep each, and every man on the alert, so that he may be able to act promptly, and decisively when the occasion demands.

Rule No. 27 states that a signal improperly displayed, or the absence of a signal where one is usually shown must be regarded as a danger signal, and train brought to a stop. This rule is very plain, and no one should allow himself to fail to notice all signals, and see that the proper display is made, and if he lives up to rule he not only insures his own safety, but also that of the rest of crew, and if a passenger train, the safety of the other lives entrusted to his care.

We also have a rule requiring all engineers and conductors to be examined yearly on book of rules, and special rules contained in time-table, and it is surprising when you find some of the older men who have allowed themselves to become rusty, and this proves beyond a doubt the necessity of keeping ourselves in constant trim, so that no matter what turns up, we are ready to say what should be done. This is especially true in the proper observance of signals, and it is my opinion that no employee who has his own, and the company's interest at heart can consistently object to the making of efficiency tests.

I recollect just before these were started on our road of an accident in which a very good friend of mine, and his fireman lost their lives, and caused thousands of dollars' worth of damage by their failing to comply with Rule No. 27. At a facing point switch, with a high switch stand on which the light had been extinguished, the switch had been opened by some unknown party, caused this fast passenger train to be derailed doing the above damage. Had my friend lived up to Rule No. 27, and brought his train to a stop, and made an examination before proceeding, just think of the untold suffering that could have been saved.

These are the things we hope to avoid by making the surprise or efficiency tests, and from our present percentage we are led to believe that the employees realize the importance of obeying the rules, and are doing everything in their power to assist us.

BILLY O.

How I Became An Engineer.

Editor:

If asked how I became an engineer I believe the right answer would be that the gradual evolution of an inborn love for things mechanical was responsible. Some of my earliest recollections are of occasional glimpses of different forms of mechanism and especially of that most human of machines, the locomotive.

SWITCH AND SIGNAL TOWER AT ROCKVILLE, PA.

Born in Iowa, my mother moved to Ohio after the death of my father which occurred when I was less than a year old. When I was five years of age we visited our former home, and my only remembrance of that trip is of a sleigh ride along the crest of a high hill and of my endeavoring to keep in sight a long train of yellow coaches far off in the valley.

At the little ungraded school which I first attended, the teacher sometimes gave the pupils permission to draw upon the board during the noon hour and several of the older boys often drew pictures of the locomotive. While I was too young to attempt to criticise their efforts, still the pictures did not look right to me, as they invariably made a full side view and drew the wheels as ellipses as in a perspective view.

I remember on one occasion one of the boys had taken particular pains and had produced what was pronounced the "best engine ever," until someone called attention to the fact that there was a wheel lacking. After a number of trials and endless discussion no place was found to put the missing wheel, which somewhat changed the good opinions before expressed. The artist in a last attempt to make things right, finally drew an ellipse in a slanting position at the front of his incomplete machine, but some observant critic said that was where the "cow catcher" belonged, when with one disgusted stroke of the eraser further criticism was silenced.

In my little old geography was a wood cut of a "Railroad Train Starting," which represented a locomotive with enormous wood-burning stack leaving the depot with its train. The artist had represented the steam from the cylinder cocks in rather a crude fashion which gave the engine the appearance of having a wooden paddle sticking out at each side. This picture had a great fascination for me, but it was long before I ceased to wonder what those "paddles" were for.

The Pennsylvania and the Hocking Valley used the same track into Toledo and their locomotives were the only ones which I had the opportunity to observe at all closely for a number of years. I watched the gradual transition from the diamond stack to the straight stack with extension front end, wondering what it was all for. When the passenger trains of these lines made the stop at the East Toledo station, the engines were always on the street crossing and I can still feel the awe inspired by the beautiful Rogers eight-wheelers of the Hocking Valley line, with their brass bands and shining bright work, black walnut cabs, and landscapes painted on the sides of the headlight casing.

In all these years I had never so much as put a foot on these wonderful creations and was in complete ignorance as to how they were started or stopped, never having had the acquaintance of anyone who had even seen the inside of a cab. I finally made friends with a teamster with whom I occasionally rode part way to school, who told me that he had once worked on a railroad. Here was my opportunity, so I eagerly asked how they started the engine, and his reply was, "They pull a rope, and to stop it they pull another rope." But I could not reconcile myself to the belief that those shining cabs were filled with a collection of rope ends, and when I found that my friend had worked on the section, I put him down as a base imposter.

The Wheeling & Lake Erie Railroad finally built a line called the Toledo Belt which was within a half mile of my home and when the construction train came opposite the house I was "Johnny on the spot."

The W. & L. E. in its early days was entirely equipped with engines built by Wm. Mason at Taunton, Mass., all but four being of the so-called Mason-Fairlie type, and the engine on this work train was one of these "bogies," as the men called them. The engineer was out on the cars with the train crew. The fireman, seeing that I was very much interested, asked me up into the cab and I was at last initiated into the mysteries of the "keyboard" of a locomotive. After the completion of this line I became quite friendly with several of the engineers and rode on a number of the little bogies and also on the "Big 4," a much larger one with Walschaerts valve gear, whose wonderful performances are still spoken of by old-timers.

During these last few years of my school life I picked up quite a little knowledge of railroading but never thought to become an engineer as my mother was strenuously opposed to my adopting that occupation. After leaving school I worked as a mechanical draughtsman for about two years, but I could not get the railroad "bug" out of my head and it ended by my finally taking a trip to Norwalk, O., where the W. & L. E. shops were located, and applying for a position as fireman. I was informed that no firemen were needed at present, but that trip was the first of about a dozen and finally I was given a job as fireman on a night switch engine in Toledo yard. Not being used to working nights it was extremely hard for me to keep awake and about the fourth night I momentarily went to sleep while we were pulling a cut of cars around a curve which was on my side of the engine. When I came to my senses three or four lanterns were violently swinging us down and we stopped just in time to avoid a collision with a road engine making a drop of a caboose. That experience taught me a lesson, and then and there I promised myself that never again would I close my eyes while there was any necessity for my being awake, and on more than one occasion have I been thankful that that promise has been religiously kept.

I suppose my subsequent experience as a fireman was about like that of scores of others—plenty of hard work and many pleasant incidents, every day adding to my knowledge of the field of work I had chosen.

After firing for three years and ten months I was promoted, my first engine being one of the same little "bogies" upon which I had received my first lesson.

While hardly an "old-timer," still I saw the motive power of the W. & L. E. grow from the 17 x 24-in. ten-wheelers, which we called the "big" engines, to the 22 x 30-in. consolidations, and I have never regretted the day I bought my first gloves and overalls and became a "railroad man."

I have found that good books and papers treating of the different branches of railroad work are of inestimable value to the man who takes an interest in his work and wants to be up to date. While in the junior class at the high school, one of the older students showed me the first edition of "Forney's Catechism of the Locomotive" which he had drawn from the public library. This book was a veritable wonderland to me and as soon as I became a real fireman I bought a copy of the second edition, then out but a short time.

When I had fired for about six months I saw an advertisement somewhere of a paper called *The Locomotive Engineer,* and upon speaking of it to my engineer he said that he had taken it for about a year and would let me have the back numbers if I wished. That was my first acquaintance with what is now RAILWAY AND LOCOMOTIVE ENGINEERING, and the benefit I have derived from reading its pages could not be measured in dollars and cents.

In looking back over my younger days I can easily see why and how I became a locomotive engineer. The interest I took in the locomotive which grew stronger year by year found its logical outcome in my making my hobby earn my living—this I have lately seen described as true happiness.

While of course there are many unpleasant things connected with the life of a locomotive engineer, there is still a sort of fascination about it that is hard to overcome which undoubtedly keeps many in the ranks long after they are financially able to retire.

To my mind there is nothing more thrilling than to be at the throttle of a modern "battleship" making a run for a hill, doing every ounce of work of which her inches are capable and giving a close imitation of how Halley's comet might look to a near-by observer.

I have often wondered if the designers of these splendid machines feel a pride in their creations as they see them doing their wonderful work day by day, giving the most spectacular manifestation of power, of which any man-made mechanism is capable, and I have always felt like taking off my hat to the shopmen who can take the poor, seemingly worn-out old "hog," leaky, wheezy, loose in every joint and turn out in a few weeks a perfect locomotive, practically as good as new.

To one who has any love for the locomotive, who is not afraid to put in several years of hard, back-breaking work, and who has the moral stamina required to succeed in any calling, I would say by all means take the path which leads to the right hand side.

After being with the W. & L. E. for sixteen years, I resigned to accept a position as locomotive engineer with the Isthmian Canal Commission with financial benefit, but as it is all construction work here, I have more than once longed to be again at the head end of 2,500 tons with about 125 tons of "Brooks" ready to heed my every wish.

This may perhaps be too long-drawn-out to find a place in your columns, but when I look back upon my past experience, not at all uncommon, it seems as if I could write a book upon "How I Became an Engineer."

FRED. M. WESTCOTT.
Tabernilla, Canal Zone, Panama.

Eddy Engines in New England.

Editor:

Your June number gives an interesting narrative of the achievements in locomotive building of the late Wilson Eddy. But it contains some errors, which you may think worth correcting. The "Addison Gilmore" was very far from settling the cab question, all the locomotives on Eddy's road having been long equipped with cabs, as in fact were all the other locomotives in New England at that period.

The locomotives on that road were very far from being of English type. I think that as early as 1846 every locomotive running there was of the eight-wheel pattern, chiefly of Hinkley and of Taunton make, with some four of strange design from the Lowell Machine Shop. Mr. Eddy's first engines were the "Atlantic" and "Pacific," eight-wheel freight engines, built from his design, by the Springfield Locomotive & Car Company.

These were followed by the "Gilmore," which was very far from being a success, being unable to encounter the steep grades between Worcester and Springfield, even with the light trains of those days. She was afterward cut down to an eight-wheel type, with six-foot drivers, the centers of which would not have prevented an old-time Hebrew from worshipping them, as they were not like anything in the Heaven above or in the earth beneath. His freight engine did good service for the road, but his boilers, while free-steamers, had the radical defect of being leaky, owing to Mr. Eddy's obstinate adherence to the design of a frame, the back end of which was bolted rigidly to the outside firebox.

Boston, Mass. GEO. H. LLOYD.

[Our esteemed correspondent might look again at the brief sketch that we published of Mr. Wilson Eddy's career as an engineer. No one ever claimed that Mr. Eddy constructed the first locomotive cab, but there was a strong prejudice against cabs which Mr. Eddy's fine artistic productions speedily overcome. Furthermore, Mr. Eddy came into prominence under Major Whistler, the celebrated pioneer railroad engineer. Both were employed on the Western division of the Boston & Albany Railroad, then all of the locomotives used on the road were of the English type, built by the Lowell Machine Shops Company, with a few of Ross Winan's "crabs." It was after several years' experience with these locomotives that Mr. Eddy began designing locomotives, and it is universally conceded that his work had a marked influence on the motive power in America. From the crude contrivances of the early days of locomotive engineering, Mr. Eddy made engines convenient to operate, easy to repair and so admirably proportioned that maximum wear was secured before heavy repairs became necessary. Mr Eddy did much to improve the utility of locomotives and established a kind of harmonious uniformity in their appearance. —EDITOR.]

Old Engine Numbers on the P. R. R.

Editor

I have read with some interest the correspondence about the old Pennsylvania Railroad locomotives, especially the letter of Mr. C. B. Chaney, Jr., in your May issue. Mr. Chaney mentions 19 Class "K" engines I have recollection of 16 as follows: Nos 1, 3, 10, 184, 260, 340, 341, 956 to 959 and 1066 to 1070.

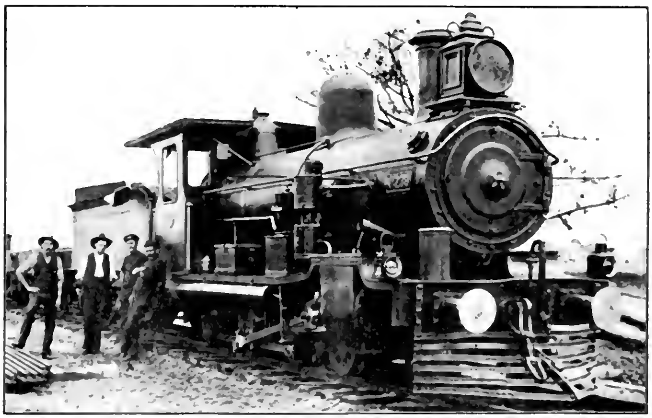
I should very much like to know the numbers of the "K" engines not included in the above list. Perhaps one of your correspondents could furnish them.

During the latter 80's a number of Class "P" locomotives, with 68-in wheels, 18½ x 24-in. cylinders and larger boilers than those of Class "K" were placed in high-speed service on the New York division. Conspicuous among these were Nos. 395, 417, 917 and 1244 to 1253. Doubtless some of these engine are still running in local passenger and freight service.

Previous to their retirement, the "K" engines had their wheels reduced to 72 ins. in diameter. When last seen by the writer they were working locals out of Camden, N. J.

The Pennsylvania has always been conservative about the introduction of very heavy locomotives, and this policy is illustrated by the persistence with which the Atlantic type has been retained for working the heaviest express traffic over the entire system. The wisdom of the policy has been proved by the fine work done by these engines. With the introduction of heavier cars and higher speeds, however, it has become necessary to "double head" on many runs; and the next move of the motive power department, in providing a high-powered passenger locomotive, will be watched with interest PAUL T. WARNER.

Philadelphia



PICTURE RECEIVED FROM MR. R. CHALK, AUSTRALIA
(In group he is leaning against the cab.)

Boiler Feeding.

Editor:

Ever since the introduction of the injector its possibilities as a boiler feeder have been recognized by intelligent and observing engineers. There are a number of injectors on the market today, which may almost be called perfect boiler feeders, they have a wide range of capacities, and when properly handled, feed water into the boiler in a highly efficient and satisfactory manner. The starting and stopping of an injector is a comparatively simple matter, but to feed water into a boiler in the most approved manner requires the best judgment. No matter how skillful an engineer may be in handling an engine—that is, with regard to the adjustment of the throttle and reverse lever—he does not have the record for good runs, unless he has the ability to feed the boiler effectively. It, therefore, behooves the progressive engineman to make a special study of this important branch of locomotive management.

There are enginemen, and we find them on every division of our standard railroads, who have boiler feeding down to a science. They are men usually of more than the average degree of intelligence, and who have the faculty of concentrating the mind to a marked degree. The latter qualification is essential to success in every branch of industry, but nowhere is it so much needed as in the handling of a twentieth century locomotive

Let us consider what constitutes perfect boiler feeding. In the first place the water should be fed into the boiler continuously, and the amount injected should just equal the evaporation In the second place the water level should be carried at the lowest point consistent with safety so that the cylinders are supplied, at all times, with dry steam. This method is theoretically correct, and at the same time is highly practicable In order to feed a boiler continuously, it is necessary to adjust the water ram of the injectors as the evaporation is increased or decreased On a hilly division, the evaporation is a variable quantity, and hence considerable judgment must be exercised on the part of enginemen in order to adhere to this method.

Motive power officials have recognized the benefits to be derived from this method of boiler feeding, and have attempted to encourage the practice by equipping engines with short water glasses, and injectors of not too large capacity. The co-operation of the roundhouse foreman is also necessary. Tanks should be cleaned at regular boiler wash periods—oftener if necessary; tank hose should be taken down occasionally and the screens cleaned out. The boiler checks should be ground in at regular boiler wash periods also; and the lift of the valves should be maintained as near standard as possible. The tubes of injectors should not be allowed to become coated with scale, nor badly worn. The steam ram and overflow valve injector should be ground in when leaks exist. If these rules are adhered to little or no trouble is experienced with injectors "flying off," and the conditions are suitable for continuous boiler feeding.

It is a well known fact that boiler feeding and fuel economy are closely allied. This has been brought out very forcibly the last few years since the question of fuel economy has been given so much attention. When the boiler is fed continuously and the water level is maintained fairly constant, the conditions are the best possible for perfect combustion in the firebox. There are no rapid changes in temperature, and a bright fire can be kept without danger of excessive loss of steam from the pops. The fireman can keep the steam up to the maximum working pressure without special effort, as the fluctuations in pressure are only those that come from changes in the cut-off and opening of the throttle. Unless an engine is a particularly good steamer the practice of putting on and shutting off the injector at frequent intervals causes the steam pressure to vary considerably, and the fireman in his efforts to keep the pressure constant wastes large quantities of fuel. There is another saving effected by continuous boiler feeding that is often overlooked, and that is the waste at the overflow when the injector is put on many times during a trip.

With continuous boiler feeding changes in the temperature of the flues and firebox sheets are slight; and hence the trouble from leaky flues and firebox sheets is reduced to a minimum. Several years ago tests were made which proved conclusively that the leaky flue trouble was caused mostly by the change of temperature from injecting cold feed water into the boiler at a time when the circulation was poor.

There are enginemen who will start from a terminal or station with the injector working. This practice cannot be too heartily condemned. In the first place an enormous quantity of steam that should be used to aid in starting the train is detracted from the cylinders to the non-productive work of forcing water into the boiler. It is said that from one-eighth to one-tenth of the steam generated by the boiler is thus consumed by the injector. In the second place the cold water entering the boiler at a time when the water is in violent circulation causes a decrease in the temperature of the boiler and a consequent fall in pressure. Under such management the best efforts of the fireman cannot bring results, and hence he becomes indifferent.

There are engineers on fast through trains that go over a whole division without shutting off the injector—except when making a start. Since the introduction of water scoops and large capacity tanks—holding fifteen and sixteen tons of coal—it is possible to go over a division without stopping. On a level division where the engine is working steam, most of the time the problem of feeding the boiler continuously is not a difficult one, but on hilly divisions, where the evaporation varies considerably, some skill is required on the part of the enginemen.

W. Smith,
B. & O. R. R.
Benwood, W. Va.

Old Colony Locomotive History.

Editor:

Herewith is presented a photograph of the Old Colony Locomotive, "Falmouth," the leading engine on the ill-fated express which left Fall River steamboat wharf in the gray dawn of October 13, 1876, for its quick run to Boston, colliding at Randolph, fifteen miles from its destination, with the engine "Pacific" which was backing a long train of freight cars on to a siding near the railroad station at that place. The lapse of over thirty years has not effaced from the minds of the older railroad men in the Old Colony region the memory of this thrilling disaster, and the reproduction of this picture will recall the single fatality in connection with the accident, the death of young Thomas Abbott, of Hyannis, Mass., fireman of the "Falmouth," who was instantly killed in the terrific crash. Engineer Alonzo G. Crosby of the "Falmouth," who also lived in Hyannis, Engineer Samuel Deckrow, of Taunton and his fireman, John Clark, of South Boston, crew of the second engine, "Old Colony," all received severe permanent injuries which terminated their respective careers on the foot-plate on that unlucky morning. All are now gone except John Clark, who for many years has been superintendent of the oil room at the roundhouse in South Boston. The crew of the freight engine "Pacific," forewarned of their peril by the roar of the on-rushing express before the headlights of the latter actually appeared around the curve dead ahead, had barely time to jump and save themselves after doing all in their power to get clear of the main line.

The Old Colony descriptive list of 1877 gives the following details regarding the subject illustrated: Road No. 68. Weight, 63,000 lbs. Cylinders, 16 x 24 ins. Drivers, 5½ ft. Built at the company's shops at South Boston, May, 1876. The engine ran with her original boiler until 1897, when a new one was provided. Despite the misfortune of 1876 the "Falmouth" proved one of the best of the Taylor engines, which is saying a great deal, as they were all noted for their efficiency. Besides the "Falmouth," whose present number in the New Haven classification is 2008, there still remains in active service in this section quite a few of the locomotives of the days when the O. C. R. R. reigned supreme along the highways of steel which traverse the length and breadth of the famous Land of the Pilgrims. Occasionally one may be seen near a station where some obscure branch joins the main line humbly waiting to take up a couple of cars dropped by a through train and convey them to their destination a few miles away.

OLD COLONY RAILROAD ENGINE "FALMOUTH."

W. A. Hazelboom.
Boston, Mass.

Wear of Eccentrics.

Editor:

I was surprised at the theories of Mr. E. J. Brewster, as presented in his letter published in the June issue of Railway and Locomotive Engineering, in regard to the wear of eccentrics being all on the small half of the eccentric and attributing it to centrifugal force. He falls into two errors. First, the wear is not all on the small part of the eccentric. There is a constant wear on every part of the eccentic as every one knows who has trued up worn eccentrics in the lathe and who knows the original size of the eccentric. That there is a greater amount of wear on the small part of the eccentric is entirely owing to the fact that it is this part of the eccentric that reverses the motion of the link at each end of the stroke, and it is a well-known law in mechanics that it requires greater force to reverse a motion than it does to carry on the motion after it has been reversed.

Each reversing movement of the eccentric rod which moves the link and which in turn moves the rocker and valve, acts as a blow in the small part of the eccentric and the long continued succession of blows has the effect of wearing away that part of the eccentric much more rapidly than the larger part of the eccentric which has easier work to perform in merely carrying on the motion which the smaller part had begun.

Mr. Brewster's idea of centrifugal motion being the cause of the wear alluded to would be correct if the eccentric rod was a revolving arm constantly impelled to fly outwards by centrifugal force and retained in position by its adhesive contact to the small part of the eccentric, but the eccentric has a reciprocating movement and like the piston rod is reversed twice in each revolution of the main axle and is not particularly affected by centrifugal force.

If anyone interested in the subject would find an opportunity to watch the movement of the eccentric rod on an engine moving slowly, the shock of reversing the link or rocker would be readily observed, especially if there was some lost motion in the joints to emphasize the movement.

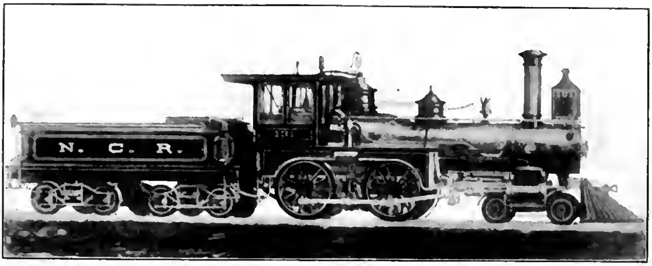
W. L. Calver, Foreman.
Interborough Shops, New York.

Old Baldwin on the Northern Central.

Editor:

In 1869 the Baldwin Locomotive Works built for the Northern Central Railway two locomotives, Nos. 131 and 133, for burning hard coal. These engines were placed in service between Baltimore and Harrisburg, doing express train service, and were in the front rank of locomotives of their day. They were handsome machines, as will be seen from the photograph, and were kept constantly in passenger train service until retired, being taken out of service in 1889, according to the practice of the Pennsylvania Railroad of scrapping an engine when twenty years old.

These engines had wagon-top boilers and single domes, unlike the majority of Baldwin engines of that period, which had straight boilers with two domes. The dimensions of these engines were as follows: Cylinders, 17 x 24 ins.; boiler, 48 ins. diameter; 155 tubes, 2 ins. diameter, 11 ft. 6 ins. long; fire-box, 34 x 102½ ins. with a 5¼ in. combustion chamber, burning anthracite. Driving wheel base, 7 ft. 6 ins.; total wheel base, 22 ft. 1¼ ins.; total heating surface, 1,035 sq. ft.; diameter of drivers, 62 ins. The photograph herewith was taken from an ink wash



OLD NORTHERN CENTRAL ENGINE NO. 131.

drawing made by the writer, and shows No. 131 as she appeared in her later years.

In conclusion, I would say that I have tried for years to obtain a photograph of either of these engines "taken from life," but without success, and if any of the many readers of your valuable paper know of any such picture being in existence, I shall be very grateful if they will communicate with me.

C. B. Chaney, Jr.
331 State street,
Brooklyn, N. Y.

Roundhouse Work.

Editor:

I have been asked by representatives of railway and mechanical papers to give a write-up of the general country roundhouse work, as handled under my charge as I find it, and with any new kinks, appliances, etc.

Roundhouse work the country over is probably pretty much the same grind. As to new kinks at this place, we have no array of very modern appliances, in a strict sense. The pneumatic calking tool recently installed is proving its worth, and doing the work in from one half to one third the time required by hand. Care must be taken, however, not to use too much air pressure, and jar the sheet and start the other flues leaking.

We are promised an extension of the plant this summer. The 10 east stalls of the 18 are to be lengthened some 20 ft. to accommodate the big, long geared engines. A pneumatic sanding arrangement is to be put in, also a larger stationary boiler to replace one of the smaller ones. Electric lights for the roundhouse, and electric power for the turn table, are being considered. Water for the engines is pumped from Silver Lake close by. While this is good water, and requiring the average amount of soda ash, the water from the city (Wisconsin River) is much better, in fact, about perfect, requiring but very little soda ash.

I do not know that I can do any better than give a resumé of the handling of the business at this point, which you can publish later if you like, where the heaviest compound engines have been transferred to the West or elsewhere and the heavy simple engines are in their place. Later I will append a comparison with the two classes of power, showing up a little in favor of the compound; however, expense of repairs is not shown, which since has appeared to be a little the heaviest for the compounds. A trial is being made of the electric head lights; results not known here as yet.

H. W. Griggs,
Roundhouse Foreman.
Portage, Wis.

Builder of the "Marlboro."

Editor:

On page 231 of your June issue you have a picture of the engine "Marlboro," said by Mr. Cassidy to have been built by McKay & Alders. Begging Mr. Cassidy's pardon, but judging from certain prominent details I think she was a "Wm. Mason" engine. Notice particularly the headlight brackets, shape of the diamond stack, cylinder and steam chest covers strap end on valve rod, pump and check valve, driving wheels with concealed counterbalance, whistle set in center of dome top, shape of dome cover and sand box, bell stand, slight taper of boiler, tank trucks and also the ogee curve at the front end of tank flange. Most of these details are distinctly "Mason."

Kirkwood, Mo. Hy. Martin.

Old Ten-Wheel Amoskeag.

Editor:

Referring to your May number I noticed a very interesting subject written by Mr. S. J. Kidder on "Oldtime Railway Reminiscences." In this connection would you be willing for me in the next issue of your paper to make an inquiry asking if anyone has any old photographs of the locomotives which Mr. Kidder speaks of, in his article of the ten-wheel type on the Chicago, Burlington & Quincy, built by the Amoskeag Machine Shops? He states they were inside connected engines, and were, in the opinion of the engineers, too large to be run with safety. I think they must have been curiosities, and I should like very much to get hold of a photograph of one, as this is the first I have ever heard of a ten-wheel type being built so far back. Thanking you for any information you can give me.

JOHN WORCESTER MERRILL.
Boston, Mass.

Edward VII in Canada.

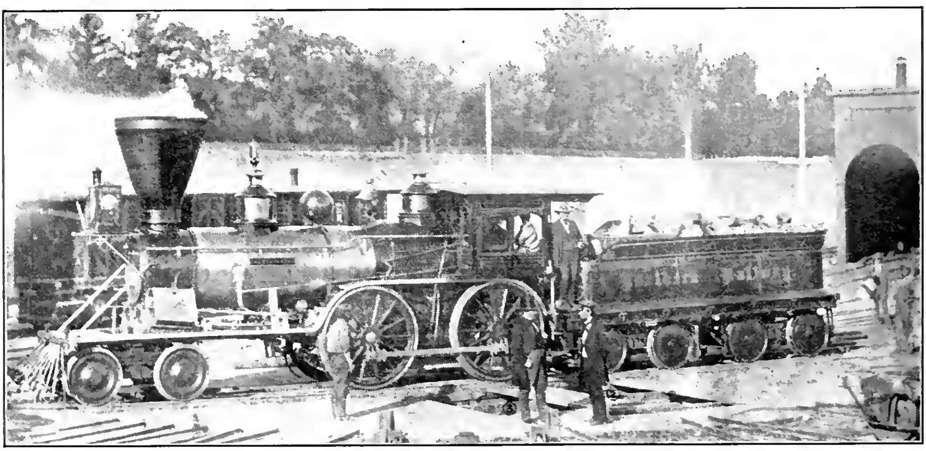
The following, taken from the columns of the *Buffalo Express*, gives some interesting particulars concerning the visit to Canada and the United States of Edward VII, then heir apparent. The writer of the article is Mr. James M. Williams, son of the locomotive engineer who ran the engine "Cumberland" at the head of the royal train. Mr. Williams says:

"It is not generally known that when King Edward VII visited Canada and the United States, in 1860, as His Royal Highness, Albert Edward, Prince of Wales, the special train, consisting of two coaches, the Prince's observation car and the finest locomotive in Canada at that time, the 'Cumberland,' named after the president of the Northern Railway of Canada, was in charge of and run by two former Buffalonians. They were James Tillinghast, then superintendent of motive power of the Northern Railway of Canada, who planned and supervised the constructing of the observation car and had charge of the special train, and Levi S. Williams (the writer's father), who was the engineer chosen to handle the 'Cumberland.'

"Messrs. Tillinghast and Williams, with J. Lewis Grant, superintendent of the Northern Railway of Canada, helped to build the Rome, Watertown & Ogdensburg Railroad, and held the same positions relatively, on this road as were afterward tendered to them on the Northern Railway of Canada. At the beginning of the Civil War J. Lewis Grant returned to the States and was made superintendent of the Buffalo & Erie Railroad, now part of the Eastern division of the Lake Shore & Michigan Southern Railway. Messrs. Tillinghast and Williams returned with him, and Mr. Tillinghast received the appointment of division superintendent of the New York Central, and Mr. Williams that of master mechanic of the Buffalo & Erie at Erie, Pa.

"The special time-table of Sept. 10, 1860, for the train of the Prince of Wales, with the photographs of the observation car and the engine 'Cumberland,' which are herewith reproduced, the writer believes are the only ones in existence. The time-table shows that the Prince traveled at the rate of 21 miles an hour, or from Toronto, Ont., to Collingwood, Ont., on Georgian Bay, 94½ miles, in 4½ hours. After the train had covered 18½ miles, in 45 minutes, which was pretty fast for those days, it had to stop for water at Richmond Hill, then again at Aurora, Ont., 30.2 miles from Toronto, for wood for fuel, arriving at Collingwood at 1 p. m. The Prince, in returning, left Collingwood at 3 p. m., and arrived at Toronto at 7 p. m., the return trip being made in just four hours, or at the average rate of 23.625 miles per hour.

"The Prince was very generous as well as democratic; for he gave personally, to all of the train crew, gold pieces. My father, the engineer, received a $20 gold piece as a souvenir of the trip. The observation car, as will be seen in the picture, had ten crowns of England on it, and I have one of the crowns in my possession."



WOOD BURNING, INSIDE CONNECTED, NORTHERN RAILWAY ENGINE "CUMBERLAND."
(Courtesy of the *Buffalo Express*.)

Testing Plant for University.

Upon the recommendation of Mr. Robert Quayle, superintendent of motive power and machinery, and with the approval of Mr. W. A. Gardner, general manager; the locomotive testing plant of the Chicago & North Western Railway Company has been presented to the University of Illinois. Under the immediate direction of Mr. H. T. Bentley, assistant superintendent of motive power and machinery, it has been taken from its foundation, the bearings and other running parts have been put in good order for service, and the plant with all the special patterns used in its construction has been loaded and shipped to the University of Illinois. It is understood that the plant will be held by the university pending the construction of its proposed transportation laboratory.

The Chicago & North Western Company's testing plant was designed under the general direction of Mr. Quayle aided by Mr. E. M. Herr, now vice-president and general manager of the Westinghouse Electric & Manufacturing Company, but at that time assistant superintendent of motive power and machinery. The drawings were developed under the immediate direction of Mr. E. B. Thompson, now superintendent of motive power and machinery of the Chicago, St. Paul, Minneapolis & Omaha Railway, but who at that time was chief draftsman for the railway company. Mr. Quayle had been made chairman of the Master Mechanics' Committee on Exhaust Pipes and Steam Passages, and some time before while master mechanic at South Kaukauna, Wisconsin, had improvised a testing plant by lengthening out the members of a passenger car truck to make the wheel spacing agree with that of the drivers of the locomotive he desired to test, and by mounting this truck bottom side up in a pit in such manner that he could run a locomotive upon it. Encouraged by these earlier experiments he later advocated the testing of locomotives at the Fortieth street shops of the railway company. The result was the plant which is now being sent to the University of Illinois. The proceedings of the Master Car Builders' Association will show that the North Western plant was an important factor in the development of several committee reports dealing with the design of exhaust pipes, steam passages, draft pipes and stacks. The plant was found useful also in working out various other problems of more immediate interest to the Chicago & North Western Railway Company. In recent years it has been idle.

The plant consists of foundation plates, pedestals and three pairs of axles with their bearings, supporting wheels, friction brakes, etc. It was the first of its kind to be supplied with permanent mounting rails, by use of which a locomotive could be rolled on or off the wheels without resort to temporary blocking.

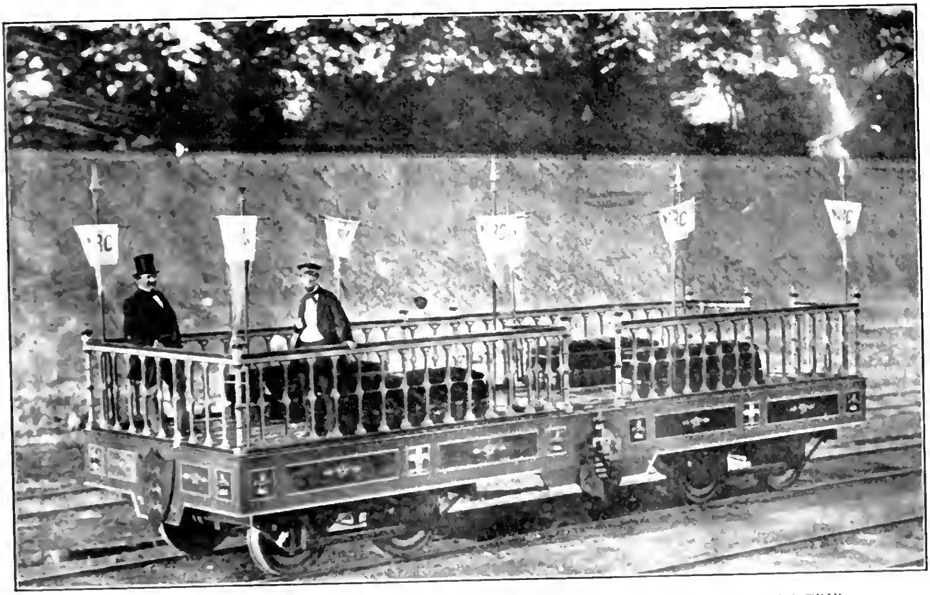
Erie Does Quick Work.

The Susquehanna shops of the Erie Railroad have made a record for that road which will be hard to beat. Some very fast time on heavy repairs had been made at the Hornell and the Meadville shops, and Mr. H. H. Harrington, the master mechanic at Susquehanna was confident that his men could beat the record of both the other shops. His intention to have a try at it was communicated to Mr. L. R. Laizure, general foreman, and the men were taken into their confidence.

The attack on engine No. 2018, after it had made 71,787 miles, was made at 7 o'clock a. m. on May 11, by a selected shop force, each man of which knew beforehand exactly what he was expected to do. Just before the whistle blew Mr. Laizure said a few words of encouragement to the men, concluding with "Do not loose sight of the Erie standard, good work and quick work." The class of repairs given to the engine are what is called T. B. M. F. repair. This means tires, boxes, machinery and flue repairs, and the work was executed in thirteen hours and thirty four minutes.

The first pair of wheels was in the wheel lathe at 8.42 a. m. The second was in another lathe at 8.50 a. m. Tires removed from main drivers, second hand tires bored, applied and turned by 2 p. m. The driving boxes were removed while wheels were being rolled to the lathe. There was a complete set of shoes and wedges laid out and fitted by 10.30 a. m. Frames cleaned, white leaded and tested for fracture. Spring rigging overhauled. Valves completed at 8.25 p. m. Motion work, eccentrics, straps, etc., and lifting shaft completely overhauled and last piece back on engine by 2.45 p. m. A new way of removing and applying flues was tried. It was done so that when the last flue was out in three hours and forty-five minutes, the first 100 flues were back and being applied.

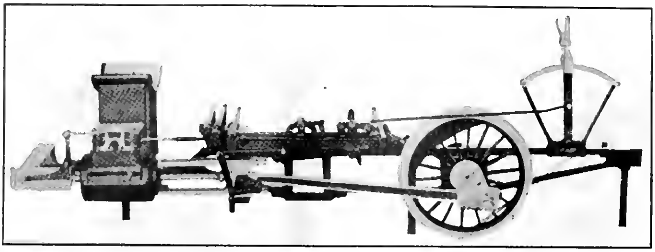
We do not pretend to give in detail the list of repairs to this engine. For full particulars the reader is referred to the Erie Railroad Employes' Magazine, from which our information is drawn. Up to this time the Hornell shops had held the record with heavy repairs done in 24 hours and 33 minutes, and Mr. Harrington has asked his men to get into the 18-hour class, but the time made, 13 hours and 34 minutes will be hard to beat in any shop. Mr. J. C. Stewart, vice-president of the Erie, complimented his officers and men at Susquehanna on their splendid performance.



OBSERVATION CAR ON THE NORTHERN RAILWAY OF CANADA FOR PRINCE OF WALES TRIP.
(Courtesy of the *Buffalo Express.*)

A New Design in Valve Gears.

Since 1812, when the Stephensons placed on their locomotives the first reversible valve gear, which was the unpatented product of the mind of young William Williams, one of their draughtsmen, there have been invented upwards of fifty reversible motions, each calculated to improve the functions of steam admission and exhaust, together with the complications resulting from the neces sity for variations in cut-off, lap, lead and quick port opening. It seems remarkable, considering the ingenuity of valve gear inventors, therefore, that only the designs of William Williams (the shifting link) and of Egade Wal-



MODEL OF THE PILLIOD BROTHERS' NEW VALVE GEAR.

schaerts should have survived through the decades marked by so many radical improvements in the general design of the railway locomotive. And it bespeaks much for the rare attainments of these two inventors, and the magnitude of the problem with which they coped.

A design, which differs from anything heretofore successfully produced, both in principle and effect, has been perfected by Messrs. Charles and Henry Pilliod, and is shown in our half-tone and drawings. Some of the features claimed for the Pilliod gear are: A uniform cut-off, uniform release, a possible 25 per cent. cut-off with a 75 per cent. release and a late release in the working notches of the quadrant. In the design of any valve motion the first consideration must be the action of the parts furnishing the power. The troubles of the valve gear designers lie principally in the difficulty of the conversion of the circular motion of the connecting rod, at the one end, into the reciprocal motion at the other, and in the elimination of the objectionable effects of the resultant angularities.

To explain the effect of this angularity of the driving parts let the crank circle be divided into 28 parts, or the half circle into 14 equal parts, the latter representing one piston stroke of the engine. The front and back centers of the crank give two points, each of which marks the beginning of the piston stroke in either forward or backward motion. It is well known, that the piston travels fastest while the crank is traveling through the first half of the piston stroke, or through 90 degs. of the crank circle. For purpose of clearness the piston stroke may be divided into 4 equal parts, 25, 50 and 75 per cent. By drawing radii equal to the length of the main rod from each of the points above mentioned, it will be seen that for 25 per cent. of the piston travel from the front end, the crank has traveled 4½ parts of the crank circle; for 50 per cent., 6¾ parts, and for 75 per cent., 9 parts. On the back end the results are 25 per cent., 5 parts; for 50 per cent., 7¼ parts, and for 75 per cent., 9½ parts. These are the conditions of angularity that must be met in the proper distribution of steam through the valve gear.

In the motion ellipse the upper half

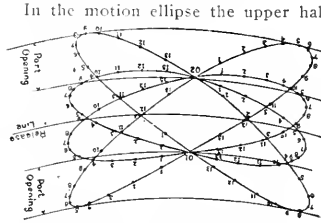
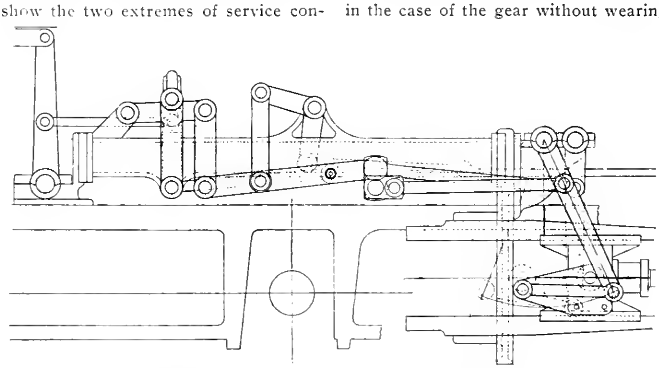


DIAGRAM OF EVENTS IN STROKE.

corresponds to the travel of the valve for the front end of the cylinder and the lower half corresponds to the travel of the valve for the back end of the cylinder. The ellipses reproduced show the two extremes of service con-



OUTLINE OF THE PILLOID BROTHERS' VALVE GEAR.

ditions, full gear and 25 per cent. travel and are the same in both forward and backward motions. It follows that with the two extreme positions in harmony the intermediate positions will show corresponding harmonization. In these ellipses are indicated the corresponding movements of the valve for each movement or position of the crank.

An interesting feature of the Pilliod valve gear is the fact that, without change in essential detail, the imparting motion may be taken from a single crosshead connection or from a return crank as in the conventional designs. This will be of particular interest to those who have experienced more or less trouble with the operation of locomotives on sharp curves where the attending distortion of the main frames results in appreciable error in the operation of the valve gear. In fact, the form preferred by the Pilliod brothers is where the motion of the right hand engine is taken from the left hand crosshead and the motion of the left engine is taken from the right crosshead by a clever arrangement not unlike the valve gear of a Worthington pump. There is no connection from the crank pin; the crosshead attachment alone does the work.

The absence of large or flat wearing parts in a valve gear is appreciated by those charged with the upkeep and in this gear, as in several others, all wear is taken by pin connections which may be case hardened and, when necessary, replaced at a minimum of expense. The absence of any great weight in the moving parts also tends to reduce the effects of wear and at the same time this feature adds to the ease with which the locomotive is controlled from the cab.

In the case of a gear which necessitates the use of a link, errors due to lost motion are often uncorrected for long periods owing to the difficulty of making some of the adjustments, while in the case of the gear without wearing parts, other than pins, a correction is so easily made by the adjustment of tapers, or by the insertion of new parts, that the general performance of the engine should be more or less distinctly benefitted in the average.

The Pilliod brothers have issued an illustrated and descriptive pamphlet which they will be happy to send to anyone interested enough to apply, Nicholas Building, Toledo, O.

New Electric Locomotive.

The Westinghouse Electric & Manufacturing Company, of Pittsburgh, recently completed a 150-ton locomotive for use on the electrified section of the New York, New Haven & Hartford Railroad between Stamford, Conn., and New York City. The entire electrical equipment, including the spring drive of the motors, is the design of the Westinghouse Company, while the mechanical parts were designed by the engineers of the Baldwin Locomotive Works and the New Haven Railroad company.

The specifications required that the locomotive be able to haul a 1,500-ton freight train at a speed of thirty-five miles an hour on level track, where the train resistance is not over six pounds per ton. They also required that the locomotive be capable of hauling an 800-ton passenger train at a speed of 45 miles an hour. This capacity would enable it to haul an 800-ton limited train from the Grand Central Station, New York City, to New Haven, a distance of 73 miles with no intermediate stops, in one hour and fifty-five minutes; or to haul an 800-ton express train the same distance in two hours and twelve minutes, with an allowance of five minutes for stops; or to haul a 350-ton local train in two hours and forty-five minutes, with an average stop of forty-five seconds.

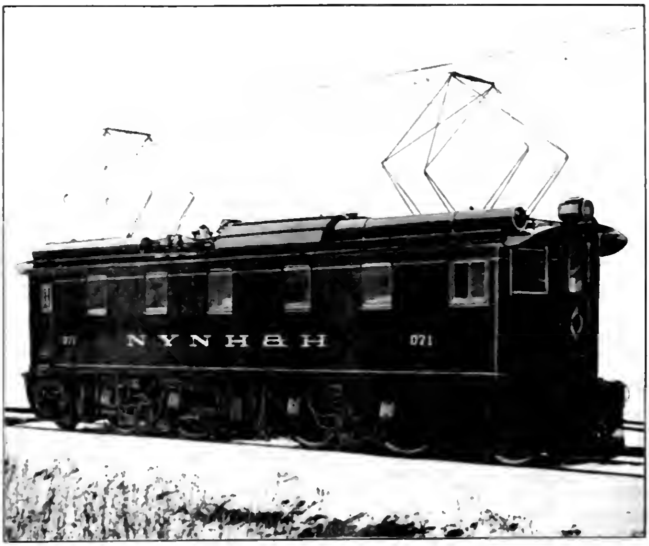
The locomotive has hauled thirty-seven loaded cars, a heavy freight engine and a caboose from New Rochelle to Stamford, a distance of eighteen miles in twenty-seven minutes. Although this run was made in a drizzling rain that froze as fast as it fell and made the tracks very slippery, the engine attained a speed of forty-five miles an hour. During some tests made at the works of the Westinghouse Company at East Pittsburgh, Pa., the locomotive started and accelerated a 2,100-ton freight train, both on lever track and on an up-grade of 0.3 per cent., on a three degree curve. A train corresponding to the 800-ton passenger train was accelerated at a rate of about 0.4 miles per hour per second and quickly reached the required speed.

The design of the trucks and running gear of the locomotive is unique. The truck frames are connected by an intermediate drawbar. One truck has only a rotative motion about its center-pin, while the other has a fore-and-aft as well as a rotative motion, in order to compensate for the angular positions of the trucks and drawbar when the locomotive is traversing a curve. The tractive force is transmitted through the truck frames and drawbar instead of through the main frame. Each truck has two pairs of driving wheels, and a single pair of leading wheels. The wheel loads are equalized as in steam locomotive practice. To assist in reducing shocks and keeping the two trucks in alignment, chafing castings and spring buffers are interposed between the truck frames, under the center of the locomotive. The weight of the cab, instead of being carried on the center pin, is carried on friction plates at the ends of the truck. The weight is applied through springs, which have a considerable latitude for motion to allow for variation in the track without changing materially the distribution of weight on the ends of the truck. The plan of running-gear and cab support adopted for this locomotive prevents any periodic vibration or "nosing," minimizes shocks on the truck and road bed, and insures easy riding. As the rigid wheel base is only seven feet for each truck, the locomotive is extremely flexible, and easy on the track at curves.

The electrical equipment, which was built and mounted by the Westinghouse Electric & Manufacturing Company, comprises four single phase geared motors, together with the auxiliary apparatus necessary for their operation from the 11,000 volt, alternating current or 600 volt, direct current circuit of the electrified section of the New Haven and the New York Central railroads respectively. The motors are of the same general electrical design as those in use on the present New Haven locomotives, the main differences being in the mechanical details and general arrangement.

Each motor is rigidly mounted on the truck frame and directly above a quill surrounding the driving axle, to which it is geared. The motors project into the cab, and the floor above them is raised. This method of mounting the motors on the truck frame gives a high center of gravity, and prevents the transmission of strains and shocks from the track and road bed to the motors. An air blast transformer is provided for lowering the trolley line voltage to that required by the motors. The control apparatus is of the Westinghouse electro-pneumatic type.

When operating on alternating current, all four motors are connected in multiple, and the control is obtained by changing the connections to various voltage taps on the main transformer.



NEW ELECTRIC LOCOMOTIVE ON THE N. Y., N. H. & H.

On direct current the motors are first grouped all in series, and then two in series and two in parallel, in combination with various resistance steps. Provision is made for cutting out any one of the four motors singly on either alternating current or direct current. A master controller and brake valve are located in each end of the cab so that the locomotives can be operated from either end, and the system of control is such that two or more locomotives can be coupled together and operated from one master controller. The speed control is extremely flexible. Two pneumatically operated pantagraph trolleys are provided for collecting current from the 11,000 volt alternating-current line.

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances.

Published Monthly by

ANGUS SINCLAIR CO.

114 Liberty Street, New York.

Telephone, 984 Cortlandt.

Cable Address, "Loceng," N. Y.
Glasgow, "Locoauto."

Business Department:
ANGUS SINCLAIR, D.E., Prest. and Treas.
JAMES KENNEDY, Vice-Prest. and Gen. Mgr.
HARRY A. KENNEY, Secretary.

Editorial Department:
ANGUS SINCLAIR, D.E., Editor.
GEORGE S. HODGINS, Managing Editor.
JAMES KENNEDY, Associate Editor.

Boston Representative:
S. I. CARPENTER, 643 Old South Building, Boston, Mass.

London Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., 3 Amen Corner, Paternoster Row, London, E. C.

Glasgow Representative:
A. F. SINCLAIR, 15 Manor Road, Bellahouston, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid in the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribe in a club, state the name of the agent.

Please give prompt notice when your paper fails to reach you regularly.

Entered at the Post Office, New York, as Second-class Mail Matter.

Anomalies of Friction.

In an article on "Static and Kinetic Friction" which was printed on page 194 of our May issue, we pointed out that the gradual blowing down of the high brake cylinder pressure, as the speed of the train slackened, was for the purpose of preserving a sort of rough average brake shoe pressure on the wheels as their speed of revolution became less.

When we examine the values for kinetic friction as recorded in the Galton-Westinghouse tests, we find that the co-efficient of friction is not only modified by the speed of the revolving wheel, but also by the length of time the surface of the brake shoe is in contact with the tread of the wheel. Viewed from the educational standpoint, the Galton-Westinghouse tests are most interesting and instructive on the subject of friction.

These tests show that at a speed below 2 miles an hour, or what may be called just moving, the friction is practically static, and amounts to 0.25, while the same wheel when revolving rapidly under a car moving at 60 miles an hour, develops what may be called a kinetic co-efficient of friction of only 0.072. This is a reduction of 28.8 per cent. A still further reduction of the co-efficient of kinetic friction is recorded, dependent on the time the surfaces of wheel and shoe have been kept in contact. If we hold the brake shoe applied for 5 seconds on the 60-mile-an-hour wheel, the co-efficient of friction sinks to 0.063, and in 10 seconds it has gone down to 0.058, although the record of tests does not indicate that the speed of the wheel has been allowed to slacken during the 10 seconds.

During every stop there are two opposite tendencies at work. One is the tendency of the co-efficient of brake shoe friction to increase due to the slackening speed of the train. The other tendency is for the co-efficient of friction to become less owing to the smoothing, polishing and heating of the surfaces in contact and probably to the actual melting of the particles on the surfaces of shoe and wheel. The variation in the co-efficient of friction during the stop is the net result of these two opposing tendencies, and under differing conditions it may cause an increase of co-efficient or the co-efficient may remain constant or it might even decrease.

The blowing down of the high brake cylinder pressure as the speed of the train slackens, at least provides for a contingency which may easily arise in actual service on the road. The train might pass over a highway crossing upon which there was sand and grit, and this, when picked up by the wheels, would have the effect of very considerably increasing the co-efficient of friction. There is also the drying of braked wheels when they are passing over partially damp track, due to the heat derived from brake shoe friction.

There does not seem to be any definite ratio existing between the figures given in the Galton-Westinghouse table. A speed of 60 miles an hour develops a kinetic friction of 0.072 as soon as the shoe is applied, while a wheel revolving under a car moving 27.3 miles an hour shows precisely the same co-efficient of friction after 20 seconds application. In other words, the fast moving wheel develops the same co-efficient of friction the moment the shoe touches the wheel as the slow moving wheel does after having been smoothed and polished and heated by the brake shoe for 20 seconds. A wheel running under a car at 30.7 miles an hour, after 10 seconds brake application, develops the same same co-efficient of friction, viz., 0.099, as a wheel under a car moving 20.4 miles an hour does in twice that time.

The general rule, however, which appears to be derivable from a study of the facts as set down in the table, is that for the same length of time applied any given brake shoe pressure will be more effective on a slow moving wheel than it will be on a fast moving one; and that for the same speed the longer the brake shoe has been applied the less effective it will be. This latter is, however, true also if the speed of the wheel be artificially maintained without reduction and against the slowing action of the brake. For all practical purposes we have also the general fact that the co-efficient of friction is less on a fast moving wheel than it is on a slow moving one. This is true since the effect of speed is the predominating influence. In everyday service this is capable of more or less modification according as the rail is sanded intentionally or by accident, or is damp or dry.

Underground Railways.

A very good example of how fast things move in the present century is afforded by the extract which follows, taken from the London *Spectator*. The article was written before electric tube railways had become an accomplished fact and at a time when there appeared to be no practical relief from steam trains in underground tube railways. The paper mentioned above says:

"There is no prospect of adequate relief from steam. The feeling of the people is wholly against elevated railways; railways on the flat only increase the congestion, and practically in the congested districts could neither be constructed nor used; and underground railways drawn by steam carriages are far too costly to construct, besides involving too much vibration for the safety of the houses above, and too little air for the safety of the travellers below. An inner and outer circle of such railways has been constructed; but though they carry multitudes, they hardly seem to relieve the demand, they cannot be made cheap, owing to the conditions of construction, and it has been found practically impossible to push them across the centres of traffic where they are most required. What is needed is either some means of motion through the air, which remains to be discovered, or motion through the earth at such a depth that buildings on its surface are not interfered with, that the streets are unconscious of the new subways, and that the rights of property can hardly be said to impede their construction. This motion can be secured. Carriages filled with human beings can be driven through iron pipes, eleven feet in diameter, placed fifty or more feet below the soil, at great velocity, yet without danger either of accident or asphyxiation.

"The electric motors emit neither smoke nor steam; they can be made to ventilate the pipes so that breathing is as easy as above ground, and they supply daylight or its equivalent, for themselves. The principle of their structure is perfect; but their use has been checked by a vague impression that pipes so laid and used at such a depth would produce unforeseen evils, and possibly injure property very seriously. This impression will now be dispelled. The joint committee, after hearing quantities of evidence from experts, has reported that the evidence is 'conclusive in favor of the sufficiency and special adaptability of electricity as a motive power for underground tubular railways'; that 'way-leaves' should be granted them to pass under any public streets, on condition of their running a sufficient number of cheap trains."

Colors of Thin Plates.

Perhaps as you have been standing beside an engine when a recent rain storm has left little pools of water shining between the stones and pebbles which form the ballast of the track, and it may be that a drop of black oil from the engine has fallen into one of these little pools, or it may be that the drop has simply fallen upon the surface of a water-soaked tie. In either case the black oil has at once lost all its dark coloring and has spread over the water or wet surface and now glows in mingling and intermingling bands, ribbons and threads of exquisite iridescent color.

These beautiful rainbow tints are not due to the presence in the oil of any lustrous mixture of bright materials which now reveals itself in the fallen drop. The oil has spread out into a film of such exceeding thinness that the waves of light which fall upon it and are reflected from its upper and lower surface interfere with one another. The shortest waves of light are those which produce the color we call violet, there being 64,631 of them in one inch. The distance between each wave being measured from crest to crest or from hollow to hollow. The wave lengths for red are such that 36,918 of them would just occupy one inch. This means that each violet wave is .000154 of an inch in length and the red wave is 0.000027 of an inch long. The intermediate colors of the rainbow have wave lengths included between these extremes.

Concerning what has been called interference. One may have observed the waves of the sea rolling in against a breakwater or solid quay. The advancing wave strikes the wall of stone and is reflected back and meets a second wave advancing toward the wall. If the crest of the reflected wave exactly meets the crest of the advancing one, the crest of the combined wave is thrown up to a greater height, but if crest meets hollow both waves are destroyed and level water takes the place of each, and the phenomena of interference is made clear.

In the case of the thin film of oil a portion of the light striking the outer surface is reflected back and a portion of the light penetrates the film, and on reaching the inner or lower surface of the film is reflected back. If the oncoming and retreating waves of light interfere they either augment or diminish the intensity of the light reaching the eye, and as the wave length for each color is different from all the others, interference is the inevitable result. The effect is augmented by the varying thickness of the oil film as it spreads out over the water surface. This increase or the self-extinction of the various light waves while traversing a film so thin and unstable as to defy instrumental measurement, results for the beholder in the flash and play of changing color, or the ebb and flow of many-tinted light and shade.

Argentine Exhibition.

An International Exhibition of railways and land transport was duly opened last month at Buenos Ayres, and in addition to the interest attached to the exhibition itself, the occasion also marks the first centenary of the independence of the Argentine Republic. That the celebration has taken the special form that it has indicates how deeply the republic is conscious of the part that railway enterprise has played in the development of the resources and in the upbuilding of the great and growing prosperity of the magnificent country. The exhibition has already had the effect of attracting and interesting the civilized world with the amazing resources of the country and to the stable and beneficial government under which its advancement cannot but be rapid in all that tends to national greatness.

Railways may be said to have been unknown in the Argentine fifty years ago. Today there are over 15,000 miles of railways and about 12,000 miles projected. The railways already in operation and those in course of construction have already called into existence ports of entry that may be said to be the foundation of cities that will shortly take their places among the busy centers of industry and commerce. These ports are already the termini of new railway systems, and the country not only seems ready but the people are anxious to assimilate and take the utmost advantage of all of the latest improvements in the matter of transportation. The progressive and liberal government is establishing telegraphs, telephones and postal service everywhere and are inviting and receiving a tide of immigration that bids fair to rival that of our own country.

The Exhibition gives an excellent opportunity to see their best products thoroughly appreciated and properly valued with the certainty of an ample and liberal market. In addition to this there is a commercial stability about the government that places it at once in the fore front of the American republics, affording a degree of confidence to the manufacturers in other countries. The British locomotive constructors and railway supply men generally have been quick to take advantage of the opportunity, but American enterprise is also already at work and much of the development in the future of the Argentine will be aided by the ready skill engendered in the atmosphere of American enterprise.

Boiler Construction and Practice.

In a report prepared for the International Railway Congress by Mr. H. Fowler, works manager of the Midland Railway of England, and Mr. L. Archbutt, chemist of the same road, we find some interesting remarks on locomotive boiler repairs. Among other things the reporters say the general practice in keeping records of boiler repairs is to make written notes of the work done, but the Western Australian government railways and the Southern Mahratta railways make sketches indicating the nature of the repairs as well as written particulars.

The report indicates that the authorities of several of the railways sending in replies are of the opinion that a more liberal spacing of the tubes near the edges of the tube plate and not allowing the tubes to come very near the edge of the plate tends to prevent cracking of the plate flanges and it also tends to save the bridges near the flange of the plate. This permits of an increased radius in the plate corners, prevents cracking and grooving. Increase of water spaces provides means for better circulation and reduces breaking of stays and corrosion.

The Great Eastern Railway uses a 1/16 copper liner between mud ring and outer firebox sheet (steel) and this copper liner is the full depth of the mud ring and extends several inches up into the water space. This prevents grooving near the mud ring and the internal angle iron used to connect the smokebox tube plate with the barrel of the boiler is said to prevent grooving. Steel tubes have been used on a number of roads in order to lessen corrosion due to galvanic action. The Cape Government Railway officials state that grooving is more pronounced in boilers with brass tubes than in those using steel tubes.

The Cape Government Railways and the Lancashire and Yorkshire officials say that increasing the width of the water spaces round the firebox has a good effect in preventing cracks, pitting and grooving. The Cape railway with shallow firebox provides a 4-in. space at the bottom, flaring out to 5 or 6 ins. at the top, and this has been found very beneficial. With fireboxes placed between the frames there has been some tendency to decrease the grate area in order to secure a similar result.

In washing out, the use of cold water is the general practice, though many roads are considering the advisability of using hot water. Six roads get the hot water they require by means of an injector while others use stationary boilers. When the boiler is refilled hot water is of course used at a temperature of about 180 degs. Fahr. The average mileage between washouts varies from 300 to 1650 miles, depending on the quality of water used. The time allowed for cooling down of boilers varies from 3 to 24 hours, eight hours being the usual thing.

From 20 to 25 roads used scum cocks, but on some, their use has been discontinued because of the danger of their sticking open and causing delay, notably on the Oudh and Robilkhand Railway in India. The London, Tilbury and Southend Railway use their blow-off cocks every 500 miles. The usual position for the blow-off cock is immediately above the mud ring and in the throat sheet, on the center line of the firebox. The Western Australian Government Railways have their scum cocks on the back sheet on the left of the firebox 3 ins. above the crown sheet, with pipe suitably arranged. Thirteen railways answering the inquiry of the reporters state that they admit feed water at the middle of the barrel, and eleven have it enter near the smokebox tube plate.

Increased Wages.

The kindly spirit with which many of the leading railway companies are meeting the demands of the employees for an increase in wages is one of the most encouraging signs of the times, and is an indisputable proof that prosperity is not only coming in a fuller measure, but it has already come. We have alluded so frequently in our pages to the fine sense which has been exhibited by the Brotherhood of Locomotive Engineers and of the Brotherhood of Locomotive Firemen and Enginemen in time of labor controversies, that it would be idle to repeat our grounds for belief that in many respects the committees of these orders might well serve as an example to all societies of working men. The appointment of committees consisting of men of ripe experience and mature judgment are pre-requisite to success in all such movements, and in this attribute the Brotherhoods to which we have referred could not be excelled.

It is a pleasure to observe that the firemen, trainmen and others are sharing in the results of these friendly conferences with railway companies. The firemen have every right to look for better conditions and better wages. As we have often pointed out, the increase in the size of the modern locomotive has become such that the work of the fireman has become nearly doubled in comparison with his work during last century. The increase in wages has not in any sense kept pace with the degree of increase of labor, not to speak of the increase of prices of almost every kind of commodity. The firemen are entitled to considerable increase in remuneration, and every indication points to a general increase all over the country.

In this connection it is to be regretted that the machinists and others engaged in construction and repair work are not apparently receiving that degreee of attention which their case demands. While the conditions under which their work is performed has greatly improved, and in some instances the hours of labor have been shortened, the increase in wages has not been what it should have been. We believe that the reward of their skilled labor should be increased. It is to be hoped that advantage may be taken of opportunities as they offer.

Railroad Trespassers.

Trespassing on railroad property in violation of the law has caused the deaths of more than 50,000 people in the United States in the last eleven years. In this same period more than 55,000 trespassers have been injured. With a view to reducing to a minimum the practice of trespassing, the Pennsylvania Railroad have determined to redouble their efforts to secure the enforcement of the law against trespassing, which in foreign countries has done so much to decrease the number of fatalities of this kind.

In 1907 the Pennsylvania inaugurated a campaign against trespassing, and, due doubtless to this, the number of trespassers killed in 1908 was only 757. In 1909, 732 lost their lives in this way. In the eleven years prior to January 1, 1910, exactly 7,072 people who were on the Pennsylvania's right of way in violation of the law were killed. It is thus seen that in the eleven years an average of two trespassers a day have been killed on Pennsylvania Railroad property. This death roll is laid at the railroad's door by the public, even though these people are killed as a result of their own violation of law.

It is not only tramps who are killed and injured in this way, but people who use railroad tracks as thoroughfares. That the practice of walking on railroad tracks is prevalent in industrial districts gives added significance to the fatalities on the Pennsylvania System as a result of trespassing. The tracks of the Pennsylvania are lined with factories, as they run through the densest industrial section, through territory which holds more than half of the population of the United States.

In 1898, as many as 4,063 trespassers lost their lives on American railroads; five years later the number was 5,000, and in 1907 the number killed was 5,612, that is more than 15 a day. These figures are taken from the annual reports of the Interstate Commerce Commission. The Pennsylvania Railroad have now posted their tracks and stationed watchmen to see that warnings are respected. The company is endeavoring to reduce the number of trespassers who are killed and injured by an even greater number than they have been able to do in the past three years.

Strains Due to Jerks.

Experiments made by placing a dynamometer between the rope and the cage in a hoisting plant showed conclusively the bad effects of starting the load with a jerk due to a slack rope. When there was 2½ ins. of slack, the stress on the rope was 39 per cent. greater than if the load was lifted slowly and gently. With 3 ins. of slack the stress was 65 per cent. greater than if lifted slowly and gently. With slack of 6 ins. the stress was 122 per cent., or more than double, and with 12 ins. slack the stress on the rope was three times as great as when starting slowly with a taut rope. Such sudden stresses on hoisting ropes necessarily cause deterioration in the strands, which eventually result in breakage, if not sudden breakage of the rope. The jerk can be greatly reduced by care on the part of the hoisting engineer, and the insertion of a good spring connection between the cage and the rope.—*Mines and Minerals.*

SELF-TAUGHT MECHANICAL DRAWING AND ELEMENTARY MACHINE DESIGN. By F. L. Sylvester, M. E., with additions by Erik Oberg. Published by the Norman W. Henley Publishing Co., New York. 333 pages, cloth. Price $2.

This is an elementary treatise comprising the first principles of geometric and mechanical drawing particularly adapted to machine design, and will be of much value to the student whose previous theoretical knowledge may be limited. The work is divided into twenty chapters beginning with a description of instruments and materials and passing in proper sequence through a series of problems illustrating a variety of working drawings and leading on to the strength of materials and introducing a variety of mechanical appliances, the whole forming a very comprehensive and masterly compendium of the practice and theory of mechanical drawing. The book is sure to meet with much popular favor. By the use of this book an earnest student can have a full and complete knowledge of mechanical drawing and designing. The illustrations, press work and binding are excellent.

General Foremen's Association

SELF-CLEANING ASH PANS.

A paper on this subject was presented by Mr. C. T. Walters, Great Northern Railway, as follows:

There are two styles of ash pans used by the Great Northern Railway—solid bottom and hopper ash pans. To clean the solid bottom ash pan, we use what is known as an ash pan swipe, which has been in use on the road for years, with very great success. The swipe is made of one cast iron column which is placed across in the pan from 4 ins. to 6 ins. from the front of the pan on the column bases are cast 4½ ins. apart, and tapped out from ½-in. gas pipe. The pipes are screwed into the column, pipes being 4 ins., 18 ins. and 30 ins. long. The number of 1½-in. pipes depend on the width of pan. After you have placed the swipe in the pan, cut a hole in the side of the pan to admit the 1½-in. pipe which is screwed in to the column and connect it to 1½-in. cock which is placed on the side of fire box from 6 ins. to 10 ins. above mud ring or in the most convenient place to get at. The handles to open the cock to blow out the pans are run into the cab. When necessary to clean the pan open the back damper and then open the cock and you have a clean pan. It is not necessary to keep the cock open more than 20 to 30 seconds. This device is used only on the light power.

On the heavy power we use a drop bottom. The hoppers are bolted to the side frames which are hung from the mud ring. The doors of the hoppers are hung and connected by levers to a shaft bolted on the engine frame; on the shaft is a lever for opening and closing the doors of the pan. There is a quadrant notched to hold the doors closed. This style of pan is standard on our road, taking the place of the slide bottom pan which was in use for a short time, as the slides were very hard to open, caused by ashes getting into the grooves. In cold weather the slides would freeze up causing delays.

This paper excited a lively discussion, most of the members favoring water pits for cleaning ash pans. Some of the members favored slatted ash pans, but these did not seem to find favor with the men located in districts subject to severe winter frosts.

Mr. J. H. Painter, Atlantic Coast Line, said they flanged the hopper door 2½ ins around the edges, and the fine ashes formed a seal that prevented leakage.

Mr. Wm. Hall, Chicago & North Western, said that they used two blow off cocks, one in front and the other at the back of the ash pan. Considerable pressure was used and the contents of the ash pan were ejected promptly.

Various methods of cleaning ash pans were advocated, the water jets finding most favor.

COMMERCIAL GAS AS FUEL.

Mr. Wm. G. Reyer, Nashville, Chattanooga & St. Louis, contributed the following paper on "Commercial Gas as a Fuel":

At the present time, as far as we have experimented with gas as a fuel, has been to remove tires. I herewith attach sketch of our burner, also method of using same, on reversed side of this sheet [not shown here].

When we first began to use gas, we had a 1-inch pipe with ⅛-in. hole, 1-in. pitch, that is for a 56-in. tire.

We used on an average of about 600 to 700 ft. of gas to the tire, but we seemed to get better results when we changed the pipe and put the holes in on an angle so it would take up the full space of the tire, and by cutting down the gas as low as we could and using the full supply of air, that is, with a 1½-in. air supply. We now take off a tire with an average of 275 to 325 ft. of gas.

We are using a double pipe, that is taking off two tires at once, but we use about the same amount of gas to the tire, the only difference being the time we save in heating.

We experimented with a double pipe, that is two pipes, around each wheel, but we did not get very good results. It seemed we could not get the gas around quick enough.

We see very little difference in the amount of time saved by using the gas; it takes about 12 to 20 minutes to remove a tire with gas, according to thickness of tire, and we did about the same with gasoline.

The following paper on the same subject, was submitted by Mr. H. D. Kelley, Chicago & North Western:

For the past 18 months we have been using commercial gas as fuel at the Chicago shops for applying and removing driving wheel tires, babbitting cross heads, driving boxes, rod brasses, and for shrinking steel spiders on piston rods. Formerly, we used gasoline as fuel. Commercial gas has proved to be much more satisfactory, by being always ready, quicker, safer to handle, and cheaper.

I made extensive tests with both commercial gas and gasoline. The tests were run for about four weeks, first with gasoline, then with commercial gas, applying and removing driving wheel tires, only. With gasoline a large iron tank, holding about 50 gallons, was used. A gauge was placed on this tank and graduated to read in gallons. The test was run for 12 days. The time for heating each tire was kept, as well as the amount of gasoline used. At the end of the 12th day, the time for heating the tires was added together and divided by the total number of tires handled, giving the average time per tire for heating. The total gallons of gasoline used in 12 days, was added together and divided by the number of tires heated, thus giving the average gallons per tire.

With commercial gas, a meter was used and the test was run for 12 days. The time for heating each tire was kept, as well as the amount of gas; at the end of the 12th day the total time was added together and divided by the total number of tires heated, giving the average time per tire for heating. The total cubic feet of gas used in 12 days was added together and divided by the number of tires heated, giving the average number of cubic feet per tire. With both commercial gas and gasoline, I took the inside diameter of the tire, in inches, and added them together for each test, and divided the number of inches into the amount of gas or gasoline used, getting the cost per inch of diameter for both tests. This, I think, gave me a good comparison between gas and gasoline.

The following table gives the time and cost per average tire, or better still, the actual cost per inch of diameter for heating locomotive tires, gasoline at 10 cents per gallon. Commercial gas at 85 cents per 1,000 cu. ft.:

Inside diam. of tire.	Gasoline.	Commercial gas.
42 in.	$0.1305	$0.1143
44 "	.1431	.1101
46 "	.1405	.1251
52 "	.1600	.1415
56 "	.1920	.1523
62 "	.2015	.1689
68 "	.2210	.1850
74 "	.2405	.2013
Average time, per tire	17.52 min.	15.5 min.
Average cost, per tire	$0.175	$0.1433
Av'ge cost per diam., inch..	.00325	.00272

In this test commercial gas showed a saving of about 16 per cent.

DISCUSSION.

This being essentially a shop subject excited keen discussion.

Mr. W. G. Reyer uses a system of coil pipes that generate gas from coal oil. If we use only 10,000 ft of gas a month it costs $1. I do not think you will find commercial gas any cheaper than gasoline, though it is safer. The coal oil burner is much safer, better and cheaper.

Mr. W. Smith, Baltimore & Ohio, said: We use crude oil for running repair work and changing tires, but we think gasoline is much more satisfactory. It doesn't flame up so high and there isn't so much trouble in burning running boards and cabs as with crude oil.

Mr. C. L. Dickert, Central of Georgia, had tried gas, gasoline and coal oil, and the experience gained induced them to adhere to coal oil. They use a home-made heater and a ring, but instead of drilling holes in it we saw it with a hack saw about every 2½ ins. It makes a much better burner.

Mr. Smith: We get better results by mixing carbon oil with the crude oil—a little less carbon oil than crude oil.

President Ogden: In my experience in using carbon oil, if we did not thin it with fuel oil there was too much carbon, and we were unable to keep the holes in the pipe cleaned out long enough to heat a tire.

Mr. W. C. Groening, Pere Marquette: At the shops at Grand Rapids we cannot get gas, but we use 87-deg. gasoline. It affords a better gas, is a quicker heater and gives better results. With a common gasoline burner there is a blazing, but with the 87 test we get a good blaze and intense heat. What test gasoline did Mr. Kelley use?

Mr. Kelley: It was 68.

Mr. C. H. Voges, C., C. & St. L.: I saw a demonstration in the Collinwood shops. They have a 2-in. pipe with ⅜-in. holes, and it makes an intense heat. They use a combustion chamber. They put a 3½-in. tire, 72 ins. in diameter, on in 21 minutes. We have been using gasoline for the last five or six years and it has given good satisfaction.

Mr. H. M. Brown, C. & O.: At the shop where I am located we have not had an opportunity of using gas for heating a tire, but use 150-deg. oil. With the class of labor that we employ to take off a tire and put it on, it is absolutely safe and very satisfactory. We have never used gasoline on account of explosions. We also use the same burner for preheating frames for thermit welding, or for a tank frame that may be bent. With 150-deg. oil a higher heat can be obtained than with gasoline that is low of specific gravity.

These men of the world who go through it in armor, defend themselves from quite as much good as evil.—*Old Curiosity Shop.*

Wheel Mounting Pressures.

The M. C. B. Committee, with Mr. E. D. Nelson as chairman, concerned with the question of mounting pressures for various sizes of axles and kinds of wheels, reported that to specify certain mounting pressures without pointing out the necessity for high grade workmanship in boring and turning, would only be giving incomplete information.

The report goes on to say it is important to consider the fact that good work cannot be performed without good tools. Everything must be in good shape and a high standard kept up. The general tendency has been to finish axles with too rough a wheel seat which results from too coarse a feed. This makes only partial contact between wheel and axle. Furthermore, in mounting the wheel the high ridges made on a roughly turned wheel seat are pushed off, reducing the diameter and making it necessary to turn the axle down when preparing for a second mounting. With fairly rigid lathes, axles can be turned at a speed of forty to fifty revolutions a minute.

Micrometer calipers are necessary for several reasons. The calipering can be done more quickly and accurately than by using a machinists' calipers or snap gauges. The difference between of wheel seat and bore of wheel, expressed in thousandths of an inch can be got at quite accurately, while with calipers it is a question of skill of the workmen and with snap gauges the same is true only in a lesser degree.

To successfully use the ordinary trade micrometer calipers, takes time and a certain amount of skill, to obviate this delay several types of micrometer gauges have been designed and used. The report describes these forms in detail and gives several half-tone illustrations of them. As to mounting pressures, your committee recommends the following, in conjunction with the character of workmanship already referred to, as being an essential in the problem.

Among the specifications included in the report may be mentioned the following: Wheel fits should be calipered at three points, namely: One inch from each end and middle and at other points if there are any indications of excessive variations in diameter.

"Axles shall not be considered as suitable for mounting where there is a difference in diameter between any two measurements exceeding .003 of an inch. This, however, shall not be construed to mean that wheel seats on each end of axle are to be of one size. Each tenth axle from each lathe shall be measured for soundness. No axle varying over .001 of an inch when measured at two points ninety degrees apart on circumference at equal distance from end shall be considered as suitable for mounting.

"Wheels to be calipered with micrometer caliper. A wheel varying over .002 of an inch in any two diameters will not be considered satisfactory for mounting. Mounting presses to be provided with recording pressure gauges. All wheels not mounted within limits given, or wheels that are forced against shoulder, to be withdrawn."

The report concludes with an important suggestion concerning uniformity of practice which might easily be adopted in all railroad shops. The committee says: "One point that may be foreign to the subject should receive attention, which is lathe centers. It would be very desirable if all shops were to adopt one angle. Generally, lathe centers used for ordinary work are sixty degrees, that is, the included angle. If this were adopted for all axle work, it would result in the axles running true on centers, reducing the amount of material necessary to turn away when truing up axles that have been previously turned."

M. C. B. Axle.	Size of Journal.	WHEELS—CAST IRON. (Tons) Maximum.	Minimum.	WHEELS—STEEL. (Tons) Maximum.	Minimum.
A	3-3/4 in. x 7 in.	44	36	66	54
B	4-1/4 in. x 8 in.	44	36	66	54
C	5 in. x 9 in.	55	45	83	68
D	5½ in. x 10 in.	55	45	83	68

Locomotive and Shop Costs.

The report of the Master Mechanics' Association Committee on Locomotive and Shop Operating Costs, of which Mr. H. H. Vaughan was chairman, showed how carefully the committee had considered the subject, especially in the matter of repairs of locomotives. The committee strongly favored the most thorough kind of repairing, and while it would hardly be possible to limit the cost of repairs to any specified amount, the committee pointed out very clearly that limiting repairs that are actually required to put an engine into good condition is not economy. The cheapest plan is always to make the repairs properly and thoroughly, so that when turned out the engine will make as many miles as possible before requiring further general repairs. The committee favored the system whereby any operation necessary in repairing locomotives may be reduced to a series of detail operations, and the time required for those may be determined with a considerable degree of accuracy. Such records are now becoming quite common, and their use enables the mechanic to know what is expected of him, as well as those in charge of the work to form an estimate as to the cost of locomotive repairs.

Norfolk & Western Mallet.

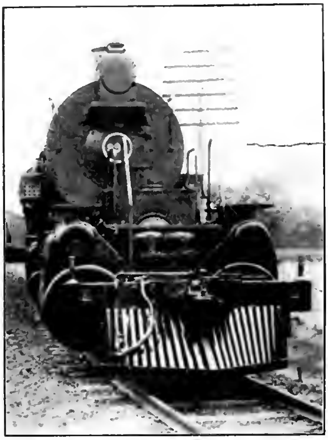
The Baldwin Locomotive Works have recently completed five heavy Mallet locomotives with the 2-8-8-2 wheel arrangement, for the Norfolk & Western Railway. These engines are designated by the railway company as class Y-1, and each is practically equivalent in capacity to two twelve-wheeled locomotives of their class M-1. The latter engines are the standard, on that road, for heavy freight service, and weigh in working order 204,000 lbs. The new engines will operate over grades of 2 per cent. combined with uncompensated curves of 8 degs. The sharpest curves on the main line are of 12 degs. The track is laid with 85-lb. rails.

These engines are in many respects similar to Southern Pacific locomotives Nos. 4000 and 4001, which were built in the spring of 1909. They are lighter, however, and present various differences in details. The design has been worked out along lines adopted by the builders for heavy Mallet locomotives, while the details, where possible, accord with existing Norfolk & Western practice.

The boiler is of the straight topped, separable type, with a feed-water heater in the front section. The fire-box has a sloping back head, and the crown is stayed by radial bolts; while 472 flexible bolts are placed in the outside rows in the sides, back and throat. The barrel of the main boiler is composed of three rings, with sextuple riveted butt seams on the top center line. In accordance with the practice of the builders, the seams are welded at the ends. The dome is on the forward ring, and the seam is strengthened by a large diamond shaped welt strip placed inside.

The water heater is traversed by 450 tubes, which are distributed over the entire cross section. Both injectors are placed on the right hand side in front of the cab, and they force water into the heater through a single check valve also placed on the right hand side. The heater is surmounted by a man hole, and the feed is discharged through a suitable fitting which is tapped into the man hole cover. The heated water enters the boiler proper through a single check valve, placed on the left side immediately back of the front tube sheet.

The arrangement of the steam piping is similar to that used on the Southern Pacific locomotives previously referred to. The high-pressure exhaust is conveyed forward, through horizontal pipes to the smoke-box, where it is passed through a



FRONT VIEW OF THE N. & W. MALLET.

Baldwin reheater. The spark arrester consists of a perforated plate, so placed that all the products of combustion must pass through it before entering the stack.

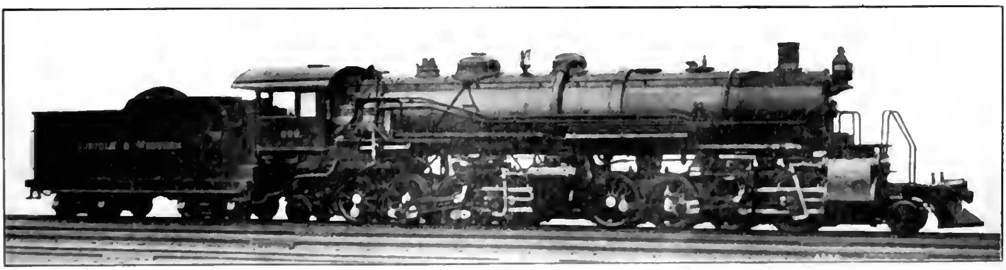
The steam distribution is controlled throughout by 15 in. piston valves, set with a lead of ¼ in. The four valves are duplicates of one another, those controlling the high pressure distribution being arranged for inside admission, while the low pressure valves have outside admission. The ports and bridges are modified to suit. The valves are of cast iron with L shaped packing rings sprung in. Walschaerts motion is used, and the high and low pressure gears are controlled simultaneously by the Baldwin power reverse. The front and back reverse shafts are connected by a single reach rod placed on the center line.

The arrangement of the articulated connection and the method of securing the cylinders to the frames, accord with the regular practice of the builders for engines of this size. The frames are of cast steel, 5 ins. in width, and of most substantial construction. The pedestal binders are lugged to the pedestals and held in place by three 1¼-in. bolts on each side. The equalization is continuous throughout each group of wheels, the trucks included. The front truck is center bearing and the rear truck has side bearing. As far as the running gear is concerned, the operation and performance of locomotives equipped with this wheel arrangement have been most satisfactory. The waist bearers which supports the forward boiler section are of the usual design, and are both under load. The fire-box is carried on sliding bearers at the front and back.

The tender frame is composed of 15-in. channels for the center sills, and 12-in. channels for the side sills. The bumpers are of oak. The frame is strongly braced, and the frame bolsters are built up of 1½-in. steel plates and 4 x 3-in. angles. The frame is braced transversely, at mid-length, by two 8-in. channels. The trucks are of the arch-bar type, with I-beam bolsters, triple elliptic springs and rolled steel wheels. The lower spring seats are mounted on rollers, thus providing the equivalent of a swing truck. The tank is of the water bottom type, holding 9,000 gallons of water and carrying 14 tons of coal.

These locomotives are far larger than any previously built for the Norfolk & Western Railway by the Baldwin Locomotive Works, but for Mallet engines their size is not unprecedented. Some of the principal dimensions are as follows:

Cylinders.—24½ and 39 x 30 ins.
Boiler.—Diameter, 80 ins.; thickness of sheets, ¾ in.; working pressure, 200 lbs.
Heating Surface.—Firebox, 210 sq. ft.; tubes, 4,309 sq. ft.; feedwater heater tubes, 1,389 sq. ft.; total, 5,908 sq. ft.; grate area, 75.2 sq. ft.; feedwater heater tubes, number, 450; diameter, 2¼ ins.; length, 5 ft. 3 ins. Engine equipped with Baldwin Reheater in smokebox. Reheating surface, 586 sq. ft.
Driving Wheels.—Diameter, 56 ins.
Wheel Base.—Driving, 40 ft. 3 ins.; rigid, 15 ft. 6 ins.; total engine, 55 ft. 6 ins., and tender, 84 ft. 3 ins.
Weight.—On driving wheels, 360,000 lbs.; on truck, front, 15,000 lbs.; on truck, back, 15,000 lbs.; total engine, 390,000 lbs.; total engine and tender about, 560,000 lbs.



MALLET ARTICULATED COMPOUND FOR THE NORFOLK & WESTERN.

W. H. Lewis, Superintendent of Motive Power. Baldwin Locomotive Works, Builders.

Locomotive Running Repairs

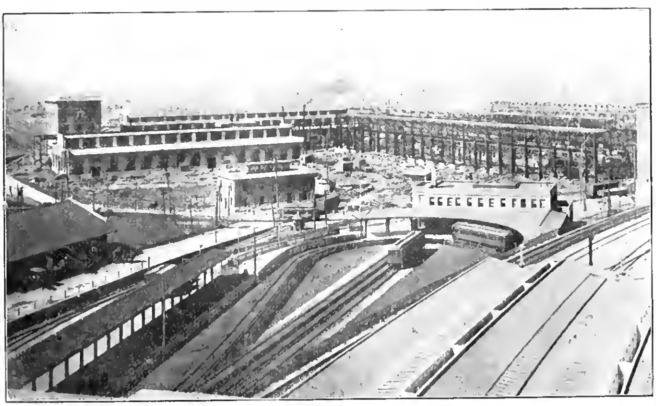
I.—Introductory

The general and running repairs of locomotives are subjects to which something new are constantly being added. The modern locomotive is not only much larger than that of the last century, but it is also much more complex, and hence it is necessary for railway men to keep in touch with the growing requirements of the time. The best methods of doing repairing work on locomotives twenty or thirty years ago would now be, in many cases, impracticable. Many new appliances for the repairing of locomotives have come into being of recent years, with the result that such work is now completed within a space of time so limited that it would formerly have seemed incredible. The improvements in traveling and jib cranes, the introduction of electric and compressed air motors, the endless variety of new machines, together with the remarkable degree of perfection to which almost every kind of tool has been brought, not to speak of the greater purity of metals, especially in the finer grades of steel, have almost revolutionized the art of making general and running repairs to locomotives.

It will readily occur to all engaged in railroad work that in the vast realm of mechanical ingenuity, as exemplified in meeting emergencies, it would be impossible to lay down specific rules for every contingency that may arise. Much has happened in regard to the mechanical appliances used on railways, and much will continue to happen that cannot be foreseen. It is also true that what may seem to be the best method of meeting an emergency or repairing a breakage is not readily applicable to every condition. Different methods may be applied to meet the same end, and it is especially observable among the most skilled mechanics that individual artisans have varieties of means or methods of operation peculiarly their own.

The same remark applies in a larger sense to machine shop tools and methods. In the New England States there is a degree of fineness to be observed in the smaller class of tools that is not equalled in any other part of the country. This is especially the case in the variety of machine shop tools used in the processes of milling and grinding. In the central or main arterial lines of railways, there is a tendency towards massiveness in construction in the larger kinds of tools, whereby the most ponderous parts of the mechanical appliances used on railways are swung from place to place with great ease and quickness.

Much of these and other methods are of course, local and accidental, and are fashioned largely to suit the growing requirements of the railroad center in which they are established. Among the most notable examples of this combination of power and speed in handling the heavy parts of locomotives may be found in its most advanced degree of excellence the appliances used at the locomotive repair shops of the Lehigh Valley Railroad at Sayre, Pa., at the shops of the Lake Shore & Michigan Southern Railroad at Collinwood, Ohio; at the Burnside shops of the Illinois Central Railroad, Chicago, Ill.; at the shops of the Chicago, Rock Island and Pacific Railroad at Silvis, Ill., and at many other of our modern railroad repair plants throughout the country.



D. L. & W. SHOPS AS SEEN IN COURSE OF ERECTION AT SCRANTON.

At Sayre the work of repairing locomotives is completed under one roof, the locomotives themselves being easily lifted from place to place in the vast shop. In this and other of the larger shops the machines are nearly all electrically driven, and there is also a very commodious system of electrically-driven trucks that move rapidly about, and to further facilitate transportation turn-tables are placed where the lines of traffic cross each other. At Collinwood the grouping of machines necessarily used in the fashioning of some particular part of the locomotives has reached a degree of convenience that would be difficult to surpass. These groups or sections are served by jib cranes that are so constructed as to be free from the possibility of contact with material that may accumulate beneath.

In the matter of wide passageways, the shops of the Delaware, Lackawanna & Western Railroad at Scranton, Pa., show quite a new departure. An extensive system of tunneling has been introduced, thereby obviating the necessity of much surface traffic between the divisions of the shops. The result of this innovation will be watched with much interest, for while the tunnels are to some extent a necessity, arising from the fact that the shops are separated from each other by public highways, it is believed that the system adopted will be found to have several important advantages.

It should also be borne in mind that modern roundhouses are keeping pace in the matter of equipment with the machine shops. The older of the establishments are of a kind that make running repairs difficult of accomplishment. This is especially the case where the largest kind of locomotives are housed in limited quarters, and it is gratifying to observe that the construction of new roundhouses is going on with increasing rapidity. The Western railways are being particularly well equipped in regard to roundhouses. These new buildings are fitted up more like machine shops, as they should be, and the roundhouse machinist bids fair to be as conveniently served and as comfortably housed as those whose work is carried on in the best machine shops.

Coming to the matter of running and

of general repairs, the work naturally divides itself into the two parts to which we have referred. Running repairs may be stated briefly as the kind of repairs naturally arising from the daily incidents of service, and not sufficiently important in themselves to call for a systematic repairing of all or any considerable number of the wearing parts of the locomotive. General repairs, on the other hand, may properly be said to consist of the complete repairing of all of the wearing parts of the engine after a lengthened period of service. Most of the chief railroads measure this period of service by the number of miles run. If the service performed by the locomotive is regular and the running repairs properly attended to, it is a safe method to establish a mileage record, as a maximum distance which a locomotive may run between the general overhaulings.

It may be noted that the records of distances run between general repairings is somewhat similar to the estimated working life of a locomotive. A fair average mileage run by a locomotive between repairings was set at about 100,000 miles many years ago. This distance is being lengthened as improvements in material and mechanism continue. Twelve or fourteen years' constant service was also set as the length of time in which not only the best kinds of boilers would be worn out, but also all of the other parts of a locomotive that are subject to the severe stresses incident to locomotive service. Yet in spite of these facts it is no uncommon sight to see locomotives that have passed twenty years of hard service.

It may be well to take up our study of locomotive repairs by presuming that a new locomotive or one that has been newly and completely repaired has begun its work. If the engine has been repaired and the work thoroughly done, there will likely be little trouble for some time, but it is very safe to assume that the valve gearing will rapidly undergo some change. This is particularly the case in locomotives equipped with the Stephenson valve gear, for no matter how carefully the gearing may have been adjusted when the locomotive was constructed or repaired, variations soon occur. These largely owe their existence to the fact that the valves are moved by a combination of rods and levers that are necessary in conveying the motion from the main driving rod to the valves. These couplings not only wear rapidly and create what is known as lost motion, but their wear is also of an erratic kind that is impossible to provide for in advance, and can only be kept nearly correct in their movement by systematic examinations and careful readjustments made by men of thorough experience in the intricate details of locomotive valve gearing.

II.—Readjusting the Valve Gear

The most common discovery made in looking over the main valves of a locomotive is the apparent variation in the lead or opening of the valve. It is almost always found that the opening has increased at one end of the piston stroke and diminished a corresponding amount at the other end of the stroke. In the case of the Stephenson gearing, a shortening or lengthening of the eccentric rod half the amount of the variation in the valve opening will square the valve, that is, the amount of opening at each end of the stroke will be equalized.

Sometimes it will be found that the lead may have increased in the forward motion and diminished in the backward motion. This may be rectified by moving the eccentrics the amount in which the valve is in error. The direction in which the eccentric has to be moved will readily suggest itself when the locomotive is on either of the centers, when the valve is in position showing the amount of opening. The rocker, it will be seen, reverses the motion so that the eccentric will have to be moved in the opposite direction from that in which it is desired to move the valve.

In the case of locomotives where the valve gearing derives its motion from a fixed crank, as in the case of the Walschaerts and Baker-Pilliod motions, the threaded valve rod will readily adjust the valve to the central position, but in case of much variation in the amount of lead in the forward and backward motion, it will be necessary to change the position of the crank. This is an important undertaking, which should only be made after very careful investigation and positive assurance of the necessity of a change.

A common mistake made in examining the valve gearing, which even the most skilled mechanics often make, is trusting to the original wheel markings for the dead centers or exact points where the end of the piston stroke occurs. It is an error to suppose that while these marks may have been correct at the time that they served their original purpose, that they remain correct after the locomotive has seen some service. It should be borne in mind that the rod connections have loosened. The locomotive in its entirety may be nearer the rails on account of the relaxing of the springs, while, of course, the wheel centers retain their original height. The result is that while the main rod may have become lengthened, the space between the center of the main axle and the center of the cylinder may be slightly shortened.

These variations, however slight, affect the wheel markings, and it is time well spent to begin the operation of looking over the valves from the beginning, and make new marks on the wheels, and also prove that the markings are correct by trying the engine, not only in the forward gear, but also running backwards, and so obtain as nearly correct as possible, an exact basis on which to conduct the investigation.

It should also be borne in mind that in construction and general repairing of locomotives the parts of the work are in a normally cool condition; whereas, in practice the engine is subjected in some of its parts to considerable heat. This change in temperature has a marked effect on the valve gearing, and the change

SPRING FLOOD AT MEADVILLE YARD ON THE ERIE.
(Courtesy of the Erie Railroad Employees' Magazine.)

is more particularly noted on the reach rod, owing to the expansion of the boiler to which the quadrant is attached. The reverse lever may be readily tried in the extreme forward and backward positions and any marked variation in the position of the link-block should be rectified; otherwise injurious irregularities in the motion of the valves will be produced.

It should also be remembered that in all cases of locomotives that are unfortunate enough to sustain even a slight shock in some apparently trifling collision, they are almost always affected in the delicate mechanism of the valve gearing. This can readily be accounted for from the fact that many of the essential parts of the motion are not traveling in direct paths, and lend themselves readily to distortion and must be reckoned with among the causes that make necessary a systematic and oft-repeated examination of the position and the action of the valves.

It is proper to bear in mind that a slight variation from the correct position is almost inevitable in all valve gearings, and especially so in the Stephenson gearing. This variation may not seem to be of much consequence, but when we remember that not only is the admission of steam at the most effective part of the piston stroke interfered with, but the compression, the point of cut-off, the release or exhaust, and also the exact balancing of the amount of effective pressure on the forward and backward stroke of the piston, are all affected, and all tend to a loss in the economical use of steam, and all contribute to a loss of power, as well as add to the cost of coal consumption which in itself is an item of great and growing importance.

In the case of the Walschaerts valve gearing, the change must be made in the combination lever the distance between the two upper joints in the lever and their corelation to the entire length of the lever being the determining factor in regard to the location of the valve. In the case of the Baker-Pilliod valve gearing, the combination lever may also be changed so as to affect the amount of lead, and a change of lead may also be effected by lengthening or shortening the lower arm of the bell crank, to which the valve rod is attached, a lengthening of the arm increasing the amount of lead, while a shortening of the arm correspondingly diminishes the amount.

Changes in the amount of lead or valve opening in the latter two classes of valve-gearings are not, properly speaking, repair work, but are really organic changes that belong entirely to the constructor's department, and affect many important points in the successful operation of the steam engine, and the changes are nearly always of a pernicious kind.

Questions Answered

CANDLE POWER OF HEADLIGHTS.

(46) W. H. H., Minneapolis, Minn., writes: Will you kindly tell me how to find the candle power of a headlight, as follows: Parabolic reflector, 16 ins. diameter and 7 ins. deep, with a 50 candle power acetylene light placed 3 ins. from the back of the reflector.—A. The method of determining the theoretical candle power of a headlight involves quite a complicated formula. In this case the factor of intensification, as it is called, due to the reflector is 107, and using a 50 candle power light we multiply 107 by 50, the product is 5,350. About 80 per cent. of this is taken as the candle power of the projected ray. In this case it would be about 4,280 candle power.

PUMP GOVERNOR CONNECTIONS.

(47) A. B., Youngstown, O., writes: When the excess pressure or S. F. 4 governor is used with the G. 6 brake valve, where is the upper connection of the excess pressure head piped to?—A. To a plugged ¼ in. connection in the lower case of the brake valve, the plug is located in the brake pipe port about 3 ins. from the gauge pipe tee. The lower connection to the governor top is piped to a plugged port in the lower case which leads to the feed port of the brake valve. This latter connection is made at the same point that the low pressure governor of the duplex reservoir control is when the feed valve is attached to the brake valve. In case the ports are not drilled and plugged, the Westinghouse Air Brake Co. will be pleased to furnish specifications for drilling.

APPARENT LOSS OF WATER.

(48) Young Boswell, Oakdale, Tenn., writes: An engine standing on a side track full, or nearly so, of water, with the fire practically dead, will lose its water. The engine not popping and no leaks in the boiler at any place. All the time the engine is losing the water the same is jumping the full length of the water glass as if the engine were swaying to and fro. Fill the boiler again and the result will be the same. The question is: What becomes of this water? The engine throttle in this case is not leaking.—A. The very conditions you say exist in this case prevents the assumption that the boiler loses water as there are no leaks. This question can only be answered in a general way and by some observations on the physical characteristics of water. The expansion of water in a boiler appears much greater than an ordinary observer would think, for instance, if you fill a boiler up to the bottom of the glass when cold, then when steam is raised to working pressure the water level is probably about the third gauge cock; and conversely if below the second cock when in steam, it will disappear when cold.

If you will fill a spherical flask with water about three-quarters full and boil it till the air is all displaced, then cork tightly and withdraw the lamp quickly, and allow it to cool, it will go on boiling for a long time, as the vapor condenses and the atmospheric pressure is prevented from acting upon it. But the character of the boiling changes as it cools and instead of boiling quietly with small bubbles, it becomes very spasmodic, boiling with large bubbles, and finally ceases. A sponge of cold water squeezed over it starts it off again and again, but always in large eruptions. There is a partial vacuum in the vessel, and if air is admitted the process ceases. In the case of the boiler if the injector is opened it will suck water from the tender, the overflow valve being closed, through the injector steam valve, and cooling will start the boiling or eruption.

AUTOMATIC, WITH INDEPENDENT VALVE.

(49) B. B., Brooklyn, writes: What causes an automatic application of the H. 6 brake when the independent valve is used?—A. When this occurs, the pressure in the reservoir pipe falls below that in the brake pipe and the backward flow which unseats the supply valve of the feed valve causes the reduction in brake pipe pressure necessary for the automatic operation. The fall of pressure in the reservoir pipe indicates that the volume of air used by the brake cylinders or cylinder and brake pipe leakage combined is in excess of the pump's capacity, or there is some obstruction in the reservoir pipe. The obstruction may be a partly closed reservoir cock or a partly stopped-up air strainer, should one be used, and the leakage mentioned may also be aggravated by the pressures in the reservoir and brake pipe being nearly equal, due to the use of an improperly adjusted pump governor.

S. F. 4 GOVERNOR.

(50) A. B., Youngstown, O., writes: Does the excess pressure top of the S. F. governor stop the pump when the brake valve handle is in release position?—A. When used with the G. 6 brake valve it does not, but when used with the H. C. brake it does. If it does not stop the pump when the handle of the H. C. brake valve is placed in release position, it must be due to leakage from the supply valve or regulating valve of the feed valve being in excess of the volume that can escape through the warning port to the atmosphere. The effect of this would be to increase the pressure in the feed valve pipe above the adjustment of the feed valve, consequently the pressure would increase until the high pressure top would stop the pump.

Air Brake Department

Conducted by G. W. Kiehm

Undesired Quick Action.

So much has been said and written on the subject of undesired quick action that if it were all collected, printed and bound, it would in itself fill a small sized library.

In spite of the many times it has existed in imagination only and the number of times it has occurred after the train had parted, there is no doubt but that it occurs every now and then on most all railroads, and occasionally it comes in epidemics, when every one concerned takes notice and the trouble is corrected for the time being, until the equipment is again neglected for a sufficient time for the trouble to occur all over again.

The occasional breaking out of the disorder usually results in a large number of triple valves being cleaned that might otherwise have been neglected, even if the fault is not with the triple valve as often as it is generally supposed to be.

A little care and attention is, however, very beneficial to the air brake equipment and in one sense of the word the undesired quick action is one of the most valuable disorders the brake can develop, even if a train is occasionally parted by it.

A peculiar phase of the situation is that with the exception of a few well-known air brake men nearly every one has some radical opinion concerning the subject, of course different views and differences of opinion being but natural.

One general impression seems to be that when the disorder occurs some part of the brake equipment is at fault; such is not always the case. Sometimes the opinion that the manufacturer is at fault is expressed, but that cannot be demonstrated to the satisfaction of air brake men who know that the manufacturers are as deeply interested in overcoming and avoiding undesired quick action as railroad men are.

Now if the quick action really does occur as the result of a disorder or improper manipulation of the valves of the equipment, it can be caused by but one condition, namely excessive or undue differential of pressure between the brake pipe and auxiliary reservoir volumes.

This is the condition, the possibility of it being brought about is from a variety of incidentals.

The chart printed in connection with this subject is for the purpose of showing in detail the causes and conditions likely to produce undesired quick action, and as stated the disorder is caused by the one condition, occasioned by any one or a combination of the disorders named under the several headings, and in order that it may not confuse the student of the air brake we will try to make clear why and in what manner some of the disorders mentioned produce the effect.

By the chart, then, we see that brake pipe pressure falling faster than auxiliary reservoir pressure can reduce, can be caused by: (1) Weather conditions. (2) Lubricant. (3) The feed valve. (4) The engineer's brake valve. (5) Equalizing reservoir. (6) Brake pipe. (7) Conductor's valve. (8) Triple valve. (9) Piston travel.

UNDESIRED QUICK-ACTION. PRIMARY AND CONTRIBUTING CAUSES.

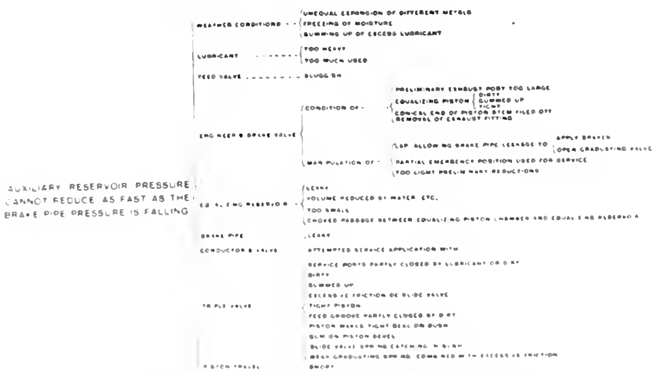


TABLE OF CAUSES OF UNDESIRED QUICK ACTION

To reason out just how each one of the parts mentioned and under what conditions it could produce the disorder is an interesting study. In the first cause, the repairman, who has made a very neat fit of a supply valve piston in a slide valve feed valve (not necessarily air tight), tested it thoroughly and after bolting it to the reversing cock or feed valve bracket located on top of the boiler, found that it refused to work or that the piston stuck in the bushing as soon as it got hot and would not work again until it was cooled off, will understand how the unequal expansion of different metals, mentioned under weather conditions, may influence the disorder we are considering.

The effect of the thin coating of ice on the slide valve seat or the gumming up of excessive lubrication requires no explanation.

Under the heading of lubricant it may be well to say that too heavy or too much used, acts as a packing, making the slide valve hard to move when pressed tightly against the seat in a similar manner that the collection of dirt in heavy oil on a rotary valve seat will make it hard to move the rotary valve.

It has at times been observed that after cleaning and lubricating a large number of triple valves, the number of cases of undesired quick action increases, which can be accounted for by the fact that in case of a dirty and gritty condition of the slide valve and seat, small quantities of air under pressure can get between them, which has a tendency to balance the pressure on the slide valve and reduce the frictional resistence to motion, while after being unsparingly lubricated the lubricant packed or excluded the air pressure from between the valve and seat and the slightly roughed valve would adhere to the seat with all the force of the air pressure per square inch effective on the slide valve.

The sluggish feed valve as a contributing cause is now pretty well understood, it being identical with lap position in allowing brake pipe leakage to start the application or open the graduating valve, as cited under manipulation of engineers' brake valve.

The tendency of the triple valve piston's movement when influenced by this improper manipulation or by the sluggish feed valve has been dwelt upon in these columns and further comment is unnecessary, but we wish to call attention to the 5/64 preliminary exhaust port, in connection with causes originating with the brake valve, and to the dirty, gummed up, or too tight fit of the equalizing discharge piston, the removal of the exhaust elbow and the too light initial reduction of brake pipe pressure.

Under the causes that will show the triple valve to be at fault is "feed groove closed by dirt," which may be considered as preventing the triple valve which causes the disorder, from being found, that is, the restricted feed groove prevents the reservoir's prompt recharge and upon the test to locate it, the triple does not work in quick action.

The other causes will be understood, and in reference to short piston travel as causing undesired quick action, this is encountered only with a very short travel when the 110-lb. pressure is employed.

In this case the auxiliary pressure expands promptly, but has not sufficient space in which to expand, which causes momentarily the excess in differential.

Many readers will appreciate the fact that this chart contains a great deal of air brake information, and locating the cause apparently becomes more complicated than ever, but concerning locating the disorder, when a triple valve is at fault, or when there is a "kicker" or "dynamiter" in the train, we will again mention Mr. Turner's remarks at Richmond in which he advocated a change in the method of locating the defective triple valve.

By cutting the train pipe until the defective valve is among four or five suspected ones, and in case the pistons do not come out on several, on the first reduction, each man watching for the defective brake, is likely to cut one out, as it is quite likely that all will apply at the same time when quick action does occur, and each man watching imagines he saw the one that "kicked," and in order to avoid mistakes, time permitting, the better method of procedure, in case the defective valve is confined to a few cars, would be to apply the brakes and cut out or rather close the stop cocks in the brake pipe on all the suspected ones and recharge the brake pipe, then open those stop cocks merely enough to release each brake, and when the reservoirs are again recharged and the reduction is started, but one brake will go into quick action, and that is the defective one.

This is assuming that the stop cock leading to the defective one is partly closed, and in this event the defective valve cannot reduce brake pipe pressure fast enough to throw other triples in the train into quick action.

Locating the disorder when it only occurs occasionally is a much more difficult matter, but we are dealing here with the disorder when it actually does occur, not when it exists only in imagination, for it is safe to say that undesired quick action only occurs about 25 per cent. of the time it is reported, and in breaking-in-two of the train, the train has often parted before the quick action occurred.

Now, in the event of light cars, with the higher percentage of braking power on the rear of the train and loaded cars on the head end, should the train part near the middle shortly after the application, who would be in position to state positiely whether quick action had occurred and parted the train or whether the higher percentage of braking power on the rear end had run the slack out fast and hard enough to part the train.

Let it be remembered that the black hand on the gauge would fall in either case and that the emergency application has been used many a time without resulting in a parted train.

Admitting that it does occur occasionally and that it is a serious matter when it does, the chart shows very distinctly that it can be overcome only by intelligent repair work, thorough test, and air brake instruction.

Concerning the latter we will call attention to one of the changes of recommended practice that has resulted from changed conditions. Eight years ago with short trains and 50 per cent. air-braked cars an initial reduction of 5 or 6 lbs. was considered sufficient to get the brake pistons out and bunch the slack, and the amount of subsequent reductions was of very little consequence.

Three years ago, with longer trains 100 per cent. air-braked, the volume of brake pipe pressure rendered the 5-lb. reduction practically valueless, and the 10, 12 and 15-lb. reduction was necessary to get the reduction through the train promptly, while today with the unequal braking power and about 50-per cent. type K triples in the train, the 5-lb. reduction to start with is about correct, as the type K triples will run the reduction through the train, and at the same time it is obvious that the 5-lb. reduction cannot develop enough brake cylinder pressure to part the train, regardless of which direction the slack is running, as a result of the brake application alone.

With 100 per cent. air brake cars and light cars on the rear, bunching the slack by means of a straight air on independent brake is poor practice, as the brakes on the light cars will surely run the slack out again, and when such conditions are felt it is policy to keep the train stretched even if it is necessary to keep the engine throttle open until after the brakes have applied.

Preventing Undesired Quick-Action

An invention intended to prevent the undesired quick-action of triple valves has received considerable attention from some railroad companies. It consists principally of a by-pass and check valve arrangement whereby auxiliary reservoir pressure can escape past a sticky triple valve piston, or rather, if the triple piston does not respond and reduce auxiliary reservoir pressure promptly, the auxiliary pressure can escape into the brake pipe by means of the by-pass arrangement and the sticky triple valve piston will not be moved, and consequently undesired quick-action will be avoided.

While this invention may do all and more than is claimed for it, it looks like a misdirected effort. It has been pointed out from time to time that undesired quick-action results from a disorder of the air brake equipment, and if the equipment is maintained in a fair condition and given a reasonable amount of attention there will be no undesired quick-action. This quick-action does not occur just previous to the break every time a train is parted, and does not occur every time a report of it is made on the work report book or on the detention report, and even if it did it would indicate that the air brake equipment needed some attention rather than a necessity for some device to prevent its operation while the brake remains in the same condition.

The inventor's idea appears to encourage neglect rather than an increased air brake efficiency; besides there is no assurance that the device itself will not be neglected and become defective along with the rest of the equipment and fail to prevent the possibility of the disorder occurring; in fact, there is every reason to assume that such would be the case. If this annoying and dangerous defect of the air brake is to be dealt with and overcome, the quick-action triple valve must receive proper repairs and a thorough test, to begin with, and occasional cleaning, lubrication, and inspection after being placed in service. The same thing can be said of the brake valve, and especial stress should be placed on the words "proper repairs" and "thorough test." The inspector and repairman's duties do not end here; the pipe connections on locomotives and cars are always subject to severe strains, which often produces leakage, and the brake requires continual attention.

In case there should be any company or individual pursuing investigations or developing inventions along a line that tends to make possible the placing of triple valves in service and allowing them to remain indefinitely without any attention whatever—to such we say an investigation along the lines of automatic lubrication of triple valves and brake cylinders, as practised to a certain extent by some Western railroads might prove interesting. This system of automatic lubrication is made possible by means of a cylindrically formed body of lubricant, a portion of which is graphite, enclosed in a brass casting located on the cross-over pipe between the cut-out-cock and the triple valve.

The moisture always present in the atmosphere or compressed air, dissolves in small quantities the body of this lubricant, the graphite portion excepted, and the flow of air through the triple valve holds this lubricant in suspension and deposits it on wearing surface of the triple valve and brake cylinder without its accumulating in the ports and passages. The graphite portion of the compound is also scattered through the brake system, and can be found on the packing leather of the brake cylinder, as well as on the triple valve, and it reduces packing leather wear to the minimum.

The system has been in use several years, and works equally well with 70 or 110 lbs. brake pipe pressure, and by continually lubricating the movable parts of the triple valve, it prevents any undesired quick-action that would result from a sticky triple valve piston.

The entire system of lubrication should be all right if it does not entirely do away with the periodical or occasional inspection of the triple valve, but in dealing with any air brake trouble it will be noticed that about the time the repair work and inspection is being properly taken care of, the trouble usually disappears, and to any one directing their efforts to overcoming undesired quick-action and at the same time reducing inspection and repair work, the writer would recommend automatic lubrication in addition to the by-pass arrangement, and without wishing to ridicule either system until they have been thoroughly tested.

Triple valves and packing leathers that had been in continuous service for several years, without receiving any attention whatever, have been exhibited and appear very satisfactory, and from all accounts the by-pass arrangement has been tested on triple valves in all conditions, and has proved that it can prevent the undesired quick-action.

Gosport station, on the London and Southwestern Railway, is the best present day example of what an important railway station looked like over sixty years ago. In appearance it has hardly changed at all since it was opened in 1841, under the name of "Portsmouth."

Energy Stored in a Moving Train

In the diagram showing the distance in which a train can be stopped from a speed of sixty miles an hour, we print the first of the series of diagrams prepared by Messrs. W. V. Turner and S. W. Dudley. They appear in a publication entitled "Developments in Air Brakes for Railroads," and a number of the most important ones will be reproduced in these columns in future numbers.

There is nothing particularly remarkable about this first diagram. We merely reproduce it to call attention to those which will follow it, and also to illustrate the enormous amount of air brake information that can be conveyed by means of lines on a single diagram.

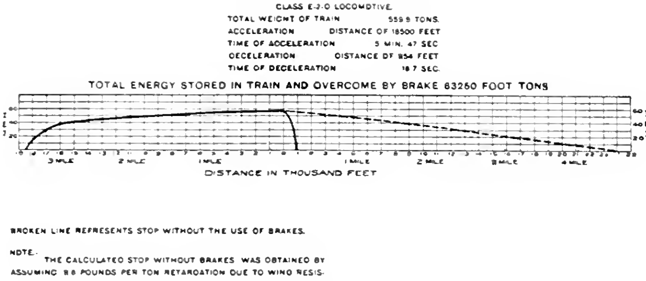


DIAGRAM OF ENERGY STORED IN A MOVING TRAIN.

Referring to this particular one, Mr. Turner has said, "this illustration taken from the records of a run during a series of tests at Absecon, N. J., the train being composed of a locomotive and ten cars. The amount of work it took the locomotive, nearly six minutes, and a distance of about three and a half miles to accomplish was overcome by the brakes in less than twenty seconds and within a distance of about one thousand feet. The broken line represents what the stop might have been if no brakes had been used, i. e., the train brought to rest by the resistance of the air and journal friction."

Brake Shoe Tests.

The report of the Standing Committee on Tests of Brake Shoes, of which Prof. Goss was chairman, presented to the Master Car Builders' Association, was of particular interest, supplemented as it was by reports of analysis made by the American Brake Shoe and Foundry Company, of Mahwah, N. J. The committee took twenty-eight brake shoes, selected from cars in service. These brake shoes were of fourteen different kinds, each kind in duplicate. One set was submitted to tests at Purdue University. The other set was tested at Mahwah, N. J.

The tests were made to determine the coefficient of friction of the shoe, and also to determine the loss in weight of the shoe and wheel under repeated applications. From the consideration of the results obtained the committee recommended that shoes when tested upon a cast-iron wheel, in effecting stops from an initial speed of forty miles an hour, should develop a mean coefficient of friction of not less than 22 per cent. when the brake-shoe pressure is 2,808 lbs., and 16 per cent. when the brake-shoe pressure is 6,840 lbs.

Considerable variation was shown in the wearing qualities of the shoes, and, as might be expected, the shoes tested wore more rapidly on a steel-tired wheel than on a cast-iron wheel, and, in general terms, it was noted that the shoes which show a wear below the average are those which cause the greatest amount of wear in the wheel. All shoes showed greater wear when applied under high pressure.

Train Brake and Signal Equipment.

The report of the committee on train brake and signal equipment, appointed by the American Railway Master Mechanics' Association, with Mr. A. J. Cota as chairman, consisted of a resumé of emergency brake tests made on the Lake Shore & Michigan Southern Railway during October, November and December of 1909, also the progress made in proposing a revision of the present code of tests of triple valves, and a brief mention of the disposal of matters referred to the committee by the executive and other committees during the year. The report is a most valuable one, the Lake Shore Tests being particularly interesting and instructive.

United States Steel.

Nearly twenty four millions of tons of iron ore was mined by the United States Steel Corporation last year as compared with seventeen millions of tons in 1908. Steel ingots were produced last year to the extent of thirteen millions of tons as compared with eight millions in the previous year. The output during the present year is said to show a corresponding increase.

Electrical Department

Running a N. Y., N. H. & H. Electric.

By W. B. Kouwenhoven.

In passing Woodlawn where the New Haven tracks end and the New York Central tracks begin, the change from alternating current to direct current is usually made without stopping the train. In fact the passengers are unaware that any change in the motive power has taken place. As there is no time allowed at Woodlawn to test the locomotive control for direct current operation this test must be made before leaving Stamford, in addition to the tests the engineer has already made.

The change-over switch must be thrown to the direct current position to try the control apparatus for direct current operation. There are two of these change-over switches on each locomotive, one to each motor unit. The change-over switches arrange the motor control connections so that when the locomotive is running on either direct or alternating current the proper contactors in the switch groups come in, as the engineer notches up the controller handle. These switches also control the connections for the blower and compressor motors, and for the lights, so that they receive power whether the locomotive is in the direct or alternating current zone. The movement of both change-over switches is automatically controlled by the set of three relays mentioned in the last issue. When alternating current enters the locomotive the two small relays lift their armatures while the armature of the large direct current relay remains down, and the control current from the storage batteries shifts the change-over switch to the alternating current position (with the handle down). If alternating current enters only one transformer, it will raise the armature of the small relay belonging to that transformer, and as that of the direct current relay is down, the change-over switch will throw over. When direct current enters the locomotive and raises the armature of its relay, while those of the small relays are down, the control current for direct current operation will throw the change-over switches back to the direct current position with the handles up. If one or both alternating current relays and the direct current relay simultaneously raise their armatures, the control circuit for both alternating and direct current is opened, as was explained in the last issue. When no current is entering the locomotive the armatures of all three relays are down.

In order to throw the change-over switches to the direct current position when at Stamford in the alternating current zone, the engineer opens both oil switches cutting off the current from the transformers, and the armatures of the two small relays immediately drop. Then by lifting the armature of the large relay by hand, the engineer establishes the connections for the direct current control circuit and the change-over switches will instantly shift to that position. Now the engineer can pull his controller handle up notch by notch while the helper watches the switch groups and checks off the proper unit switches as they come in for direct current operation. When he has completed this test with both master controllers in either direction, the change-over switches are thrown back to their former position by lifting the armature of one of the small relays. The engineer must also make sure that the small switches on the back of both master controllers are open. Then the helper closes the circuit breakers again and the locomotive is ready for operation with either direct or alternating current.

In running on alternating current one alternating current trolley is sufficient to collect all the power needed, and the other one should be kept locked down by closing the cut-out cock in the air line leading to it. The rear trolley should preferably be used because in case of the trolley striking any projection or becoming disabled it will not fall on the other trolley and ruin it for service.

In leaving the roundhouse at Stamford, passing over switches and coupling to train, and in any place where slow speed is desired the engineer may retain the master controller handle in one of the switching positions for a short time. These positions are not running positions and the controller handle should not be allowed to remain in them for any length of time when it can possibly be avoided. When the locomotive is standing still the engineer should, under no circumstances, allow current to pass through the motors.

When the conductor gives the signal to "go ahead" the engineer should throw the reverser handle to the forward position if he has not already done so, and proceed to notch up the controller handle, promptly drawing it from the alternating current switching position to alternating current No. 1 position, one notch at a time. As he does so he must watch the ammeter in front of him and endeavor to maintain the current between 1,600 and 1,800 amperes; 1,800 amperes need not be exceeded under normal conditions. Meanwhile the helper watches the ammeter at the other end of the cab to make sure that the motor unit is receiving current as well as the one supplied with current through the forward ammeter. From alternating current No. 1 the engineer should draw the controller handle notch by notch through positions Nos. 2, 3, 4, 5, up to alternating current No. 6, at which position the current is full on. He should take care not to exceed 1,800 amperes while drawing up the handle. Any one of the positions Nos. 1, 2, 3, 4, 5 or 6 are economical running points and the engineer may retain the controller handle in any one of them as long as he sees fit. When a slow speed is desired he should stop on one of the first notches and allow the controller handle to remain there. If in notching up, the engineer should by mistake pull the controller handle beyond alternating current position No. 6, the control circuit will be opened and all the unit switches will drop out, cutting off the current from the motors. In this case he should immediately return the handle to position No. 6, but if in the meantime the speed of the train has slackened considerably, then he must first pull out the controller plug which is attached to the reverse handle by a chain. This will open the control circuit and the engineer must now push the controller handle back to the off position, reinsert the plug and notch up as before.

When the train is approaching Woodlawn where the change from alternating to direct current is made, the locomotive passes a post along the right of way marked "shoes down." Here the engineer must press the button on top of the controller marked "shoes down." Pressing this button opens the small electro-magnet valves on the shoe cylinders, admits compressed air to the cylinders and forces down the shoes. The helper must see that all four shoes go down, otherwise the locomotive must be brought to a stop and the shoes lowered by hand. After passing the last overhead bridge, the helper throws the direct current main switch to the up position, closing it. Upon reaching the post marked "power off" the engineer immediately throws the controller handle to the off position and closes the small switch on the back of the controller. The closing of this small switch lowers the alternating current trolleys and locks them down and also locks the shoes in the down position. Meanwhile the helper opens the two alternating current circuit breakers, as soon as the trolleys are lowered. If the trolleys fail to come down the locomotive must be brought to a stop and the trolleys pulled down by a wooden pole provided for the purpose. The train is allowed to coast over the gap between the alternating current and the direct current zones. As soon as direct current enters the locomotive, the direct current relay is excited and raises its armature and the change-over switch automatically changes to the direct current position (with the handle up). When these changes have been completed and the direct current has entered the locomotive, the engineer pulls his controller handle up to the proper running position, while the helper closes the storage battery-charging switch for direct current. The train continues to run on direct current to the Grand Central Station in New York. Here the train is uncoupled and the locomotive is run on a siding to await its next train back to Stamford.

When the locomotive is standing idle at the Grand Central Station in the direct current zone, the engineer should leave everything the same as when standing in the roundhouse at Stamford, except that the third rail shoes should be down and in contact with the third rail.

Before leaving the station the engineer must test the control, repeating practically the same tests as were used before leaving the roundhouse at Stamford. He should start the air compressors and see that they operate satisfactorily. Then he should test the storage batteries, see that the change-over switches are still in the direct current position with the handles up, insert reverser handle and plug in master controller and by pressing the button marked "bell," ascertain that the current for the control circuits is on. Next he must proceed to test the control for direct current operation, making sure that the main switch is open and that the small switches on the back of the controller are open before commencing the test. The helper must watch the switches of the switch groups to see that they work properly while the engineer notches the controller handle up to full multiple position, using both controllers in turn and in both forward and backward directions.

He must also make a test on the controllers for the alternating current operation by throwing the change over switch to the alternating current position. Before throwing the switch, however, he must first open the compressor, blower and light circuits. After this test is completed the engineer throws the change over switch back to the direct current position. Then he closes the main switch and the small switch on the back of the master controller at the head end of the cab, making sure that the switch on the other controller is open. This small switch is always kept closed when running on direct current. The bell, sanders and lights are tested, and a general inspection of the fuses, tools and other equipments is made. The brakes are tried to see if they set and release properly, and the engineer is ready to proceed with the locomotive.

In leaving the Grand Central Station where slow speed is required the engineer may retain the master controller handle in the direct current switching position for a short space of time. The running positions on direct current are the "Direct Current Series, Shunt No. 1, Shunt No. 2 and the Full Multiple" positions. Any of these four positions are economical running points and the controller handle may be retained in any one of them for any length of time. The engineer must never allow the handle to remain continuously in any other position while operating with direct current, because it is not only uneconomical, due to the power lost in the grid resistance, but there is danger in burning out a grid.

Upon receiving the conductor's signal to go ahead and starting the train, the engineer must watch his ammeter while the helper watches the ammeter at the other end of the cab to make sure that both motor units are receiving power. The engineer must promptly notch his controller handle up to the series position and continue to shunt No. 1, and No. 2 position so as to maintain a curreat of from 1,600 to 1,800 amperes under normal conditions. From shunt No. 2 he should continue more slowly to full multiple, taking care not to exceed 1,200 amperes. The main direct current circuit breaker will open at 2,500 amperes and if he exceed this current and opens the breaker, he must immediately return the controller handle to the off position, push down the button marked "circuit breaker reset" and proceed to notch up again. If the breaker does not reset when the button is pushed, it can be reset by hand.

In passing over switches and in places where there are gaps in the third rail, an overhead rail is provided. At these points the engineer presses the button marked "direct current trolley raised," in order to obtain current for the locomotive. The trolley remains up only as long as he presses the button, and when the gap is crossed and the button released, the trolley comes down of its own weight.

SNOW SHEDS ON THE C. P. R., NORTH SHORE OF LAKE SUPERIOR.

Freight Train Resistance.

A very interesting individual paper on Freight Train Resistance and Its Relation to Average Car Weight was presented at the June convention of the Master Mechanics' Association by Mr. Edward C. Schmidt, assistant professor of railway engineering in the University of Illinois.

The tests, the results of which form the basis of the report, were part of the research work of the engineering experiment station of the university, and were conducted by the railway engineering department. The dynamometer car used was owned jointly by the Illinois Central Railroad and the university, and the tests extended over a period of about one year and were carried out over the Chicago division of the road.

The report is a very careful analysis of all the work done and the methods of conducting the tests. A number of curves were plotted showing train resistance in pounds per ton at given speeds, and comparisons with previous train tests were made.

Items of Personal Interest

Mr. R. W. Brown has been made air brake instructor on the Baltimore & Ohio South Western Railroad.

Mr. T. Duff Smith, has been appointed fuel agent of the Grand Trunk Pacific, with office at Winnipeg, Man.

Mr. George S. Goodwin has been appointed assistant mechanical engineer of the Rock Island lines, with office at Silvis, Ill.

Mr. W. P. Garabrant has been appointed road foreman of engines of the New York division of the Pennsylvania Railroad.

Mr. Geo. B. Foster has been appointed Chicago sales manager of the Wisconsin Engine Co., with office in the Fisher Building, Chicago.

A life-size bronze statue of the late Samuel Herbert Spencer, president of the Southern Railway, has recently been unveiled at Atlanta, Ga.

Mr. J. A. Barker has been appointed road foreman of engines of the Chicago, Cincinnati, & Louisville Railroad with headquarters at Peru, Ind.

Mr. F. Kinsey has been apointed inspector of transportation of the Chicago, Great Western Railroad, with headquarters at Chicago, Ill.

Mr. J. G. Boyd has been appointed roundhouse foreman at Gibson, N. B., on the Intercolonial Railway of Canada, vice Mr. E. E. White, resigned.

Mr. J. W. McIninch, locomotive foreman at Woodstock, N. B., on the Canadian Pacific, has had his headquarters moved to Aroostook Junction, N. B.

Mr. A. B. Ayers has been appointed mechanical engineer of the Chicago, Indiana & Southern and of the Indiana Harbor Belt, with office at Cleveland, Ohio.

Mr. H. J. Reed has been appointed night locomotive foreman at Winnipeg roundhouse, on the Canadian Pacific Railway, vice Mr. W. K. McLeod, transferred.

Mr. E. C. Ferguson has been appointed car foreman on the Canadian Pacific at Ottawa, Ont., vice Mr. T. A. Musgrove, resigned, to enter the C. N. R. service.

Mr. G. T. Spalding has been appointed traveling engineer of the Rocky Mountain division of the Chicago, Milwaukee & St. Paul, with headquarters at Deer Lodge, Mont.

Mr. W. H. Gardner has been appointed traveling engineer of the S. C. and D. division of the Chicago, Milwaukee & St. Paul Railway, with headquarters at Sioux City, Ia.

Mr. Charles E. Fuller, superintendent of motive power and machinery of the Union Pacific Railroad who has been elected president of the American Railway Master Mechanics' Association, was born Oct. 27, 1862, at Terre Haute, Ind., he was educated in the public schools and took a special course in mechanical studies. Entered railway service 1879 as apprentice in drawing office of the Terre Haute & Indianapolis Railroad, since which he has been consecutively to April, 1889, machinist apprentice foreman on the same road; April 15, 1889, to Feb. 8, 1890, general foreman New York, Lake Erie & Western shops at Hornellsville, N. Y.; Feb. 8, 1890, to Oct. 20, 1892, master mechanic of the New York division of the same road; Oct. 20, 1892, to Dec. 31, 1899, superintendent motive power Central Vermont Railroad Jan. 1, 1900, to Oct. 1, 1902, master mechanic Erie shops at Susquehanna, Pa.; Oct. 1, 1902, to June 1, 1903, assistant mechanical superintendent of the same road at Meadville, Pa.; June 1, to Aug. 24, 1903, assistant mechanical superintendent Erie system, including the controlled lines; Aug. 24, 1903, superintendent motive power Chicago & Alton and subsequently he took service with the Union Pacific as the chief officer of the mechanical department.

C. E. FULLER,
President, Master Mechanics' Association.

Mr. F. W. Stanyan has been appointed general manager of the Montpelier & Wells River Railroad, with office at Montpelier, Vt., vice Mr. W. A. Stowell, resigned.

Mr. C. L. Brevorts has been appointed superintendent of terminals on the Cincinnati, Hamilton & Dayton, with headquarters at Elmwood Place, vice Mr. Griffin, resigned.

Mr. E. R. Battley, heretofore machinist at Stratford shops of the Grand Trunk Railway, has been appointed locomotive foreman at Fort Erie, Ont., vice Mr. C. A. Livingston, transferred.

Mr. C. C. L. Bent, general manager of the Baltimore & Ohio Southwestern, will become general superintendent of terminals of the Baltimore & Ohio and of the Staten Island in New York.

Mr. John Lampton Conerly, general car foreman of the Illinois Central in New Orleans, has been transferred to the larger and more important plant in Memphis, on the same road.

Mr. A. R. Creelman, K. C., the company's general counsel, has been elected a director of the Candian Pacific Railway board, to fill the vacancy caused by the death of Sir George Drummond.

Mr. H. W. Davis has been appointed Eastern representative of the Falls Hollow Staybolt Company of Cuyahoga Falls, Ohio. Mr. Davis's office is in New York City, at No. 2 Rector street.

Mr. W. C. Hurst has been appointed superintendent of the Northern and Southern divisions of the Cincinnati, Hamililton & Dayton, with headquarters at Dayton, Ohio, vice Mr. J. M. Scott, resigned.

Mr. P. A. Rainey has been appointed assistant supervisor of signals on the eastern Pennsylvania division of the Pennsylvania Railroad, with office at Harrisburg, Pa., vice Mr. F. J. Bauman, resigned.

Mr. J. F. Kirby, formerly division foreman on the St. Louis, Iron Mountain & Southern, has resigned and has become master mechanic for the Hodges and Downey Construction Company at Dermoth, Ark.

Two Interstate Commissioners, Messrs. Lane and Clark, by appointment of the President, will represent the United States at the International Railway Congress to be held at Berne, Switzerland, this month.

As a result of the abandonment of the shops of the Northern Central at Mt. Vernon, Mr. George H. Burton, assistant master mechanic at that point, has been transferred to Renovo, Pa., in the same capacity.

Mr. C. A. Livingston, heretofore locomotive foreman at Fort Erie, Ont., has been appointed locomotive foreman at Durand, Mich., on the Grand Trunk Railway, vice G. H. Wyatt, transferred to Nichols, Mich.

Mr. T. J. Hamilton, formerly traveling engineer on the Chicago, Milwaukee & St. Paul, has been promoted to the position of district master mechanic on the same road, with headquarters at Deer Lodge, Mont.

Mr. J. W. Senger has been appointed master car builder of the Chicago, Indiana & Southern Railroad, and of the Indiana Harbor Belt Railroad, with headquarters at Englewood, Ill., vice Mr. T. H. Goodnow, resigned.

Mr. G. A. Smith has been appointed division freight and passenger agent of the Eastern division of the Chicago Great Western, with headquarters at 103 Adams street, Chicago, Ill., vice Mr. R. W. Goodell, promoted.

The title of Mr. W. F. Knapp, superintendent of shops and machinery on the Richmond, Fredericksburg & Potomac, has been changed to that of superintendent of motive power. His office remains at Richmond, Va.

Mr. J. J. Scully, heretofore superintendent district 1, central division of the Canadian Pacific at Kenora, Ont., has been appointed superintendent district 1, western division, Moose Jaw, Sask., vice Mr. W. J. Uren, transferred.

Mr. John M. Hofman, formerly roundhouse foreman on the Texas & Pacific Railway at Big Springs, Texas, has accepted the position of machine shop foreman on the Louisiana & Arkansas Railway at Stamps, Ark.

Mr. T. J. Sweeney, formerly a locomotive engineer on the Shamokin division of the Philadelphia & Reading, has been appointed road foreman of engines on the same division of the P. & R. with headquarters at Shamokin, Pa., vice Mr. J. W. Harris, resigned.

Mr. Ben Johnson, assistant locomotive superintendent of the United Railways of Havana, at Havana, Cuba, has been appointed superintendent of motive power of that company and the Havana Central, with office at Havana, vice Mr. Charles J. Thornton, resigned.

Mr. E. J. Searles has been appointed assistant to Mr. J. D. Harris, general superintendent of motive power of the Baltimore & Ohio, with office at Baltimore, Md. Mr. Searles is a mechanical engineer and a graduate of Johns Hopkins University. From 1902 to 1904 was engineer of motive power of the Baltimore & Ohio at Pittsburgh.

Messrs. J. D. Harris, C. E. Fuller and C. A. Seley were elected members of the executive committee of the Master Car Builders' Association. Messrs. J. F. Deems, A. W. Gibbs, C. A. Seley, W. H. Lewis and J. F. Walsh were elected members of the committee on nominations of the Master Car Builders' Association, at the recent meeting at Atlantic City.

Mr. Theodore H. Curtis, now president of the Master Car Builders' Association, has had a training somewhat like that of the late Pulaski Leeds. He was born at Terre Haute, Ind., in 1866, and he entered railway service as a draughtsman on the C., C., C & St. L., in 1886. Later he worked as draughtsman at the Brooks Locomotive Works and at the Pittsburgh Locomotive Works up to 1889. He was afterwards chief draughtsman for the N. Y. C. & St. L. for about 12 years. Subsequently he was appointed mechanical engineer of the same road, but in 1889 he went to the Erie Railroad, and in 1901 he took service with the Louisville & Nashville in the same capacity. In 1903, after the death of Pulaski Leeds, he was appointed superintendent of

T. H. CURTIS.
President Master Car Builders' Association.

machinery and has held that position to the present time. Mr. Curtis was known as a capable mechanical engineer before he was appointed to the higher position and he has maintained that reputation to the full notwithstanding the pressure of many executive duties. He is a close student of mechanical matters, and has the analytical faculty very clearly developed.

Sir William J. Sinclair, M. A., M. D., M. R. C. P., professor of obstetrics and gynecology, Pro Vice Chancellor of Victoria University, Manchester, Eng., has been elected a corresponding member of the Royal Medical Society of Buda Pesth. Sir William, as most of our readers know, is brother of Dr. Angus Sinclair, editor of RAILWAY AND LOCOMOTIVE ENGINEERING.

Mr. Thomas Tait, chief commissioner of Victoria Railways System in Australia, has, we understand, advised the government to consult Sir William Van Horne regarding the construction of a railway across the continent. Sir William is one of the most competent railway authorities and is free to advise the government of Austria and those of the various States in the Commonwealth upon a matter of such importance as the practicability of transcontinental communication, with extensive irrigation as an auxiliary feature.

At the meeting of the Master Car Builders' Association held at Atlantic City last June, Mr. T. H. Curtis, superintendent of machinery of the Louisville & Nashville Railroad, was elected president of the association for the year 1910-11. Mr. A. Stewart, general superintendent of motive power and equipment of the Southern Railway, was elected 1st vice-president. Mr. C. E. Fuller, superintendent of motive power and machinery, Union Pacific Railroad, was elected 2d vice-president, and Mr. D. F. Crawford, general superintendent of motive power, Pennsylvania Lines, was elected 3d vice-president. Mr. John S. Lentz, master car builder of the Lehigh Valley Railroad, was elected treasurer, Mr. John Kirby having retired.

The election of officers of the American Railway Master Mechanics' Association took place at the closing session of the convention held at Atlantic City last June. Mr. C. E. Fuller, superintendent of motive power and machinery of the Union Pacific Railroad was elected president for 1910-11. Mr. H. T. Bentley, assistant superintendent of motive power and machinery of the Chicago & North-Western Railway, was elected first vice-president of the association. Mr. D. F. Crawford, general superintendent of motive power of the Pennsylvania Lines, was elected second vice-president, and Mr. T. Rumney, general mechanical superintendent of the Erie Railroad, was elected third vice-president of the association. Dr. Angus Sinclair, of New York, was elected treasurer, and Mr. Joseph W. Taylor remains secretary of the M. M. and the M. C. B. Associations.

Obituary

James R. Paterson, recently in the sales department of the Commercial Acetylene Company of New York and for many years advertising manager of RAILWAY AND LOCOMOTIVE ENGINEERING, died at Cranford, N. J., on May 31. Mr. Paterson was born in London, England, and was distinguished in his youth as an all-round athlete, and participated in several of the international football matches. He was prominent in railway supply circles, and was a member of several of the leading fraternal societies of America. He was trained as a banker's clerk and went through an apprenticeship to that business. Judging that the prospects for advancement in London were unsatisfactory, he came to this country about 1890. He had been in failing health for some months. He leaves a widow and son, who is a student at the Stevens Institute of Technology at Hoboken, N. J.

This Paper Reaches Purchasers.

RAILWAY AND LOCOMOTIVE ENGINEERING has the largest circulation of any railroad publication outside of the brotherhood journals. It has more subscribers among such officials as master mechanics, general railway shop foremen and road foremen of engines than any other which makes it really the best advertising medium for people having goods to sell for railway rolling stock and repair shop purposes. A new department called Locomotive Running Repair begins with this issue. The Air Brake and the Electrical Departments are conducted by practical men in their own line.

Saratoga Wants the Convention.

The hotel people and others of Saratoga are making a systematic and vigorous effort to have the railway mechanical associations hold their annual conventions there again. A committee representing the business interests of Saratoga waited on the committees of the Master Car Builders' and the Master Mechanics' Associations at Atlantic City and made highly liberal offers of accommodation for the associations if they could be prevailed upon to patronize Saratoga regularly or every second year. No definite promises could be given, but another effort will be made before the joint committee.

Steam Heat Connections.

The M. C. B. Committee, Mr. I. S. Downing, chairman, who had the question of train pipe connections for steam heat under consideration, reported that tests were conducted at Collinwood, in March, 1910, on a train of thirteen cars, equipped with 2-in. pipe in the usual manner: Inlet controlling valves were all closed; steam was turned on at head end of train and time noted. When water appeared at rear end the time was noted; when steam appeared time was noted. When steam appeared the valve on rear end was closed. Time to get 10, 20, 30, 40, 50, 60 lbs. in rear car was noted.

The report continues: From the data obtained, the committee find that the large coupling will allow steam to pass more freely than the medium, but the difference is not so great as to be of much consequence. They believe that either large or medium is entirely satisfactory. When the Master Car Builders' adopted the large coupling and hose as Recommended Practice, in 1903, many prominent railroads immediately accepted the recommendation and put the large equipment on all of their passenger cars and passenger locomotives. Other roads did not do this, and the committee therefore do not recommend either size as standard for the Association, nor did they specify any particular make of valve as standard, though a number were subjected to test. The results of the tests were given in the report.

Inspection of Boilers.

The Master Mechanics' committee on design, construction and inspection of locomotive boilers, of which Mr. T. H. Curtis was chairman, decided to confine their report to the matter of boiler inspection for the whole field of enquiry would be too large for one report. Information on the subjects of boiler inspection rules, and also as to casualties due to boiler explosions, was received from a large number of roads. On the subject of explosions, information was received from 157 railroads, covering the period from Jan. 1, 1905, to Nov. 1, 1909. These roads operate 43,787 locomotives, have 157,169 miles of track, and in the 58 months covered by the records, made 6,012,057,467 engine-miles. The committee estimated the number of locomotives in the United States to be 58,000 and that the reports cover about 75 per cent. of the total number of locomotives in the country.

The report says, "Explosions and failures of locomotive boilers are divided into five classes, as follows: Explosions of boiler shells, explosions of fire boxes, damage by burning, rupture of flues, boiler-fitting failures. Explosions of boiler shells and fire boxes, or damage by burning, etc., are usually due to low water. Of the failures reported, 98.3 per cent. were due to low water and 1.7 per cent. to other causes. Of the failures due to low water, 98.6 per cent. were due to the failure of the men handling or in immediate charge of the locomotive to maintain a proper supply of water in the boiler; the remaining 1.4 per cent. were due to other causes. Automatic devices, either to maintain the water supply or to act as an alarm when proper supply is not provided, have been proposed and given consideration, but it has been determined that such devices are unreliable and have had the effect of taking away from the men in charge their accepted responsibility.

"Attention is invited to the item of ruptured flues, viz.: 3,204. This covers the record of an average number of 42,200 locomotives per annum for a period of four years and ten months. Assuming 250 flues to each locomotive boiler, the result shows one flue failure per year to each 15,912 flues in service.

"At the time the different railroad companies were asked for information as to boiler explosions, they were also asked to supply copies of their rules and regulations for the care and inspection of locomotive boilers. A review of such rules and regulations as were submitted shows that a very thorough and vigorous inspection of locomotive boilers is being maintained and recorded, and the rules prescribe very thorough instructions as to the proper care of the locomotive boilers."

"A statement of the explosions, failures and casualties is shown below:

	No.	Average per Year.	No. Killed.	Average per Year.	No. Injured.	Average per Year.
Low Water:						
Explosion of boiler shells....	14	2.9	20	4.1	16	3.3
Explosion of fire boxes......	246	50.9	127	26.3	144	29.8
Damaged by burning........	2,499	517.0	15	3.1	57	11.8
Ruptured flues	66	13.0	..	..	3	0.6
Fitting failures	25	5.2	..	..	4	0.8
Other Causes:						
Explosion of boiler shells....	6	1.3	10	2.0	7	1.4
Explosion of fire boxes......	2	0.4	1	0.2	1	0.2
Damaged by burning........	40	8.3	1	0.2	1	0.2
Total	2,898	590.5	174	35.9	233	48.1

"In addition to the failures shown above, there were also other failures, as follows:

	No.	No. Killed.	No. Injured.
Rupture of flues	3,204	8	21
Boiler fitting failures.........................	1,609	2	51
Total	4,813	10	72

Trade Mark Suit.

A suit for infringement of trade mark brought in United States Circuit Court over two years ago by James B. Sipe & Company (with offices at Pittsburgh), against Columbia Refining Company has lately been decided. This company made and sold a paint oil under the name of "Japinol," while James B. Sipe & Company has been manufacturing and selling a paint oil for the past twenty-five years under the registered trade mark "Japan Oil." On May 6, 1910, in the United States Circuit Court, Judge Lacombe, of the Southern District of New York, issued a decree perpetually enjoining and restraining Columbia Refining Company from using in any manner whatsoever the word "Japinol" or any other word so closely resembling James B. Sipe & Company's trade mark "Japan Oil" as to be misleading to the trade.

Locomotive Superheaters.

The Committee on Superheaters, under the chairmanship of Mr. Lacey R. Johnson, presented a very able and comprehensive report to the meeting of the American Master Mechanics' Association. The report embraced the result of experiments on twenty American railways and the data obtained was condensed and classified in such form that the most casual reader could see at a glance the number of locomotives using superheaters, their location, and a tabulated comparison with locomotives not using superheaters. From the report it appears that the Canadian Pacific has applied superheating to the largest number of locomotives of any railroad in America, there being no less than 487 locomotives so equipped. The Santa Fe comes next with 168, while the Great Northern has 61. Nearly a dozen of the leading railroads are represented by one each, the total number of locomotives so equipped being 805.

Eight types of superheaters are dealt with in the report. These and the number of locomotives to which they are attached are as follows: Vaughan-Horsey on five railroads is on 491 engines; Jacobs, 104; Baldwin, 79; Churchward (England), 61; Emerson, 59; Schmidt, 58; Cole, 13, and Union Pacific, 1. It may be added that the Schmidt superheater is in use on 130 railroads in Europe, and is in service on more than 5,000 locomotives.

The report presents a detailed description of the various superheaters with illustrations. Most of these devices have been already the subject of articles and illustrations in the pages of RAILWAY AND LOCOMOTIVE ENGINEERING. Perhaps the most novel in point of construction is the Jacobs superheater. We had the opportunity of observing the construction of the first superheater of this kind used, while visiting the shops in Topeka, Kans. It is of the smoke-box fire-tube type, and consists of two steel drums, fitted with a series of horizontal fire tubes between the heads and with steam pipe connections. Its application can be readily made to locomotives of the usual type without radical changes in the boiler or front end. It is a simple but effective method of utilizing the waste heat in the combustion gases without a sacrifice of effective heating surface in the boiler. With this design of superheater any desired degree of superheat may be obtained by setting the front flue sheet back farther in the boiler and this space utilized for superheating surface.

In the important item of running repairs per 100 ton-miles, the reports are very conflicting. An average may be taken from a few roads where they have made an exact comparison between the cost of maintaining the superheater and non-superheater classes of locomotives. In each case the locomotives were otherwise alike. The Southern Pacific reported an increase of 18 per cent. in the maintenance of superheaters. The Boston & Maine reported an increase of 13 per cent., while the C., B. & Q. reported an increase of nearly 15 per cent. These figures referred to the Baldwin, Cole and Schmidt superheaters. In the item of cost of coal, the reports are also very variable, ranging from 6 per cent. to 40 per cent., the highest coal saving report being received from the Canadian Pacific road, where the Vaughan-Horsey superheater is quoted at a reduction of 42 per cent. in coal consumption. The reports from this road are extremely variable, some showing a net reduction in coal expense of little more than 3 per cent. The general average on all roads is between 15 and 20 per cent. saving in coal by the use of the superheater.

The general practice seems to be to lower the boiler pressure when a superheater is applied, and as a consequence the result shows a reduction of boiler repairs. The increased cost of lubrication is not nearly as large as was stated several years ago, the marked improvement in oil pumps meeting the requirements of the service. Bronze valve seats are favorably reported on, and special metals are being experimented with for rod packing.

The committee, in conclusion, while pointing out that the use of the superheater is both economical and practical, wisely refrain from recommending any particular type of superheater, and while the report in point of completeness of detail leaves little to be desired, it is a noteworthy fact that the important item of first cost has been omitted as, we presume, not properly coming within the scope of the committee's work. The report is altogether not only one of the most important that has come before the convention, but the able committee have handled the subject in a masterly manner.

Tate Flexible Staybolts.

Quite an interesting and artistic catalogue, among the many that come to our office, may be mentioned that issued by the Flannery Bolt Company of Pittsburgh, Pa. This catalogue, which is of standard size, deals with the Tate flexible staybolt, an article which was put on the market in 1904 and has gained prominence in the railway world.

The catalogue is beautifully illustrated with drawings executed in half-tone, giving sizes and section of bolt sleeve and cap. Not only is the ordinary form of flexible bolt shown, but the flush head bolt is shown, where the sleeve enters the water space. The roof sheet staying, radial sleeves and button head bolts are also shown The tools made by the company for applying the Tate bolt are illustrated and described in detail. The catalogue concludes with instructions for applying the Tate flexible staybolt and also the 1910 price list of these bolts, in detail, giving all the prices for the different kind of caps, same for different kinds of sleeves, bolts, round nuts and tools.

At the May meeting of the New York Railroad Club, Mr. D. R. McBain, superintendent of motive power of the Lake Shore & Michigan Southern, read a paper on the inequality of expansion in locomotive boilers, and the remedy. He gave particulars of an engine entirely equipped with flexible staybolts, which had run 243,000 miles without leaks or cracks, or any detention for boiler work, other than that of expanding the flues. The views by stereopticon shown by Mr. McBain clearly indicated that Tate flexible staybolts were the ones used. We gave a digest of this paper on page 260 of our June issue and in it we referred to the mileage made by this engine, which is just about equal to the average distance of the moon from the earth and this fact enables one to appreciate the performance of the all-flexible staybolt engine.

In discussing Mr. McBain's paper, Dr. Sinclair said among other things: "The engineering world has striven for eighty years to restrain expansive forces of metal. They tried to resist the irresistible and to do so they made their sheets and staybolts heavier and heavier. There is an engineering aphorism that says, when an article breaks it is too weak; but that does not apply to staybolts and side sheets of boilers, for the heavier you make them and the harder you make them the more liable they are to break; and it seems now that the only remedy is to give flexibility instead of rigidity to these parts. This is a lesson to the whole railroad world—to be prepared to give flexibility instead of stability. I think, gentlemen, it is going to be one of the most important movements that has ever happened in the railroad world, and is going to save untold trouble from leaky fireboxes and the terrific expense of continuously renewing a thing that appears to be just right and goes to destruction apparently as soon as the work is done."

A copy of the Flannery Bolt Company's catalogue may be had by application to the company, Frick Building, Pittsburgh, Pa.

Traveling Engineers' Convention.

The Traveling Engineers' Association hold their next annual convention in Niagara Falls on August 16 to 19, inclusive. The president of the association is Mr. C. F. Richardson. The vice-presidents are Messrs. F. C. Thayer, of the Southern Pacific; W. C. Hayes, of the Erie; and W. H. Corbett, of the Michigan Central. The secretary is Mr. W. O. Thompson, New York Central car shops, East Buffalo, N. Y., and the treasurer is Mr. C. B. Conger, Grand Rapids, Mich.

Quick Dumping Ore Car

The transportation of ore from the mines to the docks at the great lakes and the unloading of the ore from the cars on the docks into the vessels for transportation over the lakes has always been an important part in the economical production of iron and steel and the railroad companies engaged in this work have endeavored to obtain the best cars for the purpose.

The development of the cars to meet modern requirements on the lines of greater capacity, and greater rapidity of unloading has been considerably hampered by the permanent and expensive construction of the docks with pockets at short regular distances corresponding to that between the hatches on the vessels and in accordance with which the old equipment of wooden cars had been built, and which cannot be changed without building new docks and changing the vessels. Builders and designers of ore cars for this service were required to work in accordance with these conditions, which, together with the comparatively limited knowledge in former years as to the strength and endurance of steel in car construction, resulted in the building of cars, not especially adapted to a rapid unloading. Recently the question of a reduction in time and labor required to unload the cars has become more important, in order to secure more rapid loading of vessels as well as less detention of the cars.

The Pressed Steel Car Company has just completed a sample car representing a lot of 300 cars which they are building at their Chicago plant, the Western Steel Car & Foundry Company, for the Duluth & Iron Range Railroad, and the Duluth, Missabe & Northern Railroad. These cars are of all steel construction, and have the following general dimensions:

Length over striking plates, 22 ft. 1 in.; length inside of body, 18 ft. $1\frac{3}{4}$ ins.; width over side sheet, 8 ft. 7 ins.; width inside of body, 8 ft. $6\frac{1}{2}$ ins.; height from rail to top of side, 9 ft. 6 ins.; height from rail to center of draw heads, 2 ft. $10\frac{1}{2}$ ins.; length of door openings, 6 ft. $7\frac{3}{4}$ ins.; cubic contents, level, 686 cu. ft.; cubic contents, ten-inch average heap, 802 cu. ft.; weight of car and trucks, empty, 32,700 lbs.; rated capacity, 100,000 lbs.; maximum capacity, 120,000 lbs.; ratio of paying freight to total weight of car loaded, 78.6 per cent.

The construction of the car is of single hopper center dumping type, and in order to make it self-clearing and dispense with the necessity of poking the lading when unloading, the area of the bottom opening has been made very large, being about 50 sq. ft., and the slopes of the hopper sheets have been made very steep, being 50 degs. at the ends and 60 degs. at the sides, from the horizontal. These conditions were made possible without reducing materially the carrying capacity of the cars by increasing their height and width, reducing the wheel base of the trucks and spreading the trucks further apart. The door opening is closed by two doors hinged at the sides, and which form part of the vertical sides so that when opened, part of the sides, as well as the bottom, falls away from the load, thus making a large unobstructed opening, reducing the necessity of bridging. The doors meet on the center line of the car and each are supported by two 6-in. channel bars, to which the door-operating gear bars are attached.

END VIEW OF QUICK DUMPING ORE CAR.

The door-operating gear is designed to be operated from either side of the car, besides it is so arranged that when the doors are closed and the car is loaded, there is no strain on the winding gear proper. The supporting mechanism is self-locking and the load tends to keep the doors closed rather than to open them. This is accomplished by means of cranks which turn over a dead center into a position of rest. The doors are connected to the cranks by heavy rods with screw attachment for adjustment. This causes the doors to stay tight. Gears of this kind have given good service on coal cars, and have the further advantage that when the doors are frozen so that they cannot drop by gravity they can be forced down by the connecting rods. Another feature in connection with the door gear is a safety device which will prevent the injury of the operator when opening the doors. To operate the doors the usual wrench is applied to the square end of the operating shaft; the crank arms are revolved by means of block clutches having a clearance of 180 degs. This permits the cranks to revolve half a revolution, after having been brought over the dead center, sufficient to fully open the doors without moving the wrench in the operator's hands. After the doors have been opened the clutches are in proper position for closing the doors, there being no lost motion. In a recent test at the Clinton furnaces a Pittsburgh the sample car was loaded with 100,300 lbs. of wet ore and was unloaded by one man. The time consumed by th ore in leaving the car was eight second Not a handful of ore remained in th car, and no poking or hammering of th sides to loosen the ore was resorted t during the operation. The car was afte wards loaded with 68,000 lbs. of ste punchings; the load was placed direct over the doors, and although this was very severe test of the efficiency of t door gear, there was no sign of weakne or leakage.

Be cheerful and have no regrets for t wasted or misused past, and never borro trouble about the future—but do well t duty which is nearest to you in the pre ent.—*Charles Pratt.*

Capacity of Safety Valves.

The report of the Master Mechanics' committee, Mr. F. M. Gilbert, chairman, which had considered the subject of the size and capacity of safety valves for use on locomotive boilers, stated that a series of tests were made for the committee by Mr. E. D. Nelson, engineer of tests on the Pennsylvania Railroad, to determine the maximum or worst condition that locomotive safety valves were required to take care of. With a gauge pressure of 190 to 270 lbs. it was found that the maximum discharge of steam was 2.44 lbs., the minimum 1.18 lbs., and the mean 2.05 lbs. per square foot of heating surface per hour.

The committee took twice this mean value, 4.10, as the basis for a formula, which, in their opinion, will reduce safety-valve practice to a uniform basis, and at the same time provide proper relief for the boilers. The proposed formula was:

$$A = \frac{0.0811.S.}{P}$$

Where A = Outlet of valve in sq. ins.
H.S. = Boiler heating surface in sq. ft.
P. = Absolute pressure, or gauge pressure + 15 lbs.

The committee believed that this formula will provide, on boilers carrying 200 lbs. gauge pressure, an outlet that will take care of 4.1 lbs. of water per square foot of heating surface per hour.

A number of observations were made on locomotives in passenger service, provided with safety valves, the combined outlets of which would take care of from 3.64 to 4.06 lbs of steam per square foot of heating surface per hour, and no cases were found where the safety valves failed to properly relieve the boilers. The locomotives on which investigations were made carried 200 lbs. gauge pressure, had 4,231 sq. ft. of heating surface and 56½ ft. of grate area. Past investigations have verified that Napier's rule for the flow of steam may be safely taken for the types of muffled safety valves now on the market.

A formula prepared in the 1908 convention of the Master Mechanics' Association was quoted for reference. It may be found in the proceedings for that year, page 262. In this the constant used was 0.10266. Valves designed in accordance with it were able to release 5.28 lbs. of steam per square foot of heating surface, per hour.

The committee recommend that the maintenance of proper areas of outlet should be a feature of safety valve maintenance and repair. The committee considered that safety valve outlets to either of the formulas quoted will be satisfactory for locomotive boilers only, and for those using coal as the fuel, and under the conditions now prevailing for the stimulation of the draft by the use of exhaust steam and by means of the ordinary steam blower.

Electric Fixtures.

One of the most artistic and comprehensive catalogues, out of the many that come to this office, is undoubtedly that of the Safety Car Heating and Lighting Company of New York. The catalogue is entitled "Electric Fixtures." The Co. have spared no expense in accurately illustrating the design of their fixtures, as well as the character of the workmanship which the company has uniformly insisted upon in their system of manufacture and inspection. It has been their aim in this catalogue to show a comprehensive collection from the great variety of designs as made by them, representing all the principal schools of art. The company have the advantage of patterns and tools, as well as a large stock to draw from, which is important where quick delivery is needed. Special attention has been given to the photometric tests and the designs have been worked out in a systematic way so as to insure the maximum of interchangeability of parts.

As a frontispiece they have included illustrations of ten standard metal finishes, but there are other special styles of finish made by this company. Attention is directed to the perfected "Safety Shadeholder," adaptable to all forms of electric fixtures as illustrated on page J-84. The general adoption of this device, after having been thoroughly tried in service, speaks for itself. It is timely in meeting the prevalent use of glass reflectors or shades, as it minimizes breakages. The device is self contained and does away with the possible loss of part. The company will be glad to suppl you with photographs or cuts of the illustration on receipt of size required.

The catalogue contains an index of all the numbered figures, and it is all printed on heavy plate paper from which the half-tones stand out with startling clearness. The catalogue is the same size as our magazine, 9 x 12 ins., and not only is a useful book of reference but it gives one at a glance the state of the art at the present time. It will be sent to anyone who applies for it at No. 2 Rector street, New York.

Car Wheels.

The M. C. B. Committee on Car Wheels, Mr. W. Garstang, chairman, reported that the design of cast car wheel submitted last year, has proved to be a great success, and the committee saw no reason to change or in any way alter this wheel. Some modifications were, however, required in the brackets used on existing circumference measuring tapes, so as to make them conform to the new tread and contour on the 1909 wheel. Some additional dimensions were also required to lay out the maximum flange thickness gauge. The committee received a communication from the Wheel Makers' Association in which some suggestions were made, which the committee did not feel justified in recommending to the M. C. B. Association.

Specific Heat.

The specific heat of a body is sometimes spoken of as capacity for heat, and here be it remembered that the unit of heat is such a quantity as will raise the temperature of one pound of pure distilled water from 39 to 40 degs. F. This is one British Thermal Unit or 1 B. T. U. The conception of heat is entirely different from that of temperature, as is often shown in a simple laboratory experiment. A cake of beeswax about ½ in. thick is placed in a horizontal position a short distance above the top of a table. A number of metal balls are immersed in a liquid having, say, a high temperature; and the balls soon have the same temperature as the liquid, and each of the balls is at the same temperature as all the others.

SIDE VIEW OF STEEL DUMP CAR.

If these balls with equal temperatures be placed on the cake of wax they will all begin to melt the wax and sink into the cake as they part with their heat, but the rate and depth of penetration into the cake will vary. For example, under these circumstances an iron ball will melt its way through the wax first; it will be followed by a copper ball of equal size; a tin ball will probably just show on the under side of the wax, while a lead ball and a bismuth ball may not be abe to do more than sink half their diameter into the wax.

This experiment proves that while the temperature of all the balls was equal, the amount of heat or the number of British Thermal Units possessed by each varied considerably. The iron ball contained the greatest number of B. T. U. and the bismuth least. At the close of the experiment the temperatures of the balls would all be different, but the capacity for heat of each is a property of the metal itself, and each maintained its own specific heat when all were at the same temperature.

Of all bodies, water has the greatest specific heat, and consequently it takes a greater number of thermal units to raise its temperature through any given number of degrees. Water heats comparatively slowly and cools comparatively slowly. Mercury and platinum heat rapidly, but they also cool quickly.

M. M. and M. C. B. Consolidation.

The report of the joint committee on the consolidation of the Master Mechanics' and Master Car Builders' Associations was presented at the Atlantic City Conventions last June. The committees were expected to set forth the advantages and disadvantages of a union of the two, and while they faithfully discharged this duty, the advantages to be gained by a union of the two are preponderant in the report. The committee were also charged with the work of proposing a constitution for a new association.

An analysis of the membership of both associations shows that 86½ per cent. of the men who are directly connected with railroad mechanical work are officers of both car and locomotive departments. In the Master Mechanics' Association 60 per cent. of the members whose titles indicate that they are in the mechanical department, are connected with locomotive and car matters. The report says the question for discussion is not that of absorption or consolidation, but the formation of a new and united association which, including in its members employees of both the car and the locomotive departments of our railways, may be called The American Railway Mechanical Association.

The matter was practically tabled by both associations.

Water Softener Pictures.

The Dodge Manufacturing Company of Mishawaka, Ind., have issued a couple of wall hangers, showing the exterior and a section of their apparatus. The sectional view is one of the most artistic things of its kind which we have seen for a long time. It is beautifully printed in colors and thus really forms a sort of graphic summary of the whole of the Dodge water softening process.

For example, there is an appropriate color selected to represent the raw, hard water clear or turbid as it enters the machine, another color represents the clear, saturated lime solution produced from the raw water that has been diverted to the lime tank. The quick-lime basket and the tank in which the soda ash solution is made are represented by other two colors. The treated and filtered water is also shown.

There are ten colors in all used in this hanger, and these are not simple arbitrary colors with a sharp line of demarcation between them. The colors chosen by the Dodge company in representing the "Eureka" water softener and purifier are appropriate in that the tints are as far as can be, the actual colors of the objects they represent. The shading of these colors, one into the other, is delicately and artistically managed, so that the whole picture shows the mingling of the waters, the chemicals, the solutions, the movement of the agitators and the method of drawing off the sludge and the delivery of the pure water. This company has a good treatise on the subjects of water-softening which they will be happy to send to those who write to them for a copy, and the artistic hangers are also for distribution and may be had on application by those who are interested in the subject.

UNION STATION, SOUTH JACKSONVILLE, FLA.

Coupler and Draft Equipment.

The M. C. B. committee on coupler and draft equipment, of which Mr. Durborow is chairman, included in their report specifications covering the size of eyelet for lock-lift device; gauges for knuckle pivot pins; use of knuckle-throwing devices; lock bearing area; twist gauge, and shelf brackets.

The report also deals with the subject of friction draft gear. It says that to make a series of service tests would necessitate equipping cars with various types of draw gear in turn. This would be an expensive method of test, would hold cars out of service when they might be urgently required. The possibility of using the drop testing machine was considered, but the behavior of the various types of friction draw gear under the forces of impact given by such a machine was found to differ greatly from their action in service. Any kind of static testing machine was also considered unsatisfactory.

A machine of the double pendulum type has been designed. Each pendulum is a series of weights bolted together, and each pendulum weighs 210,000 lbs. The pendulums are suspended by swinging hangers and each can be drawn back and up by suitable means. Thus provision is made for swinging each pendulum through an arc sufficient to give a maximum speed of 15 miles an hour when at the lowest point of swing, so that with one pendulum at rest and one in motion, speed up to that limit is obtainable, and with both pendulums in motion a maximum speed of 30 miles an hour is available at the point of contact, when they meet. By using pendulums in the testing machine, many uncertain variables are eliminated.

In the pendulums provision is made to accommodate all the types of draw gear to be tested. Theoretically the difference between the sum of the travels of the pendulums from the point of release to the point of contact and the sum of their recoils is the measure of shock absorbed by the draw gear under test, and it is therefore the measure of the efficiency of the draw gear. Thus draw gear having a low recoil would indicate high absorption of shocks, and vice versa.

The committee expect soon to have this machine in operation and to be able to embody in their 1911 report full details of a complete series of tests made on all the types of friction draw gear now on the market.

Widening Gauge of Track at Curves.

The Master Mechanics' Association committee on the widening of track at curves, with Mr. F. M. Whyte as chairman, reported that the committee had held several meetings with the committee appointed by the American Railway Engineering and Maintenance of Way Association, to consider this subject, and the result this year had been that the committee was able to make a final report. The recommendation of the joint committee has been accepted by the Maintenance of Way Association, and the Master Mechanics' committee suggested that approval be given by that body, as the matter concerned the engineering department more than the mechanical department of railways.

The report recommends that "Curves eight degs. and under should be standard gauge. Gauge should be widened ⅛ in. for each two degs. or fraction thereof over eight degs. to a maximum of 4 ft. 9¼ ins. for tracks of standard gauge. Gauge, including widening due to wear, should never exceed 4 ft. 9½ ins. The installation of frogs upon the inside of curves is to be avoided wherever practicable, but where same is unavoidable the above rule should be modified in order to make the gauge of the track at the frog standard."

Inverted Mantle Lamp.

The Safety Car Heating and Lighting Company of New York have sent us some statistics regarding the use of the inverted Pintsch mantle lamp. Among other things they say: "Over 73,000 lamps, using inverted mantles have been placed on cars since October 1, 1909, bringing the lamps in service up to the very large totals of 60,000 in North America, 69,000 in England, 101,000 in France, 202,000 in Germany. A threefold increase of light and a 40 per cent. saving in gas consumption is made possible; and that the cost of operating the lamp is reduced to only one cent per hour with 100 candle-power efficiency. An important fact of this development is the rapid rate at which the old lamp equipment is being brought up to date for use with the inverted mantle. About 60 per cent. of the railroads of North America have already applied the single mantle lamp, some have changed their entire equipment, others have contracted to do so and on many roads the work is being carried forward as rapidly as it is possible to shop the cars. Over 22,000 flat-flame lamps have recently been changed so that all told the Pintsch inverted mantle lamp is now in service on more than 8,200 cars in the United States, Canada and Mexico."

Car Framing Roofs and Doors.

The Committee on Car Framing Roofs and Doors, appointed by the Master Car Builders' Association, under the chairmanship of Mr. W. F. Bentley, believe that the most durable and economical roof for use is an outside metal roof of good quality of steel or wrought-iron sheets, with a medium weight per square foot of 14 ozs., thoroughly and evenly galvanized with a minimum coating of zinc of 1½ ozs. per square ft., and provided with flexible joints. Roof supported by a construction to carry at a safety factor of five, a uniformity distributed load of not less than 360 lbs. per running foot of length of car. The carlines should be metal, so constructed in connection with purlins running lengthwise, and roof boards running crosswise of the car, to provide proper tie and bracing to side and end framing at roof line.

In dealing with end bracing for box cars and bracing for side doors the committee made quite a number of recommendations which they hope will be submitted by letter ballot to the Association. The conclusions of the committee on roofs are also to be submitted by letter ballot, to the members.

The Loss of a Shoe.

As Levi struggled to detach himself from a barb wire fence, he exclaimed: "I knew that something would happen when I found that I had left the horse shoe behind."

Levi was my fireman, a lad of French ancestry, with his full share of Gallic superstition. He had seen old horse shoes nailed above doors and in other places as protection against bad luck or evil spirits, and he concluded that the inside of a locomotive cab would be a good place to install any charm, amulet or relic calculated to divert bad luck or misfortune.

Soon after coming to this conclusion, Levi picked up an old horse shoe in a junkman's collection of merchandise and carried it to the engine whence he lost no time in nailing it up in the cab above the spot where his own head appeared in his moments of leisure on the road. The horse shoe was a very rugged, rusty piece of scrap iron, but its presence was considered satisfactory for a time. The brakemen and other familiar spirits having access to the cab, were in the habit of making fun of the homeliness of the shoe, and one day Levi determined to put a shine upon it. He took the shoe to the grindstone and spent most of an afternoon laboring to convert it into a polished ornament. The work was not finished to his satisfaction when the whistle blew, so he put the shoe into the custody of the shop sweeper, telling Old Jerry to keep it locked up until the owner could return and finish the job.

Next day we started out as usual, and near the middle of the division met the result of a lap order in the form of a construction train. We met on a high hill and the crews of both trains went for the country and lingered not in their going. Levi was about the liveliest member of the jumpers and was first to land in the barbed wire fence. Nobody was much hurt, and a possible tragedy became a comedy, everybody enjoying Levi's lamentations about the absence of his horse shoe.

Splicing Underframing.

The M. B. C. Committee on Splicing Underframing, with Mr. R. E. Smith as chairman, in dealing with the maximum amount of sill splicing allowable recommended that M. C. B. Rule 65 be changed to read as follows: "Draft timbers must not be spliced. Longitudinal sills may be spliced at two points. No adjacent sills, except center sills, to have center splice immediately opposite the splice on adjacent sill; splices to be staggered so as to make joint of one splice at least 24 ins. from the joint of the splice on adjacent sill, measured from a line drawn at right angles with sills. Center sills must be spliced between body bolsters and cross-tie timbers, but not within 18 ins. of either. Splices on all sills other than center sills, as provided for above, can be located at any point between body bolsters or between body bolster and end sill, but not within 12 ins. of body bolster.

"Steel sills may be spliced in the most convenient location. Adjacent steel sills may be spliced. The thickness of each splice must not be less than the thickness of the web of the section spliced."

An analysis of the proposed rule will show that few restrictions have been placed upon the practice of economy in the use of high-grade material, which is rapidly becoming more costly and difficult to obtain; the committee did not feel that they recommended too wide a latitude in the number or location of the splices.

It has, the report continues, of course been impracticable for the committee to conduct practical tests to demonstrate the soundness of their recommendations, because of the large scale upon which such tests would have to be conducted; and it is questionable whether the testing to destruction of any reasonable number of cars, with sills spliced in a variety of ways and locations, would conclusively confirm or disprove any theory or afford positive data from which to prescribe correct practice.

Bulletin No. 1004.

The American Locomotive Company have recently issued Bulletin No. 1004, which is a very full and well illustrated description of the Mallet Articulated compound locomotives recently built for the Delaware & Hudson company. A description of this engine and the portion of the road it works on were described in RAILWAY AND LOCOMOTIVE ENGINEERING for June, pages 227 and 261. The bulletin, however, contains drawings of the boiler, intercepting valve, throttle, side spring buffers and floating balance device used in the automatic readjusting of the engine after rounding a curve. Comparison is made between it and the Erie Mallet, and a profile of the D. & H. grade is given.

Unique was the funeral of a Lowestoft railwayman, who for thirty-five years had rung the warning bell at the Great Eastern Railway station. On his coffin as it was carried to the grave was placed the bell, inscribed: "For thirty-five years I spoke at his command."

Railroad Character Sketches

The Shop Picnic

By James Kennedy.

The shop picnic was the event of the railroad year. Macfarlane was president of the picnic committee. Billy was floor manager. Shaw had charge of the room set apart for invited guests. It was customary to run the old "40" with a string of dilapidated cars along the road to some resort where, with music and mosquitoes and a blistering sun and barrels of beer, a day of alleged enjoyment was held. When Macfarlane's turn came to be president he inspired the committee with new notions. Too much beer was bad. Of course the committee met in Clark's parlors. That was a matter of necessity. Games were the proper thing to attract and interest young people. Athletic games, baseball, running, jumping, throwing weights, and most appropriate for a railroad men's outing, throwing the hammer, and the like. A subscription sheet went its usual rounds and prize money floated in. In Macfarlane's masterly hands the money, or a portion of it, took the form of shining cups and glittering medals and burnished badges. The boarding mistress could not sleep with so much precious metal in the house, so Clark arranged to have one of his parlor windows cleared for the grand display.

When the great day came the roundhouse and shop came to a stand still. The picnickers went along like a royal progress. The old locomotive was draped in red, white and blue. Some of the flooring of the old cars fell in and the merry mob had to cease dancing until they reached the grove. The party had become too well known at other resorts and it was a new place this year. The committee were gorgeous in rainbow badges. The ladies were all smiles and red ribbons. The air was vibrant with brazen trumpets. Clark had charge of the refreshments. The athletes were in great shape. What they lacked in skill they made up in enthusiasm. If they did not run as fast as they might have wished, they ran as fast as they could, and the best can do no more. The baseballists were so jubilant that some of them are in regular training now, and are destined either to become professionals after the match with Macfarlane's nine and the scoop handler's team is over, or they may have to be confined in lunatic asylums later in the season.

Macfarlane gave one or two exhibitions of skill, but he was above competing. It would not do for the president of a shop picnic to act like a common man. He becomes transfigured, just as a tricky politician becomes a statesman—when he goes to Washington. Alexander the Great offered to compete at the Olympic games if he had princes for his contestants. Macfarlane went him one better. He exhibited alone. He threw the hammer, and it was a good thing that the competitors had finished before Macfarlane began, because, after he had made two or three demoniac whirls with the hammer, the implement took wing and flew like Halley's comet and passed rapidly out of sight. Some distant strollers said that they heard something crashing among the branches of the trees in the shady distance. Whatever it was the hammer was never seen or heard of more.

When the thunders of applause had died away and Macfarlane had recovered his equilibrium, the manager came along refulgent in the gaudy glory of a spotted vest and glittering spectacles that gleamed in the summer sun, like flames of fire. Like the admiral of a ship the great man was not to be spoken to. In the shop his presence was something awful. On the road the sweat was on every brow as he passed along. At the picnic he condescended to speak to Macfarlane. The two great men moved around, like Castor and Pollux, in majestic loneliness, the manager, like a Marshal of France, and Macfarlane unapproachable as an aide-de-camp. After describing some preliminary parabolic curves about the grounds the two worthies leisurely strolled to Shaw's reception room. Under Shaw's delicate management the vocal valves of the mighty were lubricated. Havanas were in evidence and the great man hinted that there was going to be changes—a reorganization, and—would Macfarlane take charge of the roundhouse? Certainly. No—no thanks necessary. Purely a matter of business reorganization. Good day—yes—must catch the 2:30—must complete the reorganization.

Shaw automatically took something to settle his nerves. The strain was too great, so he began entertaining himself. Macfarlane, with his newly added dignity, left Shaw alone. The principal guests had come and gone and Shaw felt at liberty. The first bumper made a new man of him and, of course, he had to treat the new man that he became. Then he locked the door and put the key in his pocket and sailed over to Clark's benches, and lingered long and set valves, and built engines, and kept tools, and drew diagrams, utilizing the wet circles imprinted by the bottoms of beer glasses, and was supremely happy.

Meanwhile the grand march was in progress. Billy was radiant in white trousers and rainbow badge, and an angel of brightness on his arm. It was Eva, the golden-haired; Eva, the beautiful; Eva, the boarding mistresses' niece. She was white as an alabaster statue, and her fairy feet fell softly as snow-flakes. When Billy and Eva came down the middle and the delightful multitude clustered after them in long procession, and the warbled music melted into mellifluous modulations, all the grimy and weary memories of slimy pits and noisy shops fell away from the dark-faced mechanics, like old garments, and a brightness, as of dust from angel's wings, fell upon them, like a benediction. Macfarlane and Shaw were in a raised pavilion reviewing the merry multitude moving in measured melody. Macfarlane was full of double dignity. Shaw was full of double or, perhaps, treble X. Mazy figures succeeded mazy figures. The rhythmic rustle of flying feet, the rosy blush of youth and beauty, the visions of bright eyes and heaving bosoms, the garrulous gossip of the massed merrymakers, and above all the glare and glory of the high-set electric lamps burned the vision into the memories of the multitude forever.

But the whistle of the old "49" is waking the echoes. Macfarlane and Billy and Eva led the procession to the cars. Where was Shaw? In the semi-darkness there is a dusky figure unlocking the reception room door; there is a gulp and a gurgle, and there are several bottles of liquid fire not yet sunk beyond the equator, and there is a long-tailed coat and a hand that has not yet lost its cunning, and the bottles find a rocky resting place in Shaw's pockets and Shaw, the last of the careless crowd crawls into the cars and the picnic is ancient history.

Block Signal Report.

The report of the Block Signal and Train Control Board has just been issued. This board is, if one may so say, a department of the Interstate Commerce Commission. From the report we find that the total mileage in the United States operated under the block system upon January 1, 1910, was 65,758 miles. Of this mileage, 14,237.7 was equipped with automatic and 51,520.3 with manually operated signals. During the year 1909 there was an increase of 2,047.1 miles in the length of road equipped with automatic signals, being an increase of 4,162.2 miles in the length of road covered by the manual block system, making a total increase in miles covered by the block system of 6,209.3 miles. Ten roads which have not previously used block signals appear in this report, and twenty-two roads have made changes in their block signal installations.

During the last few years telephones have been installed on a number of roads in place of telegraph instruments for the transmission of dispatchers' orders. The telephone is used for the transmission of train orders on about 275 railroads; the aggregate mileage operated by these companies is 131,014 miles, and the telephone is used on 26,344 miles of road.

Mechanical Stokers.

The standing committee report on Mechanical Stokers, of which Mr. T. Rumney was chairman, was presented at the Master Mechanics' Association by Mr. Geo. S. Hodgins. The report contains a brief description of the Crawford No. 8 stoker, invented by Mr. D. F. Crawford, general superintendent of motive power, Pennsylvania Lines, Pittsburgh, Pa., also of the Barnum stoker, the Dodge or Black stoker, the Hayden stoker, the Street stoker, and the Strouse stoker.

The concluding remarks contained in the report are: "The main defect of the present stokers seems to be, to a very great extent, with the coal-conveying apparatus, and it is the failure of this particular feature which usually makes the stokers of today somewhat unreliable. The committee considered that the progress and the development of mechanical stokers which had been made during the past years was indicative of a determined effort to build stokers which would in every way be a success, and the committee was convinced that the mechanical stoker is destined to be a very important factor in the operation of heavy locomotives in the not very distant future."

In discussing this report, Mr. D. McBain, superintendent of motive power of the Lake Shore & Michigan Southern Railway, said, he believed that for the present the association should get away from the idea that a mechanical stoker should be more economical than a good fireman. He believed that when under all circumstances of road service a mechanical stoker could be made to do as good work as a good fireman and do it day in and day out that the first object of the mechanical stoker had been attained. After that economy could be gone into. Now was the time to encourage inventors and those interested to work along toward the production of a good all round reliable stoker, as it was badly needed on some trains today.

Drippings from Refrigerator Cars.

The M. C. B. committee on salt-water drippings from refrigerator cars, with Mr. M. K. Barnum as chairman, reported that all salt water drippings should be retained in the ice tanks of cars and only drained off at icing stations. The total capacity of drain openings should not exceed the capacity of the traps, and the capacity of both traps and drains should be sufficient to let go all the accumulated brine within the time devoted to icing the train. The mechanism for handling drain valves should be simple and positive and so designed as to insure the closing of the valves before the hatch plugs can be returned to place. Salt drippings should be conducted from ice tanks, through the drain valves and thence to the outside of the cars through regular traps and drain pipes.

The various packing companies, says the report, assisted the committee in their work of investigation, and have expressed their willingness to put into effect the practice recommended in the report, when the committee's recommendations are adopted by the Master Car Builders' Association.

Dixon Crucible Company Meeting.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Company of Jersey City, N. J., the old board consisting of Messrs. Geo. T. Smith, William Murray, William H. Corbin, Edward L. Young, Geo. E. Long, William H. Bumsted and Harry Dailey were unanimously re-elected. The board of directors re-elected the former officers, namely, Mr. Geo. T. Smith, president; Mr. William H. Corbin, vice-president; Mr. Geo. E. Long, treasurer; Mr. Harry Dailey, secretary; Mr. J. H. Schermerhorn, assistant treasurer and assistant secretary. Mr. William H. Corbin was also re-elected as counsel.

Education and Fuel Economy.

"Education as an Essential of Fuel Economy" was the subject of an able paper presented by Mr. W. C. Hayes, superintendent of locomotive operation, Erie Railroad, at the Master Mechanics' convention last month. Mr. Hayes dwelt on the need of educational preparation for young firemen before beginning actual service. A course of instruction covering all of the principles of combustion, train rules and signals was strongly recommended. Young men so prepared would have a preference anywhere and would begin their work under the most favorable conditions. After being employed, Mr. Hayes claimed that the young fireman should continue his educational course. Valuable literature can be easily secured, and the road foreman of engines should see that the studies are being kept up, and be prepared to instruct, as well as discuss with the men all matters of vital importance concerning their work.

Mr. Hayes gave some startling illustrations of how easily fuel may be wasted by careless methods in firing, and how necessary it was that young firemen should be treated quietly and intelligently and led by easy stages to a complete mastery of their calling.

Classification of Cars.

The M. C. B. Committee on classification of cars, of which M. J. Milliken was chairman, presented a list of definitions with designating letters of general service passenger equipment cars and also the same of general service freight equipment cars. In getting up this set of definitions, the rolling equipment of 43 railroads, operating 117,500 miles of track and owning approximately 1,350,500 cars, was very carefully examined. It was found to be impracticable to make a definite classification, giving the individual characteristics of the cars that would in any way be applicable to the equipment of the various railroads of this country. It therefore seemed to the committee that the classification should be broad in its interpretation, and confined only to the kind of cars of a general class, and to the stenciled capacity of the car. In working out the proposed classification of cars, a single designating letter has been given for the general service of the car and a secondary letter to cover the general type of the car. In selecting the primary and secondary letters the attempt has been made, as far as practicable, to use letters which give some indication of the type of the car, or to retain the letters that are now generally used. For example, *PV* indicate a car of the general passenger type used as a railroad official's car—a private car. *P.O.* stands for passenger-observation car.

Standards and Recommended Practice.

The Master Car Builders' standing committee on Revision of Standards and Recommended Practice, of which Mr. R. L. Kleine is chairman, proceeded with their work by sending out a circular and very carefully considering the replies. As many as forty-four matters were taken up and disposed of, either by referring the matter directly to a special committee having the matter in question, in hand, or by recommending a proposed change to the association or advising that no action be taken. In this way some definite disposal is made of all questions arising and suggestions made by members of the association.

Removal to Larger Offices.

The Bettendorf Axle Company have moved their Chicago offices from the Old Colony Building to larger quarters in the McCormick Building, the room number of which is 1508. While the Bettendorf Company is not yet quite settled in their new quarters, the offices will be much better arranged and the company will have there several full-sized Bettendorf trucks, side frames and also Bettendorf body and truck bolsters so that a sort of private exhibition of their products will always be on view for any interested person who visits their new offices.

Locomotive Frame Construction.

Locomotive Frame Construction was the subject of an individual paper presented to the American Railway Master Mechanics' Association by Mr. H. T. Bentley, assistant superintendent of motive power, C. & N. W. Ry. Mr. Bentley favored the use of cast steel driving boxes with adjustable hub liners, so that lateral motion could be readily taken up. The boxes, Mr. Bentley claimed, should be of a removable type so that it would be possible to quickly replace them without having to drop the wheels.

In regard to frame breakages in the case of locomotives equipped with the Walschaerts valve gear, Mr. Bentley had found no trouble, showing that the locomotives in his charge are properly braced. In regard to driving box brasses, it appeared from numerous experiments that a mixture of 80 per cent. copper, 10 per cent. tin and 10 per cent. lead, gave very satisfactory results. The opinion was only advanced that the frame jaws should be much widened so that the pressure per square inch could be greatly reduced. Bronze shoes and wedges were also favorably reported on, the recommendation being added that the shoes and wedges should be of the flangeless type. Mr. Bentley summed up his able paper with suggestions favoring heavier frames, and avoiding pounding in driving boxes. All weight carrying parts on frames to be braced to boiler, and all of the best material.

Rules for Loading Material.

The M. C. B. committee appointed to consider the rules for the loading of material, of which Mr. A. Kearney was chairman, begin their report by saying, "While the report involves several recommendations for changes, still the idea throughout has been to adhere as closely as possible to the rules as they now exist, making only such additions, corrections and omissions as would, in the opinion of the committee, conduce to greater unity, better sequence, and a natural clearness, principles so necessary in formulating rules of this character."

Several of the illustrations used in the interchange code have in the opinion of the committee become very indistinct and should be made much clearer. The report contains quite a number of individual opinions of the members, and the list of recommended changes is quite extensive.

A suggestion was received from the arbitration committee that the rules for handling explosives and inflammables should be incorporated in the interchange code along with those on the loading of material. The committee on loading material did not altogether approve of this suggestion, upon the ground that the interchange code might become too bulky. The chairman, however, expressed a personal opinion on the subject in which he said that the cover or binding of the book should not in any way affect the force of the rules.

Engine Performance and Superheat.

Locomotive Performance Under Different Degrees of Superheated Steam, was the title of an interesting paper presented by Professor C. H. Benjamin and Associate Professor L. E. Endsley of Purdue University, before the American Railway Master Mechanics' Association. The paper may be said to be a record of the continuance of experiments begun by Professor Goss, who read a report before the association in 1909, on the subject of "Locomotive Performance Under Saturated and Superheated Steam." At that time, it may be briefly stated, that the learned professor presented an array of facts and figures showing an increase of 10 to 15 per cent. in the amount of power developed by the use of superheated steam, without increasing the amount of fuel.

In the paper presented this year the same systematic method of careful and varied experiments are duly recorded, with a greater variety of pressures, the most important point proved being that at steam pressures over 220 lbs. per square inch, there is no apparent fuel economy in the use of superheated steam, in fact, the line may be drawn at 200 lbs. pressure as being the limit at which superheating of steam has any appreciable value in point of economy. At pressures of 160 lbs. to 180 lbs. per square inch the results as indicated verify the exhaustive reports made by Professor Goss last year that there is a saving in fuel of nearly 15 per cent. by the use of superheated steam, and a still larger saving in the use of water.

Tank Cars.

The M. C. B. Committee on Tank Cars, of which Mr. A. W. Gibbs was chairman, in presenting their report called attention to the fact that at the 1909 convention they had referred to tank cars constructed without side sills and on which no means are provided for jacking, to facilitate handling in derailment or in making repairs.

In order to determine the necessity for these jacking castings, tests were made with a loaded tank car, limit weight 132,000 lbs., fitted with continuous sills, but no side sills, and not equipped with jacking castings; also with a loaded tank car, limit weight 132,000 lbs., constructed with reinforced shell, having no center sills or side sills, and not equipped with jacking castings. Details of the operations required in handling these cars were given and the committee practically drew the conclusion that, inasmuch as there are freight cars of other types in service which should also be provided with jacking castings, on account of the present difficulty experienced in jacking up cars not equipped with side sills of sufficient section to withstand the pressure of the head of the jack, the question is one of general importance, and the committee recommended that a special committee be appointed to go into this question generally, so that any recommended practice adopted would cover the whole situation.

Steel Tire Report.

The report of the master mechanics' committee on steel tires of which Mr. A. Stewart was chairman, was brief. The committee says: "Your committee appointed to consider specifications for steel tires have given the subject considerable thought and have been in communication with the tire manufacturers, some of the committee visiting the tire works with the idea of trying to work out specifications which it would be possible to enforce under working conditions and not impose unnecessary hardships on the manufacturer or excessive cost to the purchaser.

"The results have not been encouraging, and we feel that any specification we could get up, to give any practical results, would require a test to destruction of, at least, one finished tire out of each heat. in view of the cost of carrying out a specification containing this requirement, we hesitate to offer it, and, unless it is the opinion of this association that such a requirement, with the expense of enforcement, would be justified, we ask that the committee be discharged."

Train Lighting.

The Committee on Train Lighting, of which Mr. T. R. Cook was chairman, presented a report to the Master Car Builders' Association, which the members believe will have the effect of immediately simplifying the practice of car interchange, with better protection against fire, and establish a system of rules regarding the posting of notices explanatory of the apparatus used in train lighting. Diagrams are shown in the report as to the regulation of the exact position and arrangement of battery terminals, charging receptacles, and the marking of the same in a distinctly uniform manner. Switches will henceforth be stencilled in plain letters, and all batteries will be installed in doube compartment tanks. All of the rules and regulations suggested by the committee are not only calculated to meet the growing requirements of the service, but in many cases are absolutely necessary for the safety of the trains. Many of the proposed changes will be gladly welcomed by the railway employes engaged in train lighting.

Baldwin Works Doing Well.

A recent press dispatch from Philadelphia says: An order for 85 large passenger locomotives has been placed with the Baldwin Locomotive Works by the Harriman lines. This order amounts to about $1,125,000, and is one of the largest locomotive orders recently given. The locomotives are to be of the largest and heaviest passenger type. Deliveries are to be made in October, November and December of this year. This announcement was made by Mr. Alba B. Johnson, vice-president of the Baldwin Works, Inc. In reply to a question whether the rumored curtailment and cancellation of equipment orders had affected the Baldwin works, Mr. Johnson stated that no orders had been canceled, and that there was no expectation that any would be, but that on the contrary, purchasing on a gratifying scale is anticipated. There are at present about 14,500 men employed against less than 4,000 in the depression of 1908, following the 1907 panic.

The Ready-Made Farm

Farms are already being prepared for next year under Sir Thomas Shaughnessy's scheme of ready-made farms for British immigrants. Fifty of these are to be at Sedgewick, in Central Alberta, in the neighborhood of the Canadian Pacific branch line from Lacombe to Hardistry, a rolling prairie of very rich soil, which is being filled up rapidly with settlers, says the *Standard of Empire*. The ready-made farm consists of a certain tract of fertile prairie land on which a house and barn has been built, and the first year's crop has been sown by the railroad.

The settlers are all practical agriculturists of experience, and all of the families, as their ancestors for generations before them, have been successful tillers of the soil. One representative farmer said: "Nothing could be more satisfactory than our prospects, nor more encouraging than the reports received from the advance party, who tell us that the conditions in the West more than fulfilled their most sanguine expectations, and that every promise that had been made them had been faithfully and fully carried out."

These settlers, with the 180 who arrived a few weeks ago, complete the first year's emigration of those selected under Sir Thomas Shaughnessy's scheme. They bring with them a lot of household goods and capital ranging from $1,500 to $2,500 each.

The Perfect Number.

Among all the numbers none other seems to have attained the celebrity of 7. There are seven days in the week, seven years of plenty, seven years of famine, seven wise men of Greece, seven wonders of the world, seven Mohammedan heavens, seven notes in the musical scale, seven colors in the solar spectrum, etc. The visible moving bodies of the heavens are seven—Sun, Moon, Mercury, Venus, Mars, Jupiter and Saturn.

A series of digests of all the papers presented at the Master Mechanics' and at the Master Car Builders' Associations at the Atlantic City conventions, last June, are to be found in this issue

Lumber Specifications.

The report on lumber specifications was the result of a conference of a joint committee of the M. M. and the M. C. B. associations. The chairman of the M. M.'s committee was Mr. R. E. Smith, and the M. C. B. committee chairman was Mr. G. N. Dow. The committees, before drawing up their report, put themselves in communication with the Railway Store keepers' Association and with the various lumber manufacturers' associations throughout the country. The specifications which were submitted are stated in the report to have met the approval of the various committees and especially of the lumber manufacturers. The report contains letters of endorsement from the chairman of the Northern Pine Manufacturing Association, the Pacific Coast Lumber Manufacturing Association, the Hardwood Manufacturing Association, and the Southern Cypress Manufacturers' Association.

Cape-to-Cairo Railway.

The completion of the Cape-to-Cairo Railway, the dream of Cecil Rhodes, is now well in sight, says a correspondent of the London *Daily Mail*. By the end of this year the whole extent of the line will have been surveyed. From Khartum, in the north, and from Broken Hills, in the south, the line is creeping forward. The line, with its 6,600 miles of track, will be the longest in the world.

Mr. Huberty, secretary of the Anglo-Belgian Katanga Railway Company, says that it has just been decided to survey the route of the Congo extension of the Cape-to-Cairo line from Elizabethville (close by the famous Star of the Congo copper mines) northward to Kambwe. The line between the Star of the Congo and Broken Hills (Rhodesia), will be completed by September next.

The great bulk of the line, including some thousands of miles at the northern and southern ends, will be British and the remainder will pass through Belgian territory.

The Germ Horror.

It is hardly necessary to remark that the fads that afflict so many of our people have a tendency to run into senseless extremes. For some years the thought of germs, microbes, etymons, embryos and other minute organisms has kept a nervous portion of our population in senseless dread of being murdered by diseases that the microcosms are suspected of scattering upon every living thing. Railway companies have suffered considerable annoyance from laws passed by diverse States intended to combat the ruffian germ and to increase the annoyance imposed upon travelers.

A new and amusing manifestation of the germ fright has lately appeared in various parts of the country. In suburban and city train travel the holding on straps for passengers standing in the aisles has become a recognized convenience for years. Now the germists have declared that promiscuous holding on to these straps is as dangerous as promiscuous kissing, and a movement is in healthy activity urging people to carry along their own private strap and hook attachment.

Removing An Island.

Calypso's Island has been moved to South Bethlehem, Pa., by dredging it out of the center of the Lehigh River by direction of the engineering staff of the Lehigh Valley Railroad and the material, 125,000 cubic yards of stone and earth, have been used to fill in an arch-like curve that the right bank of the river makes just west of South Bethlehem. The object of the removal of the island is to straighten the road and get space for four tracks in addition to room for building sidings.

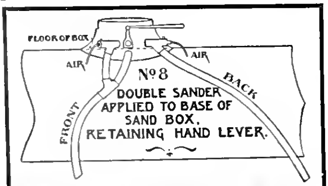
It took the working force about six months to do the work, delay being caused by high water during the winter months. In addition a new route had to be provided for a water main which had originally been laid through the island. This makes the third island removed from the river in order to carry out railroad operations.

New Railway.

A recent press dispatch from Toronto, Ont., says with hardly any ceremony at the junction of the Central Ontario and Canadian Northern Railways, in the vicinity of Trenton, the laying of steel for the Canadian Northern Toronto-Ottawa line was begun. At the invitation of Mr. George Collins, general manager of the Central Ontario and the Irondale, Bancroft & Ottawa Railways, Mr. Clarence G. Young drove the first spike. The first sod was turned last November. It is stated that Mr. Louis D. Barchfield, purchaser for the company, has secured options on property in Sidney for the extension of the line to Belleville.

Old Railroad Ballads.

Any one of our readers who may be in possession of old railroad ballads, or new ones for that matter, should communicate with Prof. John A. Lomax, College Station, Texas. He is collecting together the most typical folk songs of the United States. He has already secured a copy of "Jerry, Go Ile That Car," and others, but he desires to have his collection as nearly complete as possible. The scholarly and accomplished professor is working under the auspices of Harvard University.



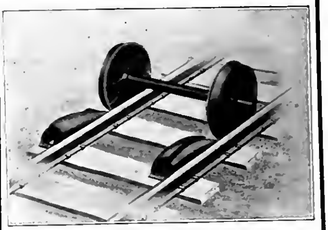
Electrification of Railways.

Mr. George Westinghouse, president of the American Society of Mechanical Engineers, has prepared a paper on the "Electrification of Steam Railways" which will be read at the joint meeting of the American Society and the Institute of Mechanical Engineers (British), to be held in Birmingham, Eng., on July 25-29. In the opening words of Mr. Westinghouse's address he pays this tribute to the magnificent discoveries which have been made in the field of electricity. He says:

"As an illustration of the wonders of the laws of nature, few inventions or discoveries with which we are familiar can excel the static transformer of the electrical energy of alternating currents of high voltage into the equivalent energy at a lower voltage. To have discovered how to make an inert mass of metal capable of transforming alternating currents of 100,000 volts into currents of any required lower voltage with a loss of only a trifle of the energy so transformed, would have been to achieve enduring fame. The facts divide this honor among a few; the beneficiaries will be tens of millions."

And in summing up at the close of his paper he makes this prediction as to the future: "The complete electrification of a railway will necessitate a rearrangement of ideas and practices in regard to operations. Coaling and watering places will not be needed; passenger trains will be differently composed, some classes being of less weight; and they will operate more frequently, thus promoting travel; other trains will be heavier than at present, or will operate at higher speeds; and branch lines, by the use of electrically fitted cars, can be given a through service not now enjoyed.

"The railway companies can combine upon some co-operative plan for the generation of electricity, thereby effecting large savings in capital expenditures, and can utilize their own rights of way for the transmission of the current, not only for the operation of trains but for many other useful purposes. Notwithstanding the fact that great strides have already been made in cheapening the cost of generating electricity by steam engines, I foresee, from the progress made in the development of gas and oil power, a still further reduction in cost which will accelerate the work of electrifying existing railways. In conclusion, I can only repeat, and earnestly recommend to the serious consideration of railway engineers and those in authority, the pressing need of determining the system which admits of the largest extension of railway electrification and of a prompt selection of those standards of electrification which will render possible a complete interchange of traffic in order to save expense in the future and to avoid difficulties and delays certain to arise unless some common understanding is arrived at very shortly."



Railway and Locomotive Engineering

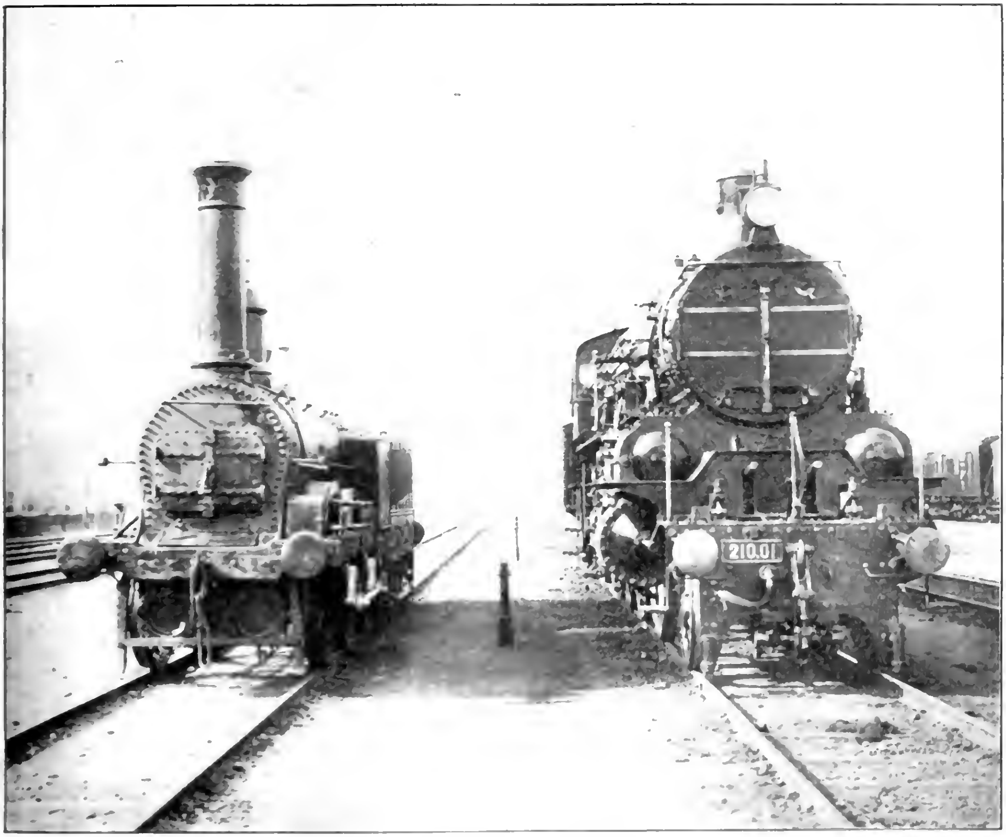
A Practical Journal of Motive Power, Rolling Stock and Appliances

Vol. XXIII. 114 Liberty Street, New York, August, 1910. No. 8

Austrian Componud Express Engine.

A class of express passenger locomotives having a somewhat novel wheel arrangement has recently been designed for the Austrian State Railways by Herr K. Golsdorf. The leading and first pair of coupled wheels are combined in one frame which is a Helmholtz truck, and the four trailing wheels are arranged in a Bissel Bogie. The cylinders have diameters H. P., 15¼ ins. and L. P. 26 ins., with a stroke of 28¼ ins. The driving wheels are 7 ft. ¼ in. in diameter and the leading and trailing wheels are 3 ft. 4¾ ins. in diameter. The total heating surface is 3,147.43 sq. ft., distributed as follows, firebox 162.54 sq. ft., tubes 2,232.48 sq. ft., superheater 752.42 sq. ft. The grate area is 48.65 sq. ft., working pressure 220 lbs. per square inch. The total weight of engine is 82 tons 10 cwt.

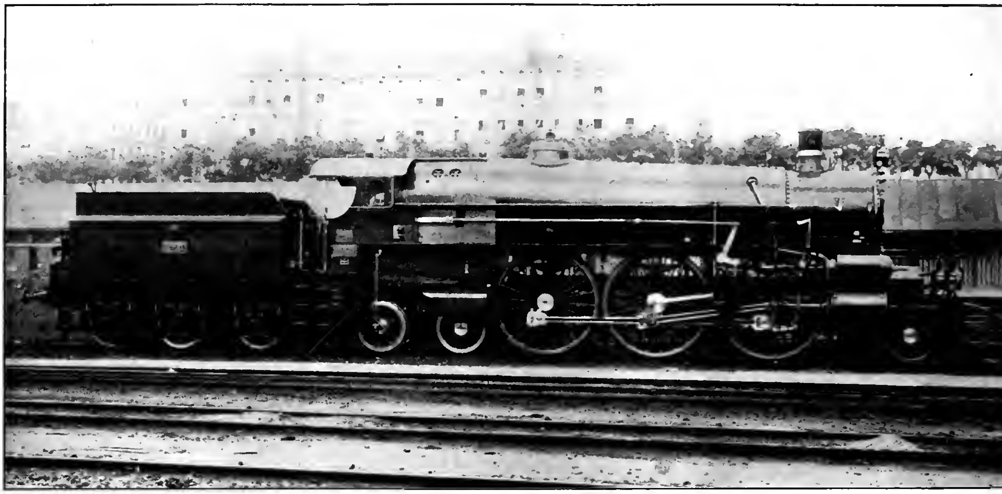
To depict the enormous proportions of this fine engine, as compared with an "old timer," we reproduce a photograph showing the two side by side. The old engine was built in 1841 by the English firm of Jones, Turner & Evans, of Newton, near Warrington, and the following are its principal dimensions, cylinders 14 ins. diameter, stroke of 20 ins., coupled wheels 5 ft. 1½ ins. diameter, working pressure of boiler 95 lbs. per sq. in., total heating surface 660 sq. ft., grate area 11½ sq. ft. Weight of engine in working order 21½ tons.



OLD ENGLISH ENGINE AND 4-CYLINDER GOLSDORF COMPOUND FOR THE AUSTRIAN STATE RAILWAYS.

At the time these photographs were

taken the four-cylinder Golsdorf compound had just returned from a trial run over the Vienna-Krakan-Lemberg section which has gradients of 1 in 100. The load was 406 tons behind the tender, the distance covered was about 963 miles, and the speed averaged 52 to 65¼ miles an hour over different portions of the route. In the side view of the two engines Herr Golsdorf is shown standing by the leading wheel of the modern engine.



MODERN 4-CYLINDER PASSENGER ENGINE FOR THE AUSTRIAN STATE RAILWAYS.

Locomotive Terminals.

A very interesting paper on American Locomotive Terminals was recently read by Mr. William Forsyth before the American Society of Mechanical Engineers at the July meeting at Atlantic City. Among other things he said:

"The most interesting example of American engine house practice is that in the classification yards of the Pennsylvania Railroad at East Altoona, Pa. Here the traffic from three divisions of the road is concentrated, classified and despatched. The freight tonnage passing through this terminal is claimed to be the largest handled by any single system of freight yards in the world. The total capacity of the yards is 10,500 cars.

"The engine house is in diameter and cross-section the largest structure ever erected for this purpose. It has an exterior diameter of 395 ft. and a turntable of 100 ft. There are 52 stalls 90 ft. deep. The main portion of the house is 65 ft. wide and 30 ft. high. On the outer circle there is a lean-to 25 ft. wide and 18 ft. high. The engines head in toward this lean-to and the smoke-jack is located alongside the main columns at the outer portion of the main building. The main portion of the house was made 30 ft. high to accommodate a traveling crane, but columns for supporting the crane have not been erected, as jib cranes secured to the main columns were found more desirable. The turntable is operated by an electric motor. There are four drop-tables, also operated by electric motors, two of them for driving wheels, one large table for all wheels except the engine trucks, and another for pony truck wheels. At one end of the coal wharf is a sand house, where sand is dried in large stoves and descends through a grating to a reservoir, from which it is elevated by compressed air to the sand bins overhead, and flows by gravity to the engines. Near the approach to the coal wharf are four ashpits, each 240 ft. long, two on each side of the wharf incline. Each pair is operated by an overhead five-ton electric crane which spans four tracks, two of them over the ashpits for ash cars.

"The work performed in an engine house includes almost everything in connection with locomotive repairs that does not require the locomotive to be sent to the general repair shop. No attempt will be made to itemize these repairs. The work which must invariably be performed periodically consists of boiler testing every six months; boiler washing, from once a week to once a month as necessity arises; staybolt testing each week; examination of smoke-box, draft arrangements and ash pans, each week; testing steam and air gauges each month; washing tenders each month; gauging height of pilots each week; gauging tank water scoops each trip; testing air brakes each trip; draining main reservoirs each week.

"When a locomotive arrives, the first information the organization receives as to work necessary is in the engineer's report, which he delivers at the inspection pit when the locomotive is turned over to the inspectors. Five inspectors are here employed, as the work must be done thoroughly in a minimum time, so that the hostler can move the locomotive to the ashpit and make room in the inspection pit for other locomotives waiting. One inspector examines the under part of the locomotive and tender; one on each side inspects the outside parts, such as driving wheels, rods, steam chests, guides, crossheads and Walschaerts valve gear; there are two air-brake inspectors, one to operate the brake valve and inspect the fittings in cab and air pump, and the other to inspect all other parts of the air and sanding equipment.

"All defects found by the inspectors are entered upon regular blanks and transmitted, together with the engineer's report, to the gang leader in charge at the inspection pit, who decides whether it is necessary to send the engine to the house or whether the repairs are so slight that they can be made on the outside repair pits in connection with the outbound storage tracks. His decision is marked upon the report, and upon the steam chest of the locomotive, and the reports are forwarded to the work distributor's office by pneumatic tube in 45 seconds.

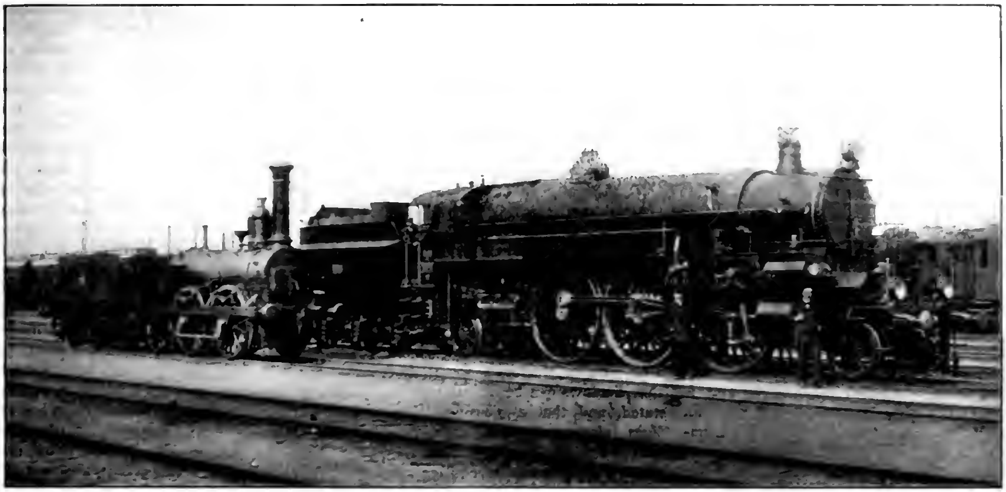
"At East Altoona there are sometimes as many as 200 locomotives within the engine house jurisdiction and it was found necessary to inaugurate some efficient method of locating them exactly at all times, so that men sent to make repairs need have no difficulty in finding any particular locomotive required. This is accomplished by telephone. Each time a locomotive moves to another locality the engine tracer in the foreman's office is advised as to where it came from and where it has been delivered, giving the number, the location on the track and the time in each case. When traffic at East Altoona is normal the engine house must deliver ready for service one locomotive every five minutes during the whole 24 hours of the day, as the engines for three divisions are here concentrated.

"For the operation of this locomotive terminal an elaborate organization has been worked out, based upon the principle that none but the heads of subdepartments shall report to or receive instructions from the foreman, his assistant or the work distributor. The responsibility of supplying material and the supervision of the workmen are placed directly upon these gang leaders, who are foremen of their respective gangs.

"Improved engine house facilities, more system and better organization are favorable to the pooling of locomotives, and cess of pooling. The reduction in boiler pressure from 225 lbs. to 160 and 180 lbs. has also reduced the number of boiler failures and permitted the more continuous use of locomotives which results from the pooling system.

"On some railways where shop facilities are limited, locomotives are required to make a large mileage before they go in for general repairs. The principal items which send engines frequently to the shop are worn tires, defective tubes, and, perhaps, worn driving boxes. At some engine houses all these repairs are made, the worn tires being replaced by new ones or by others which have been turned at the shop. In this way such machinery as rods, crossheads, guides and link motion, are kept in service, so that passenger locomotives make as high as 127,000 miles, and freight locomotives, 100,000 miles between general repairs, one passenger locomotive making 256,000 miles between shoppings. Passenger locomotives average 120,000 miles and freight locomotives, 95,000 miles.

"On the Chicago, Burlington & Quincy for the last six months of 1909, pooled freight engines made on one division as high as 4,167 miles per month, and 110 engines on three divisions averaged 3,777 miles per month. On other roads passenger engines double crewed make an average of 6,000 to 7,500 miles per month, one road reporting for engines in express service 418 miles per day and 12,780 miles per month."



ENGINES ANCIENT AND MODERN HERR GOLDSDORF BESIDE ENGINE TRUCK WHEEL.

this practice has become more general for freight engines in the United States. As recently as in 1905 the reports on pooling presented at the International Railway Congress indicated that pooling was not used on the majority of railways in the United States under normal conditions of traffic. The large increase in traffic in proportion to the number of locomotives in 1900 and subsequent years has compelled most of the roads to resort to the pooling of freight engines and the double-crewing of passenger engines, and these methods are now well established on the majority of American railways. By improved methods the operations of cooling down, washing, and filling with hot water may be performed in less than two hours without injury to firebox and tubes, and this alone has contributed in a large measure to the suc-

Small articles can be plated with brass by dipping them in a solution of nine and one quarter parts sulphate of copper and an equal amount of chloride of tin dissolved in soft water.

Block Signals for Motor Cars.

The railway block signal system has been extended to protect automobiles. At a crossing in South Plainfield, N. J., the Lehigh Valley Railroad has installed banjo signals which indicate danger automatically whenever a train is approaching. These are entirely separate from the regular railroad signals, and are operated purely as a safeguard for vehicles. The automatic bell, which has announced trains for years, has not been abandoned. It rings as usual. The new device is supplementary to it, and is designed particularly for automobiles, which often make such a noise of their own that the occupants cannot hear other sounds.

The signal is so named because of its shape. It has the appearance of a banjo standing straight up on its small end, and is similar to such signals used beside railway tracks. In the center of the drum is a round opening, which is covered by a red disk when a train approaches. Above this is a smaller opening for illumination at night. As a warning to automobiles and other vehicles, a red light appears here at night, just as the red disk appears below in the daytime. There are two of the banjos at South Plainfield, for vehicles going in both directions. The signal stands some distance up the high road away from the track, but is operated by the track circuit like ordinary block signals. It is impossible for a defect in the mechanism to lead a vehicle into danger, because any defect sends the signal at once to danger. It can show safety only when the device is in perfect working order. A signal system of this kind for vehicles is an innovation. The Lehigh Valley already has similar installations in progress at other places.

Lighting of Erecting Shops.

By S. H. Knapp.

The artificial lighting of erecting shops and machine shops so that the employees can have light about equal to what they get in the daytime, has been a difficult problem. The use of heavy cranes has made it necessary to place most, if not all, the lights underneath the cranes. In many instances it has been impossible to place lamps anywhere except on the side walls, although it is readily apparent that with an arc or incandescent cluster in that position much of the light is absorbed by the walls, and consequently, in the center of the room, the lighting is unsatisfactory. With low lighting from the side walls, locomotives or high machines may hide the source of light, producing deep shadows on the floor. Were it possible to obtain from skylights all the daylight required for satisfactory lighting, this arrangement would unquestionably give the best distribution and diffusion. Accordingly, if these satisfactory conditions can be artificially duplicated by placing the light source directly over the machines and workmen, a better distribution and the avoidance of shadows will be obtained.

The Cooper Hewitt lamp gives diffusion of light on account of its large luminous surface, and makes possible the satisfactory illumination of a floor surface from a much greater height than was formerly considered possible. At the same time the comparative length of light source in the 50-in. tubes makes it possible for heavy cranes to pass underneath without causing any sharply-defined shadows. This, with the absence of glare, makes it possible for the mechanic to distinguish with accuracy details in his work. Our illustration shows an erecting shop of one of the large railroad systems lighted by the 34 type F, Cooper Hewitt lamps, giving 28,900 candlepower at a current consumption of 13.0 kilowatts. The dimensions of this building are 442 by 94 ft., or 41,550 sq. ft. The height of the lamps from the floor is 50 ft., and 1,225 sq. ft. of floor surface is allowed to a lamp.

RAILROAD ERECTING SHOP LIGHTED BY COOPER HEWITT LAMPS.

Summing up these results show that in the use of Cooper Hewitt lamps the manufacturer can obtain a great volume of serviceable light at a minimum expenditure of electrical energy; that the source of light may be installed at a height and still give satisfactory floor illumination; that shadows can be almost wholly eliminated, and that a pleasing diffusion of light, almost equal to daylight, can be obtained. The long life of the tubes, numerous installations having averaged over 7,000 hours' burning, assures an economical maintenance. Many large railroad systems throughout the country have installed or extended this system. The Cooper Hewitt Electric Company, is one of the many Westinghouse interests.

Double Refraction.

In the American Museum of Natural History in New York there is a vast array of very interesting things to see, but in a small room on the third floor there is a unique collection of gems and precious stones. In one of the show cases there is a plate of Iceland spar, (crystallized carbonate of lime), neatly mounted for inspection, and behind this is one ordinary incandescent electric lamp constantly burning. When looked at through the plate of Iceland spar two very distinct images of the electric bulb are visible. In fact there appears to be two electric lamps glowing behind the crystalline plate. The fact that there is only one electric lamp may instantly be ascertained by looking at the side or behind the plate of Iceland spar. The appearance of two bulbs is accounted for by what is known as double refraction.

The explanation of this phenomenon is that the crystal is so formed that the enclosed particles of ether are compelled to assume different densities and consequently different elasticities in two directions. The contained ether has its maximum density in the direction of the axis of the crystal and has its minimum density in directions perpendicular to the axis of the crystal. The two different degrees of elasticity of the contained ether result in the transmission of light at two different velocities through the crystal, and double refraction is the result.

In order perhaps to more fully understand the way this is brought about one may picture a wave of light as moving in a direction represented of the axle of a cart wheel. The vibrations of the ether particles which transmit light are at right angles to the direction of motion and are like the spokes of the cart wheel at the end of the axle. One might almost liken the light wave to a spoked wheel sliding along a smooth axle without turning, and with the particles of ether vibrating up and down along the spokes. The light wave of course having no permanent structure like axle and wheel.

On entering the Iceland spar all those vibrations, say, in a vertical direction, find themselves checked, while those in a horizontal direction, though checked, are not as much retarded as the vertical ones, and the vibrations in all other directions are quenched. The spokes are all knocked out of the wheel, so to speak, except the vertical and the horizontal ones. The vertical spoke vibrations are retarded more than the others and consequently lose more of their velocity than the horizontal spoke ones. The single beam of light reaching the crystal of Iceland spar is separated into two beams, hence the two images of the glow lamp behind the plate of crystal.

Tyndall tells us that "in ordinary water there is nothing in the grooping of the molecules to interfere with the perfect homogeneity of the ether; but when water crystallizes to ice, the case is different. In a plate of ice the elasticity of the ether in a direction perpendicular to the surface of the freezing is different from what it is parallel to the surface of freezing; ice is, therefore a double refracting substance."

Let every man be occupied, and occupied in the highest employment of which his nature is capable.—*Sydney Smith.*

Ten-Wheel Passenger Engine for the Lehigh Valley Railroad

The Baldwin Locomotive Works have recently completed ten freight locomotives for the Lehigh Valley Railroad. These engines are of the ten-wheel type, and are designated by the railroad company as Class "J-55." The locomotives of this class previously constructed have been fitted with Stephenson link motion and balanced slide valves. In the present order the slide valves have been retained, but Walschaerts gear is applied to eight of the locomotives, and Baker-Pilliod gear to the remaining two.

Class J-55 has proved a highly successful engine in general freight service on the more level portions of the line. The tractive force developed is 31,100 lbs., and the ratio of adhesion is approximately five. As the driving wheels are 69 ins. in diameter, these engines are also adapted to heavy passenger service, and with this end in view, they have been fitted with train signal and steam heat equipment. These locomotives use anthracite as fuel, and have boilers of the modified Wootten type. The boiler barrel is composed of three rings, and the dome is on the second ring. This places it immediately in front of the cab. The fire-box has a vertical throat and back head and a horizontal roof sheet, and the tube sheet is straight, no combustion chamber being used. The mud ring is braced by cross-ties at two intermediate points, and is supported on expansion plates at the front and rear, and also at the second transverse cross-tie. The flexible staybolts number 538, and are located in the sides and throat. The forward end of the furnace crown is stayed from two inverted T bars hung on expansion links.

The grate is composed of longitudinal rocking bars and two-inch water tubes. The mud-ring cross-ties serve as intermediate supports, and divide each rocking bar into three sections. The bars have transverse fingers, and alternate with the water-tubes. The ash-pan has two hoppers, with cast iron sliding bottoms. No dampers are fitted, but there are liberal draft openings under the mud-ring. The smoke-box has a short extension, and the internal arrangement is extremely simple. The petticoat pipe is fitted to the base of the stack, and has secured to its lower end a wire netting basket which extends down to the exhaust nozzle. The diaphragm plate is shallow and non-adjustable, and is placed below the center line of the boiler.

The cylinders are interchangeable, irrespective of the valve motion. The steam chest centers are placed one inch inside the cylinder centers. On the engines equipped with Walschaerts gear, each combining lever is pinned to a crosshead having an inwardly projecting lug to which the valve rod is attached. This construction avoids the use of a rocker. The link and reverse shaft bearings are combined in a single steel casting, supported outside the leading drivers by two plates each 10 ins. deep and 1¼ ins. wide. These plates are bolted in front to the guide yoke, and at the rear to a cross-tie placed between the first and second pairs of drivers. The guide yoke and cross tie are of cast steel, each made of two sections which are strongly spliced at the center. The yoke is formed with suitable knees to which the guides are bolted. The latter are steel forgings of the two-bar type. Castle nuts are used throughout for bolting these members together. Our illustration shows an engine equipped with the Baker Pilliod valve gear.

The reverse lever is secured to a shaft which extends across the engine, and carries an arm placed on the center line. This arm is connected, by a short reach rod, with a corresponding arm on the reverse shaft. The radius rod is suspended back of the link, and is down when running ahead. On the two engines using Baker-Pilliod gear, the cradles supporting the mechanism are located in the same manner as the link bearers on the Walschaerts engines. The valve data and setting, on the two designs, are as follows:

	Walsehaerts.	Baker-Pilliod.
Outside lap	1 3/16 ins.	1 in.
Inside clearance....	1/32 in.	0 in.
Maximum travel....	6 ins.	5 ins.
Lead (constant)....	¼ in.	¼ in.

The frames are of cast steel, with single front rails of the same material. Each rail is recessed into the main frame and held in place by 14 horizontal bolts 1¼ ins. in diameter, and also by two keys. The main frames have cast on them vertical lugs, to which the guide yoke is bolted. The equalization is arranged with yokes over the boxes of the main and rear driving wheels, these yokes being connected by inverted leaf springs. Four such springs are provided on each side. The engine truck has a swing bolster, hung on three point suspension links of cast steel. The truck transom is of the same material, and is of most substantial construction. The tender frame is composed of 13 in. steel channels and oak bumpers. The tank is U-shaped with a sloping floor in the fuel space. The trucks are of the equalized pedestal type with cast steel bolsters. All truck wheels under the engine and tender are steel tired.

These locomotives are admirably fitted to meet the conditions existing on the Lehigh Valley. As the fuel used is anthracite, a comparatively shallow furnace will suffice; hence it is possible to place a boiler of high capacity above

TEN-WHEEL PASSENGER LOCOMOTIVE FOR THE LEHIGH VALLEY.

F. N. Hibbits, Superintendent of Motive Power. Baldwin Locomotive Works, Builders.

comparatively large driving wheels, and so avoid the use of trailers. The ratio of grate area to heating surface is as 1 to 37, and that between heating surface and cylinder volume is 282 sq. ft. of heating surface to one cu. ft. of cylinder volume.

The principal dimensions are appended for reference:

Cylinders, 21 x 28 ins.
Valves, balanced slide.
Boiler—Type, Wooten; material, steel; diameter, 69⅝ ins.; thickness of sheets, 13/16 in.; working pressure, 205 lbs.; fuel, hard coal; staying, radial.
Fire box—Material, steel; length, 120⅛ ins.; width, 102 ins.; depth, front, 63 13/16 ins.; back, 50 13/16 ins.; thickness of sheets, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube, ½ in.
Water space—Front, 5 ins.; sides, 3½ ins.; back, 3½ ins.
Tubes—Material, steel; wire gauge, No. 11; number, 363; diameter, 2 ins.; length, 15 ft. 8 ins.
Heating surface—Fire box, 200 sq. ft.; tubes, 2,962 sq. ft..; total, 3,162 sq. ft.; grate area, 85 sq. ft.
Driving wheels—Diameter, outside, 69 ins.; journals, 10 x 12 ins.
Engine truck wheels—Diameter, front, 33 ins. journals, 5½ x 10½ ins.
Wheel base—Driving, 13 ft. 4 ins.; total engine, 25 ft. 4 ins.; total engine and tender, 57 ft. ½ in.
Weight—On driving wheels, 157,150 lbs.; on truck, front, 48,400 lbs.; total engine, 205,550 lbs.; total engine and tender, about 355,000 lbs.
Tender—Wheels, diameter, 36 ins.; journals, 5½ x 10 ins.; tank capacity, 8,000 gals.; fuel capacity, 12 tons; service, freight.

Pleased with the Erie.

The open cut through the Bergen hill, formed the subject of the frontispiece illustration of our July paper, and in which was a full description of the work. The cut has come in for high praise, and the management of the Erie have been highly complimented and commended by the trustees of the board of trade of Ridgewood, N. J., for the great engineering achievement and for "the moral faith and courage" shown in "taking the risk" of building the Bergen hill open cut at such tremendous cost. In acknowledging the formal letter in which this tribute was paid, Mr. F. D. Underwood, president of the company, said:

"Such manifestations of approval of the company's effort to meet the wishes of its patrons is a refreshing surprise, and, coming at a time when railroad administration is being attacked on all sides, is especially gratifying."

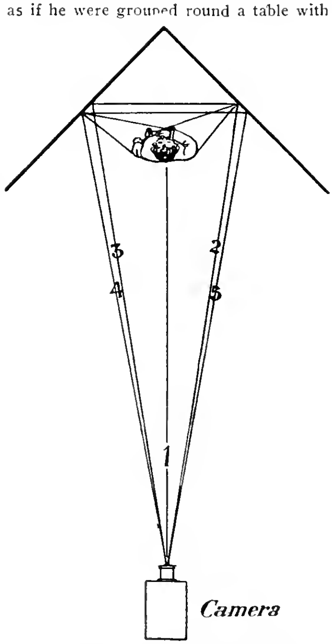
Soldering Glass.

It may not be generally known that glass can be soldered by a composition of ninety-five parts of tin and five parts of copper. When fused this composition should be well stirred with a wooden rod. The addition of one part of zinc has the effect of hardening the mixture. This solder will unite and adhere to the glass so that there is no possibility of a fracture occurring on any part of the solder. Such work is frequently resorted to in uniting parts of glass where it is impossible to obtain a welding of the glass.

One Man As Good As Five.

We often speak of a man of many parts, or as a man having many sides to his character, but in the case before us, Mr. T. M. Ramsdell, the well-known M. C. B. of the Chesapeake & Ohio Railroad, has posed before the camera so as to give us five distinct views of himself, and although there is only one pose, we see him as if he were grouped round a table with RAILWAY AND LOCOMOTIVE ENGINEERING in his hands.

MR. T. M. RAMSDELL, M. C. B. OF THE C. & O., LOOKED AT FROM ALL SIDES.



HOW THE PICTURES ARE TAKEN.

The explanation of how this clever little piece of photographic juggling is done is quite simple. The gentleman sits with his back to the camera and the rear view is the only direct one in the group. With his back to the camera he faces the junction of two mirrors placed at right angles to each other. In the line cut the position of the man, the mirrors and the camera are shown in plan. The picture of his back is on line No. 1, in the center of the picture. For convenience of illustration, we have taken one line for the total of each reflection. For example, the reflection of our subject on the right hand mirror reaches the camera along line No. 2, part of this reflection passes across between the mirrors and reaches the surface of the left hand mirror as a sort or secondary reflection, which gets to the camera along line No. 3. Similarly the direct reflection of the man on the left hand mirror reaches the camera on line No. 4 and the secondary reflection of this image passes to the right hand mirror, and pursues its path along line No. 5 to the camera.

In this way there is one direct image, the back, two showing three-quarters to full face, and practically two in profile. With a camera and a pair of mirrors arranged like this a man need never feel lonely, and can easily be surrounded by a group of kindred spirits.

Revolutions of Flywheels.

It should be borne in mind that there is a limit to the speed of flywheels, a common rule being that one mile, or 5,280 ft. a minute is the velocity beyond which it is generally agreed that flywheels made of cast iron should not run. The simple form of this rule is to divide the number 1,680 by the diameter of the wheel in feet, and the result will be the speed limit of the flywheel, if properly constructed.

All pleasure must be bought at the price of pain. For the true the price is paid before you enjoy it; for the false after you enjoy it.—*John Foster.*

General Correspondence

Some Suggestions.

Editor:

I am glad to see you have become an agitator, from the fact that you have begun a crusade against the chancetaker. Some of the best hated men on any railroad are those who endeavor to live strictly up to the rules. Time was when a major portion of the engineers and conductors were chancetakers and made a success of it, practically making their reputation as good railroad men. A great many officials want the rules lived up to, but don't want the delays consequent upon a strict observance of the rules and signals. In this matter all persons should work together, in making the system as nearly perfect as possible. Each railroad company should print its rules in question and answer form, so there can be no difference of opinion enter into their understanding by the employees. This would eliminate the different interpretations of the same rule by officials on different divisions of a large system.

A monthly periodical pertaining to changes in power, signal systems, rules, etc., should be published by all trunk line systems for the benefit of all classes of employees in the operating department. This periodical would eliminate a great many bulletins now necessary, and should contain useful instructions for employers in all departments, tending to bring out useful suggestions from officials to the men, and vice versa, without being personal. Signal rules and indications should in all cases be obeyed to the letter, no matter if the Twentieth-Century Limited or a slow freight is involved.

We have other chancetakers besides those handling trains, and you will find them in the roundhouse. They will O. K. engines with poor working injectors, sharp wheel flanges, poor, leaky air brakes, bad air pumps, leaky tender tanks, poor headlight and classification signals, dirty boilers, broken staybolts, cabs full of steam from leaky packing of valves and gage cocks, etc. Now, isn't the man that runs an engine with some or all of these conditions, naturally a chancetaker? Now, why not agitate for a modernization of the "hull bizness" and endeavor to eliminate all chancetaking? Yours for the revolution. AUGUSTINE HOLTZHOFF.

[If our correspondent will turn back to the editorials in 1903 and 1904 he will find that RAILWAY AND LOCOMOTIVE ENGINEERING has not become an agitator in the usual sense of the word, nor is there a crusade on now against any particular form of chancetaker. We want the opinions of engineers and others about the signal efficiency tests, as about other things. On page 7, of our issue for February, 1904, we referred to the men who may be responsible for lax discipline on a road as chancetakers of an advanced type. That is the man higher up. There is laxity in all branches of railroad service, but things are better than they were, and they are getting better each year. Our duty as railroad men is to help on the good work.—Editor.]

Signal Test in a Blizzard.

Editor:

Having been a constant reader of your valuable magazine the past eighteen years, I have noticed some very valuable and sensible arguments, and also have received some valuable information on the engine and air brake, especially the E T equipment; also signal observance. In the June number you invite correspondence on the question of signal observance tests. I had an entry made in my record Feb. 15, 1910, which I do not consider a fair test, and, in my opinion, I have not been treated justly in the case, and the superintendent told me he would reconsider this decision.

Here are the facts: I have been running an engine 15 years on the Burlington, and we have three different systems of block signal operation on the main line, double track, train orders are eliminated, we are governed entirely by the block signal; if clear, it gives us the right to proceed ahead of all first class trains or any other class of train. We have heading and block signals and whenever we find these set for us we know that it means head in and let some other train pass us. Diverting from main line at Aurora we run on single track on the St. Paul line; we are governed by rule No. 317, in a book of rules in regard to signals, which states that no train shall pass a block signal, even if it shows clear, unless the engineer sees the block signal drop from danger to safety himself; if he comes along and finds block clear, he must have a clearance card, form (a) from operator showing block is for his train.

On Feb. 15 I was on a passenger extra, east, and there was a very fierce blizzard raging that night which made it almost impossible to observe any signal change from danger to safety. I had an order to meet No. 81 at Shabbona, and had to stop and inquire from engineer if he was 81, on account of storm. This was about one-quarter mile from block signal. I then proceeded to the block signal and found an extra standing behind 81 emitting considerable smoke, which blew over semaphore. I slowed down to about four miles an hour, and had whistled for block when, on emerging from the smoke I found block clear. I then whistled off (two short blasts) to notify train crew we had block. The operator said to me when I interviewed him regarding this case, that he was outside with a clearance card form (a) on a hoop, but could not see two feet ahead of him, the wind knocked him down, and also put out his lantern, so that he had no means of notifying me he had this clearance. There were no trains in the five blocks ahead of

RAILROAD BRIDGE BELOW FREMONT, NEB.

me, but the blizzard was so bad this night that we had to almost stop at every block to find if block was set for us. The trainmaster was out making a signal test, which I do not consider was doing justice to me or the other men he caught on the tests he made that night. Do you know that it pierces worse than a dagger to a man to have such tests made under such conditions when he is giving the best service and devoting all of his valuable time to studying out the different conditions he has to contend with?

In talking over this case with the superintendent, he admitted that signal tests ought not to be made under the above conditions which I stated to you, and he gave me the assurance that he would reconsider his decision. Under ordinary conditions we have an efficiency test of 99 per cent., which the superintendent said he was proud of. The question is, do you consider a man is getting a fair test or a square deal under the above conditions? Would like to have your opinion.

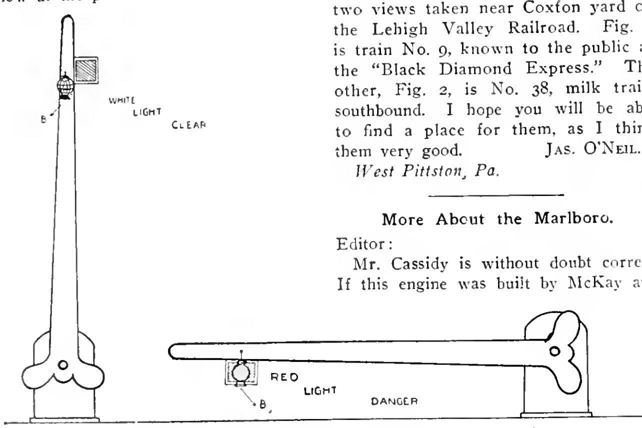
G. H.,
Engineer.

[It seems to us that your superintendent who knows the case fully, has practically answered your question when he states that he will reconsider his decision. —Editor.]

Highway Crossing Lights.

Editor:

I am sending you a sketch of a device which I think would prove of value to steam railroads at the present time, if it is not a patented device; nor do I wish to have it patented. The drawing itself will almost explain to you the idea. You know at the present time railroad cross-



ARRANGEMENT OF CROSSING GATES AND LIGHTS.

ing gates have a white light to indicate danger to the public crossing the track.

My idea is to have a small plane square of red wired glass or other material securely attached to the crossing gate in such a manner that when the gate came to the danger position the white light would drop in such a way that it would show a red light automatically.

The idea, as I can understand it, of having a white light on the gates is to overcome the objections of the engineers. This device would overcome that, for when the gate stood in an upright position it would indicate a white light The reflector, as I may call it, could be made

FIG. 1. THE BLACK DIAMOND EXPRESS.

of celluloid or rubberoid or wired glass, or some substance that would let the light pass through, but would not break when the gate was lowered to the danger position. It would not cost much to have them made, say about 25 cents apiece. I cannot explain the advantages of this device as I would like, but I believe the drawing will explain itself to you. You may publish this device if you wish.

Thomas Pratt.

Paterson, N. J.

Lehigh Valley Trains.

Editor:

I am sending under separate cover two views taken near Coxfon yard on the Lehigh Valley Railroad. Fig. 1 is train No. 9, known to the public as the "Black Diamond Express." The other, Fig. 2, is No. 38, milk train, southbound. I hope you will be able to find a place for them, as I think them very good.

Jas. O'Neil.

West Pittston, Pa.

More About the Marlboro.

Editor:

Mr. Cassidy is without doubt correct. If this engine was built by McKay and Aldus at East Boston, Mass., the resemblance to Wm. Mason's engine is owing to the fact that the late Mr. B. W. Healey was in charge of the erecting shop of Mr. Mason. He left Mr. Mason and went to McKay and Aldus and from there he went to the Rhode Island Locomotive Works as superintendent. He advertised while at Providence to build Mason engines and copied his styles. While loyal to Mr. Mason and his work I must say that Mr. Healy builds a good locomotive.

Herbert Fisher.

Taunton, Mass.

The Marlboro Again.

Editor:

In your July number I notice where Mr. Martin from Missouri has to be shown. The sources of my information regarding the engine "Marlboro" were the name on the cylinder casting and the men who have run the engine. There were three of the engines built at the same works for the F. R. P., the "Lincoln" No. 28, "Hudson" No. 30, and the "Marlboro" No. 31.

D. F. Cassidy.

Somerville, Mass.

Old Ten-Wheel Amoskeag.

Editor:

Regarding Mr. Merrill's query in the July number of Railway and Locomotive Engineering, I would say I very much doubt if any photographs of Amoskeag ten-wheelers are in existence. These locomotives must have been built prior to 1851, as it was about that time the shops abandoned the building of inside connected engines. As I recall the Chicago, Bur-

FIG. 2. TRAIN 38, SOUTHBOUND.

lington & Quincy Railroad, it had several of these engines, the last one I saw being No. 62, then in switching service at Creston, Iowa, in 1874. These engines were much of the type of eight-wheel design, built at the Amoskeag shops, though with a somewhat longer boiler shell. The driving wheels were about 4½ ft. in outside diameter, and wide running boards extended to the front end. The fireboxes were small, the engines having been built for wood burners, but were later converted to coal. When this change was made the fireboxes were provided with the Jariett water table and smokestack, which made them quite successful smoke consumers.

S. J. Kidder.

New York, N. Y.

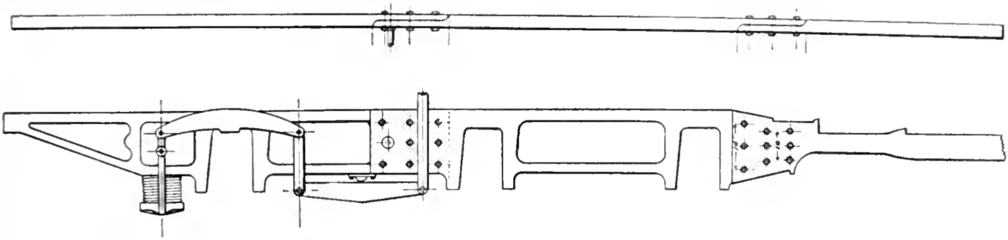
Slab Spliced Frame.

Editor:

The blue print which I enclose shows a three-pieced slab spliced locomotive frame which I believe would prove more economical than the one piece continuous frame that is now generally used. If anything happens to this frame, all that is required to dismantle is one of the three pieces, the longest of which is only 14 ft., compared with a continuous frame which is 38 to 50 ft. long, which is very awkward and expensive to handle in the average railway shop. The slab splice with bolts through the frame does not weaken it in any particular, bolts can always be driven out and replaced without reaming holes. The bolts in this splice will never get loose on account of their being only 4½ to 5 ins. long, which bolts can be easily fitted to tapered reamed holes. From my up-to-date railway shop experience, this would be the cheapest frame to build for modern locomotives, and I believe if published in Railway and Locomotive Engineering, will interest all those who repair locomotives. Chas. Markel,

Shop Foreman, C. & N. W. Ry.

Clinton, Ia.



MARKEL'S SLAB, SPLICED LOCOMOTIVE FRAME.

Making Good Engineers.

Editor:

The article headed the making of good engineers interests me and is to my mind one of the most important questions concerning railroad engineers today. The first question quoted "Would you recommend the best standard books on machinery for the education of engineers and firemen to be in railway libraries or in the home," I would say in both, but if in only one, the home by all means.

The next question, regular fireman for each engineer, yes, for they will be better acquainted and take more interest in each other. The engineers will take more trouble to instruct his fireman than he would if both were pooled and were only together for a trip now and then. A fireman will have experience with a large number of engineers by the time he has worked his way to promotion. I have worked with the scoop and would always rather have, and could always do better work with an engineer that I was acquainted with than I could with one whom I did not know.

The ninth question, "Do you believe a man with shop experience as machinist helper would make a better engineer." No; for if a man has the right kind of instruction when he is started as fireman, he will be on the lookout and will acquire knowledge that will enable him to make any repairs possible on the road without shop experience. If a fireman can be encouraged to do his best and let nothing less be his standard for doing his work, he will make a good engineer. I have had seven years' experience as engineer and have given the above as it has revealed itself to me. I am a regular subscriber to Railway and Locomotive Engineering, and am very much interested in such articles as this one. I am an engineer of the L. V. R. R.

Nelson A. Thomas.

Waverly, N. Y.

Old Things with New Names.

Editor:

I have been reading of the "Old Time Mono Rail" illustrated and described in your April issue, and also the description of this road under the heading "Peg Leg Railroad" in the May issue.

I beg to advise you that after thirty-two years' rest this scheme has come to life again, and is called the Twentieth Century Revelation in railroading. I enclose clippings from the *Sherbrooke Daily Record*, describing the new invention, also illustrations and drawings, which would perhaps be pleasing to your readers.

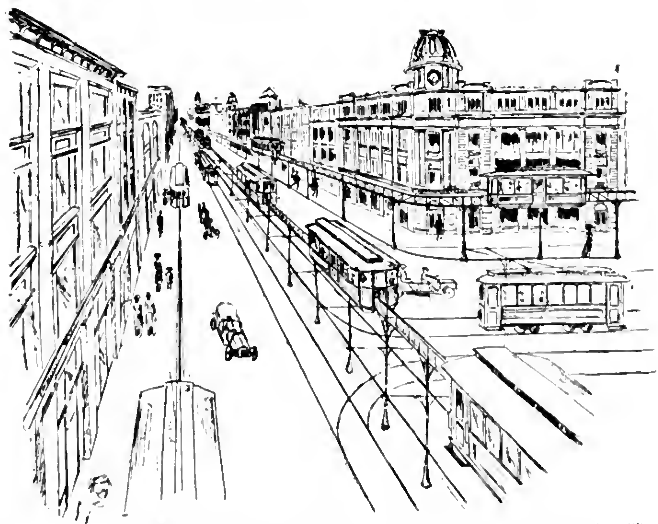
G. W. Robins.

Supt. and Gen. Agt.,

Lotbiniere & Megantic Ry.

Luyster, Que.

[We reproduce one of the principal illustrations sent us by Mr. Robins. As far as a picture goes, it is an almost ideal conception, but it has not come to anything definite so far in the railroad world. Editor.]



20TH CENTURY REVELATION IN RAILROADING AND CITY TRAFFIC USE—OUT OF THE MUD AND SNOW AND AWAY FROM ALL OBSTRUCTION

THIS IS BOTH A REVELATION AND A REVOLUTION, BUT IT HAS NOT MATERIALIZED.

Boltless Rail Joint.

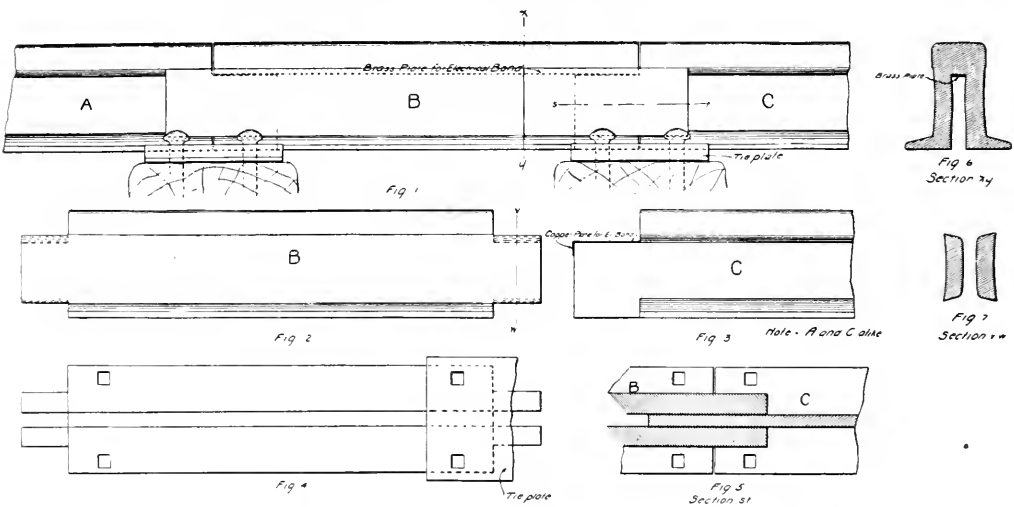
Editor:

Enclosed please find blue print of boltless rail joint, which has been patented by Mr. Frank Kelly, an employee of the Evansville & Terre Haute Railroad, If you can see your way to give a little space to it in your magazine, I will be very much obliged. Please state that any further information can be had by addressing Mr. Frank Kelly, at the E. &. T. H. shops. Mr. Kelly is also working on a noiseless railroad crossing, and he will have the blue prints ready in a few days.

CHAS. H. LUTZ.

Evansville, Ind.

[Mr. Kelly tells us that he believes his boltless rail joint is simple, durable, strong and inexpensive to make, that it will securely connect rail ends without using bolts or fish plates, and can be rapidly placed in position and spiked to the tie. In the accompanying drawings, Fig. 1 is a side elevation, showing the rail joint as it will appear when ready for traffic. A and C are the ends of the rail, and B is the joint. These are shown distended in Figs. 2 and 3, respectively. A cross section of the joint marked X Y is shown in Fig. 6. Fig. 1 also shows the tie plate and cross ties in position, and a brass plate which makes an electrical bond. This plate rests at each end upon a copper plate fastened to the web of the rail, as shown in Fig. 3, and is the same width as the web of the rail, and can be easily slipped into position in section B, as shown in Fig. 6. Fig. 2 is a side elevation of the middle of the joint on section B. A cross section of the end, marked V W, is illustrated in Fig. 7. Fig. 3 is a side elevation of the rail which fits into section B. This rail is of ordinary construction, with the exception that it has ball and flange removed at the end, and a copper plate is fitted on the web, where the ball of the rail is removed, for the purpose of electrical bonding. Fig. 4 is a bottom view of section B, and the tie plate and the slotting in the flanges of the rail is shown. Fig. 5 illustrates a horizontal cross section at S T in Fig. 1. The overlapping of the end of section B and the end of the rail C is shown. Mr. Kelly's boltless rail joint is intended for electrical roads.—EDITOR.]



DETAILS OF BOLTLESS RAIL JOINT FOR ELECTRIC ROADS.

Old Class P on the P. R. R.

Editor:

Replying to the letter of Mr. Paul T. Warner in your July issue: The Class K engines of the Pennsylvania Railroad were originally numbered as follows:

1	274	957	1067
3	317	958	1068
10	340	959	1069
184	341	960	1070
260	956	1066	

And, I believe, No. 953 was also a "K."

As Mr. Warner states, some of these engines, previous to retirement, had the driving wheels reduced to 72 ins. diameter—some were reduced to 68 ins. I have also been told that a few had their cylinders bushed to 17 ins. diameter, thus changing them into the old Class A, "anthracite" engine.

Regarding the old Class P engines enumerated by your correspondent, I would say that engines Nos. 395, 1245 and 1246 were running quite recently, and are probably still in service. In connection with these Class P engines, it is interesting to note the gradual growth of this type. Briefly outlined, the growth in size was as follows:

Class P of 1883—18½ x 24 ins. cylinders, 68-in. wheels, 54-in. wagon-top boiler, 100,000 lbs. total wt.

Class P of 1889—18½ x 24-in. cylinders, 68-in. wheels, 54-in. Belpaire boiler, 106,000 lbs. total weight.

Class P (second design of 1889)—18½ x 24-in. cylinders, 68-in. wheels, 57-in. Belpaire boiler, 112,000 lbs. total wt.

Class P of 1892—18½ x 24-in. cylinders, 68-in. wheels, 57-in. Belpaire boiler, 114,000 lbs. total wt.

Class P of 1893—18½ x 24-in. cylinders, 78-in. wheels, 57-in. Belpaire boiler, 122,000 lbs. total wt.

Class P of 1894—19 x 24-in. cylinders, 80-in. wheels, 58-in. Belpaire boiler, 127,000 lbs. total wt.

Class P of 1895—18½ x 26-in. cylinders, 80-in. wheels, 60-in. wagon-top Belpaire boiler, 134,000 lbs total wt.

This last design was later known as Class L, and many engines of the type were built and are still running.

In order to negotiate the heavy trains over the Alleghanies, the company has produced a magnificent Pacific type engine, known as Class K-2, a number of which are now in service. These engines have 24 x 26-in. cylinders, 80-in. drivers, 80-in. Belpaire boiler, Walschaerts valve gear, and weight 270,000 lbs.

C. B. CHANEY, JR.

Brooklyn, N. Y.

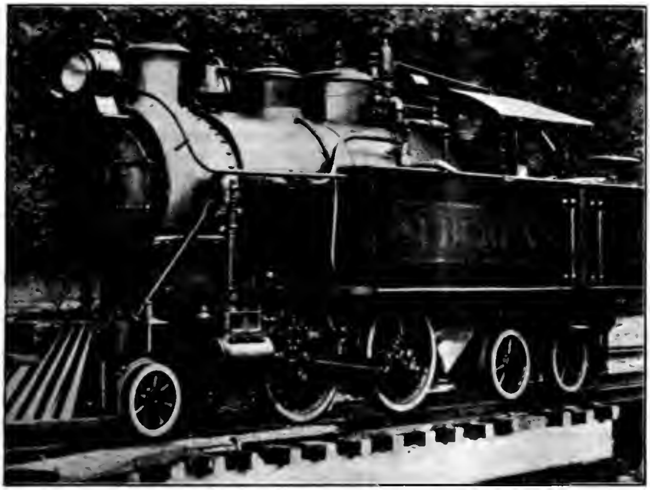
Miniature Tank Engine.

Editor:

Enclosed please find photograph of a miniature tank locomotive. Some of the dimensions are as follows: Weight, in working order, about 2,300 lbs.; gauge, 15 ins.; length over beams, 10 ins.; height from rail to top of stack, 41 ins.; straight boiler, 16 ins. diameter, wide shallow firebox, 14 ins. x 16 ins.; twenty-nine 1-in. flues by 35 ins. long; diameter of drivers, 13⅜ ins.; cylinders, 3 ins. x 5 ins.; boiler pressure, 140 lbs; side tanks, two; total capacity, 21 gals.; coal bunkers on back; capacity, 75 lbs.; fuel, blacksmith coal;

maximum speed, 18 miles an hour. Being a subscriber of your valued monthly, will further say this little machine is doing nicely, handling a miniature train at Glen Park, near Sheridan, Ill. I am sending this, thinking possibly some of the readers might be interested in it, as it was designed and built by the sender.

Sheridan, Ill. A. T. Condon.



MINIATURE TANK LOCOMOTIVE.

Western Trains.

Editor:

Enclosed find some photographs taken by myself, which I thought would be interesting in your magazine. Fig. 1 shows Southern Pacific train No. 8, the "Los Angeles Passenger," ready at Oakland Pier, Cal., to start. Fig. 2 is the Overland Limited, arriving at the Sixteenth street station at Oakland, Cal., San Francisco Bay at the right, and Goat Island in the distance. E. McBurney.

Oakland, Cal.

FIG. 2. "OVERLAND" ARRIVING AT OAKLAND.

Handling Engines.

At the last meeting of the American Society of Mechanical Engineers Mr. H. H. Vaughan read a paper on handling engines, in which the matter of pooling locomotives was discussed. He said in part:

"The desirability of pooling engines in place of operating them by regularly assigned crews depends, in the writer's opinion, on whether the engines are engaged in passenger or freight service, and in the latter case, on the conditions which exist.

"Where traffic conditions admit of the engine making greater mileage than can properly be run by one crew, two crews assigned to one engine, or three crews to two engines, will enable the engine to make as great a mileage as is desirable. On account of the comparatively short time occupied from terminal to terminal, the crews can usually make a round trip without holding the engine longer than is required to handle it and prepare it for the return trip or to await its train. By using more than one crew to the engine, it is theoretically available on its return just as soon as though it were pooled. In practice, unless pooling is carried to the extent of sending out any engine on any train, certain engines are regularly used on certain trains or groups of trains, and it is comparatively easy to arrange the crews and engines so that a reasonable time may be allowed for repairs and yet ample service be obtained from the engine.

"In freight service conditions are very different. The time is slow and a long time is occupied from terminal to terminal. [illegible] may require a full [illegible] after arrival, or may even have to be [illegible] on the road. Few, if any of the trains run at regular hours, and in place of following a defined schedule, the demand for engines varies with the traffic. When business is heavy engines are wanted as soon as they are repaired and ready for service, making it difficult, if not impossible, to select the engines in any particular order. By pooling, such difficulties may be more easily met, especially at large terminals. When engines are assigned, the practice usually required by the agreement with the men is that engines shall be prepared and despatched in the order in which they arrive, but if the engine is ready its use may be retarded by the time required by the crew for rest. In pooling, both these objectionable conditions vanish. An engine may be turned at once if fit for service and thus rendered immediately available, and the movement of the men being entirely independent of that of the engines, the detention of engines at a terminal can be regulated by simply increasing or decreasing the number in the pool. It is possible to obtain somewhat greater average mileage per engine under the pooling system, but the increase does not exceed ten per cent. when traffic is being handled smoothly and without excessive congestion and delays.

"When running successfully under the assigned engine system, repairs are less than when similar conditions exist with pooled engines. A man running an engine regularly keeps up the smaller details and knows what work is required at once, and what must be looked after in due time. His inspection reports are more reliable than those of a man who has had an engine for one trip only. As he has to run the engine next trip as well, he will handle it with greater care and avoid any action that will cause him trouble in the future. Men who have been accustomed to running pooled engines will not do all this at once, but

FIG. 1. READY TO START.

they most certainly will if assigned to an engine for any length of time, and the difference is noticeable in engine houses where some engines are assigned and some are pooled.

"Engines are sometimes taken care of on the headquarter station system, the work required to maintain the engine in proper condition being done at the terminal designated as the home station, while at the other terminal the only work done is that necessary for the return trip. With this arrangement, even with pooled engines, the same crew will, if possible, make the round trip; but when they are changed, practically as much work is required at the away station as at the home station. The result is a considerable increase in the cost of repairs, for there is not, as a rule, very much difference in the cost at the home station.

"In conclusion, the writer considers that in passenger service pooling is objectionable under any conditions and should be avoided if possible. In freight service, pooling is advisable if conditions are such that engines cannot be run with assigned crews, and probably on divisions where business is so heavy that sixty engines per day or over are despatched from the terminal; but the writer's experience is that where assigned crews can be used on engines, the cost of repairs, the amount of fuel consumed, and the class of service obtained, will all be more satisfactory. He therefore regards pooling as a practice that may be necessary under certain conditions, but that is certainly not desirable if the alternative system can be satisfactorily carried out."

Underfeed Mechanical Stoker.

The Pennsylvania Lines West of Pittsburgh are using an underfeed mechanical stoker designed by Mr. F. D. Crawford, general superintendent of motive power of that road. Referring to our illustration, the stoker engine is shown A. The steam distribution of this engine is regulated by means of the regular top head valve gear of the Westinghouse 9½-in. air pump. the reversing rod of which extends down through coring that is provided in the trunk type of piston, it being necessary, of course, to offset the reversing rod from the center line of the cylinder to register with the gland wall of the piston. It is interesting to observe that in using this style of valve gear interchangeable repair parts are available from the railway company's standard stock supply. The trunk type of cylinder is used to provide compactness and simplicity. From the pivoted end of its connecting rod B it is attached to the lower rocker arm on shaft D. The upper rocker arm on shaft D drives by means of links F, two 8-in. plungers G, which are 13½ ins. from the center line of the locomotive. Upon this center line and extending forward into the ash pan are two troughs H. which serve to carry coal that might be forced into them by means of plungers G, and after rising in the trough H, spread over upon the ordinary locomotive shaking finger grate J. These grates, J, are in three sections; two sections extending along the side sheets being 9¾ ins. wide, the center section having a width of 13 ins. Standard grate shaker rigging K is applied, so that the front half of the grates in the firebox may be agitated while the back half remains stationary and vice versa. Integral with the trough H is cast two openings in which operate auxiliary plungers, or rams, L, of decreasing size, which assist in carrying the coal forward and distributing it uniformly over the edge of the troughs upon the shaking finger grates. The necessary driving mechanism for plungers L is provided by means of arm M driven by link N, from main shaft D. This method of driving when taking the power from the under side of shaft D provides a reversal of motion between plungers G and L, which reversal is desirable to efficiently handle the coal through the trough H upon the grates J.

The conveyor handles the fuel stored in the hopper floored tender to the operating plungers G of the stoker. The conveyor is beneath the cab and under the deck of the engine and tender, extending from a hole d in the floor of the tender to the hopper p in which plungers G operate. As it is necessary to provide for the vertical and lateral movement which exists in service between the engine and tender a flexible support Q is used for the trough, this support is trunnioned at a, thereby providing for vertical movement, and being pivoted at b can move laterally over the sliding plate at c. As the pivoted point a is well back toward the rear end of the conveyor little movement takes place over the hole in the floor of the tender. The forward end of the trough simply rests in proper guides on top of the plunger hopper casting p of the stoker. this readily takes care of the greater movement existing at the forward end of the conveyor trough O.

Extending back from pin R which is driven by link F on the outside of the two hopper castings P is connecting rod S and S', the latter being coupled to a rectangular plunger T, which operates under the hole in the tender floor d in the casting U. This plunger P acts not only as an increment loader, but also as a crusher, to properly load the coal from the storage pile in the tender into the back end of the conveyor mechanism V. The operating portions of the conveyor are driven by links W and W¹, and carries the coal forward. The equivalent of a reverse motion is given to the fuel by T—this by means of lever X, which is fixed at its lower extremity e to the underframe of the tender. As the conveyor mechanism V works to and fro the series of suspended paddles Y scrape any coal which is discharged by plunger T into the conveyor trough O. These paddles are provided with stops at f to prevent them from swinging backward out of a vertical position. at the same time, they are entirely free to pass over the coal when moving on a backward stroke. Paddles Y are split up into a number of sections in a row on each of the rods, which support them; thus if in their movement they come in contact with a large lump of coal the only one which is in such contact is held up out of its vertical scraping position, and in this way the efficiency of the scrapers or paddles Y is not affected, regardless of the irregularity in the size of the fuel.

The necessary provision has been made for carrying all the coal from its storage pile on the tender into the firebox, thereby relieving the fireman of the labor involved in merely passing fuel, and the design provides for a permanent location on the locomotive, so placed, that it will not in any way hamper or interfere with the fireman when it is necessary for him to either assist the stoker by hand firing or to fire the locomotive himself. As the movement of all the working parts of the machine is exceedingly slow, not exceeding five strokes a minute, it is fair to assume that the wear and tear will not amount to much.

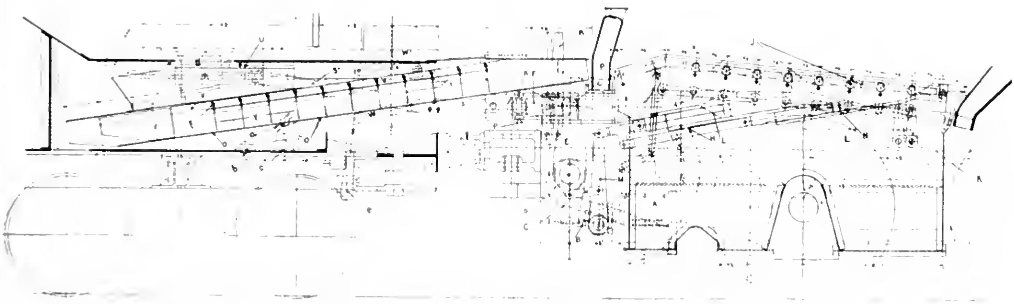
Thus far no effort has been made to have the stoker engine operate automatically, as is generally the practice in stationary stoking. The reason for this is evident for the varying conditions prevailing in a locomotive operating on a railroad does not permit of automatically meeting the sudden changes which exist. It is. therefore, quite necessary that the fireman in handling this device, should use the same intelligence in anticipating the change of load conditions so far as the steam required is concerned as he does when hand firing the locomotive. The operation is controlled by a globe valve on the fireman's side of the cab. making it possible for him to sit and observe the signals at the same time operate the stoker.

If for any reason the conveyor should become inoperative the stoker may be continued in service by handling the fuel from the tender in the usual manner and feeding it through the deck floor into the cast iron hoppers P. in which operate the main plungers of stoker G, and if a complete failure of the stoker machinery should take place there is nothing to prevent the fireman from resorting to hand firing, spreading the coal on the grates, in the same manner as if there were no stoker equipment on the locomotive.

It has been demonstrated in service trials that when the stoker is handling the fuel or when hand firing is resorted to, that the fuel will burn quite evenly over the entire grate surface. and that trouble is only brought about when an even distribution of the fuel is not provided. It was at first felt that trouble might be experienced with the formation of clinker upon the grate when using a device of this character, but experience has indicated that there is a slight reduction in the amount of clinker formed by the ash, as compared with the same fuel when hand fired.

The design which has been gone through with in detail in its application to a consolidation freight locomotive indicates to one familiar with locomotive construction that there is nothing involved in the principle which does not make the construction applicable to a firebox of any size. For example, if it is desirable to apply it to a narrow firebox locomotive a single trough of any length required may be used, and if it is necessary to apply the device to a firebox wider than 70 ins., additional troughs may be used to provide for the increased width of the firebox.

In preparing the stoker locomotive for a trip on the road, the fire is built up on the grates in the same manner exactly as with an ordinary hand-fired locomotive. After the fire is burning brightly the stoker may be started and kept in operation for the entire trip over the road. It has not been found necessary to resort to hand firing, even after being held a considerable length of time on sidings, the stoker doing all of the work of handling the fuel from the time the locomotive leaves the engine house until its arrival upon the ash pit at the other end of the run. The only labor required of the fireman being that of operating the stoker, keeping the grates clean of ash by shaking the fire, and using the hook or scraper to spread the fuel over the firebox when thin spots develop. The P. R. R. locomotive that is equipped with this stoker has been in continuous heavy freight service for several months past. The first trips were made on the Southwest system between Columbus and Dennison, Ohio, a distance of 100 miles; the machinery having been built and applied at the shops of the company at Columbus. At the present time the locomotive is running on the Eastern division of the Northwest system, operating between Conway, Pa., the Pittsburgh freight terminal yard of the company, and Crestline, Ohio, a distance of 165 miles, where it is hauling full tonnage trains.



ARRANGEMENT OF DETAILS, CRAWFORD MECHANICAL STOKER.

The Relativity of Things.

It has been said that one of the greatest helps to any man in his life's work is the ability to clearly distinguish between what is important and what is not. In a minor sense the power of conceiving the relativity of things, or the proportion of things, one to another, is a great help in understanding what one may be trying to comprehend. In "Gulliver's Travels" Dean Swift shows his hero as the "Man Mountain" to the Liliputians, and again as the merest pigmy to the Brobdignagians. Take out the traveler, and how big the big men must have been to the little people, and to Brobdignagia how very tiny Liliputia must have appeared.

Sir Oliver Lodge has published a book on the "Ether of Space." This fascinating branch of physical science is treated in an original and pleasing way by the eminent English author. Speaking of the ether, that subtle substance which is supposed to pervade all matter and to fill the depths of inter-stellar space, he says: "When dealing with such bodies as the sun, moon or stars, the force of gravitation overpowers all other forces, and all electric and magnetic attractions sink by comparison into insignificance. These tremendous forces must be transmitted by the ether, for there is undoubtedly a connecting link of some kind. There can be no attraction across really empty space."

The author goes on to show the enormous strain to which this tenuous medium must be subjected in the act of holding the earth and the moon together so that our satellite may not fly off into space and leave us alone and very nearly in the dark. In order to hold the earth and the moon together by material means and swing them around their common center of gravity, say by the use of a steel bar, one having a diameter of 400 miles, would be the required substitute for gravity, and such a bar would have to have a tensile strength of thirty tons to the square inch.

An idea of the magnitude of such a steel bar may be had when we observe that taking the city of Detroit as the center, the bar would include within its circumference Toronto, Canada; Lafayette, Ind.; Pittsburgh, Pa., and Grand Haven, Mich. The area included would be over 125,000 square miles, and would be about 100 times the size of the State of Rhode Island.

These figures perhaps look to us as the Man Mountain did to the Liliputians, but when it comes to the matter of relativity, they take on a different aspect. We have measured these colossal forces by the tiny strands of rope with which the little people tied down the sleeping giant Gulliver. Last month on page 305 we mentioned the peculiar manifestations of what is known to scientists as specific heat. Writing on this subject, Tyndall tells us that one pound of iron on being heated from 0 deg. to 100 degs. Cent., expands about one-eight hundredth of its original volume. This increase of bulk is far too small to be observed by the naked eye in a ball less than 2 ins. in diameter, yet to produce this almost infinitesimal expansion would demand an expenditure of energy competent to raise a weight of about eight tons a foot high. The relativity of these atomic forces in comparison with those which in the aggregate appeal so strongly to the imagination, causes Tyndall to say, "The force of gravity almost vanishes in comparison with these molecular forces." Here is the Man Mountain looked upon by the Brobdignagians: "The pull of the earth upon the pound weight as a mass, is as nothing compared with the mutual pull of its own atoms."

Water furnishes a more striking example of the same thing. Water expands on both sides of 4 degs. Cent., at which temperature it has its maximum density. Let one pound of water be heated from 3½ degs. to 4½ degs. Cent. That is equivalent to one degree near this critical temperature. Its volume at both temperatures is the same, there has been some internal work done to the atoms, yet with volume unchanged sufficient heat has been given to the water to raise 1,300 lbs. one foot high. If these figures were worked out in a similar manner to those given by Sir Oliver Lodge and were presented in the colossal magnitude they would assume in the aggregate as world swaying forces, we would see that the ordinary operations of daily life, such as boiling water in a teakettle or in running a modern locomotive engine acquire a dignity and an importance when seen in this new light of relativity. Our own constant and almost unthinking familiarity with them, has obscured the reality and has practically deprived us of this more extensive and wonderful view of the forces of nature.

The Straight Tip.

Here is a couple of extracts from a letter to us written by Mr. H. W. Griggs, roundhouse foreman on the Chicago, Milwaukee & St. Paul Railway at Portage, Wis. What he says is worth some attention. Speaking of calling enginemen he says:

"The call boys are in my opinion next to the foreman in many ways. A good caller is a joy to the foreman, and a poor caller is a desperate grief. Breaking in a caller is no quick work, and is a job that frequently takes a month. In my office is a blue print map of the city and the calling district, made by myself, showing the house numbers at all street corners, names of the streets and wards, distance circles, etc. A directory of all enginemen living in the city, whether residents or transients (about 200 men), hangs up close by the map. The delays laid to the callers' account have been reduced to a minimum, down to one case in two years. The caller book is used for signatures when men are called in person by the caller, and for check when called over the telephone. The use of the caller's book has in many instances not seemed to prevent any more delays, or settle some delay disputes."

On the question of oil consumption Mr. Griggs says: "It is a saying among most enginemen and others that 'what oil is wasted in oiling round would oil half the engine.' With the long-spout can and the reaching over so far to oil, makes much of this waste, at times almost unavoidable. However, it would seem that an oil can that will dribble less oil would be the thing. I have found that a two-weeks' rough check-up of the oil and mileage, as at present being made, has had the effect in making the more careful use of oil than the performance sheets do, which are at the best generally quite late in coming out. When you get engineers to come in the office and ask about how they are 'coming out so far this month on oil,' you may look for an improvement before the month is up, and not wait for the big sheet, which will show up better when it does come."

Comfort for Suburbanites.

A recent press dispatch from London alludes to the fact that a new departure in suburban traffic has been introduced by the Metropolitan Railway. It has just been put on in their service from Aylesbury to Baker street and the city. This is a journey of a little over an hour, and on the line are a number of favorite suburban towns, such as Amersham, Harrow and Willesden. A Pullman service has also been introduced on the Chesham, Chalfont Road and Pinner line. Breakfast is served on the cars in the morning, tea and other light refreshments in later hours, and supper for home-returning theatregoers at night. The average traveler prefers what they call the "Wagon-lit" system to the Pullman, if only on account of the fact that one is able to lie down in the daytime.

A New Throttle Valve.

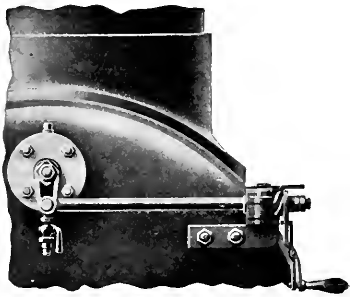
The locomotive throttle valve, which we illustrate, was invented by Mr. J. S. Chambers, superintendent of motive power of the Atlantic Coast Line, and has now had service tests of over three years, during which time the results are said to have been highly satisfactory. The apparatus combines throttle valve, throttle box and stand pipe, and is unique in many ways.

The stand pipe where the throttle stem enters above the center line of the dry pipe fits onto the elebow on the end of the dry pipe, as shown. If the throttle stem must enter below the center line of the dry pipe, the elbow is cast as part of the stand pipe.

In the type shown, no opening in the wall of the steam dome is required for operating the throttle valve proper, but if in replacing another type of valve on a locomotive already in service or for other reasons, it is desirable to bring the operating shaft through the wall of the steam dome, the valve is made to meet this requirement.

The stand pipe is held rigidly in the steam dome at the top by some form of bolted connection, and at the bottom is clamped to the dry pipe by a U-strap bolt, or by two hook straps. The throttle valve proper is a single balanced disk resting on top of the stand pipe. The valve is unseated by the upward movement of the balancing piston, which slides in a finished cylindrical seat and telescopes at the top over the reduced end of the valve. The shoulder on the valve stem in its lowest position is just far enough away from the shoulder on the other side of the balancing piston to permit of slight raise before touching and beginning to force the piston upward. This preliminary movement unseats a small balancing valve at the top of the main valve, thus permitting steam to enter the balancing chamber under the balancing piston, and thus balances the main valve before it is lifted for admitting steam to the cylinders.

The lifting rod fastened at the top to the stem of the balancing valve, extends downward within the balancing chamber and connects through the internal crank with the operating shaft, which extends rearwardly through the wall of the stand pipe and through the back end of the boiler. Here the operating shaft is connected through the external crank to the transmission rod, the external and internal cranks being similar and placed at right angles. The transmission rod at its outer end passes through the operating screw, the latter being in turn held in alignment by the babbitted split box which is secured to the bracket on the boiler. The operating screw rotates freely upon the transmission rod, and in doing so, travels toward the right or left in the screw box, this latter movement being imparted to the transmission rod. The screw and operating handle are riveted together, and travel sidewise as one solid piece, engaging on one side, a shoulder on the transmission rod, and on



THROTTLE HANDLE.

the other washers so adjusted on the outer end of the rod that there is no lost motion, the washers being locked into place by the jamb nut.

The handle in normal position for closed throttle extends away from the operator and is latched to prevent accidental opening. Turning the handle downward and backward draws the transmission rod to the right, rotates the operating shaft and thus opens successively the balancing valve and throttle. The amount of throttle opening is indicated by the position of the handle, and is limited by a stop which stays the travel of the handle. The length of the handle is such as to give practically the same forward and backward travel for any ordinary opening, as with the ordinary throttle lever.

The part of the operating shaft within the boiler is surrounded by a pipe casing which is threaded on the inner end into a steam tight bushing in the stand pipe wall, and on the outer end into a sleeve that in turn is packed into the stuffing box with metallic packing to take up unequal expansion. It will thus be seen that with closed throttle the operating shaft is entirely unaffected by boiler pressure. The inner end of the operating shaft and the annular space between shaft and casing are therefore free from steam pressure, while the throttle is closed, unless there is a leakage at the throttle valve, balancing valve, or some interior connection of the stand pipe. Such leakage admits steam to the balancing chamber and builds up pressure in the annular space around the shaft, and in the drain chamber between stuffing box and packing gland. This leakage can be detected by opening the test and drain cock. This cock may also be utilized for blowing steam through occasionally to remove any mud that may get into the pipe.

As the balancing valve opens and pressure builds up in the balancing chamber, the outward end-thrust upon the end of the operating shaft is distributed upon a number of annular bearing shoulders turned on the operating shaft and working against a babbitted bearing in the packing gland. This babbitted packing also prevents the escape of any steam or condensation that works its way into the back end of the operating shaft casing while the throttle is open.

The only pins used are on the ends of the lifting rod, and these are countersunk at their heads, and riveted over on the outer ends. No pin is used to connect the operating shaft and internal crank, as the end of the operating shaft centers itself in a square tapered socket in the internal crank.

The construction has been simplified throughout with a view to minimizing inspection and repair expenses. The operating levers being entirely within the stand pipe, and the stand pipe set far toward the side of the dome enables an inspector to enter the dome or make repairs without meeting obstructions or having to break steam joints.

No clearance is needed on top of the throttle valve save that required for the lift. The valve may therefore be placed high in the dome and deliver steam into the dry pipe with minimum moisture. There is only one valve to open for the admission of steam.

The Chambers valve is not subject to the troubles that are found on account of an unbalanced condition of the valve for the main valve does not open until almost exactly balanced by the steam pressure under the balancing piston. It is evident, too, that end thrust on the operating shaft cannot influence the valve opening. The throttle handle can therefore be moved by a light pull, and as no other force tends to displace the valve further, the engineer has easy, complete and quick control of steam admission.

The regulation of a Chambers valve is said to be so close that no special drifting valve is necessary in mountainous sections. Maintenance of an opening as small as $1/64$ in. is said to be practical, so that the engineer can admit the requisite small amount of steam to properly lubricate the cylinders and exactly balance the reciprocating parts while drifting down long hills.

The substitution of the rotary for a reciprocating operating shaft is probably a very handy arrangement. With the Chambers valve there is no end thrust on the operating shaft, while the throttle is open.

The babbitt in the packing gland is not under pressure while the throttle is closed, but is in steam tight contact with the bearing shoulders on the operating shaft. This contact is maintained by an adjustable friction ring on the outer end of the shaft. End thrust on the operating shaft while the throttle is open jambs the bearing shoulders and babbitt closer together, thus tightening the seat and lessening the possibilities of steam escape.

It is evident that with closed throttle the removal and replacement of gland and shaft for adjustment or inspection are possible under steam pressure. The Chambers valve is made by The Watson-Stillman Co., 50 Church street, New York.

THE CHAMBERS THROTTLE VALVE.

Railway Curves.

"A high-speed train cannot easily leave the rails on a straight line: Newton's first law of motion is against it, and this same first law says it shall leave the rail at a curve," says the *Electrical Review*.
curve," says the *Electrical Review*.
The necessary superelevation of a sharp curve for a speed of sixty or seventy-five miles per hour would be so great that slow-speed trains would tend to fall off the inside rail. Superelevation must, therefore, be compromised, and this means that high speed cannot be run round such a curve with safety, for the only safeguard is then the flange of the wheel, and this is not much of a safeguard unless acting merely to second the laws of motion, and not to oppose them. It is, of course, open to be argued that on a line running fast trains, it is wise policy to flatten the curves.

"Waiter," said a traveler in a railroad restaurant, "did you say I had twenty minutes to wait or that it was twenty minutes to eight?" "Oi said ye had twinty minutes to ate, an' that's all ye did have. Yer train's just gone."

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances.

Published Monthly by

ANGUS SINCLAIR CO.

114 Liberty Street, New York.

Telephone, 984 Cortlandt.

Cable Address, "Loceng," N. Y.
Glasgow, "Locoauto."

Business Department:
ANGUS SINCLAIR, D.E., Prest. and Treas.
JAMES KENNEDY, Vice-Prest. and Gen. Mgr.
HARRY A. KENNEY, Secretary.

Editorial Department:
ANGUS SINCLAIR, D.E., Editor.
GEORGE S. HODGINS, Managing Editor.
JAMES KENNEDY, Associate Editor.

Boston Representative:
S. I. CARPENTER, 643 Old South Building, Boston, Mass.

London Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., 3 Amen Corner, Paternoster Row, London, E. C.

Glasgow Representative:
A. F. SINCLAIR, 15 Manor Road, Bellahouston, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid in the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribe in a club, state the name of the agent.

Please give prompt notice when your paper fails to reach you regularly.

Entered at the Post Office, New York, as Second-class Mail Matter.

School for Firemen.

The Lehigh Valley Railroad has inaugurated an educational movement which will be of immense value to the railroad and to the traveling public. It is a school for firemen. Briefly stated, its object is to teach firemen how to perform their part of railroad work with the maximum efficiency. An important feature of the scheme is the series of examinations which firemen will have to pass before they can be promoted to the position of locomotive engineer. It is the ultimate aim of every fireman to become an engineer. The Lehigh Valley has made it a policy to employ as firemen, only men who appear capable of advancing to the right side of the locomotive and this educational plan will insure their being thoroughly trained by the time they arrive there.

A condition which makes it imperative for the railroads to have well-trained firemen is the usual waste of fuel. Every unit of heat that goes out through the smokestack or down into the ash-pan, instead of being used to turn water into steam, is money thrown away. The increase in the cost of fuel in the last few years has rendered still more urgent the necessity of getting out of coal all the energy there is in it. Just as there are many ways of wasting fuel, there are many ways of saving it. The building of the fire in the firebox, the firing on the road, and the banking of the fire when the run is interrupted or ended, are subjects in which the new fireman must be trained by those who have become experts in these matters.

According to the plan now put into effect by the Lehigh Valley, when a man is employed as fireman he receives a list of questions upon which he will be examined at the end of his first year of service. Later he will receive another series for mastery during his second year, and then, finally, a third series for his third year. He is not expected, however, to work out all the problems for himself. Several aids have been established for him.

A copy of a book on dealing with fuel and steam economy is put into the hands of every fireman when he enters the service of the company. Regular instruction in the operation of air brakes is provided. The management of the company has appointed assistant road foremen whose special duty it will be to give instruction in the proper and economical use of fuel. Moreover, every fireman is invited to apply to the master mechanic, general foreman, road foreman of engines, and the general air brake and fuel inspector, or to any other official, for information upon any matter in connection with his work.

When he stands the examinations which form a part of the educational scheme, the fireman must make a high record to pass. In the first two series of questions an average of 75 per cent. will be required, and in the last series an average of 80 per cent. He may feel sure, that no catch questions will be put forward to puzzle him. They will all be thoroughly practical. Here are a few examples: How should a fire be built up before starting? How often should fresh coal be applied to a fire? If a hole appears in a fire how should it be treated?—State as fully as you can just when the blower should be used. What is the result if the blower is left on too long?—In making station stops should a fresh fire be put in at shutting off or at starting? In approaching long down grades how should the fire be handled?—Should an injector be left on continuously throughout a trip, or be put on and shut off at intervals? What attention should a fire receive when the injector is working? What is a safety valve? How does a safety valve operate? —When and how often should the grates be shaken? Does an engine popping affect in any way the amount of coal used per trip?—What effect does the stopping up of flues have on a fire? How can this be overcome?—If you should open a fire door and discover a dull or red fire, what would you do? Why? If an engine burns the fire at one side or at the back end of the firebox, what is wrong?—What is an ash-pan? Should air be admitted to the grates through the ash-pan? If a fire appears in an ash-pan, what is the cause?—What is the object of a water glass on a locomotive?—What is a clean fire?—What is the difference between a wide and a narrow firebox engine?—What is a stay bolt? What purpose does it serve?—Name all the important parts of the air brake equipment as applied to a locomotive? What is an automatic brake? How is an automatic air brake applied? How is it released?—What is meant by "emergency" position, or an "emergency" application? What is the proper method for bleeding off a brake? What is meant by "cutting out" a brake?

A fireman is given a year to find out by asking questions, by talking over matters with engineers and other firemen and by other means what are the answers to the questions. It is not, however, the mere knowledge of the correct answer that constitutes valuable information. The practical way this instruction is given on the Lehigh Valley is of the greatest importance in helping ambitious firemen to become good locomotive engineers. It is these men we want to help. Write to us on any railroad subject that comes up.

We Want to Know—Write Us.

Our general correspondence columns are open for the full and free discussion of practically all topics relating to motive power matters, but there are several specific subjects, on which we want to hear from any railroad man who knows anything about any of them. This general correspondence feature of our paper is one which we have endeavored to make of interest and service to our readers, and the class of letters we publish are all worth while.

Some time ago we gave an invitation to our readers to write us on the subject of the position of loads and empties in a train, and we received quite a number of communications on the subject. Before that we had the derailment of tenders up for discussion, and the whole matter was carefully gone over.

We are anxious to hear from our readers on the subject of the efficiency test of locomotive engineers, or the observance of signals test as it is sometimes called. We ask our readers to turn to page 258 of our June issue and read what we said under the heading, "The chance-taker must go." Write in and let us know your views. The subject is a live one and you know something about it or at least you can judge of our arguments.

Then there is the subject of locomotive inspection. In our June paper, page 232, we have a letter on the subject written by a man who is an inspector of locomotives himself. Let us hear from you about how long in your opinion a good, competent, conscientious locomotive inspector should take to properly "look around" a modern Atlantic type engine after she has finished her day's run.

Among the Traveling Engineers' items, on page 275, of our July issue, we quoted one or two questions from the paper on "The Making of Good Engineers." We cannot do better than quote them again and ask for your views. The questions will be discussed at the Traveling Engineers' convention, but perhaps you are not going or will not take part in the discussion. You can discuss the whole matter in our columns. Here are the questions.

"Would you recommend the best standard books on machinery for the education of engineers and firemen to be in railway libraries, or would it be best, in your opinion, for each man to have these books at his home?" Again, "If possible to do so, do you not believe it would be best for each engineer to have a regular fireman?" The ninth question is, "Do you not believe a man with shop experience as machinist's helper would make a better man for the position of engineer if it could be arranged with railway companies to start them in this way, with the intention of promoting them as fast as possible to do so?"

Then there is our new department devoted to running repairs of locomotive engines. We intend to give the latest methods of doing work, descriptions of the latest appliances and shop kinks in general. We would like to hear from you on this subject. Remember that a good appliance may be several years old at your shop, but it may be a very new thing to someone else, and if you send us a sketch we will have the illustration made. We pay for ideas sent in when accepted for this department, and we are open for a good supply.

We have here briefly outlined some of the topics upon which we would like to receive letters to the editor, but you are not to be bound down to these alone. Write us on any good live mechanical department matter, perhaps you will create greater general interest in the subject you think of than by only taking up those here outlined. In any case write us.

Apprenticeship Education.

Out of the reports of conventions of representative railway men held during this season there is no more cheering note than that which tells of the advance in the matter of apprenticeship education. Our readers are well aware that we have urged the better training of railway mechanics with all the unction that we possess. We have pointed out from time to time that the thorough training of young mechanics in their calling was indispensable to the well being of the railway service. We have done all that we could to aid in the instruction of all who were studious enough to read the experiences of men who have risen to prominence in the service and who are desirous of enlightening others who may wish to travel in the same path. It is very gratifying to learn that there are now at least twelve of the leading railroads in America where a systematic course of instruction is being pursued with marked success. Skilled instructors are leading the young mechanics through graduated courses to a thorough knowledge of their calling, and the results are, so far, most encouraging.

As is well known among the older railway mechanics, any approach to a systematic course of training was hardly dreamed of. A fine mechanic was in every sense a self-made man. Most apprentices had not begun to learn their trade when their apprenticeship expired. The foreman had no time to trouble himself about the embryo mechanic. He was more anxious to get something out of the apprentice than to put something into him. The general result was that they mutually despised each other. The apprentice rarely took his trade seriously. He was working under compulsion, like a prisoner serving a sentence. When the foreman came near him he was full of uneasiness, and there was a load off his mind when the foreman had gone about his business. Neither were to blame. It was the utter lack of method that made an apprenticeship a period of ill-requited drudgery.

The beginning of a better day is full of hope, and doubtless the success of the training schools already established will induce others to follow in the same benignant path. Already the important element of natural selection is markedly active in many of the classes. Under proper instructions it is speedily recognized whether the young man has made the proper choice of a calling or not. The unfitted are weeded out and directed to other fields of human endeavor. The moral and intellectual tone of the student apprentice is elevated. Life becomes sweeter and higher and nobler when the difficulties of a calling are illumined by intelligent and kindly tuition. The burden of labor lies lightly on the shoulders of the studious youth who can call the gathered wisdom of a proficient instructor to his aid. To this is added another important factor—that the amount of work or output of the apprentice shows a marked increase where there is an instructor. Hence the apprentices under the new system are being better paid, with the result that instead of being a burden on their parents or guardians during their apprenticeship, the young mechanics are self-supporting from the beginning, and when they graduate they have the proud consciousness of knowing that they are fitted to take their part in the world's work without fear or favor. Verily the world moves onward and upward, and, in regard to a proper method of learning important mechanical occupations, it is high time.

Discussion on Consolidation.

The discussion on the consolidation of the M. M. and the M. C. B. Associations at last June's convention revealed the fact that neither of the associations is a unit for consolidation, though it is fair to say that there is a growing feeling that the formation of one good strong society, embracing the existing organizations, is desirable and will probably be brought about in due time. There was, however, a very clearly defined desire, expressed in various quarters, that nothing be done hastily or without careful consideration.

One of the speakers, a member of the committee, referred to the advisability of including in the new association, if such is formed, the Traveling Engineers' and the Air Brake Associations. There are many instances of scientific associations in which the work done by the different sections is far more diverse than that which would be performed if all these associations should be consolidated. As an example, there is the British Association for the Advancement of Science in which there is a section on biology and one on astronomy. These subjects are sufficiently remote as to appear as if they might almost require separate organizations, yet their committees work along side by side in the larger society of which each is a section.

Whether or not the Traveling Engineers' or the Air Brake Associations are brought into the new organization, there does not seem to be any insurmountable obstacle, legal or otherwise, to the union of the Master Mechanics' and the Master Car Builders' Associations. The union of the two would probably give rise to a stronger society with even greater prestige than that possessed by either of them alone. The amalgamation of the M. M. and the M. C. B. Association would be the first time that the principle involved in the larger and more purely scientific societies had been applied in the formation of a mechanical association and to the railroad men of the mechanical department the honor of putting it in practical working shape would belong.

There is, however, one thing for the executive committee to do, as the matter of union has been left for their further consideration, and that is, as it were, to formulate the terms of union. Neither the Master Mechanics' nor the Master Car Builders' Associations have any idea of absorbing the other. A new society is to be formed, and it should be officially stated that all the members, life, active, representative or associate who are in good standing in either the M. M. or M. C. B. Associations at the time the union or consolidation is effected, shall become members of the new association without having to apply for new membership or to submit their claims for admissions to the new association.

This was probably the intention of the

joint committee who drew up the report, but it would seem well if the executive committee of both organizations went on record on this matter when they come to consider the whole question next fall. There is nothing in the report bearing directly on what may be called the terms of union and it was not touched on in the discussion. We shall be glad to hear from any of our readers who care to favor us with their opinion of the proposed union.

Care of Lubricators.

There are not many things on a modern locomotive that get more attention than the law allows, as the saying goes, but among the useful appliances which have put up with what they can get, one may mention the ordinary sight feed lubricator.

One of the best tools for a locomotive engineer to use on the lubricator, if we may so say, is a thorough knowledge of its construction. The makers of sight feed lubricators—the most commonly used now are of the bull's-eye type—have each issued a book of instructions, or also a card of instructions to hang up in the cab. No locomotive engineer should be without one or other or both, and in addition, the pages of our paper are open to those who wish to state their troubles or ask a question.

Another good way to treat a lubricator is to keep it clean. There is more or less sediment, and generally some impurities in even the best kind of oil, and these are apt to clog, if not entirely obstruct the smaller and finer passages in the instrument. A lubrication is designed for the delivery of a certain quantity of oil in a given time, and the adjustment required for this purpose is exceedingly delicate, so that its derangement should be guarded against very carefully. In a sense, a modern bull's-eye sight feed lubricator is as much an instrument of precision as a microscope, and the care taken to keep it clean should be adequate. The movement of oil through the lubricator at all times is slow, and the deposition of sediment or grit where change of diameter in passageways exists, invites the accumulation of foreign matter with undesirable consequences. The passages should be frequently blown out so that the flow shall be constant and the seating of the valves tight.

One method of helping in the way of cleanliness is to put a small piece of soap in the reservoir about once in ten days or so. After the oil has been fed out the feed is allowed to continue so that all the soapy water will pass out through the sight feed chambers, it will clean the walls, passages and glasses, but the lubricator should be thoroughly blown out with steam after the soap had been used, so as to have none remain.

A writer in the *Locomotive*, a small periodical issued by the Lima Locomotive works, speaking of the matter of lubricator filling, has this to say: "Care in filling should also be exercised; only strained oil should be used and it should be heated, observing closely that the reservoir is quite full. It is better to wait a few seconds before replacing the filler plug, in order to make sure that the reservoir is absolutely full, as this will prevent all momentary pulsation of oil drop on the end of feed nipple, for the reason that a liquid is not compressible, but air is compressible, and if an air pocket is carelessly permitted to form by reason of insufficient filling or by entering in the form of large bubbles in cold oil, these air pockets, being susceptible to compression, will show the pulsations from the cylinder, which are indicated by the behavior of the oil drop until the air has worked out. A lubricator starts more readily, and operates more perfectly, upon a solid liquid column than one with air pockets in it, and great care should be taken by the manufacturers to avoid all possible air pockets in the improved lubricators Care should be taken to keep all packing nuts well set up, to prevent bleeding. When finishing a run the locomotive engineer should close feed valves first and steam valve at boiler last. The man at the throttle should bear in mind that the steam valve should always be opened first and closed last."

Staybolts.

It may not be generally known that one of the forms of staybolts had their origin in the early days of armor plating. The heads of these ancient staybolts were tapered and sunk into the plate. The screwed ends and nuts, under which large washers were placed, were, of course, inside the ship. When a cannon shot struck the plate a number of these nuts generally fell off. A few blows and the bolts went to pieces, and the plates fell off. The method of reducing the thickness of the bolts for some distance along the center of the bolt was tried, and the result was that the bolts were much more durable.

Staybolts made in this way were tried in locomotives and were found to be less liable to breakage than straight bolts. Staybolts are still breaking, however, although they are much improved in point of material since the early days of locomotive construction. If the length of life of a staybolt could be established or closely estimated a great gain would be made. It is safe to assume that the causes of breakage are rarely or never what may be called direct over-pressure. The size of the staybolts and their nearness to each other are calculated to resist a pressure at least six times greater than they are called upon to do.

The variety of stresses to which the stay-bolts are subjected are doubtless the cause of their uncertain, and sometimes, rapid fracture. Recent experiments have demonstrated the fact that the outer shell of the boiler expands considerably more than the inner sheets. This is partly owing to the fact that the outer sheets are usually of greater thickness than the inner sheets and being also of greater length a larger amount of expansion is inevitable. The introduction of the flexible staybolt was a marked improvement. The proper use of these bolts, together with the method of drilling holes in the ends of rigid staybolts, has done much to lessen the danger arising from staybolt fracture.

A systematic and thorough inspection of the staybolts should be made at short intervals. The first indication of weakness should be promptly attended to. The sides of the firebox and crown sheet depend largely on the riveted heads of the staybolts holding them in place, and when these riveted portions of the staybolt show indication of wearing away, it is poor policy to keep on calking the wasted portion until there is literally nothing holding the staybolt except the threads.

Steel Passenger Cars for the P. R. R.

The Pennsylvania Railroad system has in service on its lines, or on order, nearly two thousand passenger cars of all steel construction. These cars have been added to the company's passenger equipment since June, 1906, when it was announced that all future additions to passenger equipment on the Pennsylvania system would be of all steel construction.

The Pullman company is at present constructing a sufficient number of steel sleeping and parlor cars to equip the entire Pennsylvania system. These cars are now being delivered at the rate of from 50 to 60 a month. Already there are in service on through trains 75 sleepers, and 5 combined parlor and baggage cars. When the present order is completed there will be in service on the Pennsylvania system some 600 all-steel Pullman cars.

The steel passenger cars on the Pennsylvania system have been called "Dreadnaught" cars by reason of their construction. They weigh some 118,500 lbs. as against 85,000 lbs. in the standard vestibule wooden coach. This increase in weight very greatly reduces the vibration of the car, thereby adding to the comfort of passengers. The car is non-collapsible, its principal feature being a central box girder 24 ins. wide by 19 ins. deep extending throughout the entire length of the coach. In a collision it is expected that the girder will prevent telescoping. The car is fireproof, as it contains only about 125 lbs. of wood, which is used for window frames and arm rests in the seats.

In the steel equipment now in service, there are 457 coaches, 22 dining cars, 34 passenger and baggage cars, 33 baggage, 78 postal and 80 Pullman cars. In addition to these there are on order or under construction at the present time, 502 steel coaches, 28 steel dining cars, 83 passenger and baggage cars, 83 baggage, 39 postal, 28 baggage and mail, 1 combination motor car, and some 520 Pullman cars. With the 704 steel cars in use at present, and the 1,284 cars on order, the Pennsylvania system will soon have available for use a total of 1,988 steel passenger cars.

The Polytechnic Engineer.

"The Polytechnic Engineer" is a handsome volume of 150 pages published annually by the undergraduates of the Polytechnic Institute of Brooklyn. Volume No. 10, which has just been issued, is a fine sample of the printer's and binder's art. It presents briefly the list of the members of the corporation and officers of instruction, of which there are no less than forty-two. A list of other officers and the various engineering societies are also given. The contributions to the volume, of which there are eighteen, are all, with two exceptions, the work of students of the institute. The papers were originally read before the various engineering societies, and it is fitting that they should now be put in this permanent form. It would be unfair to select any particular paper for special mention where all are so excellent. There is a fine breadth of vision in the method of treatment of all the subjects, and it is gratifying to observe that the young engineers who are fortunate in having the opportunity to attend the classes of the institute are awake to their advantages, and are not aiming at being merely narrow experts, but are arraying themselves in the forefront of the ranks of inquiry and invention that are the marked features of the age in which we live.

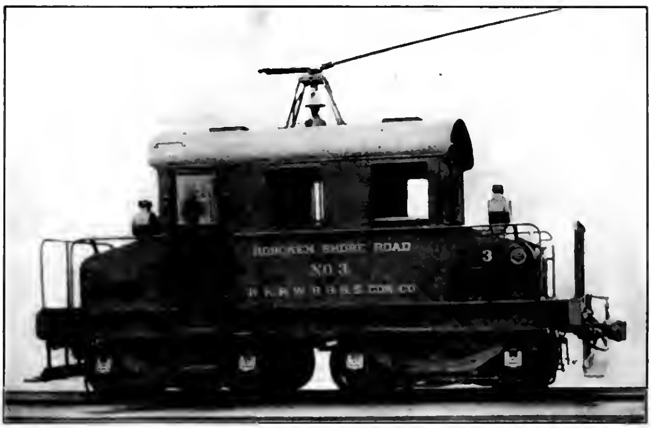
Hard Bearings.

A bearing subjected to gradually increased load while running will come to a point where the metal is said to grip. It is well known that the harder the surfaces in contact are, the less the friction and the higher the load required to produce gripping or cutting. This led to the introduction of bearings as hard as possible, consistent with absence of brittleness. Hence the introduction of bronze in bearings. The jeweled bearing of a watch is an extreme case of hardness in a bearing, but as the load is practically nil the brittleness does not matter.

Electric Switching Locomotive.

The Hoboken Railroad, Warehouse and Steamship Company have had in operation since 1906 a sixty-ton electric switching locomotive whose continuous performance has caused many very favorable comments in railroad circles. This locomotive has not only supplied the demand most urgently made by operating men that the service be perfectly reliable, but it has been operated at a low maintenance cost.

Since the electric locomotive was placed in operation four years ago there has not been replaced a single contact on the switch group or a contact on the master switches or reverser. On the control apparatus nothing other than two tips on the live switch has been replaced. The brushes that are in the motors at the present time have been operating fourteen months, and the master mechanic believes they will operate at least six months longer without replacement.



[illegible] HOBOKEN SHORE ROAD.

No trouble has been experienced with broken brushes. Except that there has been replaced one pinion which was broken when a lock washer dropped into the gears, no repairs on the motor have been necessary.

The cost of inspection and cleaning has been practically nothing. Every Saturday morning the man operating the locomotive makes an inspection of the equipment. With compressed air he blows out the motor and the various parts of the control apparatus, and cleans any part that may need it. This work is not charged to maintenance, as the operator in doing it is simply [illegible] his time. No extra time is needed for maintenance or inspection.

The locomotive has a running and starting drawbar pull of 14,500 lbs. and 30,000 lbs. respectively, and has a normal speed of [illegible] an hour. It has four 100 h. p. slow speed motors, a hand operated unit switch control, and Westinghouse air brakes with a D-4 compressor. The electrical equipment was furnished by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; the mechanical parts, the steel cab and the trucks were built by the Baldwin Locomotive Works. The Hoboken company have stated that there never has been a time when the locomotive refused to work or would not do the work required of it. It averages twelve hours a day of shunting service very nearly every day in the year.

Origin of Horse Power.

Horse power measures the rate at which work is done. One horse power is reckoned as equivalent to raising 33,000 lbs. one foot high per minute, or 550 lbs. a second. In measuring the work of a horse the estimates of the most celebrated engineers differ widely from each other. Boulton and Watt, basing their calculations upon the work of London dray horses working eight hours a day, estimated it at 33,000 foot lbs. per minute. D'Aubisson, taking the work done by horses in whims at Freiburg, estimated the work at 16,440 foot lbs. working eight hours a day. Under similar circumstances Desagulier's estimate was 44,000, Smeaton's 22,000 and Tredgold's 27,500 foot lbs. Horse power is called nominal, indicated or actual. Nominal is used by manufacturers of steam engines to express the capacity of an engine or boilers. Indicated shows the full capacity of the cylinder in operation without deduction for friction, and actual marks its power as developed in operation involving elements of mean pressure upon the piston, the velocity and a just deduction for the friction of the engine's operation. The original estimate of Watt is still counted as horse power.

Articulated Compound for the Norfolk and Western Railroad

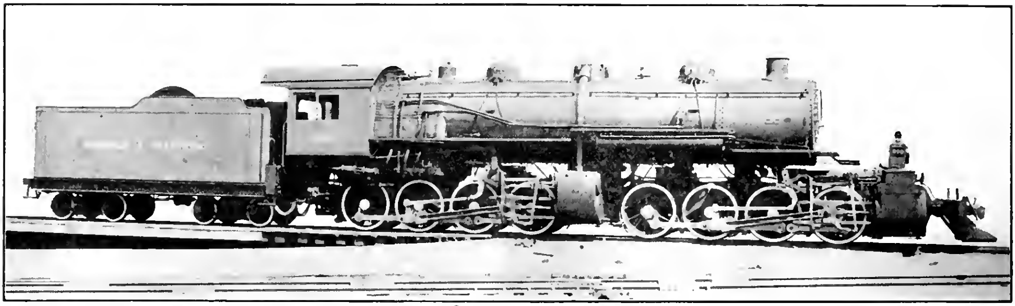
Five articulated compound locomotives built by the American Locomotive Company have recently been added to the motive power of the Norfolk & Western Railroad. The grade conditions on some of the divisions of this road are severe. On the Virginia and Ohio division between Columbus, O., and Roanoke, Va., a distance of 449 miles, there is a steep grade compensated for curves known as the Elkhorn grade, which is on an incline of 105.6 ft. to the mile. On the main line between Norfolk and Bristol, a distance of 408 miles, there are three heavy grades which govern the tonnage on the various divisions between these two points: one of 1 per cent. compensated between Walton and Christiansburg; one of 1.15 per cent. combined with 6 deg. curves between Roanoke and Blueridge, and a third between Elliston and Christiansburg, which is 1.3 per cent. with 9 deg. curves.

By adopting the articulated compound type for this service, the railroad officials will be able to greatly increase the maximum through train loads over these lines. At present the heaviest class of freight power on the Norfolk & Western is an engine, known on the road as Class M, having cylinders 21 x 30 ins., driving wheels 56 ins. in diameter, 200 lbs. pressure, and a maximum tractive power of 40,200 lbs. This class is rated at 600 tons on the 2 per cent. Elkhorn grade. The Mallet engine here illustrated is capable of handling 1,320 tons behind the tender on this grade, or more than twice the rated tonnage of the Class M locomotives.

Aside from the fact that the details of the engines, as far as possible, were required to conform to the Norfolk & Western standards, the specifications left the builders free to follow their own practice; and the design, therefore, incorporates all those features which they consider essential to the efficient operation of the locomotive under the conditions of its service. In general, the design is somewhat smaller, but similar to that of the enormous engines, six of which were recently delivered by these same builders to the Delaware & Hudson Company. The smaller diameter of the boiler in the present instance, however, obviated the necessity of following the arrangement of high-pressure steam pipes employed on the Delaware & Hudson engines. In the engines here illustrated, the arrangement of the steam pipes is the same as that most commonly employed on the articulated compound locomotive.

Boiler tubes 24 ft. long have been employed, the same as in the Delaware & Hudson design. But the boiler is not as long as that of the other engine, and does not, therefore, have a combustion chamber. Another modification from the builders' former practice for the articulated type of engines consists of a different arrangement of the reversing gear of the low-pressure engine. The reach rod to the reverse shaft of the low-pressure valve motion is on the center line of the engine. It has a universal joint connection with a downward extending arm in the center of the main reverse shaft, which is carried in bearings bolted to the high-pressure cylinder saddle. At the forward end, this reach rod connects to a central arm of the forward reverse shaft. This shaft is supported in bearings cast integral with the brackets supporting the links, and thus moves with the forward engine, on a curve. This arrangement eliminates the necessity of using universal joints in the radius bar hangers; while at the same time the reach rod, being able to swivel about its flexible connection with the main reverse shaft as a pivot, permits of the lateral motion of the front engine when curving, with the least resulting disturbance in the valve events.

In working order the engine here illustrated has a total weight of 375,000 lbs., all of which is carried on the driving wheels, the wheel arrangement being of the 0-8-8-0 type. With the high-pressure cylinders 24½ ins. in diameter by 30 ins. in stroke, and low-pressure cylinders 39 ins. in diameter and the same stroke, and with driving wheels 56 ins. in diameter, and a boiler pressure of 200 lbs., the theoretical maximum tractive power, working compound (according to the builders' formula), is 85,000 lbs. With the American Locomotive Company's system of compounding, which includes an intercepting valve, this tractive power can be increased about 20 per cent. by working the engine simple. This design also provides a number of special features which were successfully applied to the engines which were built for the Erie and the Delaware & Hudson Railroads, such as the floating balance device to relieve the main boiler bearing of excessive pressure and the side spring buffers at the frame union.



MALLET ARTICULATED COMPOUND FOR THE NORFOLK & WESTERN.

A. P. Lewis, Superintendent of Motive Power. American Locomotive Company, Builders.

The principal dimensions of the design are given in the following table:

Driving wheel bases, 15 ft. 6 ins.; total, 41 ft. 2 ins.

Wheel base total, engine and tender, 72 ft. 10 ins.

Weight, in working order, 375,000 lbs., all on drivers; engine and tender, 433,000 lbs.

Heating surface—Tubes, 5,167 sq. ft.; firebox, 212 sq. ft.; total, 5,379 sq. ft.

Grate area, 75.3 sq. ft.

Axles—Driving journals, main, 10 x 12 ins.; others, 9½ x 12 ins.; tender journals, main, 5½ x 10 ins.

Boiler—Type, straight, O. D. first ring 83⅞ ins.; working pressure, 200 lbs.; fuel, bitum. coal.

Firebox—Type, wide; length, 120⅛ ins.; width, 90¼ ins.; thickness of crown, ⅜ in.; tube, ½ in.; sides, ⅜ in.; back, ⅜ in.; water space, front, 5½ ins.; sides, 5 ins.; back, 5 ins.

Crown staying—Radial.

Tubes—Material, Spellerized steel, 367 in number; diam., 2¼ ins.; length, 24 ft.; thickness, No. 11 B. W. G.

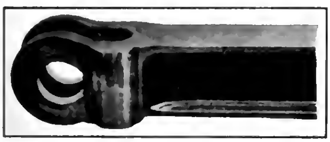
Pumps—Two $9\frac{1}{2}$-in. L. hand; reservoirs, two $18\frac{1}{2}$ x 126-in.
Piston—Rod diam., $3\frac{3}{4}$ ins.; piston packing, cast iron rings.
Smoke stack—Diam., 20 ins. I. D.; top above rail, 15 ft. $5\frac{11}{16}$ ins.
Tender frame—15-in. 33-lb. center channels; 12-in. 25-lb. side channels.
Tank—Style, water bottom; capacity, 9,000 gals.; fuel, 14 tons.
Valves—Type, L. P., double ported slide; H. P., piston, 14 ins.; travel, L. P., 6 ins.; H. P., 6 ins.; steam lap, H. P., 1 in.; L. P., $\frac{7}{8}$ in.; ex. lap, H. P. and L. P., $\frac{3}{16}$ in.
Wheels—Driv. diam. outside tire, 56 ins.; material, cast iron; tender truck, diam., 33 ins.; kind, forged steel.

Welding a Side Rod.

A very neat piece of repair work was recently done at High Springs, Fla., in the Atlantic Coast Line Railroad shops, where Mr. James Day had charge of the work. The job consisted in welding with Thermit the back section of a locomotive side rod which had one of the jaws broken off. Writing to the Goldschmidt Thermit Company of New York on the subject, Mr. Day says:

"I welded the broken jaw on again, and after the welding operation took a light cut off the reinforcing bars, and polished them so as to make a very neat job.

"I have made several welds, but this one acted differently from any I have yet seen. After tapping the crucible and allowing the metal to flow into the mold, the steel contained in the riser belched out and left the riser empty down to the bottom. In all my other welds the metal



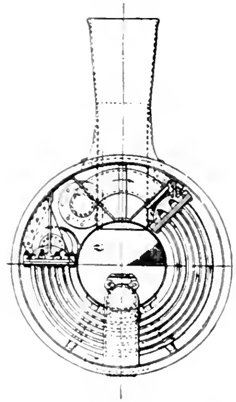
SIDE ROD WELDED BY THERMIT.

flowed freely and steadily into the riser after the mold was filled, and until the metal was all out of the crucible. I followed out the instructions as laid down by your company, poured at a low point, and had my riser at the highest point. The mold was made of one part of good, sharp sand and one part fire clay, while I used wax in making the pattern. I melted the wax out and then dried the mold with an oil heater, and brought the rod to a good, red heat. It is this belching that has puzzled me."

In answer to this, the Goldschmidt Thermit Company pointed out that the belching of the metal in the riser could only be explained by the presence of some foreign matter in the mold at that point. They go on to say: "It would seem a plausible explanation that if the neck of the riser was at all clogged up such belching might result, as the hydrostatic pressure of the metal flowing out of the crucible would finally overcome the resistance below the riser. We have only one similar occurrence on record, but in that case the phenomenon was dissimilar."

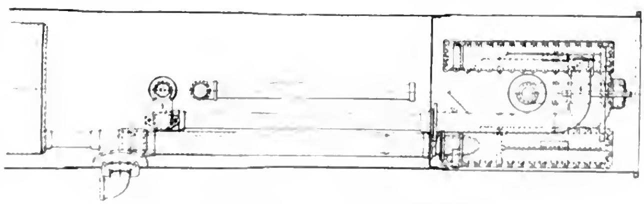
Shay Geared Locomotive Superheater.

The Lima Locomotive and Machine Company, of Lima, Ohio, are always prompt in taking advantage of new appliances or methods used in locomotive practice. The company have recently adapted the superheater to the Shay geared locomotives with a degree of success that bids fair to equal if not sur-



END VIEW OF SUPERHEATER.

pass its adaptation to any other class of locomotive. It will be observed in the accompanying illustrations that the steam after being conveyed through the throttle valve passes in a dry pipe located near the right hand side of the boiler, and after entering a header passes through a large number of small pipes located in the smoke-box. After the steam has made three circuits across the smoke-box it is carried back to the point on the boiler a little ahead of the fire-box where it passes to the three vertical cylinders which are placed in front of the



LIMA LOCOMOTIVE WORKS SUPERHEATER.

cab. The pipe conveying the steam to the cylinders is surrounded by a larger pipe through which a portion of the furnace gases pass, and by this means the steam reaches its highest temperature at the point where it is admitted to the cylinders. There are several advantages connected with the method of superheating, and the peculiar formation of the Shay geared locomotive readily lends itself to its application and it bids fair to produce a higher degree of superheating than can be obtained in any other kind of locomotive.

New Ash Pan Equipment.

The Illinois Central has 1,400 locomotives and all have been equipped with new ash pans in conformity with the law passed by Congress on May 30, 1908. Managers of a number of other roads have asked for an extension of the time limit which expired Jan. 1, so that they may be able to comply with the law. The smaller roads have found it somewhat difficult to shop their engines for the purpose of applying the new ash pan, as every unit of power has been needed to move traffic. On these roads engines shopped for repairs have been equipped, leaving a number still to be equipped and hence the application for more time.

In addition to the Illinois Central, the Chicago & North Western, the Burlington, the Chicago Rock Island and Pacific, the Chicago & Great Western and the Chicago & Eastern Illinois, will not ask for more time as they have complied with the law; but a number of others desire an extension of time.

Progress in Railway Mechanics.

The locomotives of fifty years ago contained the essential features of those of today, the great improvements wrought having been in constructive detail. The modern engines possess at least four times as great steaming power, together with more than tenfold weight. Compared with a modern locomotive, the "Planet" type of 1832 to 1836 had a weight of $7\frac{1}{2}$ tons instead of 75 to 90 tons, a fire grate area of 7 sq. ft. instead of 60 to 70 sq. ft., a heating surface of 300 sq. ft. instead of 4,000 sq. ft. and upwards. A most wonderful economy of fuel has been effected. About fifty years ago, for instance, one railway line consumed 12,000 tons per annum, while a few years later 3,100 tons sufficed for a considerably greater traffic. The tractive power has been increased most enormously, and all gradients up to one and twenty are now readily surmounted. Ordinary speeds have increased, yet express and special trains run but little faster. Steel has superseded iron for rails, at a present cost of only half that of the iron rails in 1870, while the durability is about three times as great. One may say that in every way and in every direction increase of weight and power have kept pace with increase of traffic.—*Address before [illegible] Society Civil Engineers.*

Locomotive Running Repairs

III.—Impurities in Water.

It is a noteworthy circumstance that new boilers have a greater tendency to "priming" than boilers that have been some time in use. Clean water and a clean boiler are the best preventatives. Water absolutely free from foreign admixture is not to be found. Even rain water before it has reached the ground is not free from impurities. Gases, dust and other light matter mix with the falling rain. As the water passes through or over the earth many foreign substances are added to it, and it seems as if these impurities increased in volume when the water is converted into steam.

In the case of new or newly repaired boilers it is safe to assume that there is a quantity of oil or other foreign matter in the boiler, and that priming may be expected for a few days at the first trials of the engine. The theory in regard to priming is that when steam bubbles form by the action of heat they rise to the surface of the water. The oil or soapy matter floating on the surface of the water forms a shell or covering for the steam bubbles as they break through the water. These bubbles accumulate and form into clusters as foam on turbulent rivers. It seems incredible that bubbles could exist with high steam pressures acting upon them, but the rush of steam to the throttle valve carries the bubbles intact, and they are broken in their passage to the cylinders, and appear as water in the exhaust.

This priming or foaming should be distinguished from high water in the boiler. Many young engineers have a tendency to allow too much water in the boiler. This overanxiety on the side of safety, as far as avoiding the scorching of the crown sheet is concerned, has a pernicious effect on the working of the engine. The excessive amount of water in the boiler lends itself readily to the mixture of water and steam, and the saturated or water-laden steam affects the valves, especially the valves of the piston variety, often causing a collapsing of the rings. The bursting of cylinder heads is not uncommon by this cause, as the water confined in the steam passages by the action of the piston if not relieved at the valve openings may fracture the cylinder.

While the impurities incident to water and the over supply of water to the boiler my not be entirely avoidable, there are now many devices in operation for purifying water. It is known that distilled water will not prime. The various water treating plants used by many railways for removing or minimizing the effect of foreign substances in the water has shown considerable improvement in recent years, and while there has been much mystery concerning the make-up of those compounds, their general basis is soda, and some of the other ingredients are extracts of tannic substances, some of them containing starch or gelatinous matter, which is calculated to have the effect of coating the inner surface of the boiler with a kind of mucilaginous covering, thereby helping to prevent the mineral particles floating on the water from adhering to the boiler shell. Some of these compounds are fairly effective, the foreign substances in the water being largely kept in a muddy solution, which can be easily blown out.

Water containing lime has a great tendency to form a hard scale on the boiler, and carbonate of soda has the effect of reducing the lime to the form of a soft solution. Caustic soda is also much used where the compound is fed into the feed tank. The tannic compounds that are used in boiler compositions are extracted from oak, chestnut, logwood and other timbers which contain tannin. The amounts used of these compounds vary according to the amount and kind of substances that may be in the water. The greater the amount of lime in the water, the greater is the tendency of scale forming and adhering to the plates and flues. This scale, which is largely carbonate of lime, adheres with great firmness to the metal, and forms a combination with the oxide of iron or rust, and it is expressly desirable that in washing boilers the boiler should not be emptied and allowed to dry, as in this case the atmosphere has the effect of aiding in the formation of a hard crystalline scale.

It is good practice in the first days of an engine's working to blow out the boiler while under steam pressure, and at the same time admit cooler water, not allowing the boiler to dry. The steam pressure will greatly aid in cleaning out oil or other impurities that may have given rise to priming, and the boiler should not be cooled too quickly. If scale is once formed and allowed to accumulate, it becomes very difficult of removal. In locomotive practice it is frequently noted that locomotives that run considerable distances and are supplied with water that may differ at certain points of the road on which they travel, are much more easily cleaned than locomotives that are constantly supplied with one kind of water. This arises from the fact that scale that has been formed by lime deposits, may be removed by deposits from water containing sand-stone deposits. The sand waters are softer, and have a soluble effect on limestone scale.

It need hardly be added that the use of strong acids in a boiler requires that the experiment be carried out under the most intelligent supervision. The free use of sulphuric and other acids may have the effect of attacking the plates and so lead to a rapid deterioration of the boiler, but it is safe to assume that the plates will not be seriously attacked as long as there are any scale formations on which the acid can exert its energies. As we have already stated, the cleaning and softening of water is a matter on which specific rules could not be given unless some particular water was taken as an illustration. As a rule, water from wells contains more impurities of an injurious kind to boilers than water from lakes or rivers. The self-cleansing quality of water is well known. The river Rhone is a good illustration. It is said to contain more impurities than the Wabash or Ohio rivers before it reaches the Lake of Geneva. When the Rhone reforms at the other end of the lake the water has become clarified. The lesson to be learned from this fact is of real value where there is an opportunity of forming a deep reservoir where the mineral impurities in water may have an opportunity of settling to the bottom of the reservoir, and leave the upper waters comparatively pure.

IV—WASHING BOILERS.

There is no more important item in locomotive running repairs than in the washing of boilers. Not only does thorough washing repair the faculty of transmitting heat into the water to make steam, but a thorough washing of the boiler prolongs the existence of the boiler and also avoids much repairs that would otherwise be necessary. It is a remarkable fact that in spite of the wide knowledge that exists in regard to the pernicious effect of scale accumulation in boilers, it is safe to say that there are no boilers in use on any railways that are as well cleaned as they should be. The causes that lead to this deplorable condition are numerous. Motive power is costly, and unless in times of business depression there are never any locomotives to spare. The time for repairs is limited. The time for washing is often at odd and irregular periods. The operation is usually performed by the poorer paid class of labor. The work is often performed at such times and under such conditions as render a thorough supervision almost an impossibility. Even roundhouse foremen have their physical limitations, and the work of washing the boiler must be left to some trusted helper while the over-driven foreman is engaged in finer mechanical operations that require more skill, but perhaps are of less importance.

It must be admitted that in spite of the large increase in the number of washout and inspection plugs that are located in many parts of the boiler, there are still large areas in the interior of the boiler that are invisible except to the eye of faith. This is especially true of the parts of the boiler that are exposed to the fiercest heat and where the accumulation of scale and the fracture of stays are generally to be found when a reconstruction of the firebox becomes necessary. The shell of the boilers and the flues are better attended to since the practice of leaving out several flues and filling the openings with temporary plugs became general.

The washing of the boiler should be systematic and as thorough as conditions will permit. In a general way five or six hundred miles is acknowledged as a safe distance to run between washings, but this distance is much overlapped and rarely shortened. It is a rule more honored in the breach

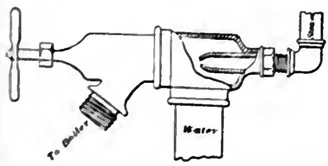


FIG. 1.

than in the observance. At many of the leading roundhouses there is some system of bookkeeping showing the distance run between washings, and stricter methods are undoubtedly being introduced with gratifying results. It need hardly be stated that the periods between washings should be regulated by the kind of water used. In some localities it would be almost necessary to wash out the boiler between each trip, while in others a locomotive might run two weeks without much danger from lack of washing.

The most approved methods seem to run in favor of washing the boiler with hot water under steam pressure of at least 100 pounds per square inch. It is certain that hot water will more readily remove scale. Steam pressure is not always available, but hot water for the purpose of washing can be economically furnished in any roundhouse where there is a pumping or stationary boiler, and where the roundhouse is heated by steam, a pipe with water attachments may be run parallel with the steam pipes. We reproduce an illustration of a simple injector apparatus that has been in use for a number of years in some of the leading roundhouses in the West. It will be seen at a glance that the steam and water connections are readily adaptable to any position, and all that may be added to the apparatus, as shown in Fig. 1, would be an ordinary globe valve attached at any convenient point on the steam pipe. The nozzle should be reduced at the point to less than half the diameter of the pipe, the nozzle being readily attached by a check

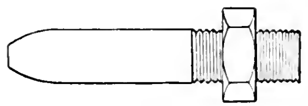


FIG. 2.

nut sufficient in depth to allow a sufficient number of threads to attach both the injector extension and the threaded end of the nozzle, as shown in Fig. 2.

In washing the boiler, it is always desirable to remove the dome cap, thereby insuring in nearly every class of boiler an opportunity to reach the crown sheet. It is absurd to imagine that any part of the boiler, even if sloped or arched, will take care of itself in the matter of avoiding the tendency to collect scale on the surface of the plates, and especially around the crow's feet or braces or stays, or whatever appliances may be used in holding the sheets together. The liability of the crown sheet to become encrusted is very great, and scale, if allowed to accumulate, becomes almost impossible of removal. If taken early in the life of the boiler and thoroughly and regularly cleaned, the scale and sediment can be washed into the legs or sides of the boiler, where it can be readily removed through plug openings.

A flexible apparatus for washing boilers is shown in Fig. 3. It will be noted that the nozzle is flexible, being screwed into a coupling at C, and the end or point of the nozzle being bent, it can be readily turned in any required direction. The handle attached to the nozzle coupling is for the double purpose of holding the nozzle in position as well as for changing the direction in which the nozzle should point. It is not necessary to enumerate the number of openings that should be readily attainable in the boiler and ser-

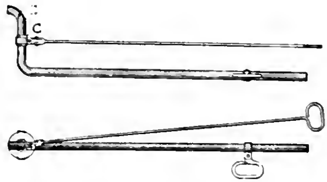


FIG. 3.

viceable in the washing of the boiler. Their location will readily suggest themselves, and are rarely sufficiently numerous to afford an opportunity of applying the apparatus on every part of the boiler, as well as affording the facility for applying chisels to such portions of scale as may be impervious to the action of the water. The application of nozzles of various form will readily suggest themselves, and also the necessity for a constant changing of the position of the nozzle so as to reach every point within range.

It may be added that a thorough inspection of the boiler after washing is absolutely necessary. A popular form of torch for this purpose is readily made of asbestos bound with copper wire and soaked in oil. The first inspection will in all likelihood, reveal portions of scale still adhering to the boiler or flues, and if a thorough cleaning of the boiler has been effected, a final inspection should be made by the foreman or some competent man detailed by him for that purpose. It is a false principle to permit the man who does the washing to inspect his own work. A systematic record of boiler washings should be kept, not only in the hands of the boiler washer, but in some convenient receptacle about the engine. The requirements of locomotive service are often of such a kind as necessitate the removal of locomotives from one part of the railroad to another. It is safe to assume that when the transfer is made the boiler needs washing, but there is usually neither time nor inclination to make any inquiry in regard to the internal condition of the boiler of the borrowed engine. Some weeks of double service adds to the accumulation of foreign matter within the boiler, and by the time that the engine is back in its old quarters a blast of dynamite would be required to loosen the rock ribbed and ancient deposits.

Questions Answered

TRIPLE VALVE FILES.

51. H. W. S., Oelwein, Ia., writes: Will you please tell me where triple valve files can be purchased. I have tried a well-known firm, but they cannot throw any light on the subject. These files are, as you know, used in the repairs of triple valve, and are a very fine file, made square in the different widths of the triple valve seat, and go, as I presume, by the different numbers of the valves. For instance, F 29, F 36, etc. I have recently been made air brake foreman here, and this company is willing to try these files, and if I can find out who makes them there is no doubt an order awaiting for that party. A.—These files can be purchased from the Westinghouse Air Brake Company, as a supply of them is kept in stock for that purpose.

PUMP REVERSING.

52. J. M., Fort Wayne, writes: What causes a pump to reverse itself or make short strokes at times and work all right at other times?—A. This is due to the reversing valve having an imperfect bearing on its seat in the valve bushing. The worn valve and seat permits steam to get between them tending to equalize the pressure all round the reversing valve, allowing it and the rod to fall of their own weight as the main piston starts on its downward stroke. This condition is aggravated by an excess of lubrication in the steam cylinder and at times when a desperate situation requires an immediate or temporary remedy, a small quantity of grinding material, such as glass or powdered emery sprinkled on the face of the reversing valve, will create enough adhesion between the valve and seat to hold the valve until the excess of lubricant works out of the bushing.

SCALE EFFECTS.

53. F. M., Syracuse, N. Y. What effect has the incrustation or gathering of scale on boiler plates?—A. Any part of the surface of boiler plates covered with scale has a marked effect in the efficiency of the part covered. Tables of temperatures by the most competent authorities agree that in the case of boiler plates covered with scale to the extent of one-eighth of an inch scale has the effect of raising the temperature more than two-thirds. Supposing the flame and flue temperature to be 3,000 degs. Fah., the maximum temperature of a clean plate rapidly delivering heat to the water will not exceed 400 degs., while a plate covered with one-eighth of an inch scale will have a maximum temperature of 600 degs. With scale it will thus be seen that the plates are much hotter, and the entry of cool air in the fire box has the effect of causing greater contraction, just as the high temperature has produced greater expansion. These stresses gradually tend to damage the boiler.

FEED VALVE DISORDER.

54. J. M., Fort Wayne, writes: When the handle of the brake valve on an engine here is placed in running position after an application of the brake, the black hand on the air gauge equalizes with the red hand, but if the handle is moved to release position after the application and then to running position, the black hand stops at 70 lbs. and remains there. Why does it not stay at 70 lbs. when the handle is first placed in running position?—A. Because the supply valve piston is a very neat fit in the bushing and the spider on the end of the piston is not quite so neat a fit in the supply valve bushing and the rush of air from the feed port driving down on top of the spider end of the piston binds or cocks the neatly fitted end in the bush. When the handle is first placed in release position to charge the brake pipe, pressure enters the feed valve less violently and does not have this effect and thereafter the amount of air necessary to charge the auxiliaries or supply leaks does not pass through the valve with sufficient rapidity or drive the piston hard enough to bind it.

STANDARD TRAIN RULES.

55. M. F. H., San Jose, Cal., asks: Is there any material difference between the book of rules issued by the larger railway systems throughout this country? I am a former employee of one of the Southwestern roads and would like to make a comparison of the rules issued by the larger roads.—A. The Standard Code of Train Rules, issued by the American Railway Association, is used by practically all the railroads in the United States and Canada. Each road has probably some local rule or rules applying to particular localities or circumstances, but the rules governing the movement of trains, signals, etc., are now alike on all roads. This secures uniformity of practice, so that a man leaving one road and securing employment on another road has not to un-learn the correct practice he has been accustomed to.

DEFLECTION SHEET.

56. McH., Port Jervis, N. Y., asks: How does the diaphragm or deflector plate regulate the draft from the fire-box through the flues?—A. It is readily observed that the air entering through the grates near the front of the fire, passes through the lower flues, while the air entering at the back of the fire passes more readily through the upper flues. The appearance of the fire will indicate whether the general current of air is regular in the front as well as in the back of the fire. If the draft in the lower flues is the greatest, the deflector plate should be raised, but if the draft in the upper flues is greater the deflector should be lowered. It will be found that nearly all deflector plates are fitted with a movable apron which can be readily raised or lowered without disturbing the deflector sheet. It is always well to observe that the flues are perfectly clear of ashes or soot before experimenting with the deflector.

Axle Failures.

Not long ago the causes of breakage of some street car axles was investigated by the Goodnow Foundry Company of Fitchburg, Mass. Four axles developed cracks and, under laboratory conditions, the wheels were run, and the behavior of the axles was closely studied.

The first axle cracked in two places in the fillet. The second cracked all the way round, in the fillet, and almost looked as if notched purposely for breaking. The third cracked all the way round, not to a uniform depth. The fourth cracked pretty evenly all round, and was run until it broke, the crack having then extended all round to within 3/8 in. of the center.

All these axle failures were from cracks which began on the outside in a 1/4-in fillet where the 3-in. journal joins the 3½-in. wheel seat. The interpretation of the facts pointed to the fillet being too sharp. On page 334 of our August, 1909 issue, under the heading of "The Lesson of the Sharp Corner," we gave the result of the Board of Trade inquiry in the case of a driving wheel failure on a British railway, where a change in diameter had been made with a sharp corner. The fillet was recommended, and axles having the sharp corner were at once withdrawn from service.

In this case it is interesting to observe that although a fillet of 1/4-in. radius was used, it was not sufficient for axles subject to alternating vibrational strains. In the case before us, a fillet of 1 5/8 ins. radius was substituted for the 1/4-in. fillet, and no more breakages have taken place. It may be mentioned that there were no flaws or defects in the axles, and the chemical composition of the steel was quite satisfactory, so that it is fair to assume that the failures were due to bad design.

May Have Been All Wrong.

A Jersey commuter met an acquaintance in a Hoboken car last week and asked: "What do you think of this weather?" "Detestable," was the reply. "And how is your wife keeping?" "Just about the same."

Air Brake Department

Conducted by G. W. Kiehm

"The Passenger Control Equipment."

The illustrations shown in this issue are the general arrangement of the Westinghouse Air Brake Company's 'P. C.' (passenger control) equipment, and the two photographic views of the control

NO. 3. CONTROL VALVE, RIGHT SIDE.

valve and reservoir. As this P. C. type is no longer an experiment but is being applied to the heavy equipment now built, we will illustrate this type of brake in detail in future issues.

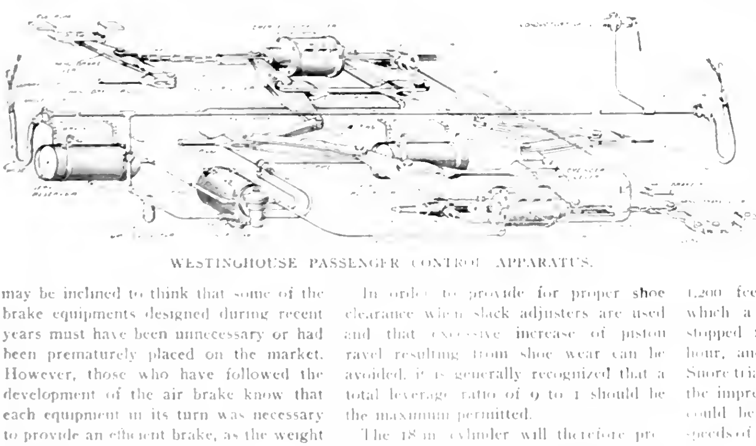
Those who have not followed air brake matters closely during the past few years may be inclined to think that some of the brake equipments designed during recent years must have been unnecessary or had been prematurely placed on the market. However, those who have followed the development of the air brake know that each equipment in its turn was necessary to provide an efficient brake, as the weight and speed of trains increased.

Necessity is the mother of invention, and practically none of our modern mechanical wonders were invented until they became a necessity, and the "P. C." equipment is no exception, because no air brake improvement has been of greater necessity since the introduction of the automatic air brake itself.

In the year 1875 a train of cars could be stopped in a reasonable distance by the use of the quick action automatic brake, but in the year 1895 the weight of engine and cars and the speed of trains had increased to such an extent that an improved brake was necessary if the trains were to be stopped from the same speeds in the same time and distance as they were formerly, or rather, a brake that would be more efficient and manifest a greater degree of safety at high speeds was necessary, and with this end in view the high-speed brake was designed.

During the next ten years, or up until 1905, the high-speed brake was relied upon to stop trains from the highest speeds attainable, but a constant increase in the weights of cars and locomotives and the speeds attained by our limited trains made necessary the use of special apparatus, such as 18-in. brake cylinders and the "L. N." passenger equipment.

The "L. N." equipment today is a very flexible and efficient brake and answers all purposes on cars whose weights do not exceed 100,000 pounds, but during 1909 many passenger cars weighing up to 140,000 or 150,000 pounds, were constructed, and it is here that the car builder met with a practical difficulty.



WESTINGHOUSE PASSENGER CONTROL APPARATUS.

In order to provide for proper shoe clearance when slack adjusters are used and that excessive increase of piston travel resulting from shoe wear can be avoided, it is generally recognized that a total leverage ratio of 9 to 1 should be the maximum permitted.

The 18-in. cylinder will therefore provide a brake for cars whose maximum weight does not exceed 127,000 lbs., but for cars above this weight it would be necessary to increase the leverage or employ a cylinder larger than 18 ins. in diameter.

As stated before, when the car weighing over 1[illegible]0,000 lbs. was built, the first proposition was a [illegible]-in. brake cylinder. This is, of course, objectionable from several standpoints, as it is a difficult matter to obtain a packing leather of this size with sufficient uniformity to prevent leaks, and the piston rod and levers would be of such size and weight that it would require a considerable percentage of the braking power developed by a light reduction to move them.

Again the question of clearance space for a cylinder of this size underneath a car and the question of strains to the car body from a cylinder of this size must also be considered.

A second proposition would be two brake cylinders per car, which would also mean two complete brake equipments whether they were fastened to the car body or to the trucks.

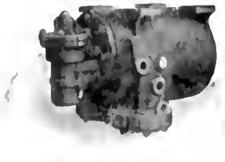
Another suggestion would be an increase in the length of the 18-in. diameter brake cylinder to provide for a longer piston travel to be used with an increased leverage, and the objections to this are apparent.

Another suggestion was a clasp brake, that is, two brake shoes on each wheel, one on either side, and this method would undoubtedly provide sufficient braking power for 150,000 lb. car equipped with an 18-in. brake cylinder and having a total leverage 9 to 1.

A final suggestion was the application of two brake cylinders of proper size to each truck.

Along with the actual difficulty encountered in securing adequate braking power for the heavy car there is another very important problem presented, and it is the increase in the distance required to stop the trains composed of heavy cars.

It is generally conceded that 1,200 feet is a reasonable distance in which a train of light cars should be stopped from speeds of sixty miles per hour, and previous to the recent Lake Shore trials many railroad men were under the impression that their passenger trains could be stopped in this distance from speeds of sixty miles per hour, but it was de-



NO. 4. CONTROL VALVE, LEFT SIDE.

veloped that about the shortest stop that could be made with the high speed brake used on modern trains was about 1,700 ft.

There are numerous reasons why the heavy trains of cars will run faster than a train of light cars, the speed, nominal percentage of braking power, and track conditions being equal.

One reason that is not given much thought is the difference in brake cylinder pressure derived from service and emergency application.

When an 8-in. brake equipment is used an emergency application will result in a substantial gain in cylinder pressure over that derived from the service application, but as 16 and 18-in. brake cylinders are used, the brake pipe remains of the same size, and the air that enters the brake cylinder from the brake pipe is not much more than equal to the volume of air required to displace the brake piston.

Another manner in which the actual brake cylinder pressure is affected is by the increase of piston travel, due to the emergency application when cars are in motion. The losses in the percentage of braking power that occur through the foundation brake gear of heavy cars is generally understood, and air brake men have for some time realized that the brake equipments in use were unable to meet the demands upon them by modern trains.

During the Lake Shore demonstrations it was noted that 2½ seconds time elapsed between the time of brake application and brake effectiveness, even with the most modern "L. N." passenger brake. A special triple valve known as the "L. G. N." was then used in an effort to develop 105 lbs. brake cylinder pressure from a 110-lb. brake pipe pressure, and in spite of the effect of emergency piston travel, came within 2 lbs. of producing the desired result, but the lapse of time between the brake application and its effectiveness still remained at 2½ seconds; whereupon it was decided that in order to reduce this time to 2 seconds, or less if possible, the use of triple valves must be dispensed with.

In order to meet this condition, the Westinghouse Air Brake Company designed and perfected the control valve and "P. C." equipment. And by the use of this equipment the aforesaid elapsed time was reduced to two seconds, and the stop from a speed of sixty miles per hour was actually made in 1,100 ft.

The control valve used contains the features of the distributing valve, and several very important features in addition, and the use of large posts and larger pipes make possible the prompter effect of brake application.

From the general arrangement it will be observed that two brake cylinders are employed—one for service operation, both for emergencies, which means that the service braking power is doubled during emergency applications. The brake can be applied to any weight of car, and the control valve works in harmony with triple valves.

The control valve contains the principal features of the distributing valve in maintaining brake cylinder pressure against leakage and excessive piston travel, and a feature in addition that results in the application of the emergency cylinder if for any reason brake pipe pressure leaks down to a predetermined figure.

Just how the valve accomplishes this and its construction and operation will be explained in future issues.

"Brakes Creeping On."

Frequent inquiries concerning the subject of brakes creeping on inspires us to offer a few comments on this matter. When the question, "What causes the brake to creep on when the valve handles of the H6 brake are in running position?" is asked, the invariable reply is, "The same thing that causes the old style or A1 type of brake to creep on when the brake valve handle is in running position."

Namely, this is due to brake pipe leakage in combination with a feed valve that will not promptly open and supply this leakage.

The explanation is generally accepted as satisfactory, and when either of the disorders mentioned are corrected the trouble on the lone engine will disappear.

However, the reapplication of the brake on the head end of a long train after a release will also affect the engine and tender brake, especially if they are in good condition, and this sometimes confuses the engineer upon the subject of brakes creeping on.

The reapplication is sure to follow the overcharge of the brakes on the head end of the train, and this trouble of brakes creeping on the engine is generally more frequent when the H6 brake is in use.

The reason for this is that the average condition of the brake on the locomotive, when a triple valve and auxiliary reservoir are used, is such that it usually requires a rather heavy and rapid reduction of brake pipe pressure to get the brake applied when desired, and as a result the slight overcharge fails to affect the engine brake to any noticeable extent. The operation of the No. 6 distributing valve does not depend upon a fixed charge in an auxiliary reservoir of limited volume, and a movement of the equalizing valve to application position results in an application of the brake, regardless of piston travel and cylnder leakage, while the movement of the triple valve piston under similar conditions does not always result in an application of the brake. With the No. 5 distributing valve the overcharge is not followed by an application of the driver brake on account of the application chamber being open to the atmosphere while the handles are in running position regardless of the position of the equalizing valve, but the same variation in brake pipe pressure is encountered after the overcharge no matter what type of engine brake is used.

Let us attempt to consider the subject of brakes creeping on without referring to any particular type of air brakes as we will try to make it plain that every automatic air brake applies from the same cause and from that cause only, otherwise it would not be considered automatic.

The movements of this earth and the planets are governed by fixed law, the movement of every thing mechanical since the creation is governed by the same fixed law that does not vary and we do not expect to see water flow up hill or rise above its own level, when influenced by nothing other than gravitation and atmospheric pressure any more than we would expect the earth to revolve in the opposite direction tomorrow.

We will not consider any movement of the earth or planets, save as an illustration and the law governing the operation of the automatic air brake is as positive and fixed, and is no more likely to vary than the law which compels and restrains the movement of celestial bodies.

The law which underlies the operation of the automatic brake is the creation of differentials of pressure. The differential may be created without necessarily resulting in an operation of the mechanism, but the mechanism cannot be operated save by the creation of the differential in pressure and having this fixed in our mind we will assume that by brakes "creeping" on, we mean an automatic application, a movement of the triple valve, or the equalizing valve of the distributing valve, and not a stuck or sticking brake.

Very often this disorder has been reported on an engine, sometimes the report was merely "clean triple valve" or "clean distributing valve," it being taken for granted that this work if performed would correct the evil or remedy the disorder.

Even when brakes "creeping" on has been reported the first move of the repairman of the old school was to take a hammer, chisel and a monkey wrench and make an assault upon the triple valve, probably the brake valve next, and as a general result very little if anything was accomplished, and very often there was nothing wrong in the first place except an ever-charged brake pipe.

There is really nothing difficult to locate and very little to reason out in order to locate the cause of a brake creeping on, whether the Westinghouse, New York, Dukesmith or any type of automatic brakes is used as an automatic application of any of the brake systems depends upon creating a differential pressure between the brake-pipe pressure and the stored volume with which to operate the brake.

Now if the disorder mentioned actually occurs on the lone engine, if we see or know that the brake will sometimes apply while the valve handles are in running position and there is no apparent disorder we know to begin with that from the very fact that the brake has applied proves that brake pipe pressure has fallen lower than the pressure in the stored volume, that is, the auxiliary reservoir, or pressure chamber of the distributing valve.

There is no other way in which the automatic brake can be applied, and no matter under what conditions the automatic mechanism is moved it can be done only by the creation of this differential in pressure.

With some of the graduated released type of brakes for electric cars, the differential might be created by an increase of auxiliary reservoir pressure coming through the supplementary reservoir, but on the railroad locomotive there is no passage to the auxiliary reservoir or the pressure chamber of the distributing valve except from the brake pipe, consequently the differential of pressure can occur only by a reduction of brake pipe pressure.

Having this idea fixed in our mind we can readily see that regardless of the condition of the feed valve or position of the brake valve handle, an escape of brake pipe pressure has applied the brake, and we also know that if slight brake pipe leakage can reduce brake pipe pressure while the brake valve handles are in running position, the feed valve is not maintaining a constant pressure in the brake pipe, and it is not only necessary to stop the leakage, but to also have the feed valves' erratic action corrected. And as this is the sum, substance and remedy for brakes creeping on with any type of air brake, the absurdity of considering a distributing valve in connection with the disorder becomes apparent.

On the contrary a movement of the distributing valve when influenced by slight brake pipe leakage alone, merely serves to prove the sensitiveness of the distributing valve, the fact that the slight variation in brake pipe pressure has operated the distributing valve proves that the moveable parts are neatly fitted and properly lubricated.

It is a desire to impress upon the mind of the student that the only way in which the equalizing valve of a distributing valve, or a triple valve can be moved to application position is by a reduction of brake pipe pressure. Of course the brake can be applied through the distributing valve by means of an independent application or even by closing the brake valve cut cut or double-heading cock and placing the automatic brake valve handle in emergency position, but those are in no sense of the word automatic applications.

The slide valve of a triple valve becomes unseated and permitting a flow of auxiliary reservoir air to the brake cylinder might result in a momentary application of the brake if the leakage from the slide valve was in excess of the capacity of the port opening in the retaining valve or an emergency valve breaking or sticking open could apply the brake, but neither could be considered an automatic application, the movement of the piston and slide valve in the latter case being merely incidental, the actual flow of air applying to brake in either case being as direct to the cylinder as any application of a straight air brake.

When we become confused and fail to distinguish the difference between a "sticking brake" and "brakes creeping on," and blame the distributing valve for causing the brake to creep on, or blame the automatic or independent brake valve for causing a brake to stick, it proves conclusively that our study of the air brake was begun at the wrong place, that is, somewhere in the middle instead of at the beginning

Going into detail on this subject may serve a two-fold purpose, it may also remind the student of the importance and necessity of starting his air brake course at the beginning and not at the point which deals with defects of the apparatus

Attention has been called to this matter in the past, and many will agree that the correct beginning of a man's study is of as vital consequence to him as the foundation of a building is to its superstructure

It is a very common occurrence to hear men whose duties bring them in touch with air brake matters, answer air brake questions correctly in one sense and yet fail to understand the answer they give.

The question, "What is the effect of a leaky rotary valve in the brake valve," is invariably answered by, "It releases the brakes."

As a general thing it does, but there are several very ordinary conditions under which it cannot, and when the student accepts such an indefinite answer to a question as foregone conclusions and gives it no further thought, he will eventually recall instances in which he was unable to state positively what caused the trouble.

In reference to brake applying due to an overcharged pressure chamber in the distributing valve, it was stated that there was no way of charging the pressure chamber or an auxiliary reservoir except by the way of the brake pipe and feed grooves, and under ordinary conditions there is no other way, as it is assumed that the safety valve is in good condition at all times an effort is being made to locate the cause of brake sticking.

If it is not in good condition it must be put in perfect working order before any tests are conducted, so that brake cylinder pressure may be retained at or restricted to the desired figure.

In case a safety valve was inoperative an emergency application of the brake, during which time the valve handle remained in emergency position for any considerable length of time, would allow a flow of air from the main reservoir into the application cylinder of the distributing valve and consequently into the pressure chamber, the equalizing valve being in emergency position, and this would result in main reservoir pressure overcharging the pressure chamber due to an inoperative safety valve, and the brake would necessarily be released by means of the independent brake valve. The valve would be held in release position until application cylinder and pressure chamber pressures were reduced below the pressure in the brake pipe at which time the equalizing valve could again be moved to release position

It is desired to mention this in connection with brakes sticking or remaining applied when handles are returned to running position, but not to confuse it with the subject of brakes creeping on while both valve handles are in running position.

We would impress upon the minds of our readers the value of learning first, the operation, constructions, and the duties of the different parts of the air brake equipment, leaving the defects that result from wear and neglect for a later consideration, it is sure to prevent many misunderstandings and avoid numerous arguments.

Order in Learning.

The true order of learning should be, first, what is necessary; second, what is useful, and third, what is ornamental, says Mrs. Sigourney. To reverse this arrangement is like beginning to build at the top of the edifice.

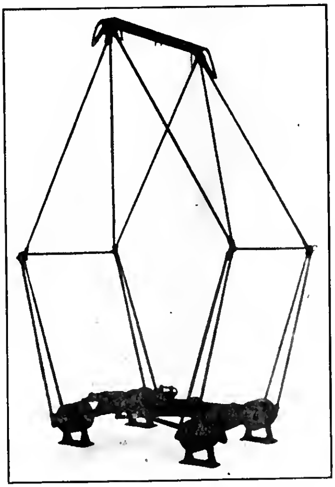
Electrical Department

Running a N. H. Electric Locomotive III.

By W. B. Kouwenhoven.

When running on direct current and approaching the alternating current zone, a post will be noticed on the right of way marked "Controller off." Upon reaching this post the engineer must immediately return the controller handle to the off position and open the small switch on the back of the controller. Meanwhile his helper, or fireman, opens the direct current main switch and closes both alternating current circuit breakers. Then the engineer presses down the button marked "Shoes and Trolleys Unlock," and holds it down until the shoes leave the third rail and fold up against the side of the locomotive and the alternating current trolleys rise. As soon as the trolleys make contact with the overhead wire, the helper starts the motor generator set and closes the switch for charging the storage battery. When the shoes leave the third rail the direct current supply is cut off and the armature of the direct current relay falls, and as soon as the alternating current enters the locomotive the two alternating current relays immediately raise their armatures. This completes the control circuit and causes the change-over switch to automatically shift from the direct to the alternating current position. When the changes-over have taken place the engineer notches up his controller handle again, being careful to see that both alternating current ammeters are reading, thus making sure that both motors are receiving power.

At Cos Cob the drawbridge is not equipped with the overhead wire and trains are supposed to coast over this gap, or drift, as steam engineers would say. Just before reaching the end of the overhead wire, the engineer should return the controller handle to the off position and allow the train to coast over the bridge, notching up—again when the overhead construction is reached on the other side. However, an alternating current third rail is provided in case a train should become stalled on the bridge. When this happens the engineer can get his train off the bridge by drawing current from this rail. To run under both these conditions the helper must see that both heater switches are closed.. Then he must remove the wooden peg against which the direct current main switch rests when it is open in the down position and close the switch in this position. Meanwhile the engineer lowers the third rail shoes by pressing the proper button and signals the tower-man in charge of the bridge to throw the current on to the third rail. Then he should operate the locomotive as in normal alternating current operation, taking care, however, to accelerate very slowly. Just before the end of the bridge and also the end of the third rail is reached, the engineer should return the controller handle to the off position, and his helper should open the direct current main switch, replace the wooden peg and pull the switch back against the peg. When the shoes leave the third rail the engineer should raise them by pressing the button marked "Shoes and Trollies Unlock," and as soon as the trolleys make contact with the overhead wire again he should draw the controller handle up to the proper running position.



ALTERNATING CURRENT TROLLEY.

In hauling very heavy trains two or more electric locomotives are necessary. When two of the electric locomotives on the New York, New Haven & Hartford Railroad are double-headed they do not operate independently, as is the case where steam locomotives are double-headed, but are operated as a single locomotive of double the horse power, and are controlled from the cab of the forward locomotive by one engineer with a single throttle or controller lever. This is similar to the ordinary multiple operation of motor cars, such as is practiced on the New York Subway, the Brooklyn Rapid Transit and many other roads.

The wires which connect the two master controllers to the unit switches or contactors, are connected in two junction boxes to what is known as the train line. A junction box is located above each master controller. The train line runs the length of the locomotive and ends in three connector or jumper sockets at each end of the locomotive. The sockets are just above the end doors of the locomotive cab, and are made so that only the proper jumper for each socket will fit it.

When double-heading two locomotives the crews make the three jumper connections with the jumpers provided for the purpose, and the air hose connections. The crew of the second locomotive remove the reverser handle and the controller plug from the master controller of their locomotive, and see that the small switches on the back of both master controllers are open. They also place the brake valves, on the second locomotive, in the running position and close the cut-out cocks under the valves by turning them to the up position. After this has been done the engineer of the first locomotive proceeds to test the control of the two locomotives, which are now operating as one, for direct and alternating current operation in both directions. While he notches up his controller handle his helper and the crew of the second locomotive watch the unit switches on their engines to ascertain that the proper ones come in on each notch, as was described in a previous article on the New Haven Electric Locomotives. While running double-header one trolley, preferably the rear one, is used on each locomotive.

The equipment of each locomotive includes an alternating current integrating wattmeter and a direct current integrating wattmeter. The alternating current wattmeter gives the amount of power consumed while the locomotive is running in the alternating current zone, and the other wattmeter gives the amount consumed when in the direct current zone. One of the duties of the engineer is to note the readings of these two wattmeters twice for each run; the first reading is taken just before leaving the station at Stamford, and the second after reaching the destination at the Grand Central station. On the return trip the readings are taken in the reverse order. The sum of the readings of the two meters gives the total amount of power in kilo-wat hours (1,000 watt hours), used by the electric locomotive during the run.

The N. Y., N. H. & H. electric locomotives are fitted with two systems for heating trains, one by electricity drawn from the power supply and the other by steam supplied by a small, oil-burning, fire tube vertical boiler within the cab. The necessity for the two heating systems is due to the fact that their long-haul trains are drawn beyond Stamford by steam locomotives and are therefore steam heated, while the cars on some of their local trains remain entirely within the electric zone, and are equipped with electric heaters.

The voltage at which the electricity, both alternating and direct current, is supplied to the heaters is about 600 volts, a single pole knife switch controls the heater circuits for both alternating and direct current, and must be closed whenever the heaters are needed. The direct current is taken directly from the third rail shoes, and the alternating current is supplied by a small transformer which may be connected to either or both of the main transformers by closing the proper two pole switches. The change-over switch automatically arranges the connections when the heaters are in service so that they receive current in both the alternating and direct current zones.

As stated in an earlier article on running these New Haven locomotives, one of the novel features is the cooling arrangement, which consists of two motor-driven fans or blowers for forcing a current of air through the four main motors, the two transformers and the resistance grids. This prevents them from becoming overheated by the passage of the electric current through them and greatly increases the continuous hauling capacity of the electric engines.

Each blower or fan supplies the air through a conduit to one motor, and the transformer and resistance grids belonging thereto. These conduits are so arranged, however, that in case of the failure of one of the fans or the motor driving it, the other fan can supply the entire equipment. Each conduit is fitted with two dampers, and in case of the stoppage of a blower, both dampers on the conduit of the stopped blower must be closed, otherwise all the air from the remaining blower will escape through the standing one. With both fans running under usual conditions, all dampers should be open. The air inlet for each fan is protected by shutters which must be closed when it is snowing or raining, to prevent moisture from being carried into the machinery by the passage of the air. During a storm the air is drawn from the interior of the cab, and the helper should open one of the doors on the lee side of the cab to supply air provided the storm is not too severe. If it is too severe to open the door he may open one or more of the trap doors in the floor of the cab.

If, when the locomotive is either running or standing, a short circuit or a ground, or an arc or spark is formed between any two points of the equipment, or smoke is discovered issuing from some point or some part becomes red hot, or an explosion occurs, or the fuses blow; in short, if any irregularity occurs, the engineer must immediately return the controller handle to the off position. If the train is in the alternating current zone, the engineer must also press the button marked "Trolleys Down" and lower the trolleys. If in the direct current zone and an arc has formed which does not clear itself, that is blow out and cease when the handle is thrown to the off position, the engineer must immediately close a small single pole knife switch which is mounted on the end of the junction box fastened to the top of the cab, just over the master controller. There are two of these small switches, one on each junction box above each master controller. The closing of this small switch closes an emergency suit known as the short circuit switch.

The short circuit switch is electrically operated by a solenoid, which is controlled by either of the two small knife switches. The closing of this short circuit emergency switch makes a dead ground on the direct current supply circuit just inside the shoe fuses, and causes the shoe fuses to blow instantly, cutting off the electric power and stopping the arc. The short circuit switch should not be left closed for any length of time, because the current which is drawn from the storage battery to operate it, is large. To open, the engineer not only opens this emergency single pole knife switch, but also he must close the main battery switches. When the arc has been cleared the engineer and his helper must place the wooden slippers between the shoes and the third rail and then proceed to investigate the cause of the trouble after opening the short circuit switch.

Now let us see what the engineer and his helper can do to bring in their train when some part of the machinery of the locomotives breaks down, and the train is out on the line. If one of the alternating current trolleys breaks or is torn off, or the current sparks over an insulator, or if any other mechanical or electrical difficulty arises with the trolleys, the engineer must immediately press the button that lowers the trolleys, and at the same time shut off the power and bring the train to a stop. If the trolleys do not come down the engineer should close the small double pole switch on the back of the controller; if this fails, the trolley can be pulled down with the wooden pole when the train comes to a standstill. The alternating current trolleys are held up by spring pressure, and they are brought down by compressed air and held down by a latch. Air is admitted to the unlocking cylinder to release the latch by the button marked "Shoe and Trolleys Unlock."

As soon as the train has been brought to a stop and the trolleys lowered the engineer and his helpers may go on the roof and clear away the broken trolley. Attached to the roof are safety chains which not only hold the trolleys down when hooked, but also make a dead ground with them. Neither the engineer nor his helper should ever go on the roof unless both trolleys are lowered, and upon reaching the roof he should snap the nearest chain to the nearest trolley and then the other chain to the other trolley. This thoroughly safeguards him from all danger of shock. If the latch fails to catch and hold the broken trolley down, it must be tied down with a rope. The trolley must be tied down on itself, not to the roof, and the engineer must be careful that none of the broken parts touch the roof. Before leaving the roof the engineer must be sure to unhook both safety chains. Upon reaching the interior of the cab the engineer should close the cut-out cock in the air line leading to the unlock cylinder of the damaged trolley, to prevent the latch releasing the trolley when the button is pressed.

If some part of a trolley breaks while running, and does not ground on the roof of the locomotive when lowered, but fails to latch down, and if the engineer does not wish to lose the time necessary to stop the train and tie down the trolley, then he can keep it down by blocking open the electro-magnet valve of the air cylinder that pulls down the trolley. This keeps the cylinder full of compressed air all the time, and thus holds the trolley down.

The alternating current trolleys are connected by a cable to which a T-connection is fastened near the No. 2 trolley which leads to the alternating current circuit breakers. When a trolley breaks and grounds it must be disconnected from the cable where it is attached to the base of the trolley. If a ground occurs in the cable connecting the trolleys to the T-connection the engineer should go on the roof and disconnect the grounded side of the T-connection at the T, cutting the grounded cable and a trolley out of service. However, if the trouble occurs in the lead from the T connection to the circuit breakers, both trolleys must be lowered, the safety chains snapped on and the engineer should call for assistance.

If, when passing from the direct to the alternating current zone, the alternating current trolleys fail to rise, it is probably due to the armatures of the direct current relay sticking up, or to the small switch on the back of one of the controllers being closed, or to the cut-out cocks in air line leading to the unlock being closed or to insufficient air pressure. The engineer and his helper should then make a rapid inspection of the apparatus and remedy the trouble.

Items of Personal Interest

Mr. J. Jackson has been appointed shop foreman, Revelstoke roundhouse, on the Canadian Pacific Railway.

Mr. D. B. Sebastian, heretofore acting fuel agent of the Rock Island Lines, has been appointed fuel agent of the same roads.

Mr. J. H. Reed has been appointed night locomotive foreman, Winnipeg roundhouse, on the Canadian Pacific Railway.

Mr. M. E. Towner, formerly purchasing agent, 'Frisco lines, has become president of the Southern Railway Supply Company.

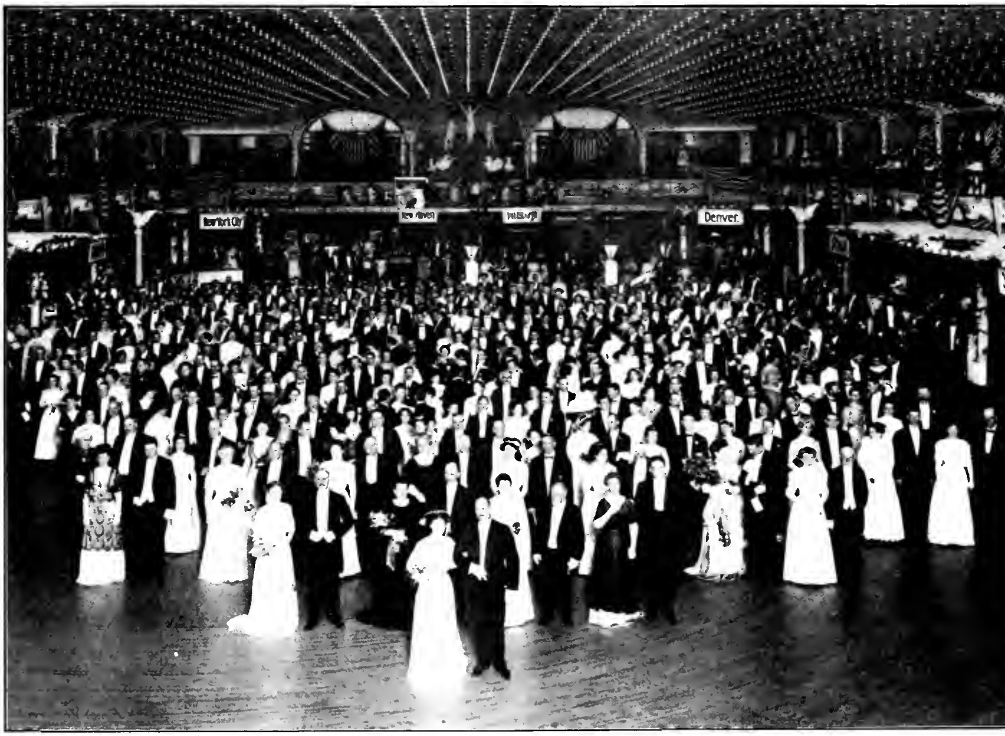
Mr. H. S. Needham has been appointed assistant engineer of motive power of the Pennsylvania Lines West, vice Mr. C. D. Young, transferred.

Mr. Joseph Turpin has been appointed general traveling engineer over the northern and southern divisions of the Temiskaming & Northern Ontario Railway, vice Mr. T. Ross, promoted.

Mr. A. L. Milliken, employed as locomotive engineer on the river division of the New York Central, has been appointed road foreman of engines on the same road.

Mr. E. J. Robertson has been appointed superintendent of car department of the Minneapolis, St. Paul & Sault Ste. Marie Railway, vice Mr. I. G. Pool, deceased.

Mr. R. J. McDonald has been appointed traveling engineer of the southern district of the Chicago & Alton, with headquarters at Bloomington, Ill.



FLASH LIGHT PHOTOGRAPH OF PROCESSION OF MASTER MECHANICS ASSOCIATION, ATLANTIC CITY, JUNE, 19[illegible]

Mr. A. W. Clarke has been appointed fuel inspector Western Lines, Canadian Pacific Railway, vice Mr. T. L. Roberts, resigned.

Mr. H. S. White has been appointed sales manager of the Detroit Seamless Steel Tubes Company, with office at Detroit, Mich.

Mr. T. Clegg has been appointed air brake instructor, Western Lines, Canadian Pacific Railway, vice Mr. F. D. Walton, resigned.

Mr. S. D. Warren, signal inspector on the Chicago, Milwaukee & Puget Sound, has been appointed assistant signal engineer, with office at Tacoma, Wash.

Mr. M. Flannagan has been appointed master mechanic of the Richmond division of the Chesapeake & Ohio Railway, with headquarters at Richmond, Va.

Mr. C. Battley has been appointed acting locomotive foreman, North Bay, on the Chicago & Alton, with headquarters at Bloomington, Ill.

Mr. J. D. Harris, general superintendent of motive power of the Baltimore & Ohio, has had his jurisdiction extended over the Baltimore & Ohio Southwestern.

Mr. A. Shortt, heretofore district master mechanic on the Canadian Pacific Railway, at Cranbrook, B. C., has been appointed master mechanic, with office at Moose Jaw, Sask.

Mr. W. J. Andrews has been appointed shop foreman Winnipeg roundhouse, on the Canadian Pacific Railway.

Mr. W. K. McLeod has been appointed locomotive foreman on the Canadian Pacific Railway at Calgary, Alta., vice, Mr. A. H. Eager, resigned.

Mr. F. E. Long has been appointed road foreman of engines of the Georgia Southern & Florida Railway, with headquarters at Macon, Ga.

Mr. F. McFarlane has been appointed locomotive foreman at Crow's Nest, B. C., on the Canadian Pacific Railway, vice Mr. A. Hall, transferred.

Mr. Don B. Sebastian, acting fuel agent of the Rock Island Lines, has been appointed fuel agent of the same roads, with headquarters at Chicago, Ill.

Mr. C. A. Wheaton, heretofore freight repair foreman of the Canadian Northern Railway at Winnipeg, has been appointed car foreman at Edmonton, Alta.

Mr. M. J. Carrigan has been appointed district foreman of the Oregon Short Line and the Southern Pacific lines east of Sparks, Nev., vice Mr. W. E. White, assigned to other duties.

Mr. A. McCowan, heretofore foreman C. P. R., Cranbrook, B. C., has been appointed general car foreman of the Canadian Northern Railway at Winnipeg, vice Mr. J. H. Morgan, retired.

Mr. J. C. McDonald, general passenger agent of the National Lines of Mexico, has resigned to become assistant to J. N. Galbraith, general manager of the Waters-Pierce Oil Co., in Mexico.

Mr. T. A. Musgrove, heretofore car foreman, C. P. R., Ottawa, has been appointed freight repair foreman of the Canadian Northern Railway at Winnipeg, vice Mr. C. A. Wheaton, transferred.

Mr. A. Hall, heretofore locomotive foreman at Crow's Nest, B. C., on the Canadian Pacific Railway, has been appointed locomotive foreman at McLeod, Alta, vice Mr. H. McDonald, transferred.

Mr. W. Owens, formerly with the New York Air Brake Company, has been appointed general air brake and fuel inspector on the Lehigh Valley Railroad, with headquarters at South Bethlehem, N. Y.

Mr. T. H. Goodnow has been appointed master car builder of the Chicago, Indiana & Southern and of the Indiana Harbor Belt Railroads, with office at Englewood, Ill., vice Mr. J. W. Senger, transferred.

Mr. L. R. Pomeroy, assistant to the president of the Safety Car Heating & Lighting Co. of New York, has resigned to take an important position with the engineering and contracting firm of J. G. White & Co.

Mr. J. F. Killeen has been appointed general mechanical foreman of the Washington division of the Oregon Railroad and Navigation Company, with office at Starbuck, Wash., vice Mr. M. E. Carrigan, resigned.

Mr. T. Ross, heretofore locomotive foreman, North Bay, on the Temiskaming & Northern Ontario Railway, has been appointed acting master mechanic, vice Mr. A. Allen, resigned. Office North Bay, Ont.

Mr. A. H. Eager, heretofore locomotive foreman, C. P. R., at Calgary, Alta., has been appointed superintendent of shops and repair yards, of the Canadian Northern Railway at Winnipeg, Man. This is a new position.

Mr. J. W. Rohrer, who has been a locomotive engineer on the Columbus, Hocking Valley & Toledo, has been appointed a representative of the New York Air Brake Company, with headquarters at Columbus, Ohio.

Professor H. M. Cottrell, for many years director of farmers' institutes at Kansas and Colorado agricultural colleges, has accepted the position of agricultural commissioner of the Chicago Rock Island & Pacific. His headquarters will be in Chicago.

Mr. Robert W. Baxter has been appointed general superintendent of the lines north of the Ohio River, on the Illinois Central Railroad, also general superintendent of the Indianapolis Southern Railroad, with headquarters at Chicago, Ill., vice Mr. Charles L. Ewing, resigned.

Mr. W. E. Lowes has been appointed assistant passenger agent of the Baltimore & Ohio, with headquarters at Baltimore, Md. Since 1897 Mr. Lowes has been general advertising agent of the company, and in his new position he will continue to have charge of all advertising matters as heretofore.

Mr. Daniel Willard, president of the Baltimore & Ohio, recently announced the creation of an additional "assistant to the president," and the appointment to the post of Mr. George H. Campbell, general superintendent of the New York division and vice-president of the Staten Island Rapid Transit.

Mr. Dudley Walker, formerly advertising agent of the Chicago & Alton Railroad, has resigned his position with that road in order to enter the newspaper magazine and outdoor general advertising agency. He has organized a company known as Dudley Walker & Co., with headquarters at Chicago, Ill.

It is announced by Dean Goss of the College of Engineering that the testing plant at the university lately donated by the Chicago & North Western Railway will constitute a portion of the equipment of the School of Railway Engineering and Administration, and that when installed it will be operated under the immediate direction of Professor Edward C. Schmidt, who is in charge of railway engineering.

Mr. W. C. Brown, president of the New York Central, and Mr. Daniel L. Cease, editor of the *Railroad Trainmen's Journal*, have been appointed by President Taft as members of the commission that will investigate employers' liability and workmen's compensation. Senators Hughes of Colorado and Warner of Missouri, and Representatives Denby of Michigan and Brantley of Georgia, also are members of the commission. When Congress meets in December it will in all probability have some data on which to frame an employers' liability act.

Mr. Edward L. Lomax, general passenger and ticket agent of the Union Pacific, has resigned, and has now become passenger traffic manager of the Western Pacific. The change will be as great a loss to the Associated Lines as it will be a gain for the Western Pacific, for Mr. Lomax is recognized as one of the ablest passenger traffic men in America. He has been with the Union Pacific since 1887, when he became assistant general passenger agent, his promotion to the head of the department was made two years later. Previously he had been assistant general passenger agent of the Burlington. He has been in railroad service since 1869.

Mr. James J. Gill has been appointed an assistant supervisor of equipment by the Public Service Commission of the second district, New York State. Before his appointment Mr. Gill was road foreman of engines on the New York Central, having charge of 125 locomotives and 300 engineers and firemen. He entered the railroad service as a fireman and then was for eleven years engineer on freight and passenger trains of the New York Central. During that time he made air brake and other experimental tests for the company. In 1901 he was promoted to be traveling engineer, assuming control of the inspection of wrecked locomotives and learning the causes of equipment troubles. In that connection his duties included the investigation and testing of new engine appliances, the instruction of the method of operating such as were adopted, and the preparing of work reports covering general repairs made. The division of engineering and inspection of the public service commission, which Mr. Gill will enter, has supervision over the equipment of steam railroads, particularly motive power, and also the investigation of accidents due to faulty equipment. The creation of the place to which Mr. Gill is appointed was urged by the railroad brotherhoods before the Legislature. Mr. Gill stood first on the civil service list and his appointment was recommended by the Brotherhood of Locomotive Engineers.

General Foremen's Department

The General Foremen.

Writing to Railway and Locomotive Engineering on the subject of the next convention, Mr. C. H. Voges, president of the International Railway General Foremen's Association, says: "Next May will be the seventh year of our association's existence and I would like to stir up every general foreman and get him interested in our movement. I am sure every member derives a great benefit from the association, especially in attending the conventions, where everything connected with our line of work is discussed and debated. I would like to impress upon all superintendents of motive power that it greatly benefits their foremen to be members of the International Railway General Foremen's Association and that they should do their part in persuading their foremen to become members.

"I think we should have 300 or 400 present at the next convention in Chicago. The date has not yet been decided, but will be published later. Our secretary, Mr. L. H. Bryan, is a very willing and hard worker for the association and surely deserves great credit for what he has done.

"I agree with Mr. Quayle, superintendent of motive power, of the Chicago & North-Western. In his remarks at the convention he said if he was a foreman he would most certainly be a member of this association, as he would want to be in big company. C. H. Voges,

President I. R. G. F. A.

Superheaters.

This paper was read at one of the morning sessions of the International Railway General Foremen's Association recently held at Cincinnati, by Mr. A. L. Ball, general foreman of the C. & I. S., at Kankakee, Ill., on the subject of superheaters. Mr. Ball said, in presenting this paper at this convention, I had expected to furnish considerable information on tests of superheaters which have been carried on during the past year, but owing to the fact that the railroads from which I had expected to procure this information, not having finished their tests, it was impossible to secure the desired information. In reply to my correspondence with one of the railroads I received the following: "We have but one locomotive fitted with superheater, and that of the smoke-box type, giving but a moderate degree of superheat, in the neighborhood of 50 degrees.

"This locomotive is of the consolidation type, has cylinders 25 by 28 ins. and carries 180 lbs. steam pressure, as compared with our regular locomotive of that type, having cylinders 22 by 28 ins. and carrying 205 lbs. working steam pressure. Trials on the locomotive testing plant and on the road seem to indicate a slight superiority for the locomotive fitted with superheater, but it is not sufficiently great to enable us to say positively whether the superheater or some local condition of the locomotive accounts for the difference."

In the last twenty-five years steam pressures on locomotive boilers have been gradually increased from 140 to 225 lbs. working pressure. The result has been that the cost of boiler repairs has been very much increased on account of the decreased life of firebox staybolts and flues. Superheating affords a convenient means of adding heat to steam without materially increasing its pressure; also the advantage to be obtained by enlarged cylinders. There is no question but that considerable economy is obtained by the use of superheated steam, preferably of reduced pressure, say of 160 lbs., to avoid excessive boiler repairs. This is especially desirable in bad water districts, and it is possible to effect considerable economy in this direction.

The smoke-box type of superheater develops a low superheat of 25 to 50 degs. Fahr. The single-loop fire-tube superheater, a moderate superheat of 100 to 125 degs. Fahr. The double-loop fire-tube, a high superheat of 175-250 degs. Fahr. Saturated stream at 160 lbs., has a temperature of 370 degs.; at 200 lbs., 388 degs.; and at 225, 397 degs., or an increase in heat of about 27 degs. for practically the entire range of pressures in locomotive practice. The low degree of superheat as afforded by the smoke-box superheater adds 35 to 40 degs., which is more than can be obtained by means of high pressures. Moderate and high superheat, on the other hand, affords a convenient and practical means of adding from 100 to 250 degs. of heat.

When superheated steam has received, say 175 degs. of additional heat after removal from contact with the water, it is found that 175 degs. of heat can be extracted at a constant pressure before it reaches the dew point. Therefore, its expansion will partake of the properties of gas, and the loss due to the condensation and re-evaporation of the cylinder walls will be largely obviated.

The advantages of superheated steam are: At high temperatures it behaves like a gas and is, therefore, in a far more stable condition than in the saturated form. Considerable heat may be extracted without producing any liquefaction, whereas the slightest absorption of heat from saturated steam results in condensation. If the superheat is high enough to supply not only the heat absorbed by the cylinder walls, but also the heat equivalent of the work done during the expansion, then the steam will be dry and saturated at release.

The firebox temperatures in locomotives must be at least 1,800 to 2,200 degs. The smoke-box temperatures will range from about 550 to 700 degs. Tests made on superheaters show a saving of 12 to 20 per cent. in fuel, and a saving in water of 15 to 25 per cent., it being larger because more fuel is required for the production of one pound of superheat than for the same quantity of saturated steam.

In order to obtain 150 to 175 degs. of superheat and over, it is necessary to resort to the fire-tube form of superheater, as it is not possible by any designs of smoke-box superheaters to get sufficiently high temperatures in the smoke-box without using a large 10 or 12-in. flue in the bottom of the boiler, as in the Schmidt earlier designs. The use of these large flues have been abandoned, even by Schmidt, on account of the extra cost of installation and maintenance, and practically all the designs recently equipped with the Schmidt system have used the fire-tube style.

One disadvantage of the smoke-box type is that the entire extra weight is concentrated at the front end in a line approximating the vertical center of cylinders. This means with a four-wheel leading truck that all the extra weight is practically added to the truck. On the other hand, the fire-tube type distributes the weight much more uniformly.

From observations made in Europe it has been found that the Germans have abandoned the smoke-box type in favor of the fire-tube, chiefly on account of the concentration of weight at the front end, the extra cost and the necessity of using a large tube to raise the temperature of the smoke-box gases. Furthermore, they attach much importance to the greater simplicity, ease of application and dismantling; and they state that these advantages have proved of such practical value that for all new locomotives the fire-tube type is being used at the present time.

While at a first glance the smoke-box

type may appear to possess some attractive features, especially in the utilization of the waste heat in the smoke-box gases, in practice it is found impossible to obtain more than a few degrees of superheat without increasing the diameter of the boiler tubes, as the temperature of the smoke-box gases is not sufficiently high to impart more than 25 to 35 degs. over the normal temperature of the saturated steam in the boiler. It is, therefore, practically little better than a drier and the economies in fuel and water which may be obtained are insignificant as compared with the use of superheated steam of 200 to 250 degs.

It is probable that the trials made in the West with the smoke-box superheat are largely in bad water districts where, on account of boiler foaming, an abnormal amount of water is carried to the cylinders. It is, therefore, possible that in the East where these conditions do not exist to the same extent, that the relative economy would be very much less.

The fire-tube form of superheater possesses important advantages over any type of smoke-box superheater, as it is possible to obtain any desired practical amount of superheat. The economy in water and coal increases very rapidly with the higher temperatures, and with 150 to 200 degs. of superheat, a conservative estimate of the saving in coal is 20 per cent., and in water 25 per cent.

To obtain the best results the boiler pressure can be very much decreased, there being no theoretical or practical economy in the use of high boiler pressures, as the necessary heat added to the steam after its removal from contact with the water, thereby increasing the volume with constant pressure. At the present time the application of superheaters to locomotives constitutes the most attractive and practical forms of improving their power and efficiency. The cylinders can be enlarged to permit greater ratios of expansion, economy of water and fuel and the use of lighter engines, which will develop a greater amount of horsepower per unit of weight than is possible with the saturated steam locomotive.

About the only additional care required in the operation of locomotives supplied with superheaters capable of heating the steam to high temperatures, is blowing out the flues after each trip to remove accumulations of soot and cinders. This, however, is the regular practice of some roads with saturated steam locomotives and probably well repays the slight extra cost on account of the better conductive qualities of the tubes when they are in a clean condition.

One of the claims made in favor of the smoke-box type is that it is better adapted for application to old locomotives in which it is desirable to reduce the pressure. The principal difference in cost is the renewal of the tube sheets required with the fire-tube type, but in case the firebox was worn out or if engines selected for the application of superheaters required new firebox tube sheets there would be practically no difference in the cost of application.

To renew the boiler tubes requires dismantling of the smoke-box type of superheater, as usually constructed, but most of the small flues can be removed, especially those in the bottom of the boiler in our later form of fire-tube type without dismantling the superheating apparatus. The superheating tubes in the smoke-box type seem to be exposed to a great deal more cutting action from the cinders, as they are at right angles to the flues and to the gases, than the fire-tube type; which would make them very short lived. The higher degree of superheat, the more the diameter of the cylinders can be increased over the normal dimensions and consequently increase the starting power, and greater ratios of expansion can be obtained for certain types of engines within the limits of suitable factor of adhesion.

The most economical results with the fire-tube type are obtained with a superheat of 180 to 280 degs., with boiler pressure of 160 lbs., the temperature of the saturated steam is 370 degs. and the temperature of the superheated steam at the figures named would be 550 to 650 degs. With suitable design of piston valve and proper lubrication no special difficulty has been experienced in actual operation.

For a superheat of 200 degs. the increase in volume is approximately 25 per cent., so that with the same cut-off the weight of steam required is 25 per cent. less than with saturated steam with the same pressure. Generally the cut-off can be decreased with superheated steam so that additional economy is obtained by the greater ratio of expansion, which added to the fact that superheated steam does not condense until it has given up all its superheat and the point of saturation is reached, adds still further to its economy.

As the limits of tractive power at medium and high speeds is largely a question of the ability of the boiler to generate sufficient steam, it will be apparent that a locomotive capable of developing the same tractive power with 80 per cent of the normal consumption of fuel will show a large increase in tractive power assuming the same amount of coal per hour is burned as in a saturated steam locomotive. This increase under favorable conditions may amount to 30 or 33 per cent.

Fast Repair Work, C., H. & D.

Mr. W. H. Roberts, locomotive engineer on the Cincinnati, Hamilton & Dayton Railway, writes us of some very fast time made in overhauling C. H. & D. engine No. 384, at the Indianapolis, Ind., shops. Perhaps the best way of presenting the information in complete form is to quote the letter sent us by Mr. Roberts. It is the report of Mr. F. C. Pickard, assistant master mechanic, sent to Mr. H. H. Hale, the master mechanic at Lima. He says:

"This report covers in detail the work and time consumed in turning out engine No. 384. She was put on transfer table early Monday morning, June 20, 1910, was moved to back shop, ready to be stripped 7:10 a. m., June 20, 1910; cab taken off 9:20 a. m., running boards 9:50 a. m. At this time engine was completely stripped. Begun jacking engine 10:10 a. m.; engine truck out 10:40; all wheels out at 1:30 p. m.; engine blocked 2:30 p. m.: cross heads and guides stripped, cleaned and delivered to machine 3:10 p. m.; steam chest valves, yokes, spring rigging, brake, rigging stripped, cleaned and distributed to the departments handling the work at 5 p. m.; wheels stripped of boxes, eccentrics and straps, distributed to machines, 5:30 p. m.; driving box brasses taken out, cleaned and taken to lathe 5:45 p. m.; reverse lever and links delivered to link bench 5:58 p. m., June 20, 1910. June 21, pedestal jaws trued up, binders, rocker boxes refitted; took tumbling frame off shaft; deck bolts examined, guide bolts out and renewed. June 22, 1910.—Rocker boxes repaired and hung new guide yoke, bolts applied, new deck bolts applied, sand box valves repaired, guides rehung, new studs applied to expansion buckles, new studs for fire door applied, shaker rigging and running boards studs out, holes retapped, studs removed, all washout holes retapped and plugs renewed, eccentrics applied. June 23, 1910.—Expansion buckles fitted by blacksmith, running board brackets, tumbling shaft, new bushings applied, new bolts applied, valve seats faced, chests closed, driving boxes fitted and applied, eccentric straps, spring rigging hung. June 24, put up cross head piston cab brackets, deck sheets fitted wheeled engine, all holes tapped in boiler sheets for fountain and checks, bell and yoke overhauled, ringer repaired and applied, air pump applied, driver brake reservoirs, also brake rigging applied. June 25, shoes and wedges put up, engine trammed, running boards applied, air drums hung, reverse lever quadrant and reach rod and links hung, engine pipes reset, dome closed, throttle connected, engine ready for boiler test. June 27. Engine tested, cab put on, lagging applied, jacket applied, boiler cocks put on, valves set, piping up cylinder cocks and rigging applied. June 28th, eccentrics keyed, rods hung and connected, engine taken out of shop at 5:30 p. m., June 28, 1910. June 29, tank coupled, engine fired and steam tests out in yard 1 p. m. two hours. This report covers work of machine, blacksmith, tinner, carpenter, paint and tank departments.

Report in detail covering boiler work on engine No. 384 is as follows:—Monday, June 20, ash pan removed, front end rigging removed, flues and cut rivets at the back end connection of boiler. June 21, removed old back end of boiler and applied new one. June 22, riveted back end at connection. June 23, stay bolts applied throat sheet and braces to back flue sheet, caulked seam at boiler connection. June 24, flues applied. June 25, work on flues completed, ready to test. June 27, boiler tested, removed and burst flues renewed, applied ash pan and front end rigging.

Subjects for General Foremen, 1911.

The subject for the 1911 convention of the general foremen's association with the chairman of each committee are given below. The subjects are not too numerous to prevent a careful and profitable discussion being made on each:

1—How can shop foremen best promote efficiency? F. C. Pickard chairman, master mechanic, C. H. & D. Ry., Indianapolis, Indiana.

2—Why is it necessary to have wheel fit, engine truck and driving wheels, larger than diameter of journals? Stephen A. Motta chairman, general foreman Nat. de Mex. Ry., Aguascalientes, Mexico.

3.—Shop Kinks, H. D. Kelley chairman, general foreman C. & N.-W. Ry., Chicago, Ill.

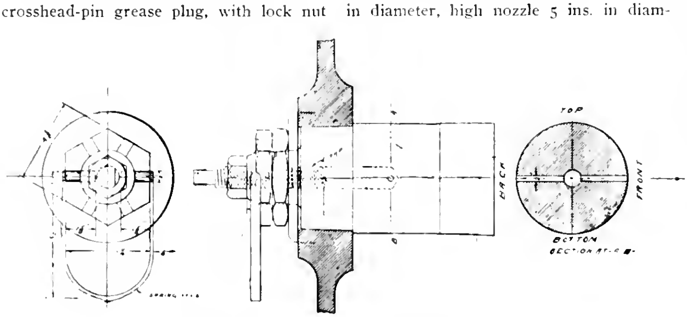
4—Methods of Shop Organization. D. E. Barton, chairman, general foreman, locomotive department, A. T. & S. F., Ry., Topeka, Kan.

Crosshead-Pin Grease Plug.

Editor:

I am enclosing sketch showing the crosshead-pin grease plug, with lock nut as used on our locomotives on the Big Four road. The device is giving perfect satisfaction, it is the most economical and is very easily applied to an engine. It was gotten up at the Bellefontaine shop. C. H. VOGES.

Bellefontaine, O.



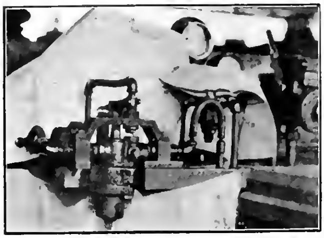
CROSSHEAD-PIN GREASE PLUG BIG FOUR R. R.

Illinois Central Railroad Company.

Editor:

Enclosed please find photographs and a blue print of an air device for clamping plain triple valves. It is too simple to require any explanation. This device saves considerable time, as it was formerly necessary to pipe each triple in order to test it. E. L. BOWEN.

McComb City, Minn.



DEVICE FOR CLAMPING TRIPLE VALVES.

Fuel Economy.

Regarding the coming convention of the Traveling Engineers' Association an engineer writes us as follows:

"For a number of years I have contended that the waste of fuel, smoke, fire, and cinders were caused by an imperfectly constructed front end, creating imperfect draft and imperfect combustion, and not the fault of the firemen, which has been the excuse since 1903. A reference to Traveling Engineers conventions 1902 and 1903 would be very advisable in this case, and ask the question 'Why?'

"Twenty years ago I ran an 18 x 24-in. cylinder, 45-ton engine with 3½ double nozzle, Blood diamond stack, evaporating 2,000 gallons of water per ton of coal. Later the engine was equipped with an extension front end, straight stack 15 ins. in diameter, high nozzle 5 ins. in diameter, the evaporation about the same; the only trouble being a tendency to fill up front end. That engine is today equipped with the standard master mechanics' front end 3½ single nozzle and evaporates 1,000 to 1,250 gallons of water per ton of coal.

That is a sample of results. At that time I never heard of any analytical tests of the gases from the front ends, but of late years a number have been published, which show a large percentage of carbon monoxide (CO), very little or no carbon Dioxide (CO_2) when it should be a maximum of 15 per cent. CO_2 and no CO. Also the fact that the general average of evaporation is about 1,000 gallons per ton of coal when it should be 3,000 gallons per ton if—not the firemen by a long shot. Automatic stokers have failed for the same reason, not the defective construction or operation of the stoker. In addition, riding on a train is made a misery from cinders and smoke, which if consumed in the firebox would create heat. And it can be done.

Collapsed Flue.

Some of the investigations made by the British Board of Trade into the cause of boiler explosions are particularly interesting as showing the causes that conduce to these disasters. At Leicester, England, an explosion occurred on the Midland Railway, resulting in the severe scalding of the engineer, and the investigation showed that the rupture of one of the flues was caused by the action of the furnace gases and the abrasion of particles of fuel on the inner side of the tubes. The flue collapsed for a length of nearly five feet near the smoke-box end, the steam pressure at the time being 120 lbs. per square inch. The explosion was so violent that the steam and water rushed through the flues into the firebox, forcing open the firebox door. The thickness of the collapsed flue was found to vary from .041 to .026 of an inch, or less than one-fortieth of an inch in thickness. The original thickness of the tubes was No. 12, B. W. G., at the firebox end and No. 14, B. W. G., at the smoke box end.

TRIPLE VALVE CLAMPED FOR REPAIRS.

Relief and Pensions.

The Pennsylvania's voluntary relief department is to have a pension branch. The plan provides that each member shall contribute two cents a day in addition to dues to insure a pension of $25 a month voluntary at sixty years after thirty years' service, and compulsory at seventy years.

Editorial Correspondence

By Angus Sinclair

Bern, Switzerland, July 10, 1910.

We Americans are so zealous to dispatch business expeditiously that our conventions for the transaction of association business are generally rushed through with feverish haste and much left undone that deserves to be performed. That comes from the practice of limiting the convention to three days' duration. Today I am attending the conclusion of the meetings of what the journals call De La Huitiome Session De l'association International du Congrès des Chemin de Fer, that is the eighth session of the International Railway Congress, which has lasted twelve days.

A railway congress resembles a number of railway conventions formed into one with a variety of meetings, and dealing with diverse subjects. If the American Railway Association, the American Railway Master Mechanics' Association, the Master Car Builders' Association, the American Railway Engineering and Maintenance of Way Association and the Traveling Engineers' Associations were all to meet together at one place, listen to an opening address from such a personage as Judge Lowell, president of the Harriman lines, and then divide up into sections for the discussion of subjects in which the various sections were interested, that would be a railway congress.

The Eighth International Congress has devoted attention to nearly all subjects that railway men are interested in, and information has been brought out which cannot fail to be of permanent value, information calculated to break up the narrow place or locality prejudices that are always springing up among persons accustomed to do things in only their own way.

This has been the largest congress held by the association, 729 delegates having been present, nearly every country in the world with railways being represented. At the previous meeting, which was held in Washington five years ago, their were 582 delegates in attendance. Want of space prevents me from naming the delegates who represented railways at this great meeting, but I think the readers of RAILWAY AND LOCOMOTIVE ENGINEERING will be interested in knowing who were there from the United States and bearing other particulars about railway representatives. Strangely enough there was no delegate from Canada, which appears doubly strange when the other countries represented are considered.

A person mixing with the delegates for a week and trying to find out their views on the topics of interest to their class could not fail to be impressed with the world-wide expanse of their various spheres of usefulness; but it needed an examination of the register to fully realize the wide-spread interest manifested in the eighth session of the International Railway Congress.

The railway managers of Great Britain and Ireland must have taken a keen interest in the Congress, for they sent 75 delegates, the largest list from any one country. France came next with 71, then Switzerland with 68, which seemed to embrace the whole of their leading officials. Russia sent 61 delegates, which was a large representation. The individuals seemed to be remarkably well selected, for they were noted for the fluency with which they could use different languages. The detailed list reads: Germany, 41; Austria-Hungary, 31; Italy, 30; Belgium, 22; Spain, 20; Portugal, 19; Sweden, 18; Holland, 18; Denmark, 12; Turkey, 10; Norway, 6; Finland, 6; Roumania, 5; Greece, 3; Bulgaria, 3.

Other countries besides the United States, far away from Europe, were remarkably well represented. India had 19 delegates, Argentine, 13; Algeria, 10; then Japan sent 5; China, 4; Turin, 3; Egypt, 2; Australia, 2; Natal, 2; Mexico, 2; Chili 2; Peru, 1; Bolivia, 1; Paraguay, 1, and far Siam, 1.

The speeches and discussions in the meetings were confined to English, French and German, but the talk heard in the lobbies and in the hotels was of an extraordinary diverse character. A large proportion of the delegates were accompanied by ladies, and many of them had children who chattered most fluently in their native tongues in a most amusing fashion. The street cars in and around Bern were free to the delegates and the guests, a privilege that was highly appreciated. They seemed to be crowded all the time, especially by women and children, and the diversity of tongues heard gave a good idea of Babel.

Considering the distance they had to travel the delegates from the United States were remarkably numerous, 48 in all, as follows: Messrs. F. W. Allen, Erie; W. F. Allen, American Railway Association; W. G. Besler, Central Railroad of New Jersey; F. S. Blair, Pittsburgh, Shawmut & Northern; C. W. Bradley, Chesapeake & Ohio; J. A. Brown, Interstate Commerce Commission; C. W. Buchholz, Erie; C. Peter Clark, American Railway

Association; F. H. Clark, Chicago, Burlington & Quincy; Geo. L. Connor American Railway Association; D. F. Crawford, Pennsylvania; Geo. W. Crichton, Pennsylvania; W. C. Cushing, Pennsylvania; L. J. Day, Chicago & Alton; J. F. Deems, New York Central; Dr. P. H. Dudley, New York Central; I. L. Eysmans, Cumberland Valley; W. A. Garrett, U. S. Commerce Commission; William Garstang, Cleveland, Cincinnati, Chicago & St. Louis; Col. H. S. Hains, U. S. Commerce Commission; Arthur Hale, American Railway Association; W. J. Harahan, Erie; W. E. Hoyt, New York Central; H. A. Jaggard, Pennsylvania; M. C. Kennedy, Cumberland Valley; W. H. Lewis, Norfolk & Western; E. E. Loomis, Delaware, Lackawanna & Western; J. A. McCrea, Pennsylvania; John D. N. Macomb, Atchison, Topeka & Santa Fé; N. D. Mahar, New York & Western; W. Mahl, Harriman lines; W. S. Morris, Chesapeake & Ohio; B. C. Mulhern, Pittsburgh, Shawmut & Northern; R. M. Patterson, Pennsylvania; A. H. Plant, Southern; Chas. E. Schaff, New York Central; John Sebastin, Chicago, Rock Island & Pacific; John G. Shedd, Illinois Central; W. M. Simpson, Manistee & Grand Rapids; Angus Sinclair, Erie; A. H. Smith, New York Central; A. Stewart, Southern; G. W. Stevens, Chesapeake & Ohio; John C. Stuart, Erie; Theodore Voorhees, Philadelphia & Reading; W. W. Wentz, Chicago, Peoria & St. Louis.

There were several American business men in attendance, among them General Miller, of Franklin, Pa.; Willard A. Smith, of the *Railway and Engineering Review;* James McNaughton, of the American Locomotive Company; Lawford H. Fry, of the Baldwin Locomotive Works, and others.

The American delegates displayed considerable interest in the proceedings and were in evidence in the discussions of the various sections. Dr. Dudley, of the New York Central, having taken a very active part, both in relation to train operation and also locomotives. He presented a summary of a paper on high speed locomotives, prepared by Mr. Wm. Garstang, of the Big Four system. Messrs. J. Peter Clark and W. J. Harahan discussed the utility of gasoline automobiles for special railway service. Mr. H. A. Jaggard, of the Pennsylvania Railroad, took a prominent part in the discussion of signals. An exhaustive discussion on railway statistics was participated in by Messrs. R. M. Paterson, Theodore Voorhees, A. H. Plant, Wm. Mahl, R. M. Patterson, W. G. Besler and others. Mr. D. F. Crawford read a paper on locomotives, and was actively in evidence in various discussions. Space will not permit me to enter into details of the business done at this congress, but I expect to do justice to the various questions in future issues.

HISTORY.

The International Railway Congress was inaugurated with a railway convention held at Brussels in 1885, promoted by the Belgian government for the purpose of celebrating the 50th anniversary of the introduction of railways. Mr. Alfred Picard, the first president of the permanent commission, had the idea of forming a union of railways, postal business and telegraphs, but this wide scheme proved impracticable and a purely railway organization was formed. The influential originator of the organization called a meeting for 1886, and there a committee of five directors was chosen, to whom the power of general management was given. The following meetings have been held up to date: 1st, Brussels in 1885; 2nd, Milan in 1887; 3rd, Paris in 1889; 4th, St. Petersburg in 1892; 5th, London in 1895; 6th, Paris in 1900; 7th, Washington in 1905, and 8th, Berne 1910. The congress has settled down to the holding of meetings every five years, and the next one will be in Bertree.

Some notes concerning Bern, the place of meeting, may prove acceptable.

CITY OF BERN.

The story of Switzerland by Linda Hug and Richard Stead says: "Bern presented the most perfect example of an oligarchy. Her decided bent was for diplomacy, and she was completely absorbed in rule and administration, and she had few other tastes. Trade and industry she considers beneath her dignity; even literary pursuits to a great extent. The Bernese aristocrats were politicians from birth, and the young men had a curious society founded for the purpose of cultivating the diplomatic art and practicing parliamentary tactics and oratory. Thus trained in bearing and ceremonial they acquired their much admired political *aplomb*. Bern was French in fashion, in manners and in language, and the German tongue was as little appreciated among the Bernese patricians as at the Court of Frederick the Great.

"The constitution presents some unique features. There was an exclusiveness which has lasted in all its force down to our own days. Three classes of society sprang up, as widely separated from each other as the different castes in India. All power was vested in the 360 reigning families, the number of these was at length, by death and clever manipulations, reduced to 80, and even fewer. From those families alone were the councils selected, and to the members of those only were the government assigned. If male heirs were wanting, then the seats on the council were given to the daughters as dowries. So exclusive was this governing body that even Haller, the great poet, was not allowed to enter it. The class next lower in rank was that of the *ewigshabitanten* with no political rights and with not a vestige of power in the commonwealth. They were not allowed to hold officerships abroad, but trade, industry and the schools and churches were theirs. Lastly came the *Ansassige* (settlers), the proletariat, including the country laborers, foreigners, refugees and common folk generally. Many were their disabilities, they were not permitted to buy houses, to have their children baptized in the city, to have tombstones set up over the graves of their families. They might not even appear in market until their betters had done their business, viz.: 11 a. m., and they were strictly forbidden to carry baskets in the archways, in order that these should not damage the hooped petticoats of the patrician ladies."

Electric Fixtures.

We have received from the Safety Car Heating and Lighting Company, of New York, a number of catalogue sheets showing the great variety of electric light fixtures made by them for use in passenger cars. The sheets contain half-tones showing the fixtures and each has a number which is tabulated in a general index for the purpose of facilitating the work of ordering or duplicating parts.

An ordinary observer would be astonished at the variety and the elegance of the fixtures and their adaptability to every variety of passenger car lighting. No style, and no form of ornamentation seems to have been omitted and the large number of separate designs shown is evidence of the popularity of electricity as applied to train lighting. The sheets are perforated ready for attaching in a standard catalogue holder. Write to the company, No. 2 Rector street, for further information on the subject.

The Baldwin Exhibit.

The Baldwin Locomotive Works have a fine exhibit at the Buenos Aires Exhibition. Besides a ten-wheel passenger engine there is a consolidation engine both built for the Entre Rios Railway [illegible] Argentine, and other exhibits from the Baldwin Works. A finely illustrated pamphlet descriptive of the exhibits is issued in Spanish, [illegible] and English. The pamphlet gives a good description of the Baldwin Works and also of the Standard Steel Works at Burnham, Pa. The exhibit shown by the steel works consists of locomotive parts such as cast iron steel-tired engine-truck wheels, cast steel truck wheels, tires, axles, springs and other parts of locomotive work. The exhibit attracts much attention.

Crude Asbestos.

Asbestos rock when it comes from the mines is in appearance much the same as other rock. When scientifically crushed this rock produces long, tough fibers which are woven into cloth for asbestos theater curtains, made into sheets of felt for roofing, and treated in various ways for making hundreds of different fireproofing materials. In making the J-M. asbestos roofing, several sheets of asbestos felt are thoroughly saturated with genuine Trinidad Lake asphalt, well known as the most permanent waterproofing material there is in existence. These sheets are then cemented firmly together with this asphalt, making one homogeneous mass. This, then, constitutes an actual covering of stone, which, because of its all-mineral nature, not only offers to a building protection against fire, water, wind and weather, but which also naturally cannot rot, rust, melt, run or crack, and requires no painting to preserve it. It is said to be able to withstand the flame of a blow-torch for an hour without being injured. This roofing is made by the H. W. Johns-Manville Co., of New York, well known as manufacturers of asbestos products. A copy of the very handsomely illustrated catalogue, which we received from the manufacturers, will be sent to any of our readers inquiring for it from the company.

Early Railway Signal History.

A station master, one of the pioneers of signalmen on the Darlington Railway, placed a lighted candle in the window of the station when it was desired to stop the train, and left the window in darkness if the line was clear. The first real signals were flags waved by hand, afterward these were placed on lofty poles and surmounted at night by lamps, with red or white lights. In 1837 the disk signal fixed on a pole came into use, which was turned edgeways when the line was clear. Gradually the semaphore, adopted in 1842, came into use, just eleven years before the block system was introduced. In [illegible] a plan of interlocking the levers was invented, but it was not until 1859 that the first interlocking frame was set in action at Willesden.—*London Chronicle.*

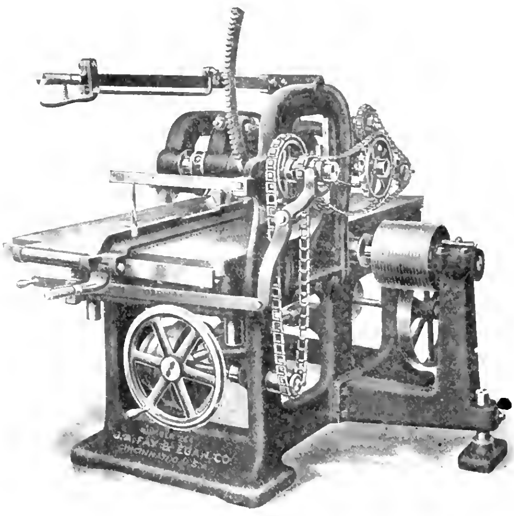
Open once the door to trouble and its visits are threefold, first anticipation; second, in actual presence; third, in living it over again.—*Watchman.*

New Self Feed Rip Saw.

Messrs. J. A. Fay & Egan Co., the well known manufacturers of wood-working machinery, have asked us to introduce to our readers their new No. 264 self feed rip saw and as our readers will be interested in this class of tool, we give a brief description below:

This saw is designed for general ripping in the car shop, and will be found a satisfactory tool for both light and heavy work. The frame is a very heavy structure, cast in one piece and is absolutely free from vibration. This machine rips 4 ins. thick with a 16-in. saw, and 8 ins. with a 24-in. blade. It takes 19 ins. between saw and fence. By lowering the table and raising the feed out of the way a timber as large as 12 ins. can be ripped. The table is raised and lowered by worm segments and is 37¼ ins. wide and 5 ft. 6 ins. long. The fence is 2¼ ins. high and 40 ins. long and can be instantly moved and clamped in any position. The mandrel pulley has an outside bearing supported by a heavy arm bolted on the side of the frame. The feed consists of two large rolls above and one spur, assisted by idler rollers in the table. The driving mechanism is the strongest possible, consisting of a train of sprocket gears and chain regulated by three step cone pulley. This machine is also made as a hand feed rip saw, with a capacity for 14 ins. thick and with the fence beveling 45 degs.

For further particulars concerning this tool, you are invited by the manufacturers to write for their large illustrated circular. The address of the company is Cincinnati, Ohio.



FAY & EGAN NEW SELF-FEED RIP SAW NO. 264.

Acetylene Signal Lamps Tested.

On the Perth Amboy branch, the Lehigh Valley Railroad has introduced acetylene gas as a substitute for oil in signal lamps. It is said that if the experiment meets expectations the use of acetylene will be extended.

German Locomotive Works.

The elegant catalogue printed on cream laid paper and profusely illustrated, has just been issued by the Hannoversche Maschinenbau-Actien-Gesellschaft, Hanover, Germany, and furnishes an historical account of the establishment of these works. It appears that in 1835 Mr. George Egestorff, an enterprising mechanician, began the construction of machinery and steam engines at Hanover-Linden, and in 1846 also took up the construction of locomotives. Dr. Strousberg, a well-known railway contractor, bought the establishment in 1868 and organized the company. In 1873 the 1,000th locomotive had been completed, and was awarded the first prize at the Vienna Exhibition in that year. In 1903, the 4,000th locomotive, a four-cylinder balanced compound of the 4-4-0 type, was completed, and was awarded the "Grand Prix" at the Paris Exhibition. Prizes were subsequently awarded to the company for their locomotives exhibited at St. Louis, and latterly at the Milan Exposition of 1906. The total number of locomotives manufactured by them up to May of the present year amounts to 5,000, of which 4,600 were supplied to German railways. The outstanding feature of their work is what may be called an elegant massiveness in construction. Their most recent innovation is known as the Lentz poppet valve gear. It resembles the valve gearing used on the Matheson gasoline motor. The parts are enclosed in a cast iron case. A cam rod lifts the poppet valves in succession and spiral springs insure the prompt return of the valves.

Factory Safety in Boilers.

The New York Public Service Commission have published a report in regard to the permissible factor of safety of locomotive boilers at different ages and with seams of various construction. With butt seams the factor of safety in boilers under thirty years is set at 4. One-quarter is added with lap and cover seams. In the case of plain lap seams, in boilers between twenty and thirty years in service, the factor is set at 4½. All boilers are condemned in the report that have been in existence over forty years. It will be understood that the factor of safety is meant to convey the idea that a well-constructed boiler which could be rent apart at a pressure of 800 lbs. per sq. in., should not be worked at over 200 lbs. per sq. in. We doubt if the commissioners would care to stand near a forty-year-old boiler being tested at anything approaching one-half of the 800 lbs. pressure, but the ways of commissioners are past finding out.

Smart "Smarty" Made to Smart.

One conductor's vacation took him up into the woods, or rather near the woods, on a farm. Being accustomed to early rising, he practiced it while off his run, as he could not sleep. Meeting the farmer's hired man one morning, he tried to "get gay" with him. "An early bird you are," he said. "I reckon you get up so soon so's to be sure the haycocks crow all right, eh?"

"Well, no," was the slow answer. "Fact is, I come out early most every mornin' to untie some o' the knots in the cordwood."—*Railroad Conductor.*

Die Crampton-Locomotive.

"The Crampton Locomotive" is the subject of an exhaustive treatise by Mr. F. Gaiser, and published at Neustadt in Germany. Besides a fine portrait of Crampton, there are sixty-one illustrations, giving details of the construction of the Crampton locomotive, with descriptive text, the whole forming a superb volume of more than one hundred pages. Thomas Russell Crampton is peculiarly fortunate in having a historian who takes such pains in recording and illustrating his work, although it seems to us, it is at a somewhat late date. Nevertheless the book before us will be of special interest not only to the railway antiquarian, but to all interested in the development of the locomotive.

Improvements at Bristol.

Rapid progress is being made on the new line the Pennsylvania Railroad is building through Bristol, Pa. This work will eliminate ten grade crossings. The entire new line, which is a four-tracked railroad, 2¼ miles long, will be completed early next year. The present line through Bristol is on a heavy curve and the new route will be on a tangent through the western part of the town with light curves to the east and west. Two curves of 1 deg. 20 min. and 1 deg. 40 min. will be eliminated. The maximum curve on the new line will be 45 min. The total curvature on the old line is 101 degs. 22 mins., while that on the new line will be only 50 degs. 8 min.

In furtherance of the policy of the Pennsylvania Railroad of eliminating all grade crossings in new and revised construction work, this change of line through Bristol includes the building of nine bridges over streets and public roads, one over the Pennsylvania Canal and three over streams. To make this change of line will necessitate the grading of some 550,000 cubic yards of earth and the construction of 5,000 cubic yards of arch masonry and 12,000 cubic yards of bridge masonry. The street bridges will be constructed of reinforced concrete with solid floors. At the present time about 250,000 cubic yards of embankment have been made and 4,000 cubic yards of concrete masonry built. One of the present tracks will be left on the old location as an industrial side track to reach the new factories in that part of the city.

P. L. M. at the Brussels Exposition.

The French locomotive builders are making a grand exhibit at the Exposition at Brussels, Belgium. The Paris, Lyons and Mediterranean Railway Company have just issued a superb catalogue, illustrated with tinted photographs and drawings, which are excellent. Apart from the elegance and symmetry of the numerous locomotives described, the luxurious and fine taste of the French manufacturers are perhaps seen to best advantage in the interior furnishing and decoration of the passenger coaches. They are simply gorgeous. Among freight cars may be mentioned some of special design for the carriage of automobiles. The various types of engines used on this well known road are in evidence among the exhibits.

Failures that Have Brought Success.

The accidental bending of a little spring in a Bell telephone, which prevented the proper working of the delicate machine, gave Mr. Bell the English patents to his invention, says the *New York World.* When he patented his invention in the United States Lord Kelvin was here

He happened to see one of Mr. Bell's machines, and was so struck with it that he took one to England to introduce to his classes. When the instrument was produced it absolutely failed to work, and despite his master mind, Lord Kelvin had to apologize for his inability to demonstrate with it. The whole failure was due to the fact that a small spring in the instrument had got bent during the journey from America. Had Lord Kelvin perceived this and rectified it the instrument would have worked excellently, and the demonstration would have prevented Mr. Bell patenting the instrument in Great Britain.

Some twelve years ago when Richard Laverson was a low-grade worker in a Pittsburgh engineering shed, he hit upon a novelty in the shape of brooch-pins. He finished a few by hand, and they seemed so much superior to the usual form of brooch-pin that he concluded to make a machine to manufacture them. On this task he spent weeks, and finally one day, in a fit of rage, he threw a hammer at the machine and left it in disgust. He did not look at the machine again for many weeks, but when he did he found it worked. Though it refused to turn out brooch-pins, it turned out splendid little safety-pins of a unique pattern. These pins have since been sold in millions all over the United States.

Twenty-Third Annual Report.

The twenty-third annual report of the Interstate Commerce Commission is just issued in a volume of 338 pages. There is much in the volume of interest to railway men. Probably the most gratifying part of the report is the large falling off in the number of casualties to passengers and employees on railways. In 1909 there were forty-six per cent. less fatal accidents on railways than in 1907. This speaks well for the increased vigilance of railway employees, as well as for the rapid adoption of safety appliances. Perhaps the most striking illustration of this fact is to be found in the report of the number of accidents in coupling and uncoupling cars. In 1893, no less than 77 men among each 1,000 men employed in the service were injured. Last year the number was reduced to 16. Copies of the report may be had from the Government Printing Office, Washington, D. C.

Plain but in Good Taste.

The steel Pullman parlor cars recently delivered to the Pennsylvania show severe simplicity, with an elimination of decorative effects heretofore so noticeable in this class of passenger equipment. The only ornamentation is a neat fresco design. The cars are also wider. More than 100 steel sleeping cars are now in use.

Gould Coupler Catalogue.

The catalogue, just off the press which has been issued by the Gould Coupler Company of New York, is excellent in many ways. Of its style and makeup we need not speak, as that is up to the standard of the company's other work. The various parts of the many devices made by the Gould Company are numbered, named, and illustrated so that ordering or reference becomes easy. The pages are arranged for the introduction of supplementary sheets.

The specialties made by the company are Gould M. C. B. freight, pilot, tender and passenger couplers; vestibules, wide and narrow; continuous platforms and buffers for wood sills; continuous platforms and buffers with steel underframing; steel platforms with friction buffers; friction draft gear for passenger equipment; trap door rigging, journal boxes, malleable iron draft beams, twin type of draft gears, tandem type of draft gears, uncoupling brackets, special type, malleable iron castings, scientifically annealed; car and engine axles, reworked wrought iron or openhearth steel, Gould M. C. B. couplers, "U" type truck bolsters, car end sills, "crown" cast steel bolsters, truck side frames, miscellaneous castings, Gould friction draft gear and Hartman ballbearing center plates and side bearings.

The capacity of the various plants owned by this company is as follows: steel castings plant, 250 tons a day; malleable iron plant, 100 tons a day; axle forge, 200 axles a day; storage battery plant, unlimited. They also have in connection with their other establishments an electrical plant where axle driven dynamos for car lighting are made.

Tunnel Boring Machine.

A new form of tunnel boring machine has lately been devised by Mr. Ebbley, formerly master mechanic of the Ild Dominion Copper mine at Globe, Ariz. The inventor says his device will average 25 to 50 ft. a day. No blasting is required, and this eliminates one of the dangers and a large part of the cost of tunneling. No gases collect to hinder progress of the work. Three men on a shift can operate the machine.

The machine drills a circular hole from 8 to 25 ft. in diameter. It is intended to go through any ground that a machine drill will work in. The track is laid and the timbers placed as the machine proceeds. From 150 to 200 h. p. is required to operate the borer, but the cost of this is offset by the saving in men, powder and time. A large hollow shaft is mounted on a carrying frame running on wheels on the track. At the head of the shaft are radial arms carrying different drilling

The trade of the machinist came with the steam engine, and millwrights claimed for a time the work now done by machinists. The millwright trade is nearly as old as the introduction of machinery and was for years a close guild in some cities.

machines of special design for cutting channels in the rock. There are three complements of drills, the outer set cutting the channel that determines the size of the bore. Another set cuts a channel in the rock or earth a foot or two inside the line of the outer channel. A third set cuts a still smaller ring in the rock, and other sets may be used. Hammers pound against the rock with smashing force as the channels are cut, thus breaking out the rock and earth and allowing it to fall to the floor of the tunnel. A shovel that has a reciprocating motion with accelerated speed to the rear gathers up the muck and throws it behind the machine. The shovel is handled by an air cylinder equipped with a specially designed valve gear.

Mere Matter of Speed.

The Reading Railway's lawyer was cross-examining a negro woman who had sworn that she saw the train hit a milk wagon whose bandaged driver had just testified. No, she had not heard the engineer blow any whistle whatsoever.

"How near were you to the train?" the lawyer asked her sharply.

She didn't know exactly. It might have been so far and it might have been a little further.

"But how far?" the lawyer persisted. "A mile or a square or what? How long would it have taken you to walk the distance?"

"Suh," the witness replied, haughtily, "dat would depend entirely on ma speed!"

The Northern Pacific Wonderland.

The Northern Pacific Railroad has just issued two high-class publications, one illustrative of their excellent train service, and the other furnishing gorgeous views with letter press description of the Yellowstone National Park. To say that the two publications are a surprise to us is putting it mildly. All the wild wonders of that marvel of scenic splendor are there, the green and golden glory of noon in the mighty canons—the rainbow-hued rocks rising in many pinnacled splendor, the flash of crystal waters, the red glory of fiery sunsets, the sparkling crystals of eternal snows, the muffled moonlight gilding the mysteries of terraced towers that seem reaching to infinitude. Then the splendid panorama of cultivated fields, and the somber picturesqueness of wooded valleys, where the light footed denizens of the forest roam in primeval seclusion. It is magnificent, and as for the train service those who have never been in the grand Northwest cannot conceive of its perfection. It leaves nothing to be desired. It is the acme of luxurious delight. They who trouble themselves wandering to the old haunts of Europe little know the unrivalled magnificence that awaits them in a trip on the Northern Pacific. The passenger department of this road is to be congratulated on the beauty and excellence of these two publications.

Chemical Names.

Before chemistry had become an exact science, substances often received their names in curious ways. Ammonia was said to have been so called because it was produced in quantity by the decomposition of animal matter near the temple of Jupiter Ammon. Phosphorus is derived from the Greek words meaning to bear light. Potash was originally made by burning plants in open iron pots and the ashes were called pot-ashes, and after being boiled with water and the liquid evaporated was finally called potash. Lunar caustic is nitrate of silver, and was named after the moon. Quicksilver was called mercury and was named after the planet of that name. A very strange origin is ascribed to antimony. It is said that at an old monastery a small quantity of this substance on one occasion became mixed with the food used in that institution, and that much sickness resulted to the inmates. When the offending element had been isolated the abbott called it anti-monos, or that which operated against the monks, hence antimony.

Dudgeon Catalogues.

In response to many applications for descriptive catalogues in languages other than English, the enterprising firm of which M. R. Dudgeon is head, has issued two new booklets, Nos. 9 and 11. Booklet No. 9 is printed in the Spanish language, and especially illustrates and describes the new Universal Hydraulic Jack. Booklet No. 11 is in French, and it also illustrates the principle of the Universal Jack and Pressure Pumps, as well as a number of types in which this Jack may be obtained. The illustrations in both booklets are numerous and excellent. The one in Spanish is actually a text book on the subject of the construction of the hydraulic jack. Copies may be had on application to Mr. Richard Dudgeon, Broome and Columbia streets, New York City.

Directory of Manufacturers.

The McGraw Publishing Company, New York, have just issued a directory of manufacturers of and dealers in engineers' and contractors' machinery and supplies. This is the third edition of this Directory, and is the only publication of its kind. It extends to 136 pages, and will be of much value not only to consulting engineers and contractors, but also to architects, bridge and structural engineers and industrial plants all over the world.

Large Stationary Engine.

The most gigantic engine was used at the zinc mines near Friedensville. It is fed by sixteen boilers, which give it a 5,000 horse power, and if it becomes necessary the number of boilers may be doubled. This would give the iron monster a power equal to 10,000 horses. Each revolution of the wheel raises 17,500 gallons of water, it is used as a pumping engine, and every day its furnaces consume 28 tons of coal. The flywheels are 37 ft. in diameter, and weight 40 tons each.

American Steel Industry.

From reports issued last month it appears that the production of Bessemer steel ingots and castings in the United States last year was 9,330,783 tons as compared with 6,116,755 tons in 1908, showing a very substantial increase this year. The highest production of any year was that of 1906, when an output of 12,275,830 tons was reached. It may be added that the total value of iron and steel products exported from the United States in 1909 approached $160,000,000.

What Was the Tin For?

"Are yez hoirin' eny min?" said a burly Irishman to the engineer in charge of the steam shovel gang.

"We are that," was the reply.

"And how much do yez pay?" the engineer was again asked.

"A dollar and seventy-five cents," he answered.

"Faith an' Oi'm glad to hear thot. Oi just passed the section foreman up the line a ways and sez Oi to him:

"'Are yet hoirin' eny min?'

"'We are,' sez he.

"'And how much do yez pay?' sez Oi.

"'It's the dollar tin,' sez he.

"'And phwats the tin fur?' sez Oi.

"'Aw, gwan,' sez he; 'gwan, ye omothon, yez don't want to work.'"—*Railroad Conductor.*

Heat Value of Coal.

It is interesting to note the heat value of coal in comparison with other fuels. The variation in coal samples, however, make it impossible to fix an exact standard. The conclusions recently arrived at by the United States Geological Survey are based upon what is known as pure coal, or actual coal, or unit coal, meaning the actual organic matter which is involved in combustion, apart from other extraneous mineral matter. The following table furnishes a near approach to the relative values of the most common fuels:

Bituminous coal, Easter field, 150 to 160; anthracite, 150 to 155; bituminous coal, Mid-Continental field, 142 to 150; lignite, black, 125 to 135; lignite, brown, 115 to 125; peat, 78 to 115; cellulose and wood, 65 to 78. These are of course comparative values.

Fifty-Eight Years of Service.

Mr. Michael Kirby, a locomotive engineer with a record of 58 years of continuous railway service, chiefly on the Baltimore & Ohio, has been retired on a pension. He began as a water boy and believes he is the only one now living who helped drive the gold spike into the cross tie at Roseby's Rock, W. Va., which marked the completion of the Baltimore & Ohio to the Ohio River at Wheeling and the establishment of the first trunk line on the American continent.

Erie Railroad Thanked.

The directors of the Second Ward Association of Nutley, N. J., have adopted and transmitted to the Erie management resolutions expressing appreciation of the enterprise and liberality shown in the completion of the Bergen cut as evidencing consideration for the comfort of the patrons of the road and a desire to please them.

They further state that the company is therefore justified in making a moderate increase in commutation rates, which, it is felt, will ultimately tend to the benefit of commuters through further improvements that it will be possible to make on the Newark branch.

Honorable Record.

Robert Witherspoon died at the age of 77 years. Mr. Witherspoon was born in Edinburgh and came to Canada in 1885 to work for the contractors for the construction of the Grand Trunk Railway. Mr. Witherspoon was engineer of the first passenger train that pulled out of Montreal for Toronto on the night of October 6, 1856, and ran the trains that carried two British Monarchs, having been engineer of the train that conveyed the late Queen Victoria from London to Cambridge, and the late King Edward from Montreal to Sherbrooke during his trip through Canada in 1860.

Silence Is Golden.

In a railroad office in West Philadelphia there is an old man and trusted clerk of Celtic extraction who keeps his associates in a constant state of good humor by an unending series of witticisms, interspersed occasionally with "bulls" so glaring that even he himself has to join in the laugh that invariably follows such a "break" on his part, says the Philadelphia *Times.* There was some trouble on the telephone one day recently, and Mike, as he is called among his friends, lost much of his usual good nature in his efforts to get the gist of a message that was being sent from another office. The man on the other end of the wire finally became exasperated and asked Mike if he was losing his hearing.

"I can hear you all right until you begin to talk," said Mike, "and then I can't understand a word you say."

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances

Vol. XXIII. 114 Liberty Street, New York, September, 1910. No. 9

By Rail to the Himalayas.

ONE OF THE LOOPS OF THE DARJEELING HIMALAYAN RAILWAY

Such great improvements have recently been made in Indian railway travel that it is now possible for the tourist to see Mount Everest and get within 200 miles of the forbidden holy city of Lhassa with no more trouble than that incurred in a trip to Switzerland or Italy.

For the Imperial mail service between Bombay and Calcutta a magnificent new "Train-de-luxe" is provided by the Great Indian Peninsula and East Indian Railways. It is entirely composed of sleeping cars, with a restaurant, and is "limited" to 32 first-class passengers, the balance of the train being required for the Postal service. The train leaves the Victoria terminal, Bombay, as soon as the mails are on board and makes a fast and direct run to Calcutta, where it usually arrives early on a Sunday morning, as 36 hours is the time allowed for the journey.

The Himalayan express of the Eastern Bengal State Railway leaves the Sealdah terminus, Calcutta, 16.30 o'clock and re[illegible] Damookdeah, a distance of 116 [illegible]. This point is the terminus of the b[illegible] gauge on the banks of the Ganges. This train is composed of handsome bogie carriages and carries all classes of passengers. It is usually hauled by a four-coupled bogie express locomotive with cylinders 18½ ins. in diameter by 26 ins. stroke and driving wheels 6 ft. in diameter.

The Ganges is crossed on a large flat-bottomed paddle steamer, and dinner is served on the passage across. It is very difficult to secure good landing jetties, owing to the shifting character of the sands forming the river banks.

The narrow gauge, 3 ft. 3⅜ ins., terminus of the Eastern Bengal State

Railway is at Sara Ghat, not quite opposite to Damookdeah, but a little higher up the river, and it is at this point where the new bridge is to be built to link up the narrow-gauge lines and bring them into Calcutta.

The run from Sara Ghat to Siliguri, a distance of 210 miles, is over the narrow-gauge rails and some very comfortable and well-fitted bogie trains have been put on for the Himalayan service. These trains are worked by six-coupled bogie engines of the State Lines standard, with cylinders 15 x 20 ins. and drivers 4 ft. 9 ins. in diameter.

ZIG-ZAG REVERSE AT GIABAREE.

Siliguri is reached at 6:11 a. m., and the "limited mail" of the Darjeeling-Himalayan train is found awaiting the arrival of the Calcutta express. A further reduction of gauge takes place, the Darjeeling-Himalayan Railway being but 24 ins. Even on this limited track, however, very roomy and comfortable cars have now been introduced, and smooth travel is ensured over the 51 miles up the mountains to Darjeeling.

Our illustrations show various scenes on this interesting little railway. The first 7¼ miles to Sootana only rises 1 in 281 ft., but after passing that station the stiff grade commences and continues at an average of 1 in 30 to the summit at Ghoom, 7,407 ft. above sea level. The rails are laid along the side of the post road, crossing and recrossing it at frequent intervals to ease the grade. The next 10 miles from Sootana is through a magnificent forest, then come tea gardens and cultivated patches along the mountain sides all the way up. The railway work shops are at Tindharia, 20 miles from Siliguri and 2,820 ft. high. Grand views are here obtainable of the valley below, the Teesta River and the Bhotan Mountains.

There are four zig-zags or reverses on the line, where the train first runs into a dead-end, and is pushed back up an incline to a higher one, to be then taken forward on its journey; there are also four spirals or loops, one being shown in our frontispiece, in which the train makes two complete turns, only one is in the picture, gaining 140 ft. in vertical rise. There are seventeen locomotives working on the D.-H Ry., all four-coupled tanks, but of two different classes. The earliest engines, known as the A class, have cylinders 10 by 14 ins. and driving wheels 2 ft. 2 ins. in diameter spaced 4 ft. 3 ins. apart. The engines weigh 12 tons in working order. The B type has larger cylinders and weighs 14 tons in working order, and can haul a load of 50 tons up an incline of 1 in 25. It has driving wheels 2 ft. 6 ins. in diameter spaced 5 ft. 6 ins. center to center. The limited usually consists of two luggage vans, a four-wheel van, mail van and one third-class car. The maximum speed allowed for the train is 11 miles per hour; for other trains 10 miles per hour is authorized.

At Kurseong, 31 miles out, and 4,864 ft. high, the train stops an hour to enable passengers to lunch; during this stoppage the locomotive is attended to the train. Our illustration shows it receiving water and coal, while the ash-pan is being emptied and the fire cleaned. The steep ascent continues amidst the tea gardens to Ghoom, the summit, 7,047 ft. above the sea level and from this point the line descends to Darjeeling on a grade of 1 in 31 for 3 miles, the terminus being 6,812 ft. above sea level. Of the glories of Darjeeling, volumes might be written; here the journey ends and any venturesome traveler desirous of exploring beyond the snowy barrier of the giant Himalayas must, for the present, fall back on the pack horse and pony, the high road to Thibet lies in front of those intent on adventure and exploration.

How Not to Do It.

By A. O. Brookside.

Lovers of Charles Dickens will probably remember his Chapter X of "Little Dorrit," in which he expounds the whole science of government as how not to do it. He humorously warns people against the danger of being lost in the Circumlocution office, and of how the officials of that famous department when they got hold of a piece of business, "muddled the business, addled the business, and tossed the business in a wet blanket." You will see, if you pursue this simple tale, that the mantle of that great department had fallen on the shoulders of an otherwise obscure individual.

Snapper Sharp was chief clerk to Goodrich Wells, second vice-president of the Rock Ballast & No Dust Railway. Wells had charge of the purchasing department of the road, and Snapper did things with a rush. He had everybody on the loud pedal when there wasn't much in sight, but showed them down when a cloud of business no bigger than a man's hand appeared above the horizon. Snapper was a 4-4-2 high-speed simple, with the E T retarding apparatus in good working order. Mr. Wells was a business man, wide awake, efficient, courteous and kind, with no frills, just a plain mister.

STOPPING FOR WATER BY THE WAY.

Snapper communicated himself, or, rather, his atmosphere, to the office staff, and they were all able to "size up a man" at first sight, to their own satisfaction, "spot a man when he shows up," Snapper said a million times to the boy in charge of the outer office railing, "and get a line on his contour, for this collateral is more useful to me than what he thinks he is going to do with the boss."

A. B. Cancelli, the boy, soon became a great adept at "collateral" and gave Snapper lots of tips that weren't so about men who called. One particular man gave rise to heaps of collateral, by which we mean what the boy thought of him, his form, his figure, his address and business. The boy had him write his name and the nature of his business on form R-8-207-a. This being the office card for that purpose made and provided. The man wrote his name, but vaguely stated the nature of his business as personal. Snapper hated "personal" callers, so after the man had been kept waiting quite a while, he was asked to call again, which he did later in the day. He was asked to state the nature of his business all over again, and if possible more definitely, but he said he could not, and was therefore kept waiting. Later on Snapper told Holden Been to see him and blast out of him some small and fragmentary token of why he was there. Holden Been's charge failed to explode, as he told the man to see Waters on the floor below. The man saw Waters, who straightway told him to go back to Holden Been, which he did. The boy now kept him waiting even to see Holden, and after he saw Holden, he was told he must wait till Mr. Sharp was disengaged. After a long time Snapper came out and told him Mr. Wells was busy. The man apologized and went away and Snapper rejoiced. The man went to the first telephone booth, got Wells direct on the wire and asked him to be godfather to his boy.

Sometime after that a man called, just a plain mister like G. W. himself, but his business turned out to be personal and private, and the office formed a flying wedge. Wells was out of town, but the personal and private business man did not know it. He was told to wait, he did. Viewed from a "collateral" point of view, he did not amount to shucks, so he waited. Snapper was told that the no-account person was waiting quietly, and he smiled happily. Minutes dragged on. Snapper was sorry he could not hamstring the minutes so that they would only be able to crawl. At length the no-account person got up, said he was sorry to trouble any one, but would the boy again see if Mr. Wells would admit him. Snapper sent out word that it was impossible to disturb his chief, and the man went away not looking over pleased. Snapper had, one way or another, used up about twenty-three minutes and eight seconds of the man's time, and he felt rewarded.

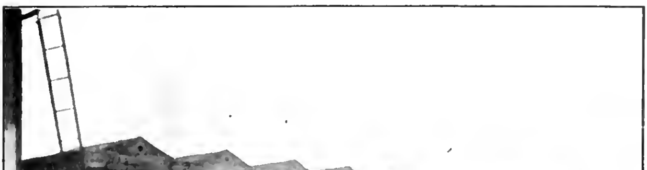
COMING DOWN FROM DARJEELING.

Some days after this the sky fell down. The man wrote a personal letter to G. W. and narrated his experience. This he accompanied with the gratuitous information that being the purchasing agent of the R. S. & T. Railroad, he had, by a lucky chance, heard of a certain deal, the knowledge of which had enabled him to buy so advantageously as to save his company $25,000 on the year's supply of a certain article, and this information was intended for the ear of his old friend G. W., who might like to save his company some money. The person had traveled all the way from Blakeley to let G. W. see on the ground floor for old friendship's sake, but he could not get into the office. (He did not, however, give away his secret information by letter.)

Wells did not like this letter, nor did he praise Snapper Sharp for scoring a touchdown on men with private business. Snapper tried to explain, but he didn't. G. W., plain mister, good man and true, saw it all at a glance. Saw that his own idea of a fine system to facilitate business had been turned by Snapper into a regulation in restraint of trade. So he acted. That is why I said the blue sky fell down. In falling it knocked the office door railing N. E. by W. of the main office, but hardly displaced a chair, and did not move the typewriter's flimsy paper even 1-10 of an inch or ruffle her golden locks.

Snapper took Holden Been's desk in the outer office, and Holden was given a trial as chief clerk, and the office boy fled from "collateral" as he would have fled before the face of the avenging Furies. The result of these changes is that now when a visitor comes along and sends in his card, he is handled so fast that it makes his head swim. After the man goes out, Holden Been, wearing a dark frown, chalks on the blackboard in plain view of the office staff, how many scandalous seconds of vestibule and outer-office time has been recorded to the detriment of the staff. If a man is not got through in less than forty-five seconds, it is equivalent to an engine failure, and the office gets the "please explain" coupon. The only danger now is that if you go there and offer to take a seat or wait they will want you to give them a release, and they will tell you their drinking water is impure if you look in the direction of the cooler. When Goodrich Wells is out they post a notice on the door.

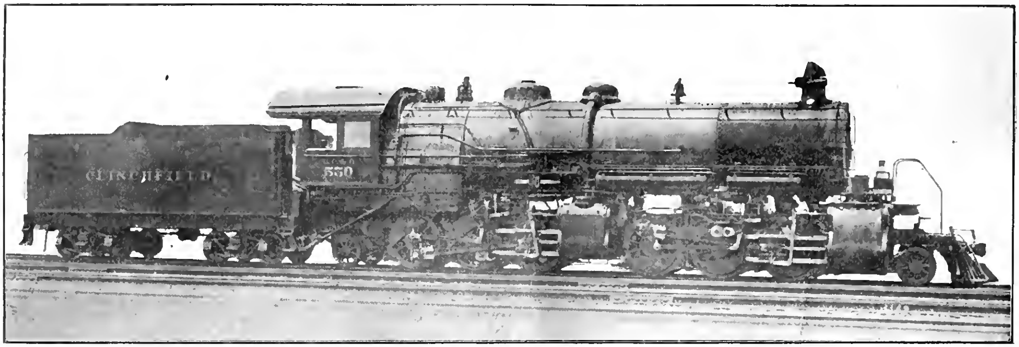
Moral: Do not size up anything but the likelihood of your being wrong about a man's appearance. Don't make the engine failure rule too sharp, for in hot weather a man may recklessly take a glass of water in the office.



THE HIMALAYAN EXPRESS ON THE E. B. S. RAILWAY LEAVING CALCUTTA.

Locomotives for the Carolina, Clinchfield & Ohio Railway

The Carolina, Clinchfield & Ohio Railway is conspicuous as a new road, built to a high standard throughout, and presenting a maximum grade, against loaded traffic, of only 5 per cent. The sharpest curves on the main line are of 8 degs. The principal source of traffic is coal, and the conditions are thus favorable to handling the heaviest class of trains. In 1909 this road received, from the Baldwin Locomotive Works, an experimental Mallet locomotive of the 2-6-6-2 type. This engine weighed 342,000 lbs. and carried 300,000 lbs. on the driving wheels, and was rated at 4,000 tons of cars and lading on 5 per cent. compensated grades. In view of its satisfactory performance, the railroad company ordered from the Baldwin Locomotive Works ten additional Mallet locomotives of greater power. These have recently been delivered, together with three passenger engines of the Pacific type.



H. F. Staley, Master Mechanic. MALLET 2-6-6-2 FOR THE CAROLINA, CLINCHFIELD & OHIO. Baldwin Locomotive Works, Builders.

MALLET LOCOMOTIVES.

These engines are designated as Class M-2, and are of high capacity for road service. The tractive force they can exert is 77,500 lbs. The design is similar, in many respects, to that of the experimental engine, but the details have been revised and improved where possible. With the limited space available in this case, a boiler of the ordinary type, without a separable joint and feedwater heater, is used; the tube length being 21 ft. The shell diameter, 86 ins., is unusually large, and the boiler has wide water legs, liberal tube spacing and ample heating surface and grate area. The firebox staying is radial, and 404 flexible stays have been applied. These are grouped in the outside rows in the sides and back, in the upper corners of the sides, and in two triangular areas on either side in the throat sheet. Firing is accomplished through two oval fire-doors, placed 44 ins. apart transversely.

The boiler barrel is composed of three rings, and the dome is placed on the second ring, immediately above the high pressure cylinders. The arrangement of the steam piping is similar to that used on the Mallet locomotives built for the Southern Pacific Company. The high pressure exhaust is conveyed forward, through external horizontal pipes, to a Baldwin reheater placed in the smokebox. The steam distribution is controlled throughout by 15-in. piston valves, which are duplicates of one another. The high pressure valves provide inside admission and the low pressure outside admission, the ports and bushings being modified to suit. The valves are all set with a lead of 1/4 in., the steam lap is 1 1/8 in. and the exhaust clearance 1/4 in. The by-pass valves consist of flat plates, which normally cover the relief ports; this arrangement being in accordance with the usual practice of the builders for piston valve locomotives. Walschaerts motion is used throughout, and the gears are controlled simultaneously by the Baldwin power reverse mechanism.

The frames are of cast steel, 5 ins. in width. The articulated connection is effected by a single radius bar, and the frame construction throughout is in accordance with the well-known practice of the builders for engines of this size. The boiler is supported on the front frames, by a single bearer placed between the second and third pairs of driving wheels. The front bearer carries the controlling springs, and normally has a clearance of 1/2 in. between the upper and lower castings. The arrangement of the trucks and running gear calls for no special comment. The practical value of these trucks is proved by their continued use on the part of roads which, like the Clinchfield, have had experience with engines so equipped.

PACIFIC TYPE LOCOMOTIVES.

These are powerful locomotives for passenger service, as they develop a tractive force of 37,000 lbs. The cylinder volume is 14.4 cu. ft. The following ratios should be noted: Grate area to heating surface is as 1 to 76; cylinder volume (cu. ft.) to heating surface (sq. ft.) is as 1 to 284; ratio of adhesion, 4.13. These ratios indicate a locomotive well adapted to handling heavy trains on long grades. With 23 x 32-in. cylinders and 69-in. wheels, the tractive force per pound of mean effective pressure is 230 lbs., which is high for a passenger locomotive.

The boiler used in this design is of the extended wagon top type, 74 ins. in diameter at the front ring and 83 1/2 ins. on the wagon top. The firebox staying is similar to that of the Mallet type, the flexible stays numbering 386. The fire-doors are two in number, and they are placed 28 ins. between centers, the width of the grate being 71 3/4 ins. The tubes are set with 7/8-in. bridges.

The stack is of cast iron, with a wide mouthed internal extension, and measures 21 1/2 ins. in diameter at the choke. The master mechanics' style of front end is used, with an adjustable diaphragm plate in front of the nozzle. No cinder pocket is provided with this arrangement. The main frames are of cast steel, 5 in. in width, and in one piece with the rear section. The front rails are single, and of forged iron. Each rail is hooked and double keyed to its corresponding main frame, and is held in place by four vertical bolts, 1 1/2 ins. in diameter. At the point of its connection with the cylinder saddle, the frame measures 4½ ins. wide by 7 ins. deep.

The front truck is of the swing bolster type, and is fitted with a cast steel saddle and three point suspension swing links of the same material. The wheels are steel-tired, with cast iron centers. The rear truck is of the radial type, with outside journals. The side swing is taken by the spring links, which are seated at each end, on flat keys, and so arranged that they have a limited amount of fore-and-aft, as well as transverse swing. This form of truck is simple in construction, and has been applied by the Baldwin Locomotive Works to a large number of locomotives.

The cylinders are lined with bushings ⅝ ins. thick, and are placed 87 ins. between centers, while the steam chest centers are 49 ins. apart. The valves are duplicates of those used on the Mallet engines. They are arranged for inside admission, and are set with a lead of ¼ in. The by-pass valves are also similar to those of the Mallet locomotives. The location of the steam chests on the Pacific type engines simplifies the arrangement of the steam and exhaust passages, but necessitates using rockers in connection with the Walschaerts valve gear. The rocker boxes are bolted to the guide yoke, and the links are carried on longitudinal bearers outside the leading driving wheels.

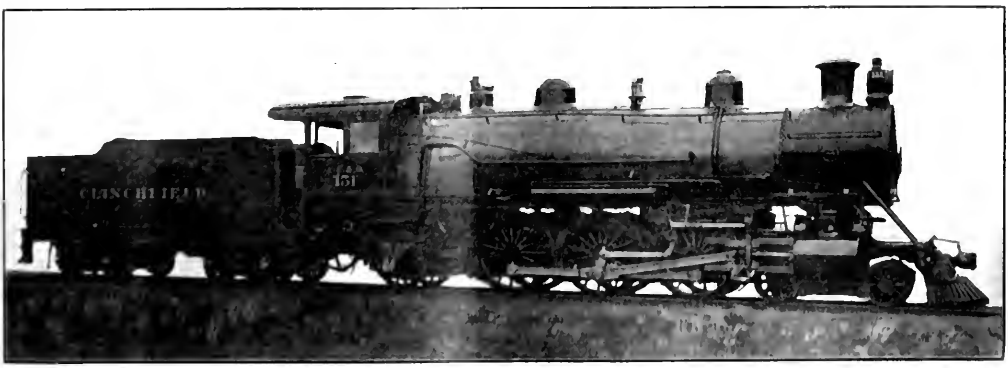
The tenders of both classes are similar in construction, although those for the freight engines have a greater fuel and water capacity than the tenders used with the passenger locomotives. The frames are composed of 12-in. channels, the center sills weighing 40 lbs. per foot and the side sills 25 lbs. The tanks are of the water-bottom type. Arch bar trucks are used, those under the passenger tenders being fitted with steel tired wheels, while the freight tenders are carried on solid rolled steel wheels. All truck wheels under the locomotives and tenders were supplied by the Standard Steel Works Company. These engines, apart from their constructive details, are of interest as representing the motive power policy of a new line, already prominent among the railways of the South. The principal dimensions of both classes of locomotives are given in the accompanying tables.

MALLET ENGINE.

Cylinders, 24 ins. and 37 x 32 ins.
Valves, balanced piston.
Boiler.—Type, straight; material, steel; diameter, 80 ins.; thickness of sheets, ⅞ in.; working pressure, 200 lbs.; fuel, soft coal; staying, radial.
Firebox.—Material, steel; length, 117 ins.; width, 96 ins.; depth, front, 79½ ins.; back, 76 ins.; thickness of sheets, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube, ½ in.
Water Space.—Front, 6 ins.; sides, 5 ins; back, 5 ins.
Tubes.—Material, steel; thickness, 0.11 ins.; number, 448; diameter, 2¼ ins.
Heating Surface.—Firebox, 233 sq. ft.; tubes, 5,519 sq. ft.; total, 5,752 sq. ft.; grate area, 78 sq. ft.
Driving Wheels.—Diameter, outside, 57 ins.; journals, main, 11x13 ins.; others, 10x13 ins.
Engine Truck Wheels.—Front and back diameter, 33 ins.; journals, 6½ x 12 ins.
Wheel Base.—Driving, 31 ft.; rigid, 10 ft. 8 ins.; total engine, 46 ft. 6 ins.; and tender, 74 ft. 11 ins.
Weight.—On driving wheels, 325,850 lbs.; on truck, front, 24,600 lbs.; back, 28,200 lbs.; total engine, 378,650 lbs.; engine and tender, about 550,000 lbs.
Tender.—Wheels, diameter, 33 ins.; journals, 6 x 11 ins.; tank capacity, 10,000 gals.; fuel capacity, 15 tons; service, freight.

PACIFIC TYPE PASSENGER ENGINE.

Cylinders, 23 x 30 ins.
Valves, balanced piston.
Boiler.—Type, wagon top; material, steel, diameter, 74 ins.; thickness of sheets, 13-16 in. and ⅞ in.; working pressure, 190 lbs.; fuel, soft coal; staying, radial.
Firebox.—Material, steel; length, 108⅛ ins.; width, 71¼ ins.; depth, front, 76 ins.; back, 63 ins.; thickness of sheets, sides, ⅜ in.; back, [illegible]; crown, ⅜ in.; tube, ½ in.
Water Space.—Front, 5 ins.; sides, 4 ins.; back, 4 ins.
Tubes.—Material, steel; thickness, 0.11 ins.; number, [illegible]; diameter, 2¼ ins.; length, 21 ft.
Heating Surface.—Firebox, 192 sq. ft.; tubes, 3,903 sq. ft.; total, 4,095 sq. ft.; grate area, 54 sq. ft.
Driving Wheels.—Diameter, outside, 69 ins.; journals, main, 10 x 13 ins.; others, 9 x 13 ins.
Engine Truck Wheels.—Diameter, front, 33 ins.; journals, [illegible] x 12 ins.; diameter, back, 45 ins.; journal, 8 x 14 ins.
Wheel Base.—Driving, 13 ft.; total engine, 34 ft.; total engine and tender, 65 ft. 10 ins.
Weight.—On driving wheels, 152,900 lbs.; on truck, front, 42,750 lbs.; back, 37,400 lbs.; total engine, 233,050 lbs.; engine and tender, about 385,000 lbs.
Tender.—Wheels, 8; diameter, 36 ins.; journals, 5½ x 10 ins.; tank capacity, 8,000 gals.; fuel capacity, 14 tons; service, passenger.



4-6-2 FOR THE CAROLINA, CLINCHFIELD & OHIO.

H. F. Staley, Master Mechanic. Baldwin Locomotive Works, Builders.

Progress in Locomotive Lubrication.

The Traveling Engineers' Association at their recent meeting at Niagara Falls received a paper on the progress made in reducing the cost of locomotive lubrication. Mr. D. L. Eubank was chairman of the committee which presented it. It appears that in 1869 Nicholas Siebert invented a down drop lubricator and in 1873 John Gates of Portland, Ore., invented the first up-drop sight feed lubricator which was experimented with but did not come into general use for a number of years afterwards, and it is asserted by one of the leading makers of lubricators, that the first sight-feed lubricator applied to a locomotive was made by him in 1880. The lubricator was at first a crude affair, but like other appliances, improvement after improvement, has been made.

The committee points out that one road reports that a comparison between two engines of same class in same service both in first class condition, one equipped with driving box lubricators and the other with oil cellars, both making 27,000 miles, the engine with the oil cellars cost $39.60 as against $16.62 for the engine with the driving box lubricator, showing a saving of $22.98.

Following the introduction of grease as a lubricant on driving box journals, it was used as a lubricant for crank pins by the use of a screw plug; but while the grease was found to be a good lubricant, the screw plug was a very extravagant means of applying it, as so much lubricating material was wasted. Later the automatic grease cup came into use. This cup proved to be very successful as well as economical. The committee know of one of these cups holding ¾ lb., which ran

4,000 miles on the butt end of a main rod of a heavy passenger engine.

They quote a committee report of the Master Mechanics' Association as follows: "They also report that back as far as May, 1855, two roads reporting on this item of expense, one shows the average miles run to the pint of lubricating oil were 10.4, and to the pound of tallow 18.89; the other reports the average miles to the pint of lubricating oil 14.62, and to the pound of tallow 41.1. This committee also reports that in the ten year period from 1898 to 1908 the average weight of locomotives (exclusive of tenders) increased from 133,000 to 164,000 lbs; and the average area to be lubricated increased from 4,000 to 12,000 sq. ins. These figures were taken from eight roads reporting, which showed an average increase of cost for the ten year period of $32.42. The Traveling Engineers' committee, has been able to get some information from one road which handles a very heavy tonnage through a coal-producing territory, for the six years ending December, 1909. This road reports the cost per 1,000 miles as follows: 1904 $2.65 per 1,000 miles; 1905 $2.75 per 1,000 miles; 1906 $2.73 per 1,000 miles; 1907 $2.78 per 1,000 miles; 1908 $2.63 per 1,000 miles; 1909 $2.57 per 1,000 miles.

The total tractive power of the engines on this road during the same period was as follows: 1904 12,371,449 lbs.; 1905 12,997,910 lbs.; 1906 15,145,844 lbs.; 1907 16,843,463 lbs.; 1908 16,824,622 lbs.; 1909 17,268,241 lbs. The average tractive power per engine in 1904 was 30,622 lbs.; in 1909, 33,926 lbs., showing an increase in the average tractive power of locomotives of 10.8 per cent., with a reduction in the cost for lubrication of 7 per cent. per thousand miles.

Summarizing the progress that has been made in reducing the cost of locomotive lubrication. One of the most important factors was the introduction of the sight feed lubricator. Other things that have followed in the line of progress are the reclaiming of all old packing and waste, the careful attention given to renovating and re-using of same, keeping a correct record of all lubricating materials, charging it to engineers as well as to engines, and submitting monthly statements showing the amount of oil drawn and miles run by each engineer, which have resulted in a reduction of the cost, as the engineers can always be depended on to wish to be at the head of the list, making the most mileage at the least possible cost for engine supplies.

Another important factor is the driving box lubricator and the use of grease on the crank pins, by the grease being pressed into cakes for the driving box cellars and into sticks for the crank pin cups; also by the reclaiming and re-use of grease taken from cellars of engines undergoing repairs. It is estimated that with the economical handling of grease this device has been responsible for a reduction of from 25 to 40 per cent in the cost of lubrication.

The road foreman should see that a liberal allowance is made for the service required and should also see that the allowance called for in the different schedules is issued. He should also confer freely with the engineers, furnish them with all the information possible with reference to lubrication and encourage them to make the greatest mileage possible with the least possible cost.

Where engines are pooled, the individual supply cans have resulted in a reduced cost and have encouraged the engineer in his efforts to make a good showing. Another very important factor in the progress that has been made is the practice of one of the leading lubricating supply companies, who, after establishing confidence as to the merit of their materials, agreed to furnish lubrication to the railways on a guaranteed cost per unit of service, and to comply with the contract requirements they employed a force of lubricating experts who were assigned to different sections of the country. These experts co-operate with the railroads in meeting the contract obligations by conferring with the officials of the mechanical department, watching the practices of employees whose duty it is to care for lubricants and lubricating devices, giving instructions as to the methods of operating them and reporting the results of their experience as to economical methods and devices observed by them on the different lines of road under their supervision.

The committee did not believe it was practicable to place the whole of the matter of locomotive lubrication in the hands of the traveling engineer for while no one was better fitted to know what should be done in the way of lubricating a locomotive, than he, this item of expense is handled in some instances by the mechanical department and in some by the store departments and therefore it was considered advisable by the committee that there should be one higher in authority, than the traveling engineer who could more satisfactorily deal with the whole question.

N. Y. C. & St. L. Use Telephone.

The telephone has been substituted for the telegraph in transmitting all train orders over the Cleveland division of the Nickel Plate from Bellevue to Conneaut, 132 miles, the busiest division between Buffalo and Chicago. With the exception of the twenty-five miles between Cleveland and South Lorain, and a short distance in New York State, this telephone train dispatching is done over a single track. To successfully operate the large number of trains which this road handles, with the many sidings where the meeting points must be made, is not an easy undertaking.

A Few Words to Ourselves.

The conclusion of the very valuable report of the committee dealing with the subject of educating firemen to become successful engineers, deals with what the committee refers to as a few words of advice to ourselves as traveling engineers. The report says: "Our duties as teachers and advisers should never cease. We must continue to aid every man in every possible way to become a successful engineer as long as we fill the position we now hold. If we as traveling engineers would teach our subordinates and aid them to become successful engineers we must first successfully fill the office we now hold. It is possible that some of us may have to burn the midnight oil very often to keep ahead of some men in our classes. Perhaps some of us have had occasion to look up a few things in advance to prepare ourselves to make a favorable showing when the more modern machinery has been presented in our territory.

"The traveling engineer has little or no idle time if he faithfully performs the duties of his office, and we, as traveling engineers, should never forget when addressing others in regard to their education on the locomotive and the duties expected of them that the same rule applies to ourselves. We, as teachers, cannot afford to cease our studies if we are to each others how to be successful, and should always be ready for an examination ourselves if required by the officials of the road we are serving.

"We, as traveling engineers, in order to successfully teach and handle the men, can have no favorites. Every one should share alike in our teachings and decisions regardless of relationship or friendship. Fair and impartial decisions should be rendered in every case.

"We take it for granted that every traveling engineer before he accepts the position has agreed with himself that he has come to a parting of the ways, a peaceable and self-respecting parting however, and we do not believe it possible for any one, we care not how honest he may be, to do justice to himself or any one else if he tries to look with one eye at the men and with the other one at the officials. Either one or the other of his eyes will be badly strained in the course of time and eventually both will become useless."

Don't be stingy because some of your charity went wrong. Think how much wasted mercy has been poured out on you. —*C. H. Yatman.*

General Correspondence

Low Water Alarm.

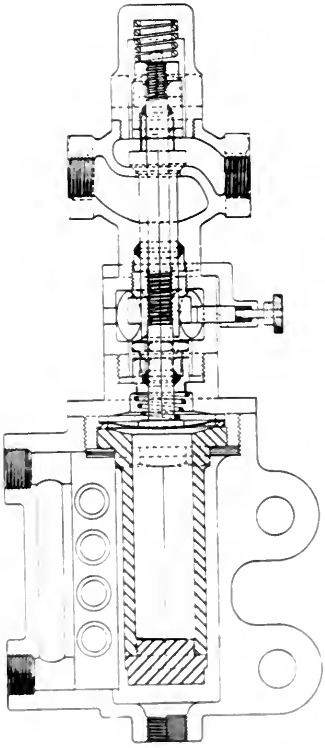
Editor:

I have just read the article in the July number of RAILWAY AND LOCOMOTIVE ENGINEERING concerning the inspection of boilers. I was particularly interested in the paragraph which makes the statement that automatic devices either to maintain the water supply or to act as an alarm when proper supply is not provided, have been proposed and given consideration, and that such devices have been found unreliable.

It is a well-known fact that an automatic low-water alarm has received a great deal of attention for a number of years. We have ourselves tried everything we have seen and could think of, endeavoring to find something that would be absolutely reliable in protecting our company from the results of boiler explosions. The necessity has been pressed upon us since the advent of the oil-burning locomotive which burns just as readily when the crew is asleep as when they are awake. We had almost given up the idea of ever perfecting a device that would be considered reliable, but each explosion brought the matter again to mind and we finally settled our experiments on perfecting an apparatus that would work on the principles of the thermometer. We now think that we are able to furnish an apparatus that is absolutely reliable. We have been working this for nearly a year on locomotives and stationary plants, placing them so they would operate whenever the water reached the point they were set at. In our experiments we have set them at half-glass. We have never had a failure and we consider that the apparatus is just as reliable as the thermometer.

I am enclosing blue-prints, showing the apparatus in section, the inner cup of which is filled with mercury and the lower connection is connected to the boiler at any desired height which is considered safe. This cup is surrounded with water, and when the boiler is filled and is maintained at the height of the water in the boiler there is no circulation of water, consequently no incrustation. As soon as the water in the boiler falls to the height of the boiler connection the water in the cup flows by gravity back into the boiler and steam enters. The steam being hotter than the water, which is somewhat cooled by exposure to the atmosphere, expands the mercury against the diaphragm, this in turn opens the steam valve similar to a governor on an air pump and after the steam is liberated from the boiler it is, of course, available for such purposes as we may wish to put it to. On an oil-burning locomotive the steam is then used first to blow an alarm whistle and second there is a connection to the steam pipe which shuts off the supply of oil and they will remain closed and the whistle continue to blow until it receives attention from the crew, or as long as there is steam in the boiler.

It is probable that the 260 explosions



LOW WATER ALARM FOR LOCOMOTIVES.

averaged $10,000 each, without counting the cost of life which is shown in your report and which cannot be computed in dollars and cents. Not figuring the engines which were damaged, which is the larger proportion, due to low water and assuming that the explosions would average $10,000 each, it would represent a money value of $2,600,000, and at $100 each for a device of this kind, would equip 2,600 locomotives or approximately half the locomotives in use in the United States.

I have a report from the B. of L. E. going to show that there were 102 deaths caused by boiler explosions of locomotives since 1896. If these men were insured at the minimum amount of $1,500 each, the B. of L. E. has paid their wives and relatives $153,000 death benefits.

I have a report from the Hartford Insurance Company going to show that there were 450 explosions in 1905 and 431 in 1906 and that these explosions killed and injured 1,670 persons. Their record on the Pacific Coast for the last five years shows 400 boiler explosions and 1,466 persons killed and injured. These statistics include both locomotive and stationary boilers that they have received a report of.

The matter is, therefore, of vital importance to railroads as an insurance feature and to the people engaged in operating them as a safety device. We have applied for a patent on this apparatus and have the matter up with the Nathan Mfg. Co. as to manufacture.

You may use all or any portion of this article, without reference to the writer or the company, at your discretion. You will remember me as a former club raiser and correspondent. SAFETY DEVICE.

Wants Information.

Editor:

In reply to Mr. W. H. Roberts' letter in the August issue of RAILWAY AND LOCOMOTIVE ENGINEERING as to work and time consumed in turning out Engine No. 384 of that road. The reader will please note the most important part of the job was left out; viz., the size of the engine and the number of mechanics used in turning out this engine.

I judge it to have been an 8-wheel passenger engine and number of hours worked 90. Now with men enough quite an amount of work can be done in that length of time. We should remember this magazine goes before the eyes of many mechanics, such as foremen and superintendents of motive power. And no interested foreman or master mechanic wants to see his shop in the rear, so I think we are all entitled to know the size of the engine, number of hours and men employed on the job.

While I was serving my time with the Baldwin Locomotive Works, at Philadelphia, Pa., we gave a 10-wheel passenger engine a general overhauling, including one new cylinder, in 80 hours.

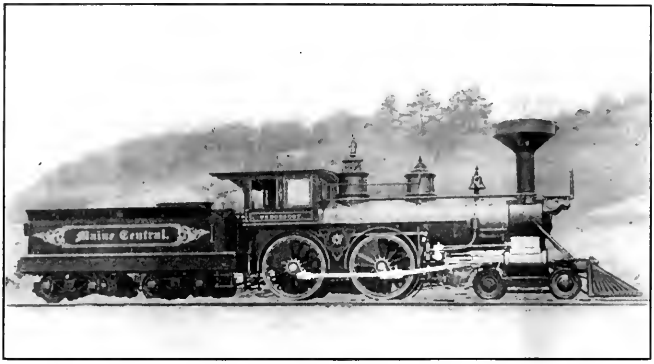
and did not consider it to be much of a record, either. I hope we may have a more full report that we may take notice of it and be governed accordingly.

L. C. BUCKHOUSE, C. & O.
Covington, Ky.

Some Portland Co.'s Old-Timers.

Editor:

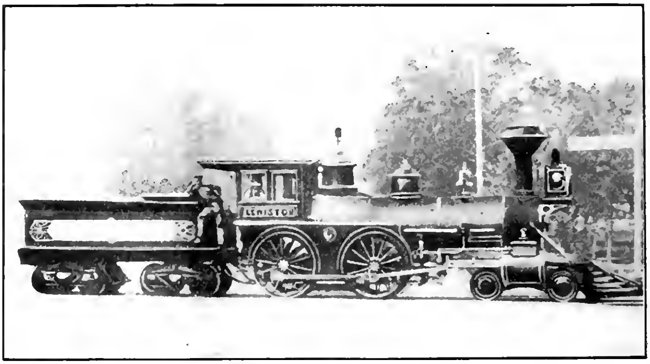
Engine No. 5, the "Penobscot," was the second engine of that name and number on the Maine Central Railroad. It was built by the Portland Company in 1871. The cylinders were 15 x 24 ins.; drivers, 5 ft. This engine was one of several of the same model built at that time, viz.: The second No. 1 "Androscoggin," second, No. 6 "Bangor," No. 10, "R. B.Dunn," No. 15, "A. D. Lockwood," and No. 20, "H. N. Jose." All proved to be very smart, and they were very pretty machines, with their brass encased cylinders, steam chests, domes and brass boiler bands, red driving and pony wheels, and fancy painting.



MAIN CENTRAL NO. 5, "PENOBSCOT," PORTLAND CO., 1871.

The "Penobscot" ran on various main line passenger trains for many years, until heavier engines gradually crowded out the lighter machines, then branch freight runs, snow plows were her portion, and eventually she ended her career as a switcher, and was sold and broken up with most of her mates in 1894. Originally these engines were equipped with balloon-shaped stacks, then the sunflower or mushroom stacks became the rage, and later they were equipped with diamond stacks and burned coal.

The old "Lewiston," built for the Androscoggin Railroad in 1870, leased to the Maine Central in 1872, was considered by the Androscoggin boys to be a little the slickest of anything on wheels. They thought she could pull the whole State of Maine behind her. She was built by the Manchester Locomotive Works with cylinders 15 x 24 ins., drives 5 ft., boiler 48 ins. She pulled freight on the hilly Farmington run for many years, and was sold and broken up in 1894. The photograph was taken on Maine Central crossing at Brunswick in 1875, with the veteran of the Lewiston branch, Charlie Nutting, in the cab.



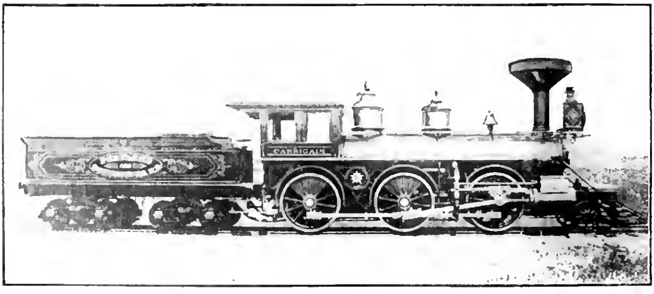
ANDROSCOGGIN RY. ENGINE "LEWISTON," BUILT 1870.

Portland & Ogdensburg, No. 7, "Carragain," was one of the first if not the first Moguls to run on a Maine railroad. They tried eight-wheelers at first in freight service, but the hills in the mountain district were so steep they could not handle many cars, and after No. 7 was tried, all their freight engines were Moguls. She was built by Portland Locomotive Company in 1874. Cylinders 17 x 24 ins., drivers 46 ins., boiler 48 ins., weight of engine 81,800 lbs., tender 55,550 lbs. when ready for road. She was a peach on the pull and was a very handsome engine, resplendent with brass and fancy painting.

The Portland, Saco & Portsmouth engine, No. 13, "Monsam," was a Portland Company product of 1877. She shows a distinct departure from Eastern practice in shape of stack and monitor cab roof She was evidently built for a racer.

The old Vermont Valley engine speaks for itself, and the Daniel Nason shows a fine modeled, old inside-connected wood burner. Note the six-wheel arrangement of tender; also mechanism between wheels.

CHAS. S. GIVEN.
Bowdoinham, Me.



PORTLAND & OGDENSBURG NO. 7, THE "CARRAGAN," 1874.

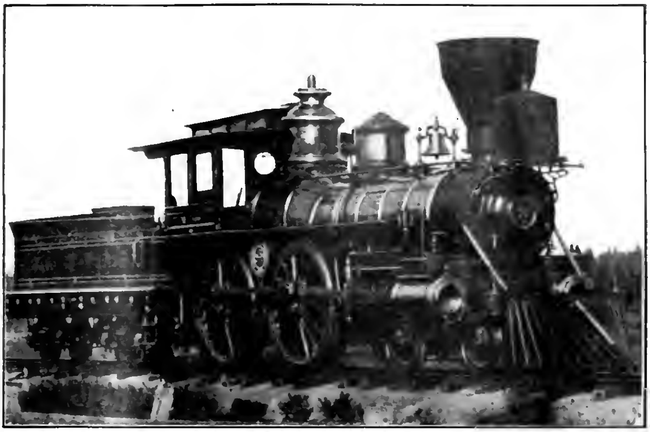
Road Kinks and Other Things.

Mr. W. H. Griggs, roundhouse foreman on the Chicago, Milwaukee & St. Paul at Portage, Wis., writes us about shop and road kinks as follows:

"Watching the 'loose screw' and little items is very often of as much importance as looking after the more glaring cases. It is often very handy to know just what some simple idea will save in delays and expense. If the steam heat between engine and tender on the through passenger engines happens to break off, and the pipe threads are left, it is handy to put two steam heat hose in place of the iron pipe to get the engine through and save changing engines.

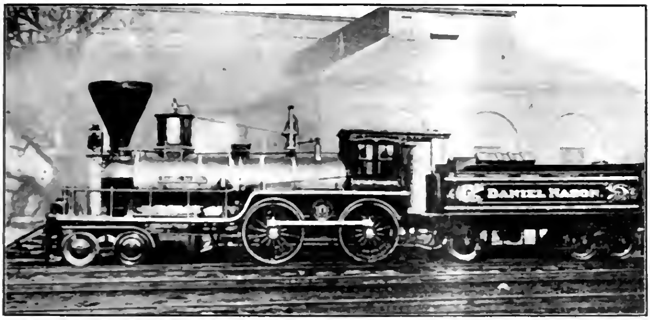
"Hot boxes on the through passenger engines can often be cooled at the station and packed if the journal is not cut, even if it takes 30 or 40 minutes rather than pick up an engine that may give worse trouble. A broken trailer spring or trailer equalizer does not always call for another engine to take the train through.

"If the small copper pipes leading to the pump governors breaks off one or more, it is not necessary to leave a big train up the country and come in light, when plugging the pipe with wood and blocking down the train governor valve will do the business until home is reached. Same with the pipe breaking off the equalizing reservoir.



PORTLAND, SACO & PORTSMOUTH NO. 13, "MONSAM."

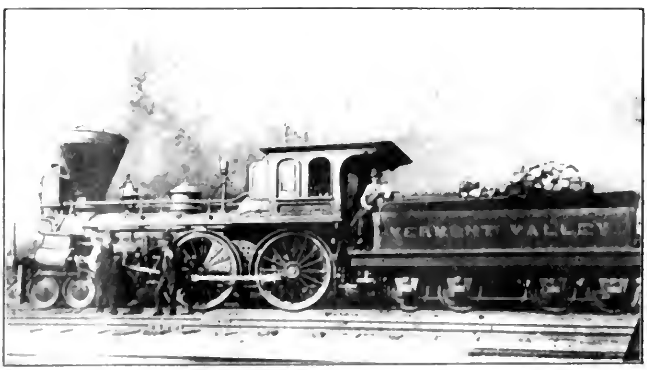
"Changing tires. This we do with the tire heater using fuel oil with the air-blast. It takes about 17 minutes to loosen a tire and about the same time to heat and get the other one on. Can change an engine with 6 tires in about 6 hours.



VERMONT VALLEY "DANIEL MASON," WITH [illegible] HELF TENDER

"Keep your roundhouse and premises clean. This house has often received compliments along this line. The cleaning up at the turn table, lead tracks, wood pile, at the doors, etc., is done by the roundhouse force, instead of being done by the section men as formerly. Same with the ice and snow of winter. Switches being the first thing the section men attend to in snowy weather, the turnable pit and tracks have to be cleaned by the roundhouse men. In dry weather the house and grounds are wet down every day from the pump. The roundhouse laborers now have to unload wood, and ties that are cut, unload sand, load scrap and any shipments and unload all material for the house.

"Instructions from the division superintendent are for the roundhouse foreman to report any excessive speeds of passenger trains through the yard passing the roundhouse that happens to be noticed. Also all unnecessary whistling in yard and blowing [illegible] the station. The roar of 200 lbs. steam [illegible] even small amounts soon becomes a nuisance.



[illegible] VALLEY ENGINE WITH WHISTLE DIRECT FROM BOILER

"M[illegible] inconvenience is experienced at time[illegible] in cold weather getting pro[illegible] of locomotive material. Cars get side-tracked, have to be traced, shipments of iron and bolts are generally slow in coming. The movement of locomotive material which is often needed in a hurry, would be more promptly delivered if these cars were given the preference, when it is known that they contain locomotive material. The company's material in 'peddler cars' often stands around the yard a few days before it is sent forward, even after the train department is notified.

"All enginemen and the roundhouse foreman are required to have their watches inspected once a week, on the week ending the 7th, 14th, 21st and last of month. The watch must be the prescribed standard and to run inside of 30 seconds either way during the week. The watch has to be cleaned every two years."

Class "O" on the Pennsylvania Lines.

Editor:

I have seen quite a bit of comment lately in Railway and Locomotive Engineering, about the Pennsylvania class "P" and class "K" locomotives. I have been greatly interested in the illustrations and discussions about them, and hope to see more about these engines in your paper, especially the older ones, as they have peculiarities about them which distinguish them from the engines of other roads. I have seen but little mention, so far, about the old class "O" engines. The locomotives of this class first came out in 1883, the same year that the "P's" appeared, but differed from the class "P" engines in

FIG. 1. P. R. R. ENGINE NO. 9316.

having but 130 lbs. boiler pressure, while the "P's" carried 140 lbs. I am sending you a photograph, Fig. 1, of a class "O" engine, No. 9316, built at Altoona shops in 1887. It has 18 x 24-in. cylinders and 62-in. driving wheels. The boiler is of the wagon-top pattern. The type of stack and headlight and the graceful outlines of the sandbox and dome all give the engine a distinctly "Pennsy" look, and older Pennsylvania men could easily recognize her.

The engine belongs on the Cleveland and Marietta division of the Pennsylvania Lines, and has just been turned out of the Fort Wayne shops, after a general overhauling. Later "O" engines were built having Belpaire boil-

FIG. 2. P. R. R. ENGINE NO. 7393.

ers. Quite a number of "O's" with Belpaire boilers are at present in suburban service around Pittsburgh and Allegheny on the "Lines West." In 1897 the Pennsylvania adopted a new system of classification, the old one becoming inadequate. All of the eight-wheel engines of the "A," "B," "C," "K," "O," "P" and "L" classes were reclassified as "D" engines, the letter "D" being the symbol for the 4-4-0 type in the new system. The engine shown in the illustration is known as class "D-10A" on the company's books.

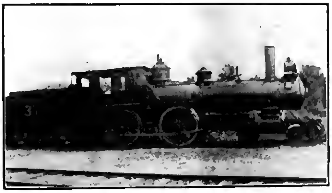
Engine 7393 (Fig. 2) is a standard "H 6A" class freight locomotive. She has 56-in. driving wheels, cylinders 22 x 26 ins., and a Belpaire boiler with wide firebox. The engine belongs on the main line (P., F. W. & C.) and has just received general repairs at Fort Wayne. I hope you will be able to publish these photographs, as they may be of interest to your readers.

ROB'T. C. SCHMID,
Draftsman, Penna. Lines.
Fort Wayne Shop.

The Making of Good Engineers.

Editor:

In answer to question as to making engineers and firemen, I would say that I would recommend that it would not be a disadvantage to any engineer or fireman to have in his possession a standard book on machinery, of all latest equipment. In my opinion the books would be read in a more careful manner at home, for a great many men of families would prefer this. Of course the libraries are all right for young single men and men who would prefer studying these books from home.



MASON ENGINE, BUILT IN 1857, STILL GOING STRONG.

In my opinion it is best in all cases for engineers to have regular firemen, as they remain together on the same engine or run. They become attached to ways of one another. The two will understand how to work to each other's advantage and, to the interest of the company they are employed by.

I have had several different firemen from time to time and want to say that it is best to have regular firemen in all cases. With regular firemen you can make a better showing in coal consumption than with a new fireman. Every trip, also, I can make better water runs where a regular fireman is assigned to me.

If a fireman expects to make an engineer out of himself he will take an interest in the engineers he might be firing for and also an interest in his engine. In my opinion if he does not do this, he cannot expect to become an engineer.

I would say, if a man who wishes to become an engineer he will take an interest in the machinery of the locomotive he may fire and make a careful study of handling an engine he will make as good a man as the helper might out of the shop. Shop experience is all right; at the same time a shop man may have some experience on line of road that he might not get in the shop. In my opinion the majority of men, brought up to engineers from the school, make good engineers if they elevate their ambition this way. I would be very much pleased to see this in the September issue.

SAM MUSGROVE,
Chattanooga, Tenn. Engineer Q. & C.

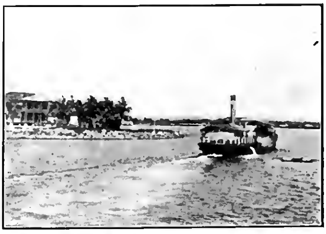
BIG FOUR, 4-4-2, MODEL.

Big Four Engineers, Attention.

Editor:

Being an old-time subscriber to RAILWAY AND LOCOMOTIVE ENGINEERING, I beg to ask you to give me some details about the fine Atlantic express locomotive built for the Cleveland, Cincinnati, Chicago & St. Louis Railroad, the Big Four, No. 361, as to the color of the engine and of the tender.

For the locomotive, I want particularly the color of the boiler and the part where the automatic coupling is; also the cowcatcher, engineer's cabin and wheels. For the tender, I want the color of the outside, as well as the color of the name panel, and also the wheels.



ENTRANCE TO CANAL AT COLON.

Furthermore, you will greatly oblige me, if it is possible, for you to send me a photograph of the Atlantic locomotive, Big Four No. 361. You will find a sketch of my model locomotive that I want the correct colors for.

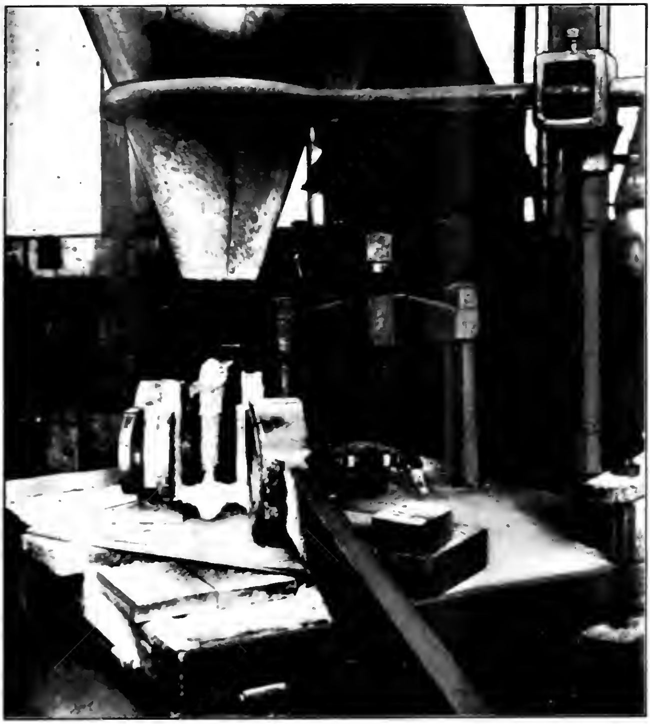
F. E. SCHUYLER.
Munich, Germany.

[We would be glad to have any of our readers on the Big Four send us the correct colors for the parts named by our correspondent from Munich, and we will publish them for his benefit.—Editor.]

Welding with Thermit.

Editor:

I send you herewith photograph showing the method of welding jaws on the clevis end of two ten-wheel locomotive side rods at one heat which was done at our Conneaut shops, using the Goldschmidt-Thermit compound. Prior to using the Thermit process for welding it was necessary to make an entirely new clevis end in case of the clevis jaw breaking. This added very much to the cost and time required to make the repairs as compared with the present method.



WELDING JAWS ON CLEVIS END OF SIDE ROD.

E. A. MILLER.
S. M. P. of the Nickel Plate
Cleveland, Ohio.

Making of Good Engineers.

Editor:

Replying to the question asked on page 275 of July issue of RAILWAY AND LOCOMOTIVE ENGINEERING, entitled "The Making of Good Engineers," I hereby wish to express my views on this subject. In reply to the query, "Would you recommend the best standard books on machinery for the education of engineers and firemen to be in railway libraries?" Answer—I do. It was at the Riverside Baltimore, Maryland, department of the Young Men's Christian Association where I first had the prestige to enjoy reading RAILWAY AND LOCOMOTIVE ENGINEERING. I at once became a regular subscriber.

I consider it best to have these books at my home, as I find I can concentrate my thought and time to the reading of the sacred pages of useful information that a man could never get at the street corner or in the roundhouse. I believe in a regular fireman, but I will say that a new fireman every trip makes the best man as fireman, for he fires for all kinds of men, from the one that would make a better marine engineer to the one that uses dry steam. Ninth question I do not care to answer.

WM. F. EBERSWEIN,
Engineer B. & O.
Philadelphia, Pa.

Curious Optical Illusion.

Editor:

Some time ago I saw the following in a daily paper:

Prof. R. W. Wood of Johns Hopkins University some time ago described a rather startling optical illusion which any one may see with a little practice. A lead pencil is held, point up, an inch or two in front of a wire window screen, with a sky background. If the eyes are converged upon the pencil point, the wire gauze becomes somewhat blurred and of course doubled. As the gauze has a regularly recurring pattern, however, the two images can be united, and with a little effort can be accommodated for distinct vision of the combined images of the mesh. As soon as accommodation is secured the mesh becomes perfectly sharp and appears to be nearly in the plane of the pencil point. If now the pencil is moved away from the eyes, which are to be kept fixed on the screen, it apparently passes through the mesh and becomes doubled. If now the pencil be removed entirely it will be found that the sharp images of the combined images of the gauze persist, although the eyes be moved nearer to or farther away from the screen. Now bring the eyes up to within six or eight inches of the plane in which the mesh appears to be and attempt to touch it with the finger. It is not there. The finger falls upon empty space, the screen being in reality a couple of inches farther off. "This," says Prof. Wood, "is by all means the most startling illusion I have ever seen, for we apparently see something occupying a perfectly definite position in space before our eyes, and yet if we attempt to put our finger on it we find that there is nothing there."

New York. S. H. G.

Central American Engines.

Editor:

I am enclosing you some kodak pictures taken in Central America of some engines and, also enclosing you some train orders, No. 31, and two letters written from an engineer who is running an engine down in Guatemala, Central America.

These pictures may be of some interest to you and you may be able to place them in next month's RAILWAY AND LOCOMOTIVE ENGINEERING. After they have served your purpose you might return them to me. I noticed in this month's magazine a great many cuts of American type engines and some of our engines, and these being from Central America, I thought it might interest a great many readers that take RAILWAY AND LOCOMOTIVE ENGINEERING. The stamps which I enclose are also from Central America

VIEW FROM CAB WINDOW.

and which are for your own personal benefit. F. C. Reed,

Master Mechanic, Mo. Pac. Ry Sym.

McGehee, Ark.

[We print below one of the letters referred to by Mr. Reed. It is from Mr. L. Woodworth, of Puerto Banios, Guatemala, C. A. It is addressed to Mr. Wm. Reed.—Editor.]

Your very pleasant letter dated April 7 received was indeed. I was pleased to hear from you, also to know that the post cards and photos were of interest. I have a number of pictures I have taken along this road recently and will send you a few providing they are O. K.

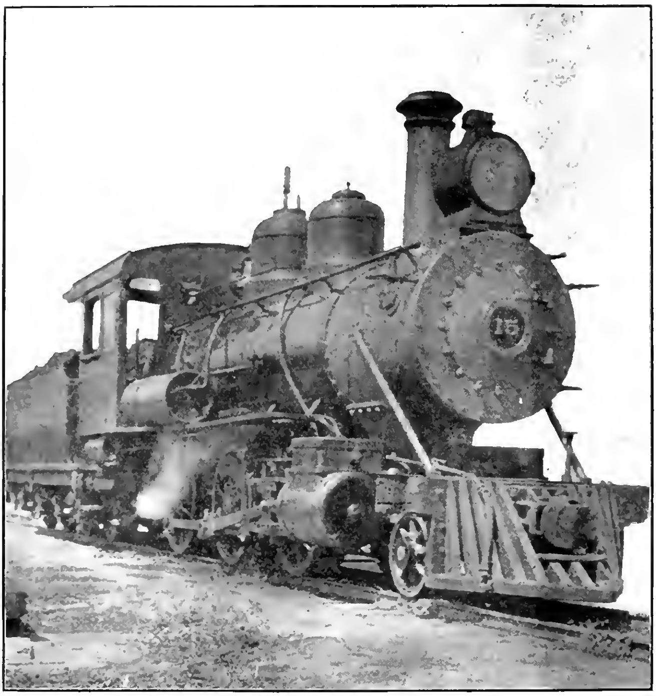
I note what you have to say regarding a trip to Central America. I am sure you would find many points of interest in this country. It will not be long until there will be a direct rail connection between Puerto Banios and the United States. I have been in the mountains for the past six days and killed a snake 9 ft. long. I have had it skinned and intend to take it to the United States when I go. I got two tiger kittens; one died on the way home, but the other is doing fine as I am feeding him from a bottle.

I'll try to do a little railroading now. The wrecking gang has just returned from picking up an engine which has been laying at the bottom of one of the high fills, with ten cars on top of it, for the past two months. There is nothing left but the wheels and the boiler. Even the jacket was torn off. She got away on a 4½ or 5 per cent. grade and ran about one-quarter to one-half mile before leaving the rails, and when she left the rails with her train she never marked a tie nor injured the track. Everyone of the crew was killed.

I'll tell you how I look at a man working in any of these countries; for instance, myself. I have been with this company about four years, and have a regular passenger run over two divisions —east, 102 miles; west, 94 miles, running time, 6 hours and 20 minutes. Class of engine, Baldwin, 17 x 24 ins.; 2-6-0 type; drivers, 48 ins.; steam pressure, 180 lbs.; three and four coaches is the regular train. The west division is 60 miles mountain, with as nice a climate as anyone could wish for. In fact, it is the best place I have ever seen or worked at. Now I'll give you a few reasons why I would like to locate in some part of the United States. One is, as soon as the natives here can be trusted to handle an engine they will get us out, meanwhile I am getting older instead of younger, making it more difficult to secure a position in the United States when I go back. About six months ago the company put all native brakemen running trains, but they made a complete failure, so much so that there are only two left; but the day will come when they will not need the American here to teach them. I worked for the Missouri Pacific about seven years ago, as fireman, and I have been on a number of other roads, in different parts of the United States. I did my first running on the old Ohio Southern, out of Jackson. I am personally acquainted with one of the oldest engineers on the Missouri Pacific, Mr. W. S. Bound, at present running out of Kansas City to Omaha, Neb. He has written me at different times to come home. On account of my neglect and not sufficient courage I remained here, but my mind is made up to leave here in September and see what I can do for myself in God's country again. I would prefer to work South rather than in the extreme cold of the North, as I have not been up against any snow for about six years.

L. Woodworth,
Locomotive Engineer.

Puerto Banios, Gautemala, C. A.

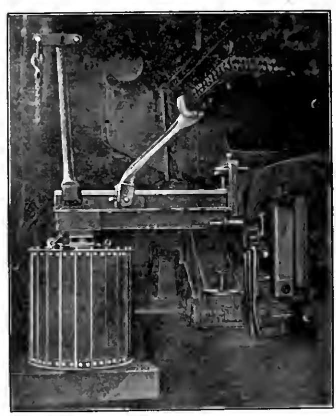


2-6-0 ENGINE ON THE GUATEMALA RAILWAY.

Air Jacks for Wheeling Engines.

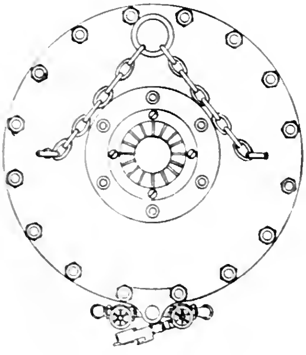
Editor:

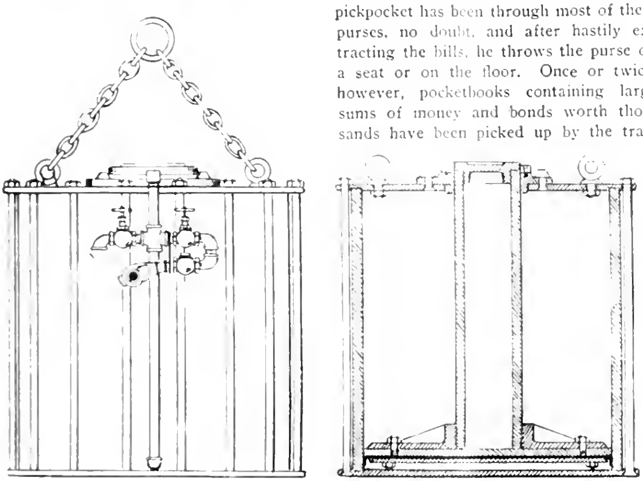
I am sending you blue prints and photograph of our method of wheeling modern locomotives in an old-time shop that was built in 1865. One print shows details of the 21-in. jacks that are used, and the other print shows the cart used to transfer the jacks from engine to engine. These air jacks have in every way answered the purpose for which they were built.



AIR JACK PLACED FOR A LIFT.

They are used to wheel modern up-to-date locomotives and do it with ease, with air pressure of 110 lbs. The jacks are used at front end of engine and 24-in. jacks at back end are made from boiler steel, ½ in., rounded up and fastened with





SIDE VIEW AND SECTION OF AIR JACK.

strap and rivets, which was afterwards bored out, making smooth fit for leather. Our method of jacking is as follows: Jacking bar is made from two 80-lb. rails riveted together and held in place on engine as shown by photograph. This jacking bar is of such length that it allows the wheels to be rolled out or in without crankpins interfering with jacks when in position. The engine is raised by jacking up rear end about 18 ins. and then blocking, and then jacking from front end and blocking used after truck is removed.

By this method modern locomotives can be wheeled in one hour and thirty minutes. The jacks are operated by two laborers, one man operating one jack only, and signal given to raise or lower by machinist in charge. Air is admitted to cylinders by ½-in. globe valves, and exhausted by same method. A ½-in. check valve is placed next to air hose connection, which will hold the air in the cylinder in case air hose bursts. On end of jacking bar you will notice a mast with chain, which is used to raise the jack from floor to place blocks under the jacks as engine is raised or lowered. Believing that this will interest readers of RAILWAY AND LOCOMOTIVE ENGINEERING, and trusting it will be published,

CHAS. MARKEL,
Shop Foreman C. & N. W. Ry.
Clinton, Ia.

Lost Articles on Railways.

The lost article departments of the railroads are curiosity shops. They contain the accumulation of years, as fully a third of the articles left on trains are never called for. A company has, for example, a bushel or more of purses. They contain very little money as a usual thing, but pictures, newspaper clippings, poetry, and samples of dress goods in abundance. The pickpocket has been through most of these purses, no doubt, and after hastily extracting the bills, he throws the purse on a seat or on the floor. Once or twice, however, pocketbooks containing large sums of money and bonds worth thousands have been picked up by the train men. Boxes of cigars and shoes are quite common. Violoncellos, snare drums and cats in boxes have been taken out by the conductors. Some years ago, it is said, a man stopped at New Haven long enough to hand an expressman a traveling bag, directing the latter to take it to a certain address, where he said he lived. The address was fictitious, and the expressman was wondering what to do with the bag when he discovered that it contained a live infant. The supposed father had taken another train, so the satchel's contents went to an asylum.

Slide Valve Trouble.

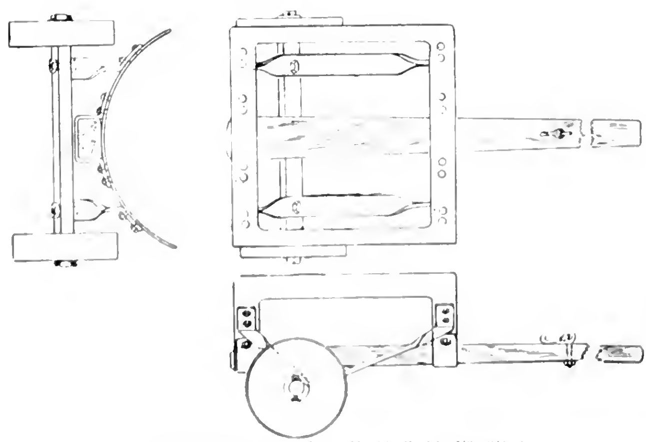
Editor:

We are experiencing some difficulty in getting the blow out of an engine, and would be glad if you or any of your readers will fathom the mystery for us.

The engine referred to was equipped with the Allen-Richardson ported slide valve, and for some cause the Richardson balanced valve was substituted in the place of the ported valve. The engine will blow very hard when in full gear and in starting the train the valve seems to be cocked in some manner. After ten or fifteen revolutions and when the reverse bar is cut back, the engine stops blowing and presumably the valve seats itself. I give you all the dimensions and would thank you it you would advise where the trouble lies. Steam ports, 20 x 1⅝ ins.; exhaust ports, 20 x 3¼ ins.; valve travel, 5½ ins.; area included within the valve packing strip, 32.5 sq. ins.; lap outside, 7/8 ins.; lap inside, none.

We tried to overcome this difficulty by filling in the valve seat on both sides marked A in the sketch, thinking that on account of having changed the ported valve to the solid valve this would decrease the area on the bottom of the valves. This change helped one engine a little, but it did no good to the other.

The rule that I have in figuring up the area necessary to include within the inner edges of the same strip is as follows: To the area of the exhaust cavity add the area of one steam port; total area so found is the area which should be in-

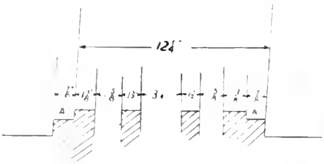


WAGON FOR CONVEYING AIR JACK ABOUT SHOP.

cluded within the packing strips, which figures out in this case thus:

1.625 width of steam port.
20 length of steamport.

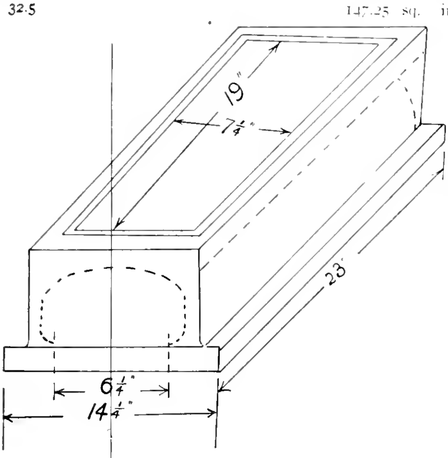
32.5 ins. area of steam port.



VALVE SEAT.

9 width of exhaust cavity.
20 length of exhaust cavity.

180 ins. area of exhaust cavity.
32.5



PERSPECTIVE VIEW OF VALVE.

212.5 sq. ins. total area of steam port and exhaust cavity.
7.75 width between packing strips.
19 length between packing strips
147.25 sq. ins. area are included within the inner edges of the packing strips.

OLD MASON ENGINE BUILT AT TAUNTON, MASS., IN 1873.

212.5 sq. ins. total area of steam port and exhaust cavity.
147.25 sq. ins. area, included within packing strip.

65.25 sq. ins. area lacking, to be included within the packing strips, and it seems to me this deficiency would favor the defect. However, the valve is giving trouble. Can you or your readers enlighten me as early as possible, and oblige

A SUBSCRIBER.

C. & O. Shops,
Covington, Ky.

[We would be pleased to hear from any shop men or others who have had similar trouble, who have remedied it, or who can offer a solution of the difficulty here presented by our correspondent. The illustrations which he gives should aid in finding the remedy. —EDITOR.]

Engines, Ancient and Modern.

Editor:

I am enclosing two photographs which I think may be of interest to your readers. The one, Engine 217, is a Mason engine, built in Taunton, Mass., in 1873, before the days of air brakes and automatic couplers. The only person I know in the photograph is Mr. W. H. Delaney, the engineer, of Sayre, Pa., now engaged in running one side of trains, No. 5 and 6, between Sayre and Buffalo, with a modern F. B. class.

Engine 900 is one of the latest engines and is included in an order of 15 to be built in the System shops at Sayre, Pa. Hoping you may find space in your valuable paper for these photos,

E. J. DELANEY.

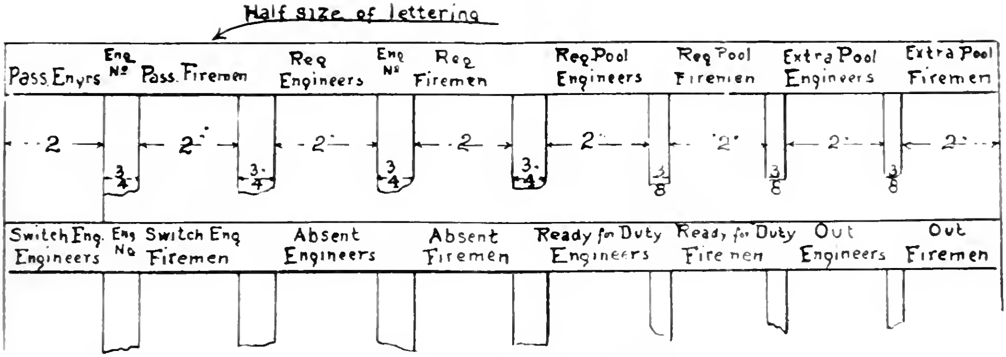
Athens, Pa.

A New "Block" System.

Editor:

One of the most annoying conditions a roundhouse foreman has to contend with is keeping his crews straight. More especially where he has a number of different classes of work. Take a terminal, for instance, same as we have here, where we have about 218 crews, some on passenger, some on regular runs, some in regular pool, regular switch engines and extra crews, some method must be used in order to keep these crews in their places and know where they belong. Where this is not done, the foreman has everybody after him, and anyone who has never had the experience of a roundhouse

LEHIGH VALLEY 2-8-0, BUILT AT THE COMPANY'S SHOPS AT SAYRE, PA.



SECTION OF CABINET FOR CONTAINING NAMES OF ENGINE CREWS

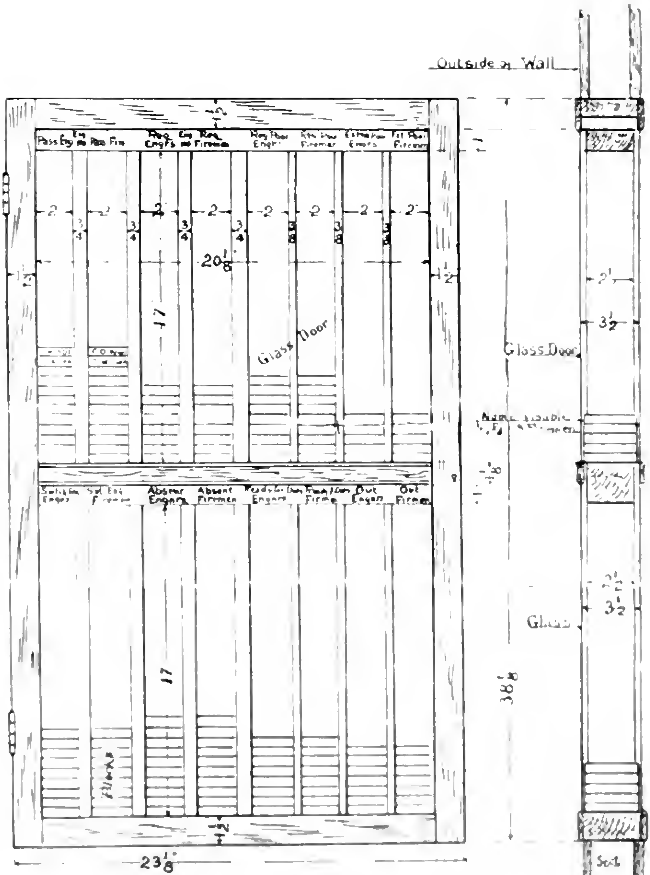
foreman cannot conceive what he has to contend with, especially at a large terminal.

Our first method to keep a record of "out" crews was a large bulletin or blackboard. When a man, or, rather, a crew, came and registered, the foreman or his clerk would mark them up on this board in their turn; this was done with a piece of chalk. Crews coming in after this one would be put up or marked up under the first one and so on. As soon as their turn came to go out they were marked up on the outgoing bulletin board, and their names erased from the other board. However, this board was pie for the engineers and firemen, in case there was anything going on around town, such as a dance, circus, street fair, etc. By the time you wanted men there was none, no record of them laying off, and simply no names on the board, as they would come to the roundhouse and erase their names, and no one knew where they were or where they belonged. The method we had in finding them was by checking them up on the register; we could get some in this manner, but some of them were so foxy they would not register, and there was hard work to locate them.

I finally conceived the idea of making a bulletin box with the block system; this shows at all times where the men are, whether out on the road or at outside points, laying off, suspended, sick, regular run in pool or on extra list. In fact, there is no chance to make an error in handling the men as outlined and as is shown on this print. The men can see at all times just how they stand and do not need to bother the foreman as to when they will get out or turn come, as there is a glass door on either side of this box, and the names of the men are on each end of the block so they can be seen on either side. This system can be handled by anyone, as it is very simple and well liked by all who have ever used it or who have seen it used. The men cannot take their name blocks out of the case, and as the record covers all kinds and all classes of cases, everything goes on all right.

W. J. SHADLE,
General Foreman C. & N. W. Ry.
Clinton, Ia.

The grace of God forbids we should be
overbold to lay rough hands
On any man's opinions. For opinions
Are, *certes*, venerable properties;
And those which show the most decrepitude should have the gentlest handling.



CABINET CONTAINING WOODEN BLOCKS WITH NAMES ON EACH END.

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances.

Published Monthly by

ANGUS SINCLAIR CO.

114 Liberty Street, New York.

Telephone, 984 Cortlandt.

Cable Address, "Loceng," N. Y.
Glasgow, "Locoauto."

Business Department:
ANGUS SINCLAIR, D.E., Prest. and Treas.
JAMES KENNEDY, Vice-Prest. and Gen. Mgr.
HARRY A. KENNEY, Secretary.

Editorial Department:
ANGUS SINCLAIR, D.E., Editor.
GEORGE S. HODGINS, Managing Editor.
JAMES KENNEDY, Associate Editor.

Boston Representative:
S. I. CARPENTER, 643 Old South Building, Boston, Mass.

London Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., 3 Amen Corner, Paternoster Row, London, E. C.

Glasgow Representative:
A. F. SINCLAIR, 15 Manor Road, Bellahouston, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid in the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribe in a club, state the name of the agent.

Please give prompt notice when your paper fails to reach you regularly.

Entered at the Post Office, New York, as Second-class Mail Matter.

The Parting of the Ways.

In the very thoughtful paper presented at the recent convention of the Traveling Engineers' Association on the subject of educating the fireman of to-day to be the successful locomotive engineer of the future, the committee dealing with this very important subject, goes a little out of the usual rut when in the concluding paragraphs of the report they say: "Now a word of advice to ourselves as traveling engineers." They have dealt with the matter of education and the systematic instruction of firemen in a broad-minded and comprehensive way. A synopsis of that paper is to be found in another column of this issue. We have, however, printed the concluding paragraphs of the report in which the traveling engineers' committee give advice to those of their own order, as a separate article in this issue of RAILWAY AND LOCOMOTIVE ENGINEERING, headed, "A Few Words to Ourselves." It is to be found on page 362.

One of the most significant points made in this piece of advice is that when any locomotive engineer is appointed to the position of traveling engineer he has, they say, silently and quietly come to the parting of the ways. Not that he must give up all feelings of sympathy for the men from whose ranks he has come and go over body and bones to the company that has promoted him; nor can he, by the same loyal feeling which animates him, accept the position as a gift from the company and yet secretly work against them. He has silently come to the parting of the ways and he honorably accepts his responsibilities to both, and adopts the strong, fair, impartial middle course.

Somewhere below the surface a man wth the old Anglo-Saxon love of fair play ingrained in his very nature, will recognize the necessity of impartiality when he is placed so that he must work between two interests, for the common good. It is here that the manly man makes good his claim to the respect and confidence of both sides. The thing is possible of accomplishment and the traveling engineers have in this report gone on record for fair play and a square deal. It is alike creditable to their quick and keen appreciation of the undoubted and acknowledged difficulties that confront them, and to their honest determination to play the game according to the rules and conduct themselves honestly and earnestly between company and the men, without fear, favor or effection.

We commend the report to which we have referred and the "advice to ourselves" which it contains, to everyone of our readers from engine wiper to president. The committee have covered the subject ably and well, and they have seen with unclouded eyes their plain duty and the words they have written is the speech of manly men.

The Railway Congress at Berne.

The International Railway Congress which is generally held every five years, met at Berne, Switzerland, this year. The congress was well attended, railway experts from all parts of the globe were present and the session lasted two weeks. In dealing with railway rails, the reports on tracks and maintenance methods showed that the practice of the English speaking countries limits the length of the rail on account of the difficulty of handling. In the United States rails are about 33 ft. long. In Great Britain they are about 45 ft., while on the continent lengths as high as 72 ft. appear to have given satisfaction. The best form of rail joint has not been decided on and the work of the committee on that subject is to be continued.

In Great Britain engine loads are commonly 100 tons with axle loads of about 20 tons. In the matter of improvements in locomotive boilers Messrs. Fowler and Archbutt, of the Midland Railway of England, presented a very extensive report among the many on this subject that were presented. In RAILWAY AND LOCOMOTIVE ENGINEERING for January, 1910, page 17, April, page 151, and July, page 287, a synopsis of this paper may be found. Superheating which has been very extensively experimented with on the continent and on the Lancashire & Yorkshire in England, from indications given in the report, will probably become general.

When it came to the matter of statistics Mr. W. M. Ackworth said: "There are no statistics of railways in operation, and no uniform classification of working expenses." Other English railway statisticians vigorously combatted this opinion, while representatives from the leading railways of India and Argentina believed that ton-mile statistics were useless unless local conditions were known. The American delegates supported ton-mile statistics but admitted that they could be wrongly used. An attempt was made to pass a resolution to the effect that uniformity of railway accounts on broad lines might be arrived at and this would make the results in different countries comparable. It was urged in support of this that South Africa had been the gainer from being able to compare the results of railway working with those in the United States. The general opinion seemed to be that owing to the diversity of conditions, not only in different countries, but in the same countries an international system of uniform railway accounting even on broad lines was not possible..

Electrification of railways received attention in four reports. Mr. George Gibbs, for America, spoke on electric traction on existing steam railroads. He believed that all first costs of conversion of steam roads to electric working should be dealt with separately. He showed that the Long Island road operated their electric system at a cost of 18.8 cents per car mile, against steam traction costs of 27.95 cents. No separate report was presented for Great Britain, but the single phase system by which the Brighton Company's South London lines are operated has proved successful. The London, Brighton and South Coast Company have now decided to convert other suburban lines to electric working.

An interesting report was presented by Dr. Gleichmann on the preliminary work for the introduction of electric operation on German main lines of railway. He showed that when it is a question of introducing electric traction on large connected lines an alternating system is preferable. The Swiss Federal Railways are also contemplating the adoption of electric traction on their international lines. The Austrian State Railway were reported to have the subject under consideration, the proposal being to convert 2,690 miles of main line, within range of available water powers, to the single phase system.

It was shown that in the United States

the average cost of freight carriage by rail was below the average cost of water transport on the continent. The lowest rate on French waterways is 7.8 mills per ton mile, against an average rate on the New York Central of 6.4 mills, and on the Big Four of 5 mills.

Another of the many interesting topics was large railway stations. Other subjects were motor-car and motor-rail services, the operation of light railways, and long railway tunnels.

The congress adjourned at noon, July 16, to reassemble at Berlin in 1911. Mr. Franklin K. Lane, a member of the Interstate Commerce Commission, and Mr. W. F. Allen, the general secretary of the American Railway Association, were elected members of the Permanent International Commission. Mr. George W. Stevens, president of the C. & O., and a member of the same commission, was re-elected. The opinion of the Americans attracted much attention throughout the meeting of the congress, which adopted several American recommendations, among them that of Mr. W. G. Besler, vice-president and general manager of the C. R. R. of N. J., regarding car hire and demurrage, also the recommendation of Mr. J. M. Culp, the vice-president of the Southern Railway, concerning perishable freight; and the recommendations of Mr. H. A. Jaggard, superintendent of the Pennsylvania, and Mr. D. F. Crawford, superintendent of motive power of the Pennsylvania lines west, as to large stations and the use of steel in the construction of locomotives and rolling stock.

The American and English delegates were successful in compelling the introduction of English parliamentary practice for the conduct of the business of the congress. The session was the eighth in the history of the congress and was attended by 1,500 representatives.

The Roundness of Wheels.

In an interesting paper on the subject of unevenly chilled and untrue car wheels, read by Mr. T. W. West before the American Society for Testing Materials, the speaker pointed out that an uneven depth of chill in the treads of cast iron car wheels was a very serious defect, and failure often takes place in such cases, while there would probably have been no failure if the chill had been of uniform depth.

This leads to the consideration of strength and it appears from experiment that taking two casts from the same ladle, and allowing one to make the ordinary gray iron and the other to chill, the latter has on the average about twice the strength of the former. In the matter of contraction the chilled and the gray iron from the same ladle it was found that the two samples were about equal.

In dealing with the roundness of wheels Mr. West referred to some careful tests that had been made on the Lake Shore & Michigan Southern for the purpose of ascertaining how closely the average car wheel approximated to being a true circle. The tests were made under the supervision of Mr. S. K. Dickinson, assistant superintendent of motive power of the road, and Mr. H. E. Smith, engineer of tests. Six pairs of wheels, each of different make, were mounted on axles and placed in a lathe with centers firmly pressed up. The treads were divided into eight sections each, and the wheels were turned by hand. A specially constructed micrometer was used to detect any variation in roundness; some of them were found to be as much as .043 in. out of truth (that is nearly 3/64ths).

The speaker held that the results of these experiments proved the necessity for testing the roundness of cast iron car wheels, and that some improvement should be instituted for securing a more uniform depth of chill and closer approximation to the perfect circle. He believed that if systematic tests of wheels for roundness were carried out by railroads, few wheels now made would be passed. A cheap and easy method of making the test for roundness would be by the use of an internally-turned ring placed over the tread before boring.

While the uneven depth of chill undoubtedly tends to shorten the life of the wheel, the fact that it is more or less out of round must cause some vibrations and prevent the smooth running of the wheel with the result that pounding due to irregular shape aids in creating fractures and in any case is hard on both wheel and rail.

Another fact shown by the experiments is that the chill-mold expands about ¼ in. in diameter after the pouring of the metal. This causes a movement which is opposite contraction and which, in the case of the compression chill causes the arms to pull away from the contracting crust of the wheel more than their expansion can force them inward. This defeats the purpose for which the chill mold was designed, viz.: that of having the arms hug the contracting crust, which is necessary in order to obtain an even depth of chill and secure true roundness in wheels.

Hot Bearings.

Hot bearings as may be expected occur oftener in the dog days than in midwinter. The condition of the atmosphere, however, is never the main cause. Over-pressure, lack of lubrication, sand or other substance in the bearings, and excessive speed are among the chief causes of heating. Graphite is generally acknowledged to be a good cooling lubricant, and should be mixed with a suitable form of grease. In all cases the trouble should be attended to as soon as possible. In the case of a driving box the wedge should be loosened sufficiently to insure the freedom of movement of the box in the wedges, but not further, as the tendency of a loose box is to increase the trouble. If cooling the box and loosening the wedge fails to relieve the liability to heating, the weight on the driving box should be relieved if possible. This may be done by moving the wheel up on a wedge placed on the rail. This will raise the box above its usual place. The space between the frame and spring saddle can then be blocked, so that when the wheel is in its normal position on the rail there will be little weight upon the driving box and unless the brass or axle is cut it will not likely heat when relieved of weight.

In the case of heated eccentric straps it is always safe to loosen the strap and add one or more thin liners. The reverse lever should be moved very cautiously as heated eccentric straps are easily broken, and cast iron straps should not be cooled with water. Heated rod brasses are very apt to close the hole in the oil cup and care should be taken in examining the heated bearing to note that the opening to the oil cup is clear. Most of the larger locomotives have now hose pipes which can be readily brought into use and water applied to the heated bearings. The rod keys may be slightly loosened and if carefully cleaned and lubricated the rod-brass may not give further trouble. In oiling care should be taken to oil the sides of all boxes and bearings. Perhaps the principal cause of heated driving boxes is the insufficient packing of the cellar. Unless tightly packed the cotton waste soon settles away from the box and the oil is thereby lost to the bearing. The packing in the cellars should be examined occasionally, and all oil cups on rods and guides and rockers should be removed and carefully cleaned at regular intervals.

Good Records Aid the Men.

Good discipline is the principal factor of organization, and nowhere is this fact recognized more than on the great railroads of this country. To attain this end different methods have been adopted by different roads. For many years the Lehigh Valley Railroad have dealt with minor infractions of its rules by what are known as "record suspensions." It is recognized that on any large railroad system, where thousands of men are employed, there will occur certain infractions of the rules which are not sufficiently grave to cause dismissal, but which cannot be passed by without notice.

The old method was to suspend a man for a certain period, thereby depriving him of the wages which he would otherwise earn, and this generally was a hardship to his family. The Lehigh Valley have therefore adopted a system of "record suspensions" whereby no time is lost by an employee. A suspension of one week, two weeks, or one month, as the case may be, is entered against his record in the same manner as if he were actually out of service for that time, although actually he does not lose the time. These records are taken into consideration when an employee is considered for promotion.

The Lehigh Valley Railroad have found "record suspensions" to be as efficient as actual suspension, as it being a matter of personal pride with railroad men to have a clear record, it was decided by this road to further revise their system of discipline so that, beginning July 1, 1910, employees with records in which suspensions appear would have an opportunity to clear them, by loyal and efficient service in the future, and to provide a system whereby their future records would receive the benefit of meritorious service. Clear records for a stated period are now recognized by credit allowances, and heroic or meritorious service, whether in or out of the usual line of duty of the employee, are now rewarded by further credit allowances. A definite limit to demerit records has been established to indicate the unfitness of an employee to be retained in the service.

Employees having a clear record for two years prior to July 1, 1910, are entitled to cancellation of all previous demerits up to that date. A clear record for one year prior to July 1, 1910, will cancel all demerit records prior to Jan. 1, 1905, and a clear record for twelve consecutive months at any time after July 1, 1910, will cancel demerit records to that date. Employees not having a clear record for one year prior to July 1, 1910, will retain their records as entered upon the books, but a clear record for twelve consecutive months at any time will cancel their demerit record prior to Jan. 1, 1905, and a clear record for two periods of twelve consecutive months each, will together cancel all demerit records to July 1, 1910.

The Conservation of Energy.

The subject of the conservation of energy which is one of the most profound conceptions of the physical universe ever framed by the human mind is interesting to all students of science, but it has in it something which peculiarly appeals to railroad men, who in the performance of their many duties are constantly experimenting with and exemplifying this great truth, even though they may not be fully aware of the fact. On page 245 of the June issue of RAILWAY AND LOCOMOTIVE ENGINEERING, one of the editorial staff took up the subject of Potential Energy. In this article the actual or kinetic form of energy was incidentally treated. Energy has been defined as the ability to do work, and this energy may be either in the potential or in the actual form. The great theory of the conservation of energy depends practically on the truth of the statement made by the highest scientific authorities after exhaustive experiments, and backed by accurate mathematical investigation, that "Throughout the universe the sum of these two energies is constant."

This means that it is as impossible to create energy as it is to create matter, but it is within the range and scope of man's powers by various means, more or less ingeniously contrived, he may change energy from one form to another, and so perform many acts for his own comfort or pleasure which would be utterly beyond the reach of his own unaided powers, but notwithstanding all this, he is as unable to destroy even the smallest fraction of existing energy, and he is equally unable to call into being even the merest trace of energy not already existent.

As a rule, the transformation of energy most easily accomplished is that from the higher to the lower forms, as, for example, when the flow of electric current generates heat and light in an ordinary incandescent lamp. The electrical form of energy may have consumed much coal and have been generated by the use of a costly and delicately designed machinery with much frictional and other losses, but it easily runs down the scale to that form of energy known as heat.

Faraday in 1831 discovered that when a conducting body is made to move in the neighborhood of a magnet, the relative motion of the two produces currents of electricity in the conductor. This is the fundamental principle underlying the use of dynamic electricity as applied today. Unless the electricity so produced be made to do work or become, so to speak, stored up in the potential form, it will in time fritter itself down to heat in the machine and on the wire. The tendency is for the higher form of energy to seek the lower and when mankind takes the lower form and endeavors to raise it to the higher, he is only able to do so at the cost of great mechanical loss.

An interesting view of the conservation of energy that appeals to railway men is that the usefulness to man of the work done, does not come into nature's view of the case. When you go into a railway repair shop and see a heavy, powerful, electrically-driven axle lathe "hogging" off the metal in a hot, blue, crisp, crackling curl of steel, you see very forcibly that as far as man is concerned, it is the formation of the axle he is anxious about, while with nature it is solely the transformation of energy and the incidental production of heat, and in amount proportional to the energy expended in turning the axle against the cutting tool. The workman eventually turns the axle, the hot chips drop and cool, and nature has liberated an enormous quantity of heat.

In like manner, the hauling of a train from New York to Chicago requires the expenditure of a prodigious amount of energy, changed from the potential form in which it resides in the coal, into the form of heat, which is, with great loss, used to generate steam, and, finally, through the motion of pistons, rods and wheels, the train is made to rush from city to city. The engine is well-lubricated and the journals of the cars are oiled, but there are still heat losses, and every time the train stops the whole of its motion is arrested, and the moving energy is dissipated in the form of heat. When the train stops at Chicago, if one may so say, nature has taken little notice of the trip except to abstract heat, and from nature's standpoint one may say that the splendid performance of the Twentieth Century Limited or the Pennsylvania Special has only been the transformation of one form of energy into another. The better the lubrication of the train the easier it can be run, but at any moment in its course, its motion can be rapidly changed into heat by simply bringing it to a stop. The total amount of heat will be the same whether the heat be generated for a few thousand feet at the smoking brake shoes, or liberated in a shorter distance by disastrous collision or wreck. Nature cares not that cars have been moved at high speed or that the business of two great cities has been facilitated. Nature has been concerned with the change in the form of existing energy, and from whatever standpoint our magnificent train service may be viewed, the sum total of all the energy in this wide universe has neither been increased nor diminished by the equivalent of even one jot or tittle of the law.

Traveling Engineers' Association.

The eighteenth annual meeting of the Traveling Engineers' Association took place at Niagara Falls, Canada, on Aug. 16, 17, 18 and 19. Among the papers presented was one on superheat as applied to locomotives. In it the various forms of superheaters were described and illustrated. The committee having this matter in hand were Mr. H. H. Haig, chairman, and Messrs. Max Toltz, E. Shally and O. R. Rehmeyer.

A short paper was also presented on the important subject, "How can the traveling engineer best educate the present-day fireman to become the successful engineer of the future?" Mr. J. C. Petty was chairman of this committee. A synopsis of this report is given in another column. The latest developments in air brake equipment and their effect on train handling was another of the subjects, the paper presented being well illustrated. Mr. E. F. Wentworth was chairman of the air brake equipment committee.

A paper on new valve gears as compared with the Stephenson or link motion, referring particularly to economy of operation and maintenance and also the necessary procedure in case of breakdowns. This important paper not only took in the Walschaerts valve gear but included the Baker-Pilliod gear and the Hobart-Allfree gear. The chairman of this committee was Mr. J. McManamy. A paper on the progress made in reducing the cost of lubrication was also read at the meeting. A digest of this paper will be found elsewhere in the columns of this issue. Full economy has been very very fully dealt with and an abstract of the paper is to be found in another part of this issue.

Book Notices

The twenty-first annual report of the "Statistics of Railways in the United States," has just been issued by the Interstate Commerce Commission, and forms a bulky volume of 1,000 pages. The report embraces the year ending June 30, 1909, and at that date it appears that there were 333,645 miles of railways in operation in the United States. These figures embrace about 79,452 miles of yard tracks and sidings. The increase in mileage over the previous year was 8,705 miles. The great bulk of the report is occupied in detailing the financial operations in connection with the railroads, and to those interested in this feature of railroad work there is a degree of fulness in the report that leaves nothing to be desired.

The twenty-eighth volume of the "Transactions of the American Institute of Electrical Engineers," has been issued and the amount of matter is so voluminous that the work appears in two parts, each part containing over 750 pages. Of the subjects treated it can be justly said that there is a spirit of research encouraged by the great and growing use of electricity that perhaps has no parallel in the history of our time. To advanced students in the science of electric engineering these volumes are of great value and should be welcomed as a rich contribution to the electric literature that is constantly coming from the press.

Change of Office.

The publicity department of the Pennsylvania Railroad has had an office in New York City at 85 Cedar street. This office has now been moved to the new Pennsylvania station at Seventh avenue and Thirty-third street. The entrance to the offices is on the left side of the corridor, coming in from Seventh avenue. The telephone number is 7,000 Chelsea. Mr. J. W. Lee, Jr., whose office is in the Broad street station in Philadelphia, is chief of the publicity department. Mr. Lee's representative in New York is Mr. G. Flatow.

Making of Successful Engineers.

Briefly, instruction is the keynote of the paper on "How can the traveling engineer best educate the present-day fireman to become a successful engineer of the future?" This paper which is the work of a committee of five, of which Mr. J. C. Petty was chairman, was read at the recent meeting of the Traveling Engineers' Association. The committee believe that this object can only be accomplished by teaching and advising the fireman until he has a thorough knowledge of the rules of the railway he serves and of the engine he may later have to run.

It is taken for granted that any man who accepts the position of fireman does so with the intention of some day becoming a locomotive engineer, and it is the duty of traveling engineers to exercise great caution in the selection of men who are to become firemen. The committee therefore recommends a visual and physical examination for all candidates for the position of fireman. The committee, however, disclaims all intention to create a hardship, by conducting such examination less rigidly than the government does in selecting recruits for the army. Yet a suitable test is deemed advisable.

In the matter of giving lessons on the locomotive the committee recommends the boiler and its attachments to be the subject of the first lesson. The construction of the steam gauge and the meaning of the figures on the dial should be taken up, also pop valves and the danger from their not working properly. The circulation of water in a boiler, the bad effects of too much water and the danger from too little. Staybolts and the function they perform and the load they are supposed to carry. The draught rigging in the smoke-box and the construction, use and function of the various parts of the injector.

The second lecture should be on the inspection of the locomotive, names and functions of parts and how to make out reports. Defects called pounds and blows, and the methods of locating them when the engine is running or standing still. The committee recommends that the engineer of to-day be required to be able to set up wedges, key rods, and do other things such as were done by the locomotive engineers of a former generation.

In this connection the report goes on to say: "There was another old custom with some railways where they compelled men to have some shop experience before they were promoted to the position of engineer, which we believe would be valuable in educating the young men of today, if possible, to practice it at the present. They were given positions as machinist helpers, which gave them information on the locomotive and its construction that served them well in after years. If young men of today between nineteen and twenty-one years of age could be given these positions at a living salary and afterwards transferred to road service, it would be best for both individual and railway company and would not be compelling them to serve two apprenticeships, as they are not eligible for road service until they are of age."

Engine failures and how to remedy them should be the subject of another lesson. The men should be taught how to remedy any trouble or breakdown in the quickest way and to clear the main line with the least possible delay. Valve motion should in another lesson be taught carefully and patiently. The report holds that locomotive engineers have a right to know how to set an eccentric, how the length of the rods is obtained, the different lengths of movement of the valve for different cut-offs and also the setting of the valves. The expansion of steam should also be taught, so that a man could trace the flow of steam from boiler to cylinder and from cylinder to exhaust pipe.

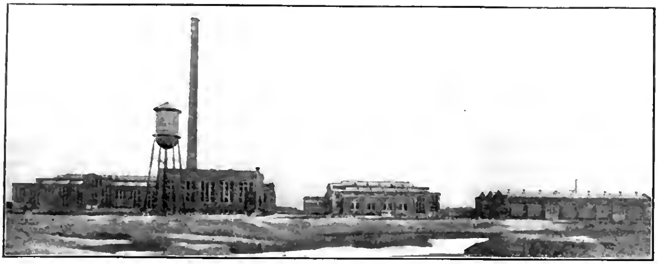
The committee comes out squarely for what they call the literary study of the locomotive. A literary knowledge of the locomotive, they say, is within the reach of every man who can read and understand mechanical literature offered today and it is very necessary in aiding the men to understand the engines they will later have to run and also to more succesfully handle them. Continuing in the same strain the report goes on to say: "Another and one of the best methods of educating the firemen on machinery is in the class room. Meetings held as often as possible are valuable and very necessary for the education of firemen on the locomotive. The traveling engineer should preside over them and teach and advise the men to the best of his ability. A good valve model is very valuable for these meetings.

Turbine Locomotive.

An interesting experiment is being made with a new locomotive constructed at the shops of the North British Locomotive Company at Glasgow, Scotland. A horizontal turbine is employed to drive a direct-current dynamo, from which power is taken to motors attached to the driving axles through geared wheels running in oil. After the steam passes through the turbine it enters a condenser, and after being condensed is pumped through a cooling apparatus where the blast of air, induced by the running of the locomotive, facilitates the cooling, and the water is conveyed into a supply tank and pumped back into the boiler. The supply tank is of sufficient capacity to carry enough water to make up for losses in condensing. A draft appliance is used in the form of a fan that delivers air to the boiler fire. The reports so far are of a satisfactory kind.

Pennsylvania Railroad Shops at Trenton, N. J.

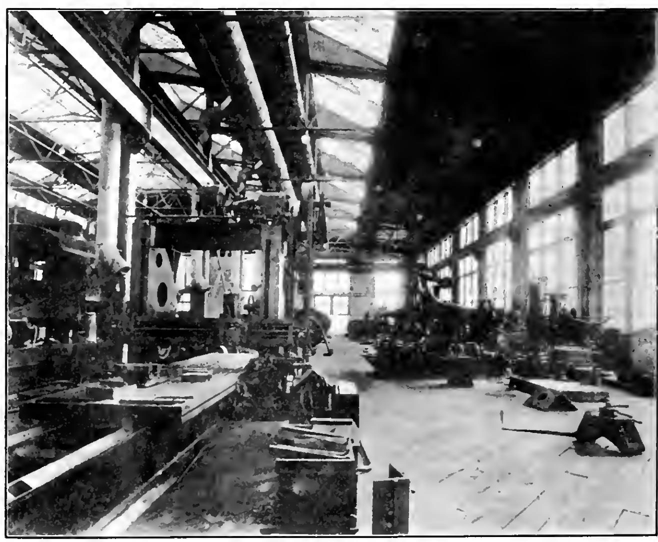
When the shops of the Pennsylvania Railroad were built near Trenton, N. J. some years ago, the location did not look to be a very promising one. The meadows had the appearance of prairie lands, —rank with weeds in summer and dismal as the desert in winter. This is all changed now. The cluster of buildings forming the repair shops seem to have transfigured the location into one of expanding beauty. The buildings form a group of half a dozen squares of substantial steel and brick structures, faced with gray granite, and in the commodious spaces between the shops there are miniature gardens of flowers where the red portulica, white alyssium and the blue lobelia blossom into geometric grace. The offices are elegant. The drawing rooms are commodious, and there is an airiness and lightness everywhere that is refreshing.



PART VIEW OF P. R. R. SHOPS AT TRENTON, N. J.

Mr. H. H. Maxfield, the genial and gentlemanly master mechanic belongs to the younger school of mechanical department officers. A graduate of Stevens Institute he super-added to his technical training a practical experience in the central shops at Altoona, and was placed in charge of the Trenton shops before they were completed. There are about 800 men employed in the shops in connection with the repairing of locomotives, and as an illustration of the amount of work that passes through their hands, it may be stated that their average output per month is 68 locomotives. The time occupied by the locomotive in passing through the shops is 12 days, such repairs, of course embracing a thorough overhauling of the entire working parts of the engine necessary after two years or more of continuous service. The highest record made during any month, occurred in March of the present year when 78 locomotives were repaired, 8 of them being furnished with new fireboxes

Of the equipment it may be said generally that it is of the best and is being constantly added to as occasion requires. One does not need to ask if the machine men are piece workers. It can be seen that they are by the amazing speed at which all of the machines are moving. The wheel lathes turn out 8 pair of wheels each day of nine hours, the total cost of the operation including transferring the wheels to and from the lathes being 75 cents per pair. Not only has the original equipment been added to from time to time, but we observed quite a number of new appliances and methods that ought to become popular in other shops. Among these appliances is a portable crane the invention of Mr. Maxfield, and which is particularly adapted for use in



INTERIOR VIEW OF MACHINE SHOP, P. R. R., TRENTON, N. J.

the fitting of the heavy driving boxes used on the locomotives of this division. As will be seen in our illustration the crane is not only portable but is self-supporting.

From a substantial cast iron base of circular form 4½ ft. in diameter and 4 ins. in thickness, three angle iron braces 3 by 3 by 3/8 ins. rise to a height of 9½ f and are joined by another heavy castin in which there is a place for accomodat ing and holding an arm extending 6 f from the center to the end at which movable pulley is attached. This arm ex tends 4 ft. on the other end, where counterbalance weight of 450 lbs. is at tached. The motive power of the cran is derived from an air motor set on th base of the tripod, and a steel rope con veys the motion to the pulley. Th chief merit of the device lies in its read adaptation to any location. As is we known the fitting of the driving boxes especially on passenger locomotives, is a operation requiring the best mechanica skill, and necessitates a repeated numbe of trials of the box upon the axle. I using a traveling crane much delay an annoyance may be caused on account o other work being interrupted, with th result that the driving box is often no fitted as well as it might be.

Even in the use of stationary ji cranes, the wheels must necessarily be re moved to the vicinity of the crane, where as Mr. Maxfield's portable crane can b lifted up by the overhead traveling cran and placed anywhere within the range o the regular traveling cranes.

Of equal importance is a clever devic used in adjusting the return crank which is attached to the main crank pin on th wheels of locomotives equipped with th Walschaerts valve gear. As is wel known the return crank must be set a right angles to the main crank. Quite a number of devices are in use for this purpose, but the Trenton contrivance is one of the very best we have ever seen. It consist of a duplicate of the apparatus used in moving the wheels of a locomotive during the process of valvesetting. The main driving wheels with axles and cranks attached are placed in this apparatus, the return crank being held temporarily in position. A connecting rod is attached to the return crank, and also to a small crosshead adapted to move in miniature guides. With the dead centers which are easily obtained and their position definitely marked, the perfect adjustment of the return crank is a simple matter and can be readily proved by moving the wheels both backward and forward and marking the position of the crosshead moved by the return crank at each dead center. When the adjustment is correct the bolt holes are carefully reamed and the bolts fitted in place or a key is fitted in the keyway as the case may be, and the return crank never requires further examination.

A number of methods of construction work are of interest as showing that the leading spirits in the Trenton shops are not alone satisfied with a well-equipped shop and established methods. Recently they adopted a new feature in bolt making. In forging the head of the bolt a spherical protuberance is left on the top of the head outside of the hexagonal body. It resembles the carefully rounded point of a finished bolt projecting through a nut. When the bolt is finished and fitted to its place in the cylinders or braces and about to be driven into place, a "button set" is held on the head of the bolt and an air hammer is applied to the button set, and with a few rapid blows the bolt is driven, while the head of the bolt retains its form and finish.

In the construction of crown bolts there is a combination of operations that embrace the cutting of the threads on the point as well as on the neck of the bolt, together with a formation of the button shaped head with a notch cut between the head and the short square portion attached to the head usually left for the purpose of screwing the crown bolt into place. These operations are simultaneously carried on, and the crown bolts are produced at a cost of $1.75 per hundred.

Another ingenious method in repair work was observable in applying hub liners to the sides of driving boxes after they have become worn. It is customary to apply liners of brass or bronze and securely attach them with countersunk screws. In Trenton they face off a recessed portion of the side of the box and in the bottom of the recess they cut two other dovetailed recesses and then covering the side of the box with a suitable appliance a quantity of molten babbitt is poured into the [illegible] thus prepared and in a short time the box is ready for the operation of facing off on the boring mill. The boiler testing and boiler washing plant is, among other mechanical appliances, one of the most complete of its kind that we have seen. A constant supply of hot water is maintained at 200 lbs pressure. With this powerful stream the washing of a boiler is thoroughly done. It may be remarked, however, that on the eastern divisions of the Pennsylvania Railroad the water is almost free from lime, the impurities being of the

PORTABLE SHOP CRANE USED AT THE TRENTON SHOPS OF THE P. R. R.

kind common to [illegible] or sandstone deposits, and boilers supplied with such water are comparatively easily cleaned.

The extensive store rooms are also managed [illegible] methods recently evolved [illegible] to the general supplies of the [illegible] branches operated in New Jersey [illegible] the interlocking and signal stores [illegible] the East are handled at this point. [illegible] idea may be obtained [illegible] of supplies called for [illegible] that over $100,000 worth [illegible] distributed each month [illegible] branches supplied. An [illegible] worth of supplies are [illegible] Trenton. [illegible] at present about 1,000 men [illegible] in the shops and stores, and extensive additions are already being made to the store rooms and an increase in the size of the shops, especially the machine shops, is already a growing necessity.

Relief Department, P. R. R.

According to the regular monthly report of the relief department of the Pennsylvania Railroad System, the sum of $[illegible] was paid to members during the month of May [illegible]. Of this amount $120,513 [illegible] represents the payments made on the Lines East of Pittsburgh and Erie, and $50,873.14 on the Lines West. On the Lines East of Pittsburgh and Erie in the month of May, the payments in benefits to the families of members who died amounted to $[illegible], while to members incapacitated for work they amounted to $[illegible]. In May, the Relief Fund of the Pennsylvania Lines West of Pittsburgh paid out a total of $50,873.14, of which $25,436.24 were for the families of members who died, and $31,436.90 for members unable to work.

Locomotive Running Repairs

VI.—Setting Up the Wedges.

It will readily occur to the engineer or mechanic that in view of the fact that the wedges are subjected to incessant shocks at each stroke of the piston, and also to great friction by the vertical movement of the driving boxes, the rapid wear of the wedges is inevitable, and for this reason one of the wedges, generally the back wedge, is so constructed that it may be moved, the upward movement of the wedge along the inclined face of the jaw reducing the space between the wedges, thereby affording means of maintaining a close contact with the driving box and so preventing a kocking or pounding of the box while the engine is in motion. It should be remembered that it is always preferable that in setting up the wedges the locomotive should be under steam pressure, or in such heated condition as will nearly approach to the condition in point of temperature that is to be expected while running. It should be borne in mind that while the frames do not expand to any appreciable extent, those portions of the frames that are near the fire are subjected to considerable atmospheric change, and consequently do vary slightly from their condition when the entire frames are perfectly cool.

Previous to setting up the wedges it is also desirable that the crank pins should be moving forward near the top center at which point the driving boxes will be bearing hard against the front wedges or shoes as they are frequently called. Whatever there may be of lost motion between the driving boxes will then be located between the movable wedge and box, and if the wedge bolts are in good condition it should be an easy matter to move the wedge upwards in the jaws until wedges and box are prefectly tight. The best method of insuring the tightness of the wedge is to have two pinch bars applied to the wheel, the bars being pinched in opposite direction by two men. It should be seen that the driving box moves vertically between the wedges, and when the box ceases moving it may be taken for granted that the wedges are tight and touching the box snugly on both sides. The point at which the lower part of the wedge comes in contact with the box should then be marked and the wedge should then be drawn down until the box moves freely between the wedges. The box should move before the wedge has been drawn down one-sixteenth of an inch, and the wedge should not be drawn down beyond this amount, care being taken to observe that the box is not being jammed by the failure of the application of the pinch bars to overcome the sheer weight of the locomotive.

Particular care should then be taken to observe the amount of lost motion that may occur in the head of the wedge-bolt in relation to the recess in which the head is located. If there is much lost motion in this space, and the wedge-bolt is left in the position at which the pulling-down process ceased, it may be readily seen that the wedge will drop the amount of space of such lost motion on account of its weight as soon as opportunity occurs by the vertical movement of the box. To avoid this contingency it is well to screw the wedge-bolt upwards again the amount of the lost motion referred to. In the case of wedges where a tap bolt passes through a slot in the frame and engages the wedge the liability of the wedge to move is greatly lessened, but these slots in frames are much less common than formerly on account of the fact that the loss of the material has a weakening effect on the frame. The tightening of the jam-nuts is an operation usually requiring a special wrench as the space inside the frames is frequently of the most limited kind. The practice of tightening the jam-nuts by the application of a hammer and chisel is a sure method of shortening the life of the nut and adding to the causes of future troubles.

After the wedges have been thus carefully set up on one side of the engine, the wheels should be moved forward, if possible, until the crank pins on the opposite side are on the upper centers and the same method of tightening and loosening of the wedges proceeded with. The wedges should then be in a position to maintain an equable bearing upon the boxes for at least five or six hundred miles of running service, unless some unforeseen cause produces a heating of one or other of the driving boxes, in which case it will be immediately necessary to loosen the wedge in order that the increased size of the box caused by the expansion superinduced by heating may find room. When the heated box is cooled the wedge should be promptly and properly returned to and fixed in its place, the mark on the pedestal serving as a guide in a condition where the pinch bars, perhaps, could not be brought into operation.

Consequent, on the setting up of the wedges, a slight readjustment of the connecting rods is always necessary. In examining the rods all that will be required, except in the case of refitting the brasses, will be to move the engine so that the rod bearings may be tested in both front and back centers. At these points the keys should be driven sufficiently to tighten the brasses against each other, but care should be taken not to continue striking the key after it has been already tightened against the brass. Brasses that are much worn are easily bent. After the key has been driven it should be slightly loosened, and it should be noted that the brass moves easily on the crank pin. In the event of any pronounced variation on the different centers, it is well to try a tram on the centers of the wheels and also on the centers of the crank pins in order to ascertain if the various centers correspond exactly. If the centers tram correctly and any variation be observed in the movement of the brasses at either end, the strap should be removed at the end where the tightening occurs and the brass properly fitted to the bearing. As we have already stated the matter of the temperature of the engine should be taken into consideration. Rods that may appear to be somewhat tight between the centers when the locomotive is cold will likely loosen somewhat when the engine is heated.

It need hardly be added that the lubrication of the wedges is a constant necessity, and to this end many constructors approve of drilling a hole between the top of the driving box and the sides of the box where the wedges are located. This insures the admission of oil between the wedge and driving box. It is also good practice to provide some means for keeping dust and ashes from finding lodgment between the wedges and driving boxes. Plates may be fitted covering the space on the top of the driving boxes, such plates being kept in place by the spring saddles. These plates should fit easily so that they can be readily lifted to admit the waste and oil necessary for the lubrication of the driving boxes and wedges.

V.—Pounding.

It is to be expected that in mechanism of a kind where the moving forces act reciprocally a certain amount of wear will speedily manifest itself in what is known as pounding. With the increase in the size of the working parts of locomotives this chronic defect has perceptibly lessened. It still, however, remains what it has always been—one of the leading troubles in locomotive running and management. While it is, as we have said, to be expected, it should not under any condition remain unheeded. It should be taken as a note of warning, for neglect is almost always sure to lead to disaster. The location of the trouble is not always easy of discovery, and it should be looked for with carefulness.

A good method of locating a pound, after determining on which side of the engine the pounding occurs, is to move the engine until the main crank pin is on the top quarter on the side on which the pounding has been located, then block the driving wheels, and admit steam to the cylinder, and by reversing the lever so that the steam may act alternately on each side of the piston, the location of the pound will likely be detected. If there is no movement visible in the driving box or cross-head or main rod connections, it is safe to assume that the trouble is in the cylinder. The trained ear will readily detect the sharp, metallic sound of piston rings, or loose follower bolts, which should be easily distinguishable from the duller sound of pounding on account of the wearing, or loosening of the wearing parts. A loose piston head may be said to have a sound peculiarly its own, partaking of both sounds previously referred to, and is usually much exaggerated in sound in proportion to the slight amount of lost motion that may have arisen from the loosening of the piston on the piston rod.

Some kinds of locomotives produce a pounding sound when running in full gear and care should be taken not to experiment blindly with them. It will be easily observed whether the pounding is of a constant or growing kind. If the sound is constant the trouble will likely be in the lack of compression as the piston approaches the end of the stroke. The sudden release of the steam at a high pressure in the cylinder rendering something of a shock. This is particularly noticeable when pulling a heavy load with a full stroke of the valves. It should be remembered that if the valves are properly proportioned and adjusted the compression which occurs as the piston approaches the end of the stroke should preclude any shock or apparent pounding, but the valve gearing seldom retains its exact position for any considerable length of time.

Pounding may be caused by the loosening of the cylinders on the frames, and also by the piston striking the cylinder head. When the latter condition occurs the sound is of a loud and hard kind that is readily distinguishable. This condition should be guarded against by observing the striking points usually marked on the guides, as there is always a tendency towards a lengthening of the main rod which may culminate in a collision between the piston and cylinder head.

It is safe to assume, however, that in most cases of pounding the trouble may first be looked for in the driving boxes, and it is often found that the condition of the wedges in their relation to the driving boxes is the cause of the pounding frequently complained of in the locomotive. It would seem that no matter how carefully the wedge may have been fitted when the locomotive was constructed or repaired, the driving boxes will be found sooner or later to be loose in the wedges. The tendency among railway men to loosen the wedges is very great. The heating of the boxes renders the loosening of the wedges sometimes an absolute necessity, but care should be taken to set the wedges up to their proper position again as soon as practicable. Many frame fractures are due to the loosening of the wedges, thereby allowing the shock of the piston to strike with great force against the pedestal jaws. These shocks or blows are greatly increased when the wedges are loose in the boxes, and even if no fracture occurs to the frames the wear of the wedges and boxes are very rapid when allowed to run loosely.

It should be noted that in fitting wedges in the machine shop it is good practice to have the space between the wedges slightly less at the bottom than at the top. It is a remarkable fact that when the weight of the engine is placed on the top of the driving boxes there generally occurs a slight contraction of the bottom of the boxes. In the event of the wedges being perfectly parallel to each other, it will be found that the tendency of the box to rock in the wedges is greater than when the wedges are fitted somewhat closer at the bottom than at the top. The amount of variation need not be great. What is generally known as a thickness of paper will be sufficient to make up for the contraction incident to the superimposed weight applied to the top of the box.

It would hardly be possible to enumerate all of the causes that lead to pounding. One of the common causes is in the fitting, or rather misfitting of the driving box brasses. When the brasses are bored out a little too large, they are easily passed as fitting, when in fact they are loose and invariably develop lost motion and consequent pounding almost from the beginning of the service of the locomotive. The brasses should fit lightly on the crown, and should fit snugly on the sides. It is good practice to clear the crown of fitting marks by scraping away a portion of the metal. It may be relied upon that the weight upon the driving boxes will soon bring the axle and the crown of the brass in close contact while nothing can ever remedy the defect of a loosely fitted brass, except refitting.

The irregular distribution of steam, which may occur by reason of some slight distortion of the valve gearing, will also speedily create pounding on the side of the engine where the greater amount of steam is being used. An excessive amount of lead also has a tendency to beget pounding as the shock of the admission of steam at the point of the center line of motion cannot have any other effect than that of a severe blow, and the multiplicity of such blows gradually finds a yielding point that soon gives vocal utterance to the weight of its overwork. This gives us another reason why the valve gearing should be constantly supervised, as errors of any kind in the valve gearing are among the certain causes of pounding in the working parts of the engine.

A dryness of any of the working parts of the engine will also, in addition to superinducing a heating of the parts, cause pounding or knocking. This is especially so in the case of the cylinders not being sufficiently lubricated. The same effect, in a lesser degree, will be noted if the rod brasses or any of the driving connections are allowed to approach a condition of dryness. A loose crank pin will also speedily develop into a knocking sound, as also will any fracture of the frames or deck casting or saddle or any of the heavier braces that may be attached to the frames. It may be said, however, in a general way, that the loosening of the wedges, either wilfully by careless changing of their position, or by reason of their wear, is the most common cause of pounding in all locomotives. The friction on the face of the wedges is very great, and the holding of movable wedges in position is a problem that has not yet been completely solved. Wedges that are secured by a tap bolt passing through the pedestal jaw and securely screwed into the wedge are more likely to retain the wedge in position than any single or even double system of wedge bolts passing through the binder beneath and sustaining the wedge without the security of a tap bolt. Both systems do not prevent the wedge from loosening, but both afford a better means of securely holding the movable wedge than any single system of sustaining the wedge, even if secured with double jam nuts. A thorough securing of the position of the sliding wedge is an object of much importance in lessening the running repairs of a locomotive.

Standardization of Safety Appliances.

An important work soon to be taken up by the interstate commerce commission is the standardization of safety appliances on railroads; a law authorizing this standardization was passed at the last session of Congress. In the meantime and preparatory to action by the commission, its experts and a committee representing the Master Car Builders' Association are conferring together. Hearings will be held which railroad officials, leaders of the brotherhoods and the car builders' committee will be invited to attend.

Questions Answered

FEED VALVE DEFECT.

57. J. M., Ft. Wayne, writes: What is the effect of a broken supply valve piston spring in the slide valve feed or the straight-air reducing valve? The straight-air brake on an engine here would not apply until reducing valves were changed and all that was found wrong was a broken spring. Would not the effect of the broken spring be to allow main reservoir pressure to enter the brake cylinders?—A. Yes, if the broken spring does not interfere with the movement of the supply valve piston, but in this case it is evident that a piece of the spring or the spring tip lodged between the supply valve and the cap nut and held the piston and supply valve in their closed positions.

DUTY OF FIRE LIGHTERS.

58. A. McX., Detroit, Mich., asks: What is the duty of the man who lights up or starts a fire in a locomotive firebox?—A. He should first ascertain the height of the water in the boiler. The indication given by the gauge glass is not sufficient, as it may be stopped up or shut off. He should make sure of the water by opening the lower try-cock and observe the flow of water. If the engine is cold a good way is to take out the stem of the lowest gauge cock, if possible, and observe the flow of water. Simply opening the lower try-cock when the engine is cold may only cause water lodged in the cock to drip out, as the lower cock may be stopped up. The safest course is to get a good flow of water out of the boiler and then one knows there is plenty inside and it is safe to light up.

CAUSES OF UNDESIRED QUICK ACTION.

59. J. H. M., Osceola, Pa., writes: I notice on page 295 of the July issue of Railway and Locomotive Engineering a number of causes of undesired quick action of air brakes.

Will you kindly explain, through the next issue, how the partly closed feed groove and the very short piston travel can cause the undesired quick action?—A.—You will notice that the chart referred to was printed for the purpose of showing the contributing as well as the primary causes of this disorder and the feed groove in the triple valve being partly closed by dirt contributes to undesired quick action in the same manner that a "sluggish" feed valve or "loafing on lap" does. If for any reason whatever brake pipe pressure falls very slowly reservoir pressure will escape through the feed groove into the brake pipe without moving the triple valve piston, but if the feed groove in a triple valve is partly closed the pressure cannot escape as it does through the grooves of the other triple valves in a train of cars consequently a movement of this triple valve piston, against the slide valve results and communication between the auxiliary reservoir and brake pipe is closed while the service ports are not yet in position to expand auxiliary pressure into the brake cylinder, thereore, due to a partly closed feed groove, the triple valve has assumed the same position that it does just previous to the time that undesired quick action is influenced by a defective feed valve or the improper use of lap position of the brake valve. One of the reasons for calling attention to the feed groove in connection with this disorder is that once a triple valve works quick action during the service application the partly closed feed groove on the defective triple valve will prevent its prompt recharge along with the other brakes and upon the following test to locate the disorder the quick action does not occur because the auxiliary reservoir is not fully charged. The undesired quick action due to a very short piston travel is encountered only in passenger service when the brake pipe pressure is 110 lbs. With the high air pressure and short piston travel a high brake cylinder pressure is quickly obtained, and this frequently retards the rate of expansion of auxiliary reservoir pressure during a brake pipe reduction to such an extent, that sufficient differential is created between auxiliary and brake pipe pressures to result in a compression of the graduating spring and quick action. Roughly speaking, it is a matter of insufficient space for auxiliary volume to expand into in a given period of time, and it is not merely a theory but a condition that results in undesired quick action.

WATER LEVEL AFTER BLOWING OFF.

60. H. S., Kingston, Ont., writes: I have often noticed that when steam is blown off a locomotive boiler the level of the water in the boiler goes down; why is this?—A. Water in a boiler with a steam pressure of say 200 lbs. absolute pressure has a temperature of 381.7 degs. Fahr. As the pressure falls a portion of the heat stored in the water is liberated and turns some of the water into steam, which is of course blown off. At 100 lbs. absolute pressure water is at a temperature of 327.9 degs. Fahr. That is, there has been a fall of 53.8 degs. Fahr. between those two pressures and the heat units, in the quantity of water affected has been employed in causing a large body of water to turn into steam, with a consequent reduction of water level. As soon as the water gets down to a temperature of 212 degs. Fahr. no more is evaporated, and the pressure is 14.7 lbs. absolute, or atmospheric. Before blowing off a boiler it is a good plan to put on the injector and fill up the boiler for the double purpose of having the crown sheet well covered when steam is off, and the introduction of the comparatively cool feed water somewhat reduces the temperature of the water, and shortens the time taken to blow off.

BROKEN AIR PIPE.

61. J. M., Ft. Wayne, writes: From reading the air brake department of Railway and Locomotive Engineering I am left under the impression that if the reducing valve pipe of the H6 brake was broken off from the independent brake valve while out on the road, the break toward the independent valve should be plugged and the adjusting nut of the reducing valve unscrewed to stop the leak of air, then, when the brakes are applied with the automatic valve, the independent valve should be placed in application position also. Now, when the brake is to be released the independent valve would have to be placed in running or release position, in fact, both handles would have to be moved when applying the brake and both moved in order to release. Would it not be more convenient to plug both the broken pipe and the exhaust port of the independent brake valve which would prevent the escape of application cylinder pressure and allow the independent valve to remain in running position all the time?—A. It might be a litlte more convenient in handling the brake valves, but the exhause port of the brake valve should never be plugged when it can be avoided because of the fact that the plugged port may be forgotten when proper repairs are made. The only time that occasion for the use of the exhaust port of the independent brake valve arises is when the engine and train brakes are being used alternately or in case the driving wheels should lock and slide during an automatic application of the brake, and if the exhaust port were plugged at such a time some damage to the driving wheel tires would likely result. The E. T. brake, with its positive assurance of a constant locomotive brake cylinder pressure, has an ample protection against wheel sliding, through the agency of the exhaust port of the independent brake valve, and this port should never be plugged while dealing with the effect of a broken valve pipe.

It is not our part to look hardly, nor to look always to the character and deeds of men, but to accept from all of them and to hold fast that which we can prove good and feel to be ordained for us.—*Ruskin.*

Air Brake Department

Conducted by G. W. Kiehm

Braking Power Chart.

When a freight car is equipped with an air brake the weight of the car is determined and the foundation brake gear is designed in a manner that when the maximum brake cylinder pressure developed is multiplied by and transmitted through the brake gear, the resultant pull on the eight-brake shoes will equal a certain per cent. of the light weight of the car. Sometimes this is taken at 70 per cent. sometimes at 80, 85 or 90 per cent. of the car's weight, and is sometimes based upon a 60-lb. cylinder pressure which is obtained with a quick action application, and sometimes upon a 50-lb. cylinder pressure, the maximum pressure developed by a service application of the brake.

Regardless of the exact percentage of braking power or the cylinder pressure employed, it is based upon the pounds pull of the shoes against the wheel as the brake is applied and the total in pounds of the shoe against the wheels is less than the weight holding the wheels to the rail. And under these circumstances it is considered that the friction obtained between the shoe and the wheel will not exceed the adhesion of the wheel to the rail.

The wheel-sliding subject is a very broad one, embracing rail and track conditions and the effectiveness of other brakes in a train of cars, but in equipping a car with an air brake 15 to 30 per cent. less pull on the shoe than weight of the wheel on the rail is relied upon to provide a safe margin against wheel sliding.

If the pull in pounds of the shoes on the wheels is 70 lbs. for every 100 lbs. resting on the wheels, what is termed the calculated or nominal braking power is 70 per cent., but it makes no provision for an ample percentage of braking power for the car when it is loaded, and consequently loading the car lowers the percentage of braking power, as the shoe pressure remains constant regardless of the load, and the heavier the load the less percentage of braking power available with which to stop the car.

The chart shown illustrates percentage of braking power on the car when light and loaded.

The chart shows that when braking power is based on a 50-lb. cylinder pressure and has a pull on the brake shoes equal to 60 per cent. of the light weight of the car, the car weighing 40,000 lbs. having a capacity of 110,000 lbs., the percentage of braking power falls to 21 per cent. when the car is two-thirds loaded and to 16 per cent. when the car is loaded to its capacity.

The Westinghouse Air Brake Company has recently developed what is termed an "Empty and Load Brake" for grade service, which provides for normal braking power when the car is empty, and a much higher braking power for the car when loaded, so that the braking effort throughout a train of any length is almost uniform.

The chart also shows that by the use of this brake the percentage of braking power on the car when two-thirds loaded is increased from 21 to 53 per cent. of the total load, and when the car is fully loaded the percentage of braking power is increased from 16 to 40 per cent.

The necessity for a brake of this kind is apparent and has been for many years, and we would be pleased to publish a general description of this brake, but the manufacturers do not at the present time wish to go into details concerning its construction.

The schedule U or high pressure control brake was intended for this same purpose of providing a more efficient brake for heavily loaded cars, but as the increase in the retarding effect was derived from an increase of brake cylinder pressure obtained through an increase of brake pipe pressure it naturally became effective on all cars in the train.

For this reason the higher pressure could not be employed on mixed trains of loads and empties, the braking power on the heavily loaded cars even with the increase of brake pipe pressure was but a small percentage of that which could have been safely employed, while the braking power on the light car was at the same time increased to such an extent that wheel sliding, while not positively assured, was likely to occur if all the braking power available were used.

The increase in braking power secured by the use of the "empty and load brake" is obtained through an increase of leverage and is effective on the loaded car, while the braking power on the empty car remains normal.

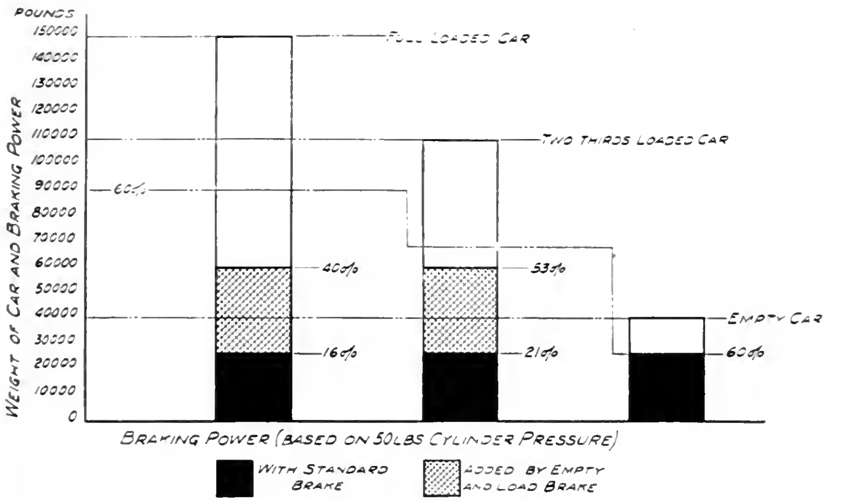


CHART SHOWING WEIGHT OF CAR AND BRAKING POWER.

Piston Travel Chart.

This chart shows the effect of variation in piston travel and also the difference in braking power on loaded and empty cars. This has particular reference to piston travel effect, and is based upon the calculated percentage of braking power termed nominal.

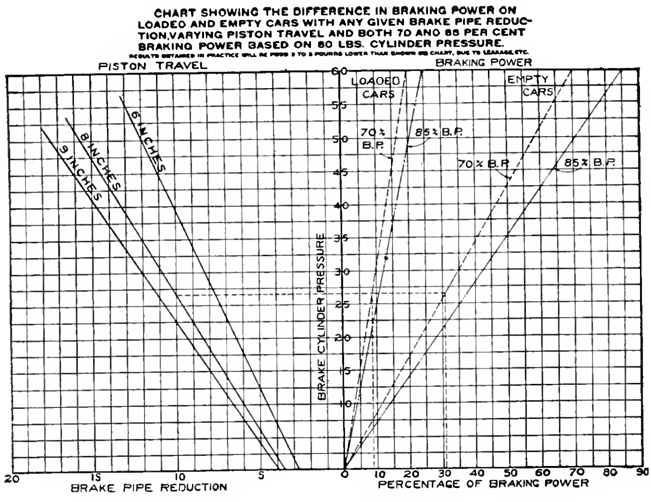
By referring to the chart it will be seen that if a train is composed of loaded and empty cars and there is a short piston travel on the empties and a moderately long travel of say 9 ins. on loaded cars, the difference in the percentage of braking power on the different cars is somewhat startling if considered from a viewpoint of parted trains and damaged draw gear.

By following the lines on the chart we see that the effect of a 13-lb. brake pipe reduction on a loaded car with a 9-in. piston travel would be about 33 lbs. brake cylinder pressure, resulting in a braking power of about 11 per cent.; that is, the pull of the shoes against the wheels roughly speaking would be 11 per cent. in pounds of the weight holding the wheels to the rail. This is found by following the 13-lb. brake pipe reduction line to the 9-in. piston travel line and then following an imaginary horizontal line past the brake cylinder pressure line, which would pass at about 33 lbs., and continuing on this line to the "loaded car" line and going directly to the bottom of the chart from the point they cross shows the percentage of braking power developed is 11.

Following the lines in a similar manner shows that a 13-lb. reduction on the 6-in. piston travel results in a brake cylinder pressure of 53 lbs., and on an empty car the percentage of braking power will be 65 or 78 per cent., depending upon the total leverage ratio employed.

Now if a number of light cars with short piston travel are on the rear end of a very long train, and if the loads having a long piston travel are ahead, after nicely bunching the slack with straight air, or independent brake, the effect of a 13-lb. brake pipe reduction is somewhat problematical, but those giving the subject any thought will appreciate the situation.

A condition of this kind shows a total possible difference of 67 per cent. of braking power between light and loaded cars and reversing the conditions of piston travel would reduce this difference wonderfully, as the 6-in. piston travel on the loaded car will produce, under the same conditions a braking power of 18 per cent. of the total weight and the same 13-lb. brake pipe reduction on the 9-in. travel on the light car would result in a braking power of 39 per cent. of the weight of car or a difference of but 29 per cent. in braking power between light and loaded cars after the 13-lb. reduction. This is something that is worth considering.



LOADED AND EMPTY CARS, DIFFERENCE OF BRAKE POWER.

Air Brake Instruction.

We take pleasure in quoting from a letter written by a reader of RAILWAY AND LOCOMOTIVE ENGINEERING the following extracts. On the subject of air brake instruction our correspondent, an engine house foreman, writes, "What the roundhouse men and enginemen seem to need is more of the simple A, B, C of the brake literature and business, and not have to wade through so much letter-press to find out what they want to get at," and "Tell the men what to do if either or both governor pipes break off and not to leave a 60-car train on the road and come in light." "The same can be said of many other little pipe failures which cause delays and unnecessary expense; happily, however, we are improving in this respect, due to some simple experiments made in the roundhouse for the benefit of engineers."

Other letters of this character and personal observations have led us to form a definite conclusion to the effect that there is a crying need for a more effective air brake instruction to all men who have to do with air brakes and road men in particular. If there was any need for an air brake instructor five or six years ago, how much more necessary is one now in view of all the new air brake equipments that have been developed during the past five years; or if the air brake instructor is doing his full duty and taking care of all his business, he must have had a very easy time of it five years ago, assuming that his territory is the same. There has not only been an advancement in brake design, but the railroad business has increased, more men are employed, trains are longer and traffic is heavier, and it is evident that if an instructor was kept busy in a certain territory five years ago and that it has not been reduced or if no assistance has been given him in the mean time, it is safe to say he is not unable to cope with the situation, and it is safe to assume that the instructor was busy five years ago as we have never heard of one having finished his work.

From our correspondent's reference to demonstrations being conducted in the engine house for the benefit of engineers, we would infer that there is no car or room equipped for this purpose, which is a deplorable state of affairs. The average road man cannot receive any very beneficial instruction in a shop, or if it is given by a shop man and the average shop man is not benefited to a great extent by any instruction coming from an engineer, because regardless of how well they get along together, the majority of the road men will seldom benefit from any instruction coming from any one but a road man. On the other hand, the average shop man, as a general rule, will take nothing for granted unless it comes from a machinist or foreman.

There are, however, a great number of railroad men, although they may not be in the majority, who recognize an air brake man when they come in contact with him and accept his explanations on air brake subjects, giving no attention to where he came from, be it road or shop service. It is, however, preferable for the air brake instructor to be a road man and the supervisor of air brakes to be a shop man.

In spite of all the expense and difficulties encountered, the air brake instruction and examination is absolutely necessary and only the instruction car or instruction room can be fitted up in a manner as to make the instruction entirely comprehensible and profitable. Some railroad men consider the instruction car an unnecessary expense, some consider the instructors and supervisors' time as wasted and others seem a trifle slow to grasp the fact that they are compelled to educate their employees to a certain extent, at least. It requires training for a man to fill any position, the more difficult the work the more education is required, and few employees are willing to educate themselves when they imagine the company gets all the benefit from it; and if the employee will not pay for his own education or training pertaining to his own particular line of work the company is compelled to pay for it; and the workman or apprentice is not always consulted as to whether he is to be sent to school or to a shop for instruction, whether the instruction is to be brought to him, or whether the company will pay for the material he wastes and mistakes he makes while he is training himself. The latter method is by far the most costly, as any air brake repairman can testify.

In road service it may be even more costly to allow the firemen and engineers to educate themselves. The engineer may never fully learn the proper use of release and lap positions of the brake valve or show a proper appreciation of the advantage of the short cycle method of controlling trains on grades until he has a serious accident, and the company pays a bill that would in many instances equip several instruction cars. We can say that there is constant need for air brake instruction, especially for the road man because with him rests the responsibility of getting the train over the road on time, and he must devote some of his time to the study of the brake if his department is to keep pace with improved shop methods in promoting the air brake art.

The reason for the statement is that with the improved facilities for handling work and with competent workman practically all the air brake failures can be put up to the road foreman of engines and the air brake instructor. As an illustration, if the workman puts an overhauled air pump in practically as good condition as a new one, which every repairman should be able to do, the life of the pump certainly will depend upon the care it receives on the road or while on the engine. The pump then being removed from the engine at certain periods for inspection, and repairs if necessary, leaves very little opportunity for tracing an air pump failure to a shop where repair work is being done properly. Of course, it is not intended to mean that all shops turn out first-class work, and we know that in some engine houses the repairman will take a hammer and chisel and attack an air pump while it is on the locomotive, but this is entirely the affair of the company that permits it. Again, there is always the possibility of a flaw in repair parts, causing a pump failure; but a careful observer will note that pump failure due to defective repair parts are rarely if ever heard of when the pump comes from a shop where competent workmen are employed.

To avoid any misunderstanding, it might be said that piston-rods do not usually get fractured if the piston-rod nuts are removed as they should be and the end of the rod does not snap off in service if the rod is annealed when it is removed from a pump. To determine the cause of loose air or steam pistons, loose reversing plates, bent or broken valve rods and broken air valves, it is a good policy to investigate shop methods, but to find the cause of pieces being broken out of the steam and air pistons, the cause of top heads being broken and threads stripped out of the reversing valve chamber, and to closed ports in the air cylinder we look to the engine crew and the head brakeman for an explanation, assuming, of course, that the hostlers or engine watchmen are not permitted to start or use the air pump.

If the hostler is allowed to use the air pump the engine crew cannot always be blamed for broken air and steam pistons, for it is evident that those parts are broken at the time when the pump is being run at or nearly its maximum speed when there is no air pressure in the main reservoir, and this seldom occurs except when the pump is first started. It is merely a matter of the high steam pressure slamming the pistons against the center piece hard enough to break pieces out of them.

Similarly the engine crew is not always responsible for a broken top head, it may have been done by the hostler or the head brakeman; for when the pump is located on the left side of the boiler it is often his duty to keep the pump moving when the oil supply gets low in the lubricator, and many brakemen must labor under the delusion that the brass plugs in the ends of the port holes in the top head were placed there to indicate the point at which a blow with the coal maul would be the most effective, since they have been told not to strike the reversing valve chamber cap.

Any comment upon closed ports in the air cylinder or oiling of pumps is unnecessary, the engineer has every right to demand that the pump, the locomotive and all appliances be kept in perfect condition, and the company has the right to insist that their property be protected. In modern shops the brake valve, feed valve, triple valve and all air brake apparatus receive a rigid test before being placed in service and when the repair work is being done properly and the brake equipment is receiving the daily trip inspection there is little opportunity, indeed, for tracing air brake troubles to the shop. Another reason for considering the road man's instruction first is that the fireman is there for instruction to fit him for promotion; likewise the brakeman; while the engineer must keep in touch with new devices that are coming into use; while if the repairman in the shop is incompetent he can be dismissed and another employed or some one can be trained to fill the place he has vacated.

We heartily agree with our correspondent in that the shop and road man need instruction and always will need it, and as for the simple A, B, C of instruction it is a pleasure to say that the Air Brake Association has placed on permanent record and in book form a course of air brake instruction that begins with the straight air brake, the three-way cock and the trigger pump, going into detail in giving the operation, construction and defects developed by every railroad brake equipment that has been placed on the market.

This course or record is being added to annually, and it has already assumed such proportions that very few air brake men will be able to learn thoroughly all the information it contains; but each subject is taken up step by step in such a manner that anyone can understand it; in fact, it is intended for the beginner at the beginning and for the air brake expert as the subject advances. In this connection questions on air brake subjects are always in order, and when sent to RAILWAY AND LOCOMOTIVE ENGINEERING will receive prompt attention and be answered correctly and in few words.

Eighty-eight Per Cent. on Time.

The Public Service Commission, second district, has just issued the record of passenger train operations in the State of New York for the month of June. The total number of trains operated over the steam railroads of the State was 63,717, as against 55,551 last year and 50,122 in 1908. Of this number 88 per cent. were on time at divisional terminals. The average delay for each late train was 21.2 minutes and for each train run 2.5 minutes. The principal causes of delay were waiting for trains on other divisions, 28.3 per cent. train work at stations, 18.5 per cent.; waiting for train conections with other railroads, 11.5 per cent.; trains ahead, 7.6 per cent.; wrecks, 7.2 per cent.; engine failures, 6.0 per cent.; and meeting and passing trains, 6.4 per cent.

Be yourself. Ape no greatness. Be willing to pass for what you are. A good farthing is better than a bad sovereign. Affect no oddness, but dare to be right. —*S. Coley.*

Electrical Department

Running a N. H. Electric Locomotive. IV.

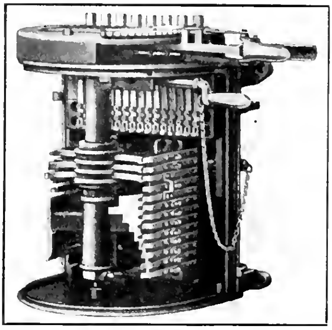
By W. B. Kouwenhoven.

If, while running on the alternating-current zone of the N. Y., N. H. & H. Railroad, a third-rail shoe or a support or beam should strike an obstruction and be broken, the engineer should bring his train to a stop and either tie up the broken shoe, remove it or break it off clean, doing what will take the least time. He should be careful in tying it up, to make sure that there are no loose springs or wires that will work off and cause further trouble. If the break occurs in the direct-current zone, the engineer not only stops his train, but in addition he should open the direct-current main switch, and the blower, compressor and heater switches. Then he must be very careful to insert the wooden paddles or slippers between the other shoes and the third-rail before proceeding to clear the damaged shoe. Neither the engineer nor his helper should ever use a crowbar or a coupling pin when breaking off a broken shoe, but always a tool with a wooden handle. In fact, this is a very good rule to follow not only when working on a third-rail shoe, but on all parts of the electric locomotive and in all branches of electrical work.

Sometimes when crossing a gap in the third rail a set of third-rail shoes will unlock and rise and ride against the side of the third rail. If this occurs and is discovered, the helper should at once disconnect the control wire holding that set of shoes down, and allow the shoes to remain up until a place is reached where the third rail ends on that side. Then the helper can connect the control wire back in place and the shoes will go down. The shoes should be examined at the first opportunity to make sure that the spring that holds the shoes against the third rail has not broken or slipped out of place. An engineer should never enter the direct-current zone without at least one good shoe on either side of the locomotive.

If a current of over 2,500 amperes is used while running on alternating current, then either one or both alternating-current circuit-breakers will open, and before resetting them the controller handle must be returned to the off position by the engineer. The circuit-breakers are reset by hand. If a circuit-breaker opens repeatedly without any apparent cause, the pair of motors which receive their current through that circuit-breaker should be cut out of service by shifting the motor control cut-out switch for that circuit-breaker to the proper position. If a transformer gives trouble because of the failure of the insulation or for some other cause, or if a motor bucks or jerks, overheats or gives trouble the engineer should cut the damaged transformer or motor out of circuit, using the proper cut-out switch.

There are two motor control cut-out switches on each locomotive, one at each end of the cab. Each switch controls the circuits of one transformer and one motor unit and has four positions as follows: "both in," "motor out," "transformer out" and "both out." The object of these switches is to cut a transformer or a motor out of circuit when it or any part of its equipment is damaged or fails. The circuits are so arranged that either motor unit can be supplied with current from either or both transformers. The motor control cut-out switch consists of a long wooden drum on which are mounted a series of copper strips that make contact with a set of fingers. The drum is rotated by a handle. When the handle is in the "motor out" position the control circuits of the motor unit at that end of the locomotive are opened. In the "transformer out" position the control circuits to the transformer taps are opened, and in the "both out" position the circuits of both the motor and transformer are opened. In the "both in" position the circuits are closed. Failure of the switch to operate satisfactorily can usually be traced to some of the fingers making poor contact.



MASTER CONTROLLER OPEN.

Under normal conditions a New Haven locomotive should start a train with a current of 1,800 amperes or less per motor unit. If a train does not start with this amount of current, the engineer should return the controller handle to the "off" position, and send the conductor back to see if all the brakes have released properly. When starting a heavy train on a steep grade a current of 1,800 amperes may be exceeded for a short time, but never under any circumstances can 2,500 amperes be exceeded, because at this current the circuit-breakers for both alternating and direct current will open.

If, while running on alternating current a motor grounds, the engineer should cut out the motor unit to which the damaged motor belongs using the control cut-out switch for this purpose and proceed with his train using the other motor unit; both transformers will be in use. Under these conditions 1,800 amperes can be exceeded while accelerating. If the train fails to start on the first notch the engineer can pull the controller handle to the second notch. Then if the train does not start after the slack has been taken up, the train is too heavy for the crippled locomotive. On direct current with one pair of motors cut out, 1,800 to 2,500 amperes may be used while accelerating. However, the engineer should not pull the controller handle beyond the direct-current series position.

If, when double-heading in the direct-current zone, it becomes necessary to cut out a motor unit, the crews must pull the control jumpers and then the two locomotives must be operated separately, as is the custom with steam engines. If this occurs when running on alternating current, the motor control cut-out governing the damaged motor should be thrown to the "motor out" position, and then the train can proceed under one engineer, using both pairs of motors on the one locomotive and the good pair on the other.

The unit switches or contactors sometimes fail to operate when on the road after having shown up satisfactorily in the test before leaving the terminal. This may be due to one of the following causes which should be investigated (1) low-air pressure; (2) low battery voltage; (3) plug in master controller making poor contact, and (4) improper or poor contacts or broken connections in the master controller or in the control circuit. If none of the switches come in when the controller handle is notched up, the trouble is probably due to one of the first three causes. The engineer should first look at the control gauge which should register at least 70 lbs. of air pressure. If the pressure is lower than this and the gauge on the main reservoir registers 130 lbs. the trouble is either in the three-way cock or else in the reducing valve. If the control pressure gauge reads 70 lbs. or more the engineer cuts out the battery in use and throws in the other one and presses the controller plug to make sure that it is all the way in. Then he tries the bell to see if the battery current is on the controller.

If some of the unit switches come in while others do not, the fault probably lies in the master controller or its circuits. If the trouble is confined to one side of the locomotive, that is, in the switches that belong to one motor unit. The best thing the engineer can do to save time is to cut out the motor units which are affected. If this is impossible then he should remove the cover from the master controller and proceed to test the control in a manner similar to that employed before leaving the yard. When the notch is reached where the trouble lies, the engineer should take a piece of wood and press the fingers of the master controller and the interlocker on the switches to see if they make good contact. If the trouble is slight the engineer can make the adjustment of the tension of the fingers himself. Or if the trouble is confined to the master controller at the head of the cab, then he can operate the train from the other controller. If the engineer finds it impossible to clear the trouble after investigating all the causes he must lower the trolleys and call for assistance.

Sometimes a bad ground occurs in a switch group because of a switch freezing in, as it is called, that is, the switch sticks due to roughness or some other cause and fails to open when it should. In this case either the engineers or his helper should pry open the switch with a stick of wood, being sure to open both alternating-current circuit-breakers first. Occasionally the current flashes or sparks over from a unit switch to the iron frame work supporting the switch group, with a report like a shot, and generally clears itself, that is, it ceases. If this is the case it is not necessary to stop or to cut out the group or to lose any time looking for the trouble.

If the studs or shunts or wires on the unit switches get loose, the switch will get red hot and burn the insulation. When this is discovered the power should immediately be shut off, both alternating-current circuit-breakers opened and the loose parts tightened up. If arcing starts in a switch group and continues, the engineer should cut out the motor unit belonging to that side, using the motor cut-out switch.

If the resistances ground or burn up when operating on direct current the engineer should slowly return the controller handle to the "off" position and call for assistance. These grids do not affect the operation of the locomotive in the alternating-current zone, and if that can be reached before the train comes to a stop then the enigneer can proceed to his destination.

Should the third-rail shoe fuses blow when making the change over from alternating to direct current, at the instant the direct current enters the locomotive, very likely the short-circuit switch has been forgotten and left closed. The fuses must be replaced before proceeding. To do this the train is brought to a stop and the direct-current main switch and the compressor, blower, heater and short-circuit switches are opened. The paddles are placed between the shoes and the third rail. Then the engineer loosens up the thumb-screws that hold the burned fuse in place, removes the fuse and inserts a new one and tightens up the thumb-screws again. When the paddles are removed, care should be taken that no one is in front of the fuse-box, because the fuses may blow when the current comes on and spatter the hot metal about. Before putting in direct-current fuses the engineer should not only open the switches enumerated above, but also be sure to put the paddle between the shoes and the rail. On alternating current both circuit-breakers should always be opened before replacing any fuse.

If the chang-over switch fails to shift automatically when passing from the alternating to the direct-current zones it may be due (1) to low air pressure; (2) to a weak battery; (3) to the armature of one of the alternating-current relays sticking up, and (4) to the direct-current main switch being left open. If it fails when runing in the opposite direction it may be caused by (1) low air pressure; (2) a weak battery; (3) armature of the direct-current relay sticking up; (4) small switch on the back of the controller left closed; (5) controller plug making poor contact, and (6) cut-out cock leading to trolley-unlock cylinder, closed. The engineer and his helper should locate the trouble and remedy it if possible. If no trouble is found and still the switch does not shift, it can be shifted by hand.

Should the master controller handle catch in one of the running positions while the train is in motion, and cannot be thrown to the "off" position, the engineer can cut off the power by either pulling out the master controller plug or opening the switch of the storage battery in use. If the brakes fail to hold, the engineer as an extreme measure can reverse the electric locomotive to stop the train just as his brother on the steam locomotive may reverse his engine if necessary. In order to reverse the electric locomotive, however, the engineer must first throw the controller handle to the "off" position, pull the reverse handle to the backward position and proceed to slowly notch up the controller again. He must be very careful not to use too much current which would probably result in damage to the machinery and complete loss of stopping power; just as the steam engineer when starting must be careful not to knock out the cylinder heads of his engine.

However, an electric locomotive or any electric car with a two-motor equipment can always be stopped, even if the brakes fail to work and power is off the line by bucking the motors. To stop a New Haven locomotive under these conditions, throw off the power, reverse the direction and, if on alternating current, pull handle up to any one of the alternating current running positions; if on direct current, pull handle to some point beyond the direct-current shunt No. 2 position. Each motor when connected this way that is in parallel for the opposite direction of rotation generates current which tends to drive the other motor in the opposite direction, and will bring a locomotive to a stop very quickly. It must be remembered that on these New Haven electric locomotives that the reverser handle and the controller handle interlock and that the reverser handle cannot be shifted unless the controller handle is first thrown to the "off" position.

In case of fire starting on the locomotive, sand should be used to extinguish it. Water should never be used because of the danger of short-circuits being formed. The engineer should cut off the power when a fire starts and lower the alternating-current trolleys, if in the alternating-current zone; and blow the shoe fuses if in the direct-current zone, if the fire is likely to prove serious.

In case of a wreck the trainmen must caution every one to look out for the overhead wires. The conductor should proceed at once to the nearest tower and notify the towerman of the wreck and state that tracks are blocked. The towerman must immediately cut off the power on the overhead wires of the tracks affected and must notify the towerman at the other end of the section to cut off the power from his end. The conductor must remain at the tower until he receives notice in writing that the power has been turned off. The first duty of the wrecking crew, upon reaching the scene of the wreck, is to ground the overhead wires. Care should be taken in handling the wrecking crane that it does not come into contact with the overhead wires. The last duty of the wrecking crew before leaving the wreck is to remove the grounds and notify the towerman that the line is ready for operation.

New Line Opened.

The Chicago, Milwaukee & Puget Sound and the Oregon & Washington recently opened the Grays Harbor Line to Cosmopolis, Aberdeen, and Hoquiam. The line runs through the Chehalis Valley and has been under construction for two years. Grays Harbor cities gave a public welcome to the first trains arriving from Tacoma.

General Foremen's Department

Mechanical Department Efficiency.

Below is the address of Mr. F. C. Pickard, master mechanic of the Cincinnati, Hamilton & Dayton, at Indianapolis, Ind., delivered at the last convention of the International Railway General Foremen's Association. He said, It has been my pleasure to watch the workings of the General Foremen's Association since its commencement. I have had the pleasure of attending two of your meetings, one in Chicago last year and this one here.

A remark was put to me yesterday by a certain individual that he could not get away. Whenever a man is in the position that he cannot get away, and is holding the position of general foreman, there is something wrong with the man, not the organization. They should take more interest in these things—put forth greater effort to co-operate and bring about the results that are desired by the members of this organization.

The efficiency of the mechanical department depends upon the co-operation of the general foreman and the subordinates, also the other departments to see that they work in perfect harmony.

One most essential thing for increasing the efficiency of the mechanical department is in regard to the handling of locomotives. The first step in connection with the matter is attention to the time that a locomotive is cut off in a yard until it is again made ready. This calls for an effort on the part of every foreman and every individual that may come under your supervision. The roundhouse foreman may have a job upon the engine that requires the attention of the blacksmith foreman. You should call together your subordinates and discuss these things, show it to them at your staff meetings if you have that arrangement of organization, if not you should organize at once.

We have a plan on our railroad by which we call together on Monday morning every shop foreman and we discuss the various things of interest to our department. We might say to the general foreman, "We only turned out five engines last week and we should have turned out six. Why?" There is a representative of the store department there. It may be on account of the material: if it is, he tells us about it—what efforts have been made to get it and what results we are going to get from that department and what we can expect. It may be that the blacksmith shop is at fault. Perhaps the blacksmith lacked air; it may be the machine production. In that way the discrepancies of the various departments are put before the head of the department and the best results obtained.

Another thing: You men are daily coming in contact with the men under you. Do not criticize an individual but question him. The success of a man is brought about by questioning him and getting him to think. Whenever you get him thinking you are going to get results, and he will produce the highest efficiency that lies in his power and ability.

Another thing that is attracting attention the world over is fuel economy. We have a meeting in Chicago next month along this line. We find in this country that we have about 63,000 locomotives: If each and every individual of the mechanical departments of the railroads in this country would set about to obtain desired results in the roundhouse and in each department, we could save a million tons of coal a year.

Another branch that is attracting the attention of many is the apprentice system. We inaugurated a school on our road about six months ago for that purpose. When it was suggested there were some of the men who said we did not have the facilities, but we made them. We took two box cars, put them together and put windows in them, and you gentlemen would be surprised at the results we are getting from the apprentice boys that started in the school six months ago. They are all students. There should be more students among the mechanical men.

We need the necessary material—men of proper qualifications for promotion. My superintendent of motive power called on me not long ago for a man to fill an important position. We mentioned one who had been with us for a long time. I said to him: "That man can neither read nor write but he is a good mechanic." He is standing in his own light. I have done everything I could to raise him up. I offered him the opportunity of attending this apprentice school and he did not grasp it. That man, when he was wasting his time should have been burning the midnight oil. We have all read of Gladstone who mastered the Greek language at eighty, which fully demonstrates to us that we are not too old to learn.

We should not dwell upon subjects over which we have no control, or dicsuss subjects before this organization that we are not called upon to decide. I have had men say to me a great many times: "If we had a shop like they have at Beach Grove or other places we could accomplish that thing." It is all right to tell me about it, but the question is to do it. We should take the things that we have at our fingers' ends and do the best that we possibly can. You will be surprised at results. We had a wheel lathe that was not producing results at all. By the application of a little "kink" that we had attached to the machine we increased the output fifty per cent.

I recall another shop that had three machines, a coach wheel lathe, an old type lathe and a modern machine. The modern machine was working fifteen hours, the coach wheel lathe was working nine and the other ten hours a day. After we collected shop kinks and put them on those machines, one man did all the work, and I have seen that man get his work all out on these three machines and drop over and assist on the turning of car axles.

I heard a man say this morning that he was traveling around and there were a great many foremen in his territory who knew nothing about this organization. That is a matter that is worthy of the attention of this organization. To get together, co-operate and exchange ideas and by so doing you can perform a wonderful service for each individual of your organization.

I came over here this morning to talk to you men the same as I would talk to the foremen in the shop over which I have supervision. The state of your organization is the same as the Master Mechanics' was back in 1861. You are just building up and beginning to perform the service that these men are doing now. This organization is just in its infancy. The master mechinic has developed to such a stage today that he has to have assistance. He looks to the general foreman for that one thing. One of the strongest features of the mechanical department today is the method that your organization is based upon. First, to obtain success, you must have it all lined up so that each and every part is governed by some foreman; that the responsibility can be placed in the proper direction. By so doing you will get the desired results. You must not build a fence around you so that you cannot be approached at any time. The master mechanic or the general foreman cannot be the whole thing. You may have a strong leader but he cannot do it all. He is simply the pivot which the organization swings around. Each one of you forms a tooth in the gear wheel. If one is missing the whole thing does not run smoothly. You should lend your able support in carrying out the details of your organization.

Whenever a man gets it into his head that his shop is all right—that his organization is all right—he has the wrong idea. He is a back number. You can go away and stay for thirty days and when you come back you will find some changes. By getting together through this organization and exchanging ideas you will perform a wonderful service for your brother. Unfortunately, we are a little embarrassed. We do not get up and say what we think. I know it is that way with me and it is true of a great many others. There are many here who are far more able to discuss these matters than I am. Throw off this embarrassment and you will get some great results from your organization. Here may be a man who is performing an operation much more economically than some one else. If he will get up and tell us about his little shop kinks he will assist his brother over here, and vice versa.

I am highly elated to be called upon by you gentlemen to talk to you because I like to associate with you. You are filling these positions because of your alertness and ability. You were not the men who dropped your hammers when the whistle blew, but you finished your job that you were working on and did it well. That is what brought you here.

Another matter in connection with your duties is to watch the dispatch of your power, especially at the present stages of the mechanical departments where we have more business than we can take care of. Every hour that an engine lays around a terminal means something.

We have a system in our shops that is known as the Index Card System. We know each and every engine that is going over our pits, thirty, sixty or ninety days ahead of time. Each foreman consults it and sees what is necessary and confers with the storekeeper so as to have his material on hand.

Our shop was built and designed by Mr. Pulaski Leeds in 1879, and is classed second. Last month we had a little illustration in our shop. We took an engine on April 11, and on the 19th we removed the engine from the shop and she went into service on the 20th. She received a new fire-box, new driving box also shoes and wedges. To illustrate to you how that was done: We built an extra back end so as to cut her box off at throat sheet. We are doing that for every class of engine we have on our system. With a locomotive of that capacity, if it lays around twenty days at $500 a day, it means something to your company. This matter was lined up in one of our staff meetings with the storekeeper, and when the engine arrived on the pit, each man had his part to look after. We had a flat car with a new box on it and it was placed behind the engine with one end vacant. The other was cut off on Tuesday morning, taken out to the turntable and the other put on. The jaws were faced on Monday and the shoes and wedges laid off on Tuesday. In order to get out of the way of the machinist, the blacksmith had to make two welds on the frames. We put him at that Monday evening. So you see by lining these things up, we arrived at some wonderful work, which I attribute to the co-operation of departments brought about by staff meetings.

You have noticed a man pick up a certain piece of work and carry it over to the tin shop and carry it back. Why not move the man and the job to the place where the work is being done and do away with this unnecessary loss of time going to and fro? You have seen shops where the benches were all lined up in a row in front of locomotives. They were probably working fifty to one hundred machines and you have seen the men go over to this bench or that bench. You take the time consumed in this way and figure it into minutes and hours and it amounts to a surprisingly large sum.

Another important thing is attending these meetings. I would like to see more than there are here today, especially general foremen. You must build up and construct your organization so that if you drop out tomorrow there is a man there who can take up your place and go along. You will hear from a man once in a while: "I am too busy; I cannot get away." Whenever you hear a man make that remark, you will know there is something wrong with the man and not his organization. I would like to see this organization built up to the standard of efficiency to that of the Master Mechanics', and I am going to do all in my power to make it.

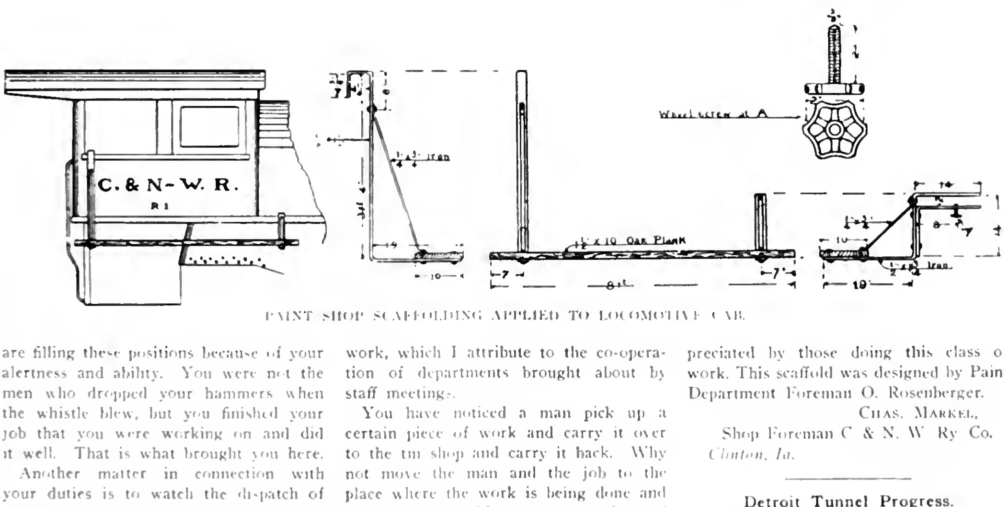
There are a great many general foremen in this vicinity who do not know of this organization. I would like to see it advertised and encouraged, so that by the time the next meeting is called there would be not less than 300 members, and I think if we all put our shoulders to the wheel and push we can get it there.

Paint Shop Scaffolding.

Editor:

The print I send you shows the scaffold that is used to paint sides of cabs and is held in position by hooked end over cab window opening and the other end fastened to the running board by handle screw as shown. This print shows very plainly what is wanted and will be appreciated by those doing this class of work. This scaffold was designed by Paint Department Foreman O. Rosenberger.

CHAS. MARKEL,
Shop Foreman C. & N. W. Ry. Co.
Clinton, Ia.



PAINT SHOP SCAFFOLDING APPLIED TO LOCOMOTIVE CAB.

Detroit Tunnel Progress.

The first train to go through the new Michigan Central tunnel at Detroit passed under the river on July 28. The train consisted of a special car, a baggage car and an electric engine. On board were Mr. W. K. Vanderbilt and several Michigan Central officials. Reaching the Canadian side a steam locomotive was substituted for the electric one and the train started for New York. It is expected that work on the tunnel will be completed by Oct. 1, and trains will then run regularly through the tubes.

Items of Personal Interest

Mr. C. T. Broxup, locomotive superintendent of the Manila Railroad, at Caloocan, Philippine Islands, has resigned.

Mr. T. J. Powell has been appointed purchasing agent of the Frisco Lines, with office in St. Louis, Mo., vice Mr. M. E. Towner, resigned.

Mr. Frank L. O'Donnell has been appointed assistant road foreman of engines on the Philadelphia division of the Pennsylvania Railroad.

Mr. Charles F. Roberts has been appointed assistant locomotive superintendent of the United Railways of Havana, with headquarters at Havana, Cuba.

Mr. C. J. Anderson, formerly master mechanic of the National Lines of Mexico, has been appointed assistant superintendent of the Southern Pacific at Mazatlan, Mexico.

Mr. F. J. Bauman, assistant supervisor of signals of the Pennsylvania Railroad at Harrisburg, Pa., has been appointed supervisor of signals of the Renovo division, at Renovo, Pa.

Mr. J. B. Canfield has been appointed master mechanic of the Albany division of the Boston & Albany Railroad, with headquarters at West Springfield, Mass., vice Mr. A. J. Fries, promoted.

Mr. F. A. Butler has been appointed master mechanic of the Boston division of the Boston & Albany Railroad, with headquarters at Beacon Park, Allston, Mass., vice Mr. J. B. Canfield, promoted.

Mr. George H. Bussing, superintendent of motive power of the Evansville & Terre Haute, has resigned and has taken a similar position with the Buffalo & Susquehanna at Buffalo, N.Y.

Mr. T. H. Haggerty has been appointed smoke inspector on the Chicago terminal division of the Chicago, Rock Island & Pacific, with office at Chicago, Ill., vice Mr. E. A. Lutzow, resigned.

Mr. C. S. Brauch, formerly master mechanic on the Chicago, Peoria & St. Louis, has been appointed superintendent of the mechanical department of the same road, with office at Jacksonville, Ill. The office of master mechanic has been abolished.

Mr. W. E. Gray, formerly connected with the St. Louis, Iron Mountain & Southern at Little Rock, has been appointed machine shop foreman on the Louisiana & Arkansas Railway at Stamps, Ark. Mr. Gray succeeds Mr. J. M. Hofman at the Stamps shops.

Statue of the Late A. J. Cassatt.

The new Pennsylvania Railroad station in the city of New York was officially declared open on Aug. 1 by Mr. James McCrea, president of the Pennsylvania Railroad. The ceremonies took place in the presence of a small party of officials and invited guests and were very simple, the chief feature being the unveiling of a

STATUE OF A. J. CASSATT.

large bronze statue of the company's late president, A. J. Cassatt.

Mr. Samuel Rea, second vice-president, in opening the ceremonies paid a high tribute to the late president, and Mr. T. De W. Cuyler presented the statue to the board of directors of the road.

In accepting the statue Mr. McCrea said:

"It is fitting and proper that the unveiling of this statue should be coincident with the official opening of the great terminal which the Pensylvania Railroad Company has, prompted by his foresight and courage, builded for itself in this, America's greatest city."

The statue occupies a conspicuous place in the new building standing at the head of the grand stairway at the end of the main waiting room. The base of the statue bears the following inscription:

Alexander Johnston Cassatt,
President, Pennsylvania Railroad Co.
1899 1906
Whose Foresight, Courage and Ability
Achieved the Extension of the Pennsylvania Railroad System Into
New York City.

Mr. O. H. Rebmeyer has been appointed to the position of road foreman of equipment of the Iowa Central Railway, headquarters at Oskaloosa, Ia., vice J. L. Brummell, transferred. Prior to Mr. Rebmeyer taking this position he had been road foreman of equipment on the Chicago division of the C., R. I. & P. for the past eight years at Blue Island.

Mr. W. J. Hatch, general air brake inspector on the Canadian Pacific Railway at Montreal, Que., was elected third vice-president of the Air Brake Association at the last annual convention. By an error we mentioned the name of Mr. J. T. Slattery as third vice-president. He was elected to the executive committee of the association and Mr. Hatch as third vice-president.

Mr. G. L. Potter, third vice-president of the Baltimore & Ohio, announced the promotion of Mr. John C. Walber, general superintendent of transportation on that road, to assistant general manager. Mr. C. W. Galloway, superintendent of transportation, succeeds Mr. Walber, and Mr. C. C. F. Bent, general manager of the Baltimore & Ohio Southwestern succeeds Mr. Campbell.

Mr. Stephen W. White, secretary of the Northern Central Railway and various other subsidiary companies of the Pennsylvania System, has been retired from the service of the company in accordance with its pension rules, which provides for the retirement of all employees at the age of seventy years. On the first of January, 1875, Mr. White entered the service of the Pennsylvania Railroad System as assistant secretary of the Northern Central Railway and was elected the secretary of that company Sept. 28, 1877, which position he has occupied continuously since that time.

Mr. J. R. Frink has been appointed purchasing agent of the Macon, Dublin & Savannah, with office at Macon, Ga.

Mr. Robert Snedden has been appointed roundhouse foreman of the Evansville & Terre Haute Railroad at Evansville, Ind.

Mr. William Hill has been appointed master mechanic of the Iowa Central, with office at Marshalltown, Iowa, vice Mr. C. E. Gossett, resigned.

Mr. Harry Love has been appointed master car builder of the Evansville & Terre Haute Railroad at Evansville, Ind., vice Mr. S. L. Wood, promoted.

Mr. David W. Pye, formerly vice-president of the Safety Car Heating & Lighting Co., has resigned to become president of the United States Heating & Lighting Co.

Mr. G. I. Evans, heretofore chief draughtsman of the Canadian Pacific Railway at Montreal, Que., has been appointed mechanical engineer of the road with office at Montreal.

Mr. C. E. Fuller, superintendent of motive power and machinery on the Union Pacific Railroad, has, under the new system, been appointed assistant general manager of the road.

Mr. Geo. M. Wilson, master mechanic of the Evansville & Terre Haute Railroad, has resigned to take a similar position with the Buffalo & Susquehanna, with headquarters at Galeton, Pa.

Mr. H. H. Boyd, heretofore electrical engineer Western Lines, of the Canadian Pacific at Winnipeg, has been appointed district master mechanic at Cranbrook, B. C., vice Mr. A. T. Shortt promoted.

Mr. Thomas O'Leary, master mechanic on the Tucson division of the Southern Pacific at Tucson, Ariz., has been appointed master mechanic at Los Angeles, Cal., vice Mr. D. P. Kellogg, resigned.

Mr. J. A. Douglas, heretofore electrical foreman of the Winnipeg locomotive shops, on the Canadian Pacific, has been appointed electrical engineer Western Lines, vice Mr. H. H. Boyd transferred.

Mr. W. C. Peterson, roundhouse foreman of the Southern Pacific at Yuma, Ariz., has been appointed master mechanic on the Tucson division at Tucson, Ariz., vice Mr. Thomas O'Leary, promoted.

Mr. C. H. Hogan, division superintendent motive power of the New York Central & Hudson River, at Depew, N. Y., has been appointed assistant superintendent motive power, with office at Albany, N. Y.

Mr. C. E. Gossett, master mechanic of the Iowa Central at Marshalltown, Iowa, has been appointed master mechanic of the Minneapolis & St. Louis, with office at Minneapolis, Minn., vice Mr. J. Hill, resigned.

Mr. T. C. Hudson, Master Mechanic of the Canadian Northern Quebec Railway and of the Quebec & Lake St. John Railway has been appointed acting general car foreman, vice Mr. A. R. Holtby, resigned.

Mr. Alexander B. Todd has been appointed master mechanic of the Tonopah & Tidewater Company, which operates the Tonopah & Tidewater Railroad and the Bullfrog Goldfield Railroad, with office at Stagg, Cal.

Mr. George H. Bussing, superintendent motive power of the Evansville & Terre Haute, at Evansville, Ind., has been appointed superintendent motive power of the Buffalo & Susquehanna Railway, with office at Galeton, Pa.

Mr. D. P. Kellogg, formerly master mechanic on the Tucson division of the Southern Pacific at Tucson, Ariz., has been appointed shop superintendent of the general shops on the Southern Pacific at Los Angeles, Cal.

Mr. L. L. Wood, formerly master car builder of the Evansville & Terre Haute Railroad, has been appointed superintendent of motive power of the same road with headquarters at Evansville, Ind., vice Mr. G. H. Bussing, resigned.

Mr. John J. Mallay has been appointed general purchasing and supply agent of the Safety Car Heating & Lighting Co. He will have charge of all departments heretofore under Mr. D. W. Pye, who severed his connection with this company.

Mr. O. H. Rehmeyer, road foreman of equipment on the Chicago division of the Chicago, Rock Island & Pacific, at Chicago, has been appointed road foreman of equipment of the Iowa Central, with office at Oskaloosa, Ia., vice Mr. J. L. Brummell, resigned.

Mr. Peter Smith, assistant road foreman of equipment of the Chicago, Rock Island & Pacific at Chicago, has been appointed road foreman of equipment on the Terminal and Illinois divisions of the same road, with office at Chicago, vice Mr. O. H. Rehmeyer, resigned.

Mr. G. E. Ellis, formerly signal engineer of the Chicago, Rock Island & Pacific at Chicago and recently connected with the Federal Signal Company, has been appointed signal engineer of the Kansas City Terminal Railway, with office at Kansas City., Mo.

Mr. A. J. Fries, division master mechanic of the Boston & Albany, at Springfield, Mass., has been appointed division superintendent of motive power of the western division of the New York Central & Hudson River, with office at Depew, N. Y., vice Mr. C. H. Hogan, promoted.

Mr. J. L. Brummell, road foreman of equipment of the Iowa Central at Oskaloosa, Ia., has been appointed road foreman of engines of the Minneapolis & St. Louis, with office at Minneapolis, Minn. He will have jurisdiction over trainmen, enginemen and all roundhouse foremen on the Eastern division.

Mr William H Egan has been appointed station master in charge of the Pennsylvania station at Seventh avenue and 33d street, in the city of New York, which will be officially opened on Sept. 8, for Long Island traffic only. Mr. Egan has been in the employ of the Pennsylvania for the past 26 years, entering its service as freight brakeman in June, 1884. Since Feb. 1, 1909, he has been assistant station master of the Hudson River division.

Dr. Angus Sinclair, editor of RAILWAY AND LOCOMOTIVE ENGINEERING, arrived home on Aug. 28, having made an extended trip in Europe. After attending the Railway Congress in Berne, he visited Italy and France, but took a look at the heathery hills of Scotland before sailing for America. He was accompanied by Mrs. Sinclair, and both have returned in the best of health and spirits.

Mr. Lewis B. Rhodes, master mechanic of the Georgia Southern & Florida Railway, has resigned from that road to accept the position of superintendent of motive power of the Virginia Railway, with headquarters at Princeton, W. Va. On the eve of his departure from the G .S. & F. he was presented with a silver water set as a token of loving esteem and regard from engineers, firemen, machinists, blacksmiths, boilermakers and indeed all classes of employees in his department.

Mr. Edwin F. Atkins, of Boston, was, at a meeting of the directors of the company, last month elected president of the Westinghouse Electric and Manufacturing Company to succeed Mr. George Westinghouse. Mr. Robert Mather was re-elected chairman of the board. Mr. Atkins is of the firm of E. Atkins & Co., Boston, and has been since the reorganization of the company a member of the board of directors of the Westinghouse company. Mr. Atkins, at the earnest solicitation of the board, has accepted the presidency with the distinct understanding that his retention of the position is to be temporary and until the board shall select a permanent successor. He was born in Boston in 1850 and is principally known as a manufacturer and importer of Cuban sugars. He was president of the Bay State Sugar Refining Company in 1878-88 and has been a partner in Atkins & Co., importers of sugars, commission merchants and bankers since 1874. He was also vice-president and director of the Union Pacific Railway system from 1889 to 1895.

Obituary.

We have to record with feelings of the deepest regret the death of Albert W. Jack, formerly vice-president of the Starr Headlight Company of Rochester, N. Y. Mr. Jack was born in 1841, and his decease at the age of sixty-nine is sincerely mourned by his many friends and acquaintances.

4-6-2 for the Chicago, Milwaukee & St. Paul Railway

The passenger service of the Chicago, Milwaukee & St. Paul Railway includes a large number of heavy trains which are run on fast schedules. Between Chicago and Milwaukee, a distance of 420 miles, two of the most important passenger trains are often composed of 13 or 14 cars, and seldom have less than 10 weighing about 508 tons. The lighter through trains between Chicago and Omaha, a distance of 492 miles, have 7 cars of an aggregate weight of about 372 tons. On the Chicago and Milwaukee division, 85 miles, trains of 750 tons composed of 14 cars are usual and as many as 16 cars have been run in one train.

Till within the last year, a very heavy class of Atlantic type engine, having a total weight in working order of 210,400 lbs. and a tractive power of 22,200 lbs., was used for this class of service. The performance of the Atlantic type engine, with these trains, considering its limitations of weight and power, was very creditable; but in ordering new passenger equipment last winter, the management of the Chicago, Milwaukee & St. Paul Railway adopted the Pacific type engine in order to meet the increased requirements of this service, and an order of 50 of this class of power was placed with the American Locomotive Company.

These engines, the general design of which may be seen from our illustration are the first of this type to be used on this road. They represent a simple design of a powerful 4-6-2 locomotive, embodying no new or unusual features. The design, however, is worthy of interest because of the very satisfactory balance obtained between weight, power and boiler capacity.

The specifications in regard to the weight per driving axle were very rigid. The maximum weight per single axle allowed by the railway company was 54,000 lbs., which could not be exceeded. At the same time as large a boiler capacity was desired as had been provided in some recent Pacific type locomotives having an axle load as high as 57,000 lbs. That the problems in connection with the design were successfully solved is evident from a study of the principal dimensions and ratios given below.

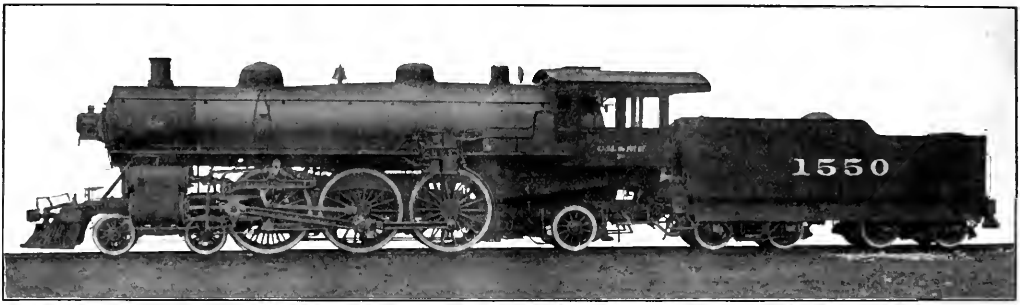
With an ample factor of adhesion of 4.82, these engines have a theoretical maximum tractive power of 31,900 lbs., which places them among the most powerful of recent engines of their class. Based on the horse power curves published in the American Locomotive Company's Bulletin No. 1001, the theoretical maximum horse power which they will develop is 1770. This would be developed at a piston speed of from 700 to 1,100 ft. per minute. With 79-in. driving wheels and a stroke of 28 ins. a piston speed of 1,100 ft. is equivalent to a speed of about 55 miles per hour. In working order this engine has a total weight of 247,300 lbs. This gives 7.2 horse power for every 1,000 lbs. of weight. Compared with a number of the most notable of recent Pacific type locomotives, the figure is somewhat higher than the average.

The large boiler capacity which has been provided is indicated by the ratio between heating surface and horse power. The boiler, which is of the type having a conical connection sheet, has a total heating surface of 3,937 sq. ft., of which 3,658 sq. ft. is in the tubes, and the remainder in the firebox and the arch tubes. The design incorporates a 3-ft. combustion chamber which makes the actual heating surface of the boiler less than it otherwise would be. Based on the actual heating surface, there are 2.22 sq. ft. of heating surface per horse power, which is about the average for recent designs of this class of engine. Taking into consideration the fact that the heating surface of the combustion chamber is more effective than the amount of tube heating surface which it replaces, the above ratio would indicate a still greater boiler capacity.

These ratios are evidence of the care with which the design has been worked out and would indicate a very satisfactory engine for the difficult service outlined above. That they have proved successful in meeting the requirements is evidenced by the Chicago, Milwaukee & St. Paul Railway having recently placed an order with the builders for 20 more locomotives of the same design. The cylinders are 23 ins. in diameter by 28 ins. in stroke. Steam is distributed to them by 14-in. piston valves, having a maximum travel of 6 ins. one inch steam lap and 1/8-in. exhaust clearance. The valves are operated by the Walschaerts valve gear, the arrangement being the same as that previously employed by these builders on engines of this class, and is designed to give a constant lead of 1/4 in. The frames are of cast steel, the main frames being 5 ins. wide. The trailing truck is of the DeVoy non-radial type with inside bearings.

Weight on drivers ÷ tractive effort...... 4.93
Total heating surface ÷ grate area....... 80.7
Volume of two cylinders (cu. ft.)........13.44
Total heating surface ÷ vol. cylinders.... 293
Grate area ÷ vol. cylinders............. 3.63

Cylinder.—Type, simple piston; diam. 23 ins., stroke 28 ins.; tractive power, 31,900 lbs.
Wheel Base.—Driving, 14 ft.; total, 35 ft. 7 ins.; total engine and tender, 67 ft. 5 ins.
Weight.—In working order, 247,300 lbs.; on drivers, 157,200 lbs.; engine and tender, 385,300 lbs.
Heating Surface.—Tubes, 3,658 sq. ft.; firebox, 250 sq. ft.; arch tubes, 29 sq. ft.; total, 3,937 sq. ft.
Grate area, 48.8 sq. ft.
Axles.—Driving journals, 10½ x 12 ins.; engine truck journals, diameter, 6½ ins., length, 12 ins.; trailing truck journals, diameter, 8½ ins., length, 14 ins.; tender truck journals, diameter, 5½ ins., length, 10 ins.
Boiler.—Type, Conical, Conn.; O. D. first ring, 72 ins.; working pressure, 200 lbs.; fuel, bituminous coal.
Firebox.—Type, wide; length, 107 1-16 ins.; width, 5 ins.; thickness of crown, 3/8 in.; tube, 1/2 in.; sides, 3/8 in.; back, 3/8 in.; water space, front, 4½ ins.; sides, 4 ins.; back, 4 ins.
Tubes.—Number, 369; diameter, 2 ins.; length, 19 ft.; gauge, .125.
Boxes.—Pump, one 8½ ins. cross compound; 2 reservoirs, 42 x 31¼ ins.
Engine Truck.—4-wheel swing center bearing.
Trailing Truck.—DeVoy non-radial.
Tender Frame.—13-in. steel channels.
Tank.—Style, "U" shape with gravity slides; capacity, 7,000 gals.; capacity fuel, 10 tons.
Valves.—Type, piston 14 ins.; travel, 6 ins.; steam lap, 1 in.; ex. clearance, 1/8 in.
Setting.—1/4-in. lead constant.
Wheels.—Drivers, diameter, outside tire, 79 ins.; engine truck, diameter, 36 ins.; kind, cast steel; trailing truck, diameter 43 ins.; kind, spoke center; tender truck, diameter 38 ins.; kind, cast steel.



4-6-2 FOR THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.
A. L. Manchester, Superintendent Motive Power. American Locomotive Company, Builders.

Traveling Engineers' Association

Address of Mr. C. F. Richardson, President.

The past year has been a gratifying one for this association; good work has been done and many new names have been added to our membership roll. Our increasing numbers mean a stronger organization, and every new member adds strength to our ranks. It is with co-operation of effort and unity of purpose that every organized body must work if great results are to be realized. Results are what the world is looking for today. The good work this association has accomplished can be seen by following the footsteps of many of its members, who have advanced, step by step, to higher and more responsible positions, and I believe I can say without fear of contradiction that every one of these men would, if called upon to testify, say that they had been materially helped through this association, and now let next year show twice the increase in membership that this year has shown.

We must keep abreast of the times, if we would maintain our reputation in the eyes of the management, which we represent, and, while we look backward with just pride upon the good we have done, let us in no way relinquish our efforts, for there are still greater things to be accomplished. The papers presented and discussed at our previous annual conventions have been helpful and instructive in a high degree, and we want this present convention to be the equal of any in the past.

At the present time all railroads are facing an unusual condition. The increased cost of operation, brought about by increased cost of material and labor, makes it necessary to practice the strictest economy, and I believe one of the greatest opportunities for the traveling engineers to assist in reducing the cost of operation lies in fuel economy. This question has a special interest for us, and it comes directly under the supervision of the traveling engineer, and the possibilities of economy in fuel consumption, together with the question of how to educate the engineer and fireman to the highest efficiency in the work, are questions demanding serious consideration by the members of this association.

The saving that can be brought about by using low grade coal in many places where high grade coal has been used, will cause your general manager to wonder why it was not done before. If you will study the situation and make a recommendation showing what can be saved by making the change, it will be worth while. Most railroad managers are looking for subordinates who can work out plans to reduce the cost of pulling a ton of freight a mile, and how much we can do towards this depends entirely upon our own efforts, and the more we accomplish makes each traveling engineer a more valuable official to his company. Another important matter is to systematize our work, and I think we should keep certain records that we may work intelligently. I believe every traveling engineer should have a record of the draft arrangement in the front end of every engine on his division. By having this record, he will be able to regulate the drafting of the engines to reduce fuel consumption.

I am assuming that the traveling engineer receives proper support from the master mechanic in not allowing the roundhouse people to change the drafting appliances after they have been properly adjusted. It has been my observation that more fuel is wasted by reducing nozzle tips to overcome poor operation of a locomotive and neglected work in the roundhouse, in not keeping flues bored out, grates in good condition, valves squared, front ends tightened and packing in good order, than can possibly be saved by the traveling engineer. When an engine is once properly adjusted to steam and be economical in coal, if she fails for steam, the real cause of the failure should be located instead of reducing nozzle tips to overcome stopped-up flues, defective grates, valves out of square, leaky front ends and worn-out packing, and when the traveling engineer can get the proper support from his master mechanic to have the draft appliances let alone after they are rightly adjusted, it will increase the efficiency of the traveling engineer by allowing him more time to ride with and instruct such engine crews as are not 100 per cent. in efficiency.

Too much can hardly be said on this subject, and I regret that I am unable to devote more time to it. Many railroads fail to get the best results from the work of the traveling engineer, the organization being such that he has no authority over the men. He is expected to instruct and direct. An organization of this kind I consider sadly defective, and I am unable to understand why it should be allowed to continue. The traveling engineer should be a man capable of instructing and directing the men under him, and if he is not, a change should be made at once. The engine crews must understand that the traveling engineer is responsible for the successful operation of the locomotives on the road, and that they are operating them under his supervision, and when their attention is called to irregular or improper handling of engines, the instruction of the traveling engineer must be obeyed, and not referred to the master mechanic, one hundred miles away.

The proceedings of this association contain much valuable information that should interest the engineers and firemen, and I recommend that this association make a special effort to put the proceedings in the hands of these men. I want to thank the members of all committees who have prepared papers. The work they have done is a credit to them and to the association, and I wish to emphasize the importance of every member giving his assistance to the chairman of the different committees so they may have abundant material to work from when preparing papers.

I want to personally thank our able secretary for the assistance and loyal support he has given me during the year, and I know I express the feelings of this convention when I say that this association is deeply indebted to Mr. W. O. Thompson. Now when the work of the year is over, and the call of duty has been answered, I trust it will make a milestone in the history of our organization that will not be forgotten, and that great achievements may be ours in the years to come. I believe that success spelled in large letters will mark the future work done by the Traveling Engineers' Association.

Traveling Engineers' Notes.

The paper on "Fuel Economy," a synopsis of which appears in another column of this issue, was read and discussed at length at one of the morning's sessions, important comments being offered thereon by members of the association and others, notably by Mr. W. C. Hayes, superintendent of locomotive operation, Erie, and Mr. D. R. McBain, mechanical superintendent Lake Shore & Michigan Southern.

At the opening of the convention the invocation was offered by the Rev. Mr. Hueston, of Niagara, followed by a very pleasing address of welcome by the Hon. Mayor Dores. The opening address of the president, Mr. C. F. Richardson, also appears in another part of this paper. The social features of the session were automobile trips about the town and vicinity for the benefit and entertainment of the visitors, particularly the ladies, of whom there were a large number.

On Tuesday evening, Aug. 16, a musical concert was given by the 19th Infantry Band of St. Catherine's, Canada. On Wednesday evening a ball and reception was held. On Thursday there was a trolley trip over the famous Gorge route, and in the evening a vaudeville entertainment by first class talent, followed by an informal dance was provided. All the entertainments, and they were many, and good, had been arranged for by the Railway Supply Manufacturers' Association.

The discussion on new valve gears was the topic of part of one of the morning sessions. A recommendation by the secretary, Mr. W. O. Thompson, was adopted. It was that the Traveling Engineers' Association appoint a committee to formulate a series of standard questions and answers to be used in the education of firemen—or in other words to be answered by applicants for position as firemen on locomotives.

ELECTION OF OFFICERS.

The election of officers for the ensuing year resulted as follows: President, Mr. F. C. Thayer, general road foreman of engineers, Southern Railway; first vice-president, Mr. W. C. Hayes, superintendent of locomotive operation, Erie Railroad; second vice-president, Mr. W. H. Corbett, road foreman of engines on the Michigan Central Railroad; third vice-president, Mr. F. T. Roesch, master mechanic, El Paso & Southwestern Railroad; treasurer, Mr. C. B. Conger, Grand Rapids, Mich.; secretary, Mr. W. O. Thompson, master car builder New York Central, East Buffalo, N. Y. Executive Committee: J. McNamany, road foreman of engineers, Pere Marquette; C. F. Richardson, assistant to general superintendent of motive power, Rock Island; M. J. McAndrews, road foreman of engines, Michigan Central Railroad.

The city of Chicago was selected as the place for holding the convention in 1911.

Traveling Engineers' Subjects for 1911.

(1) Benefits derived from the use of the brick arch, on fuel economy.

(2) The increased efficiency of locomotives and benefits derived from chemically treated water.

(3) Value of actual demonstration compared with that of oral instruction in air brake operation.

(4) The lubrication of high pressure and superheated locomotives and method of introducing lubricant between the surfaces. Also kind and quality of lubricant.

(5) Proper methods to be observed in the efficient handling of the electric locomotive.

(6) Latest developments and improvements in automatic stokers.

(7) Revision of progressive examination for firemen and new men for promotion.

(8) Mallett compound in road service.

We want our readers to look over the list of subjects given above and to write us on any or all of the topics mentioned. We also wish our readers would go carefully over the paper on educating firemen to become successful engineers. A synopsis of it appears on page 375 of this issue. The Traveling Engineers' "words of advice to themselves" is on page 362, and our comments are on page 372.

The "Gold Systems."

This is practically the title of a very extensively illustrated catalogue recently issued by the Gold Car Heating and Lighting Company, of 17 Battery place, New York. The "Gold Systems" are steam, vapor, hot water, electric heating, acetylene lighting and ventilation for railway cars. This catalogue is presented with the intention of embodying in one volume all the various devices, fittings and special fixtures of the Gold systems of train heating and lighting, so that they may be readily identified when ordering complete outfits or repair parts. In the early days of steam heating, all that was considered necessary was a simple line of radiating pipe, steam valve and trap. This was the acme of simplicity, but as the railways became more and more solicitous for the comfort of their passengers, regulating apparatus was provided, where the pressure, and consequently the temperature, of the radiating pipes could be varied to a considerable extent. In the Gold systems this is accomplished by an improved temperature regulator, any car being adjusted independently of the others or the train line pressure. For those desiring a low degree of heat in the radiating pipes, or an absence of pressure in the body of the car, the vapor system has been produced, in which method the apparatus works with an open drip, insuring both of the features. More recently the combination pressure and vapor system was evolved, whereby it is possible to operate with an open drip and the lowest temperature in the pipes or by various pressures with the closed drip, up to that on the train line. The hose couplings have also received attention, and the demand for larger port openings has been met by the production of couplers having an orifice in the gasket of 1½-in. diameter, and an additional convenience has been provided by the Universal Straight Port Coupler, which will interlock accurately with the older types and in which the nipple and gasket can be changed in a few moments to suit various sizes of hose and port openings. If you are interested in any of these matters write direct to the company.

Spark Arrester Test.

At the engineering laboratory of Purdue University tests are being made of a spark arresting device for locomotives with results which are said to attest the efficiency of the new front end construction and promise success for the inventor. In a twenty-minute run under full steam pressure and forced draft not one spark was seen, but in the smoke box nearly a bushel of cinders was found. The constant and carefully conducted experiments on the front end ought eventually to produce a non spark throwing arrangement.

Artistic Production by P. R. R.

The Pennsylvania Railroad have issued a colored picture of the district in which their new Manhattan terminal is situated and which is designed to show at a glance the relative location of the passenger station as regards the center of New York's social and business activities. The rough draft having been laid out by the officials of the Pennsylvania, the basic or black drawing was made with accuracy and skill by Mr. John A. Gurd of New York. He has reproduced the architectural characteristics of each building, and placed each one in its relative position in the group. The coloring was done by Mr. Hughson Hawley. He has touched, with fidelity, each building with its proper tone of color. The picture measures 2 ft. 10 ins. by 4 ft. 6 ins., and is well worthy of a good frame and a conspicuous place in any business office.

J-M Metallic Packing.

J-M Metallic Packing is made of a special foundered gray cast iron. In service it develops a hard polished surface which reduces friction. The packing is made from rings built up in segments with ground joints. To prevent any one of the segments from cocking or tipping and scoring the rod, the cast iron ring is counterbored and a bronze ring inserted. The latter is built up in segments and held in place by dowel pins. This inner or bronze ring also prevents the point of one segment from being forced under the heel of the one ahead, a condition which invariably results in a scored rod. If you are interested write the W. H. Johns-Manville Company of New York.

Dixon's Steel Car Paint.

The Joseph Dixon Crucible Company, of Jersey City, N. J., have just got out a very attractive little booklet of envelope size on their paint for steel cars. The booklet not only goes into the merits of the Dixon paint for this service, but illustrates a number of different types of steel cars upon which Dixon's paint has given excellent service. It also contains color chips showing the four colors in which Dixon's silica-graphite steel car paint is made. Anyone interested in steel car painting should send for a copy of this booklet which will be forwarded, free of charge.

Corrugated Sheets.

The Wm. H. Wood Loco. Firebox and Tube Plate Co., of Media, Pa., have issued a neat little postal card reminder of their factory, office and product which they are mailing to their friends. Our readers will remember that this company are the makers of the corrugated firebox for use in locomotives. If you desire any information on the subject write to the company at Media, Pa.

Fuel Economy.

A brief summary of the report of the Traveling Engineers' Committee on Fuel Economy, of which Mr. C. B. Summers is chairman, must include the list of questions which the report was intended to answer.

(A) Value of present draft appliances, can they be improved to effect fuel economy?

(B) Firing practices, including the prevention of black smoke.

(C) Roundhouse practices, whether it is more economical to knock or bank fires at terminals.

(D) Whether it is more economical to buy cheap fuel of a low heat value or a higher price fuel of a greater heat value.

(F) Devices and appliances for use on engines and tenders to prevent waste en route, etc.

In answer to the first question the committee says that with the different kinds of fuel used for locomotives there is without doubt a large field to work in for drafting engines to obtain fuel economy. They believe that the first consideration should be given to the service required, next to the quality of coal furnished, and then the engine should be drafted to use the minimum amount of coal for furnishing the necessary amount of steam.

There are so many conditions which enter into the proper drafting of the locomotive, to be economical in fuel consumption, that to get the best results the engine must be in good condition.

Prof. W. F. M. Goss, giving results of his test, estimates that of the 90,000,000 tons of coal consumed by the 51,000 locomotives in the United States in 1906, 720,000 tons were lost through imcomplete combustion of the gases; 10,080,000 tons were lost through heat of gases discharged through the stack; 8,640,000 tons were lost through cinders and sparks and 2,880,000 tons were lost through unconsumed fuel in the ashes. These figures indicate that there is considerable room for improvement in our present draft appliances.

While our present draft appliances are good, still a number of roads are experimenting with different draft appliances, and there is no doubt but what they can and will be greatly improved. It has been the experience of the committee that where the grate area and netting was increased fuel economy has resulted, and we believe that there is room for further economy along these lines.

(B) Firing practices, including the prevention of black smoke. In order to prevent black smoke and form the habit of proper firing, it is necessary when employing the fireman to instruct him in the importance of learning to fire light and often, scattering the coal as thinly over the grate surface as possible, opening and closing the door between each scoopful of coal and allowing sufficient time for the gases to be expelled and consumed. Explain to him that black smoke is unconsumed gas and a waste of fuel.

The brick arch, when heated to a high temperature, has given good results in preventing black smoke and in saving fuel, but by many mechanical men it is not considered economical on account of the expense of its application, cost of maintenance and prevention of easy access to the flues. The use of the blower with the firebox door slightly open, when the engine is standing or drifting, is successful in preventing black smoke to a large extent. A very important thing in the prevention of black smoke is to have the engine free from leaks in the firebox and smokebox, the boiler cleaned, all flues open, grates working properly, ashpan with sufficient openings for the proper admission of air, and the pistons and valves not blowing. Another thing essential in reducing black smoke, as well as to secure fuel economy, is to have the engine crew working in harmony and cooperation with each other at all times. The committee finds it necessary that the roundhouse forces should lend their best efforts in keeping engines in proper working condition.

Referring to the third heading of the subject—"(C) Roundhouse practices, whether it is more economical to knock or bank fires at terminals." The committee states that the many replies received from the members of the association show a difference of opinion on this subject, and it is difficult to state which practice is the best to follow. The committee believes that this matter is best governed by local conditions. For instance, where boiler troubles prevail, due to bad water and inferior coal, it has not been found practicable to bank fires; however, in some sections of the country it has been found very economical to do so. A number of tests were made by one member of the committee on a road having about 1,000 engines in daily service, 75 per cent. of which had banked fires at terminals for twelve hours. It was found that there was a saving of fuel of about $700 per day or $200,000 per year by banking the fires. It is their conclusion that the length of time the engine is out of service and the local conditions governing on each division will determine which method is the most economical to pursue.

(D) Whether it is more economical to buy cheap fuel of a low heat value or a higher price fuel of a greater heat value.

The answer depends upon locality, length of time the engines are under steam, using fuel and not performing work, class of service to be handled and purchase price of coal. As to location, if the characteristics of the road are such that the engine is required to work at

Willie, accompanied by his father, was visiting a circus and menagerie for the first time. "Oh, papa," the boy exclaimed, as they passed before an elephant, "look at the big cow with her horns in her mouth eating hay with her tail!"

maximum capacity the greater part of the time, it may be cheaper to buy a higher priced coal of a greater heat value. Where a large amount of coal is used while the engine is idle, it is evident that the cheapest fuel, so long as it has the steaming qualities, is the best fuel to use. In cases where the class of freight to be handled is high and the competition for passenger traffic keen, it is necessary to use coal of sufficient heat value to prevent detentions, even though the cost of fuel may exceed that which would give satisfaction under ordinary conditions. It is more economical to have an occasional engine failure on account of poor coal than it is to pay $75 to $100 a day more for coal on one division. On the average division from 600 to 1,000 tons of coal are consumed per day. If the price of coal is advanced 10 cents a ton, the cost is increased from $75 to $100 per day. Therefore, it is a question of how many engine failures a road can afford to have for $75 to $100 a day, due to burning an inferior grade of coal. An average freight engine does not work to its full capacity more than 25 per cent. of the time on an average division, and if the grade of coal is good enough to maintain the maximum steam pressure during this time the committee believes the right grade of coal has been selected in the way of economy. If the better grade of coal is selected at the higher price, there will be 75 per cent. of the time when the coal would not be needed and a great deal of it is wasted through the pop valve and in other ways, which demonstrates that the cheaper grade of coal that will get the train over the maximum grade is the most economical to be used.

(E) Devices and appliances for use on engines and tenders to prevent waste en route, etc.

There are quite a number of devices and appliances used on engines and tenders to prevent waste en route, such as shields over tank valves, side boards and racks. One of the best devices which we have seen of this kind is a hood extending about twenty-four inches toward the center of the tender. These are not advocated for tenders in passenger service, as it is claimed they make the tender top-heavy. One of the best methods of preventing waste of coal is to have the coal docks spaced so that there will be no occasion for overloading the tenders in order to make coal stations. Considerable attention should be given to the lost motion between engine and tender, so coal will not be jarred off while running. The springs and tender trucks should also receive careful attention to prevent coal being jarred off. An angle-plate placed at the right side of tender at the gangway prevents coal from working out of the gangway.

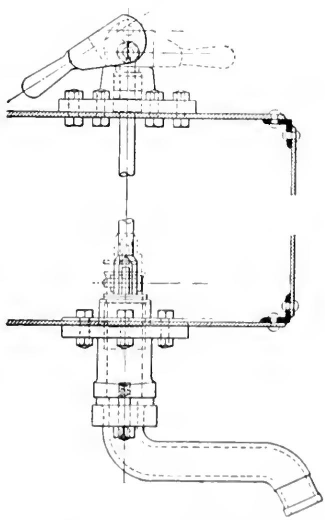
The enormous saving which would result in stopping the many and various small coal leakages is almost beyond belief.

Joint Railway Commission.

The governments of the United States and of Canada have been considering the advisability of establishing a joint railway commission, for the control of freight and passengers carried from one country to another. Mr. M. A. Knapp, chairman of the Interstate Commerce Commission, and Mr. J. F. Mabee, chairman of the Canadian Railway Commission, have been directed by their respective governments to confer on the subject and to report as to the feasability of the project. The formation of such a commission is believed to be desirable in both countries and if reported on favorably by the commissioners it would probably be effected by a treaty between the United States and Canada or it might be created by concurrent legislation, by Congress and the Canadian House of Commons.

Tank Valve Handle.

We have received from Mr. C. L. Meister, mechanical engineer of the Atlantic Coast Line Railway, a blue print of a tank valve handle which is



CAM HANDLE FOR TANK VALVE.

designed to give ample lift to the valve and at the same time prevent its being accidentally pulled out of the valve case.

The valve itself is an ordinary butterfly valve and the unseating is done by the movement of a cam handle which gives a lift of 1¼ ins. The valve stem guide at the top and the valve stem are made so as to prevent further lift. The valve stem has a boss on it which strikes the top of the guide at the point of maximum lift. The valve can be ground in without removing the case.

Light of Day on the Right of Way.

We have just received from the Commercial Acetylene Company of New York a very fine descriptive catalogue of their standard locomotive headlight equipment. This catalogue they describe as booklet "H." The equipment consists essentially of a steel cylinder, 12 x 36 ins., weighing 180 lbs., and containing 225 cu. ft. of commercial acetylene, attached to running board or other convenient place on the locomotive. There is a regulating valve which reduces the pressure in the cylinder to a usable or burning pressure. There is, of course, a gauge which indicates the quantity of gas in the storage cylinder, and small steel tubing for conveying the gas to the headlight. If desired this tubing may be led to the marker, or classification lights, and to the cab lights. No special style of headlight or lamp is required. Oil lamps and headlights can be converted to the use of Commercial Acetylene, though the company say that the best results are secured by using their headlights, which are made purposely for the use of this kind of gas. The storage cylinders are packed with asbestos discs saturated with acetone, which is a liquid resembling wood alcohol. This at ten atmospheres, or 150 lbs. pressure, absorbs twenty-five times its own volume of the gas at normal temperature, increasing the storage capacity ten fold. Large storage capacity is thus secured and there is no free gas in the cylinder. The method employed in charging the storage cylinders is the same as is used on other gas systems. They may be charged from a yard line. If used on locomotives that do not reach charging stations the cylinders may be detached and shipped to charging plant. The catalogue is very fully and very carefully illustrated and the descriptive letter press clear and concise. If you want to know anything about the mechanism, maintenance or the performance of the Acetylene headlight, write to the company, at 80 Broadway, New York.

The same company have also issued booklet C, which is a descriptive and illustrated catalogue of their standard railway car lighting equipment. This shows the same system of storage in tanks under the cars. The tanks are, of course, larger than the locomotive ones and the lamps fixtures, brackets, etc., for inside the cars are the same as those used on any of the car lighting systems. The same system of charging the tanks may be used as with the headlights. If you want either or both of these catalogues or would like other information on the subject write direct to the company.

M. C. and L. P. Association.

The forty-first annual convention of the Master Car and Locomotive Painters' Association will be held at St. Louis, Mo., Sept. 13, 14, 15 and 16, 1910. The Hotel Southern having been selected as headquarter, members and others attending this meeting are requested to make early application for reservations by addressing Mr. Henry C. Lewis, hotel manager.

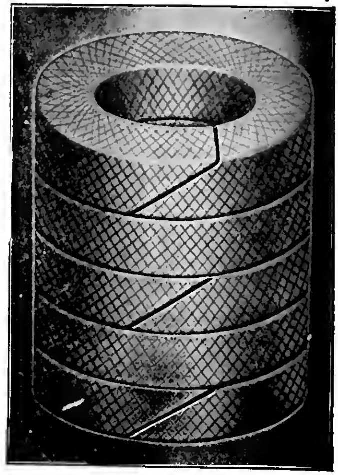
The programme contains an attractive and interesting list of subjects and queries for discussion which are fully up to the high standard established and held by this association for so many years. Attention is called to the three essays to be presented at this meeting by gentlemen of long and varied experience and whose unquestioned ability to handle their respective subjects in a logical and intelligent manner gives assurance that the sessions will be exceptionally interesting and instructive. All foremen and assistant foremen of railway paint shops, steam and electric in the United States and Canada, and others interested in the work of this association, are very cordially invited to be present. There are five subjects to be taken up, four queries, and three essays. The essays are, first, "Is it economy to keep a practical painter in roundhouses to look after things generally." Second, "Inert pigments—their use and abuse" and third "An ideal railway car paint shop, embracing construction conveniences and shop location."

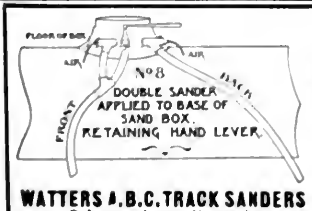
Speed Indicators.

A report current in the daily press says: Passenger engines on the Baltimore & Ohio are being equipped with speed indicators, so that engineers will have no excuse for exceeding established limits.

Attached to the device is a paper chart, the registry on which shows the speed on every point of a division. This goes to the superintendent after a run is made, and thus he has before him daily a record of the speed at which trains are run in his territory.

If this is true it will help the engineers, especially if the idea is to get at the truth, they will welcome the installation of speed indicators as a good thing. The reason for this is that the indicators will also show the delays along the line. A locomotive engineer of our acquaintance used to say that he got over the road better when the general superintendent's car was attached to the flyer, for the simple reason that news of this fact was quietly telegraphed ahead and every station agent became very quick and very alert when the G. S. was on hand; and as for station baggagemen, you wouldn't know them. They hit the stopping point of the baggage car door in a way that was wonderful to see and in went the trunks before you could say "Jack Robinson." The train was a car heavier, but the detentions were light. The indicators show delays that the engineer is not responsible for, and the G. S. used to wonder why it was not done that way every day.





Agricultural Specials.

The Houston & Texas Central, following the example of other lines, have sent out an experimental farmers' demonstration train with the usual number of lecturers and exhibits. The venture will cost the company about $5,700.

On some roads this work has gone beyond the experimental stage, notably on the Pennsylvania and on the Erie. Through the greater prosperity of the farmer incidental to larger yields, and more scientific methods, the tonnage of a road can be materially increased and the Pennsylvania and the Erie have benefitted from it in no small way both as regards the carriage of vegetables and fruit.

Railroad Volapuk.

The elderly matron with the bundles, who was journeying to a point in Wisconsin and occupied a seat near the middle of the car, had fallen asleep. On the seat in front of her sat a little boy. The brakeman opened the door of the car and called out the name of the station the train was approaching. The elderly woman roused herself with a jerk.

"Where are we, Bobby?" she asked.

"I don't know, grandma," answered the little boy.

"Didn't the brakeman say something just now?'

"No. He just stuck his head inside the door and sneezed."

"Help me with these things, Bobby," she exclaimed hurriedly. "This is Oshkosh. It's where we get off."—*Youth's Companion*.

Bridge or Tube.

Mr. W J Wilgus, president of the Amsterdam Corporation of New York, made an inspection and study of sundry transportation matters at Portland, Ore. Mr. Theodore F. Knowlton, an associate of Mr. Wilgus, is, at the invitation of Mr. C. K. Henry, to further study local conditions and submit a report as to cost, feasibility, etc., of a tube under the Willamette River. A controversy is pending as to whether the stream shall be bridged or a double compartment tube built for street car traffic only. Mr. Knowlton will make his report to Mr. Wilgus and then a final report will be made up as to the feasibility of the whole proposition.

Mr Henry is an earnest advocate of the tube, and Mr Wilgus is on record in an opinion that it will be preferable to a bridge because of the elimination of many disadvantages of the latter, especially as to annual cost of maintenance, operation, depreciation and delays, and in harbor traffic as well as risks of accident. The tube will probably be decided on.

Good Crops This Fall.

It is reported that after a three-days' tour of the corn country, tributary to the Wabash, Mr. F. A. Delano, president of the road, says that in his opinion the scare about the wheat and corn crop being burned is over. "General rains have changed conditions wonderfully and we think the prospects now are for close to a bumper crop. Altogether the farmer will be a prosperous individual this fall."

Change of Date.

We have received a notice issued by the Imperial Russian Technical Society that the International Exhibition of Electricity applied to the railways, which was to have been opened in August, 1910, has been postponed till the 15th of April, 1911, in order to adapt it to the seventy-fifth anniversary of the Russian railways. The programme of the exhibition and the rules for the exhibitors remain unaltered. New terms are fixed as follows: Inquiries are accepted from the 15th to the 28th of February, 1911; exhibits are accepted from the 15th to the 28th of March, 1911, and from the 10th to the 23d of April, 1911. The exhibition opens from the 15th to the 28th of April, 1911, and closes from the 15th to the 28th of July, 1911.

Western Pacific Opens Line.

The first through passenger train over the Western Pacific, between the coast and Salt Lake City, was a special from San Francisco. It made the run in 36½ hours which will be the time for the regular service for 30 to 60 days when the time probably will be shortened. Those who have been over the line say that there is marked diversity in the beauties of nature spread out in a lavish way at various points, along the Feather River there being between 80 and 90 miles of picturesque canyon scenery and in the Sacramento Valley there is a stretch of 200 miles as level as a floor running almost at a tangent into Oakland.

Steel Passenger Car Shops.

Large shops for building steel passenger cars are to be established by Mr. Charles M. Schwab, president of the Bethlehem Steel Company, at Wilmington, Del., at the Harland & Hollingsworth plant, of which Mr. Schwab has had possession for several years. The raw steel will, of course, be made at Bethlehem, Pa., and the shops are to be equipped with the highest class facilities.

Fewer Idle Cars.

A recent press dispatch from Chicago states: A leading traffic authority says August shows a decreased surplus of cars throughout the country despite business contraction, because agricultural tonnage is very heavy and a strong demand for box cars from many grain sections of the West will continue for several weeks. October traffic will bring back surplus increases and shortage decreases except for prospective heavy coal traffic.

Angularity of the Main Rod.

If a locomotive be placed with one side having the crankpin on the back dead center, then the crosshead pin will be at the back limit of its stroke in the guides, and when the crank pin is on the front dead center the crosshead pin will be at the forward limit of its stroke; the piston also will reach the ends of its stroke at the same instant. Now if the butt end of the main rod is taken off the crank pin and the center of the butt end of the main rod be put on the center of the axle, then the crosshead pin will be in the exact center of the stroke, and the piston also. If the crosshead be secured in this center position and the butt end be raised or lowered until the center of the hole intersects the crank-pin circle it will travel on an arc having the radius of the main rod. It will not travel on the vertical center line through the axle, and will therefore intersect the crank-pin circle at some two points, top and bottom, ahead of that vertical center line. These two points give the position of the crank pin near the top and bottom centers, when the crosshead and piston are in the exact center of the stroke.

If the crank pin be placed on the vertical center line through the axle, top or bottom, the butt end would not go on the crank pin, but would have to be pulled back, and would pull the crosshead and piston back to a point behind the center of their stroke, and when the engine is in motion the crosshead and piston must always be in that position when the crank pin is on the top and bottom centers. Therefore the piston must travel twice the longer portion of its stroke while the crank pin makes the front half of its revolution, and travels twice the shorter portion of its stroke while the crank pin makes the back half of its revolution. Now, as the driving wheels revolve at a uniform speed, being compelled to do so by the weight of engine and train, the time occupied by the crank pin during these two half revolutions must be equal, and the time occupied by the crosshead in making the two front, or longer, part-travels, is equal to the time occupied in making the two back, or shorter, part-travels, and therefore the speed of the crosshead and piston must be greater in the forward part of the stroke to make a greater distance in equal time. If we now divide the piston stroke equally it is plain that the forward half is passed over in less time than the back half.

As the wheels and eccentrics revolve at a uniform speed, the valves would do the same, but they must be given a differential speed in the forward and back movement to correspond to the differential movement of the piston in order to produce equal cut-off in different times, therefore we have to modify their motion accordingly. The saddle pin location, which is offset to produce equal half travels, can be so adjusted as to give the equal cut-offs required.

Tunnel Through the Andes.

Argentina and Chile are connected by railway. Between the two South American countries rises the huge wall of the Andes, with peaks from 18,000 to 23,000 ft. above sea level.

A railway from Buenos Ayres, touching Mercedes, St. Louis and La Paz, towns in the interior of Argentina, runs to Mendoza at the eastern foot of the Andes and climbs thence up a river valley with one huge loop and many curves a full hundred miles to the summit of the pass. Thence the Chilean end of the line descends by the San Rosa River valley to Valparaiso.

British methods and machinery were used in driving the Andean tunnel, and the engineering problems presented were of unusual interest. In length the tunnel is not remarkable. The great Alpine tunnels are much longer. While the Andean tunnel is about three miles in length, the St. Gothard is over nine, the Mont Cenis nearly eight, and the Simplon about twelve. The Arlburg of Austria is nearly six and a half miles long, and the Gravenholz of Norway is about three and a third miles. The Hoosac tunnel is four and three-quarter miles, and the Tequixquiat drainage tunnel of Mexico is six miles long.

None of these tunnels, however, were driven at such an elevation as the Andean tunnel, which is nearly 10,500 ft. above sea level. The only railway tunnels at such a height are some on the line leading from the coast of Peru across the crest of the Andes into Brazil and Bolivia. The Oroya Railway from Lima crosses the Andes by a pass at an elevation of more than 15,500 ft., and the railway from Mollendo to Lake Titicaca crosses the mountains at an elevation of more than 14,700 ft., and reaches the lake at an elevation of over 12,500 ft.

Heavy Train.

A monster train of loaded coal cars, over a mile and a quarter in length, was hauled over the middle division of the Pennsylvania Railroad between Altoona and Harrisburg a few days ago. The train was made up of 120 steel cars, all of 100,000 pounds capacity.

A year ago a model H-8 engine hauled 105 loaded cars over this division and at that time the performance was regarded as remarkable.

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances

Vol. XXIII. | 114 Liberty Street, New York, October, 1910. | No. 10

The Tait Suburban Car.

A very large traffic is dealt with by the Victorian Railways Commissioners on their suburban lines at Melbourne, Australia. The number of suburban passengers carried on these lines during the year ended June 30, 1909, was 74,541,251, and the revenue derived therefrom, £746,844. About 1,300 suburban trains and 150,000 passengers arrive and leave

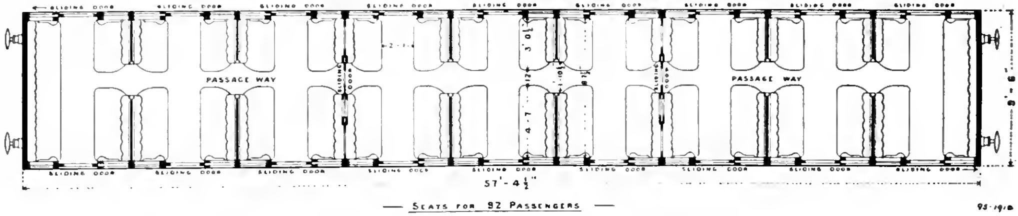
TRAIN OF "TAIT" SUBURBAN CARS ON THE VICTORIAN GOVERNMENT RAILWAYS OF [illegible] AUSTRALIA.

the central passenger terminal every day.

When Mr. Thomas Tait, the chairman of the Victorian Railway Commission was in Europe and America, three years ago, he inspected various types of suburban carriages then in use, including those which had just been constructed for service on the Hamburg Altona line and the "Sullivan" suburban side door cars running on the Illinois Central Railway at Chicago. This car was very fully illustrated and described in our March, 1907, issue, page [illegible]. As a result of his observations the car shown in our illustrations, was designed to meet the requirements of the Melbourne suburban traffic. Mr. Tait was formerly manager of transportation of the Canadian Pacific Railway.

The suburban carriage hitherto in use at Melbourne is of the ordinary cross-compartment non-corridor type with swinging doors for each compartment. The improvements introduced by Mr. Tait are the provision of a passage way and the substitution of sliding doors for the swinging doors. The object of the passage way is to permit of passengers distributing themselves throughout the car, thus obviating the overcrowding of one compartment when there may be vacant seats in other compartments.

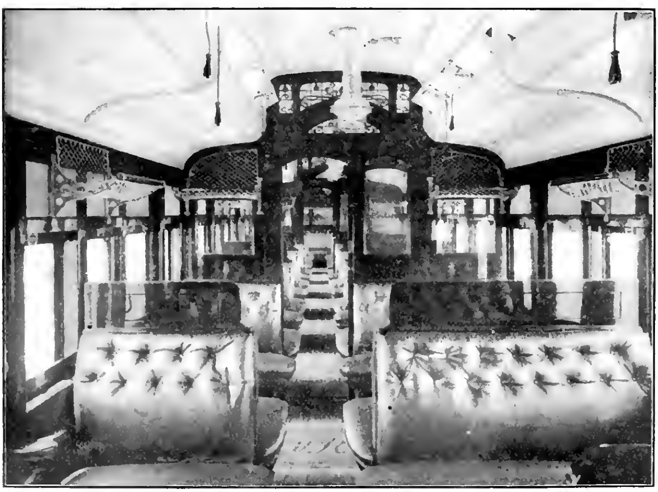
In order that the seating accommodations would not be diminished by this passage-way, the cars have been made about 1 ft. wider, and this has necessitated the use of sliding doors, as there would not be sufficient clearance of other trains on double tracks or of structures if swinging doors were used. Apart from this consideration, however, sliding doors are considered to be an advantage, as they do away with noise, eliminating an element of danger, and reduce the expense now contingent on the opening and closing of swinging doors, but, what is more important, in the event of the electrification of the Melbourne suburban lines, the possible quick acceleration from stations will not be lost owing to trains having to be started slowly to permit of the swinging doors being closed and fastened. In this connection it may be mentioned that it is intended that passengers shall open and close the sliding doors themselves, and that this will permit of some reduction in the station platform staff being effected. It may also be mentioned that apart from the locomotive driver and fireman only one other man, a



PLAN OF THE TAIT SUBURBAN CAR, VICTORIAN GOVERNMENT RAILWAYS.

guard who travels in the compartment provided for the purpose at the extreme rear end of the train, is employed on the Melbourne suburban trains. The provision of a passage-way and of a door on each side of the car for each pair of seats combines the advantage of the American car or of a corridor car, in enabling passengers to distribute themselves, with the added advantage of quick ingress and egress of passengers afforded by the European ordinary cross-compartment cars, with side doors for each compartment.

The new cars are 57 ft. 4½ ins. long



INTERIOR OF FIRST CLASS COMPARTMENT, TAIT SUBURBAN CARS.

over the bodies, and are divided into three large compartments, separated by partitions fitted with sliding doors and glass panels, so that passengers can see from one compartment into the other. These partitions prevent too much draught through the car, and provide subdivisions as required for smokers, etc.

Each car comfortably seats 92 passengers, two on each seat on one side of the passage-way, and three on each seat on the other side, and six on the seat at each end of the car.

A feature of these cars is that being one foot wider, which brings the bodies out to the full width of the footboards of the cars hitherto used, and in line approximately with the nosing of the platforms, and with the floors being designedly low, no footboards are required, and there is only one step, about 10 ins. deep, between the car floor and the station platform. The end of the guard's van compartment has been made elliptical in shape, with a view to it being used as a motor compartment in the event of electrification, and a wide landing for the guard has been provided in the doorway of this compartment. It has not been considered available to provide moveable sashes at those windows past which the doors slide owing to the possibility of injury to passengers' arms or hands in the event of the doors being incautiously opened, but ample provision has been made for ventilation. Steel has been used largely in the construction of the bodies, and the underframes and bogies are entirely of steel. The whole of the external panelling is of steel, and the interior ceilings and panels are of embossed steel of Australian manufacture, suitably painted and grained. The body framing and pillars are of teak, and Australian cedar and maple have been used in the linings, mouldings, etc., of the interior. The seats are upholstered in Australian green leather. In the design and finish of the interior all sharp angles and corners or other receptacles for dust and dirt have been avoided. The lighting is by Pintsch gas with incandescent mantles. Although steel has been used so largely and the cars are a foot wider, they will not weigh as much per passenger seat as the suburban cars of the same length hitherto used.

The extreme ends of each carriage are furnished with large sepia bromide photographs illustrating various Victorian tourist resorts. A complete train of these cars was put into service on one of the Melbourne suburban lines on Jan. 6, and has met with the general approbation of both the public and the railway staff. With the exception of a few minor alterations, which experience of these cars may show to be advisable, the commissioners will probably adopt the "Tait" car for their Melbourne suburban service.

Analysis—Chemical and Otherwise.

In a paper recently read before the Central Railway Club, Mr. E. M. Tewkesbury, general superintendent of the South Buffalo Railway, discussed "Analysis—Chemical and Otherwise." Following an outline of the early developments of the great agencies of transportation, he presented in condensed form some of the figures covering the last two decades in the United States. He said:

"At first thought, one would hardly realize the necessity of a chemical analysis of the material entering into track, bridges, locomotives, cars, etc., but when we consider that in the last twenty-five years the increase in the size of our engines and cars places upon our tracks and bridges, as well as upon the locomotives and cars themselves a burden that must attract the attention of those responsible for the safety of the property and the human freight carried over these roads, it is then that we appreciate the need of assistance from analytical science."

Mr. Tewkesbury insisted that great advancement is being made in correcting rail failures due to piping. Experiments have been made with good results by the use of an alloy of ferro-titanium in the Bessemer steel rail. To test load wear, as well as side wear, due to curvature, the speaker stated that his road is putting down a mile of track for this purpose, in which a 90-lb. section of ferro-titanium rails are laid on oak ties, hook shoulder tie plates, the Abbott joint plate and stone ballast, on about a 1 per cent. grade, varying from a tangent to 12 degs. 26 min. As heavy traffic will pass over it the wear will be subject to all tests except that of high speed. Benefits derived from analysis, he said, may be traced through every department. Material used in car building where nearly everything is of steel is carefully analyzed, and the protection which is the maximum protection to be gained is one of the big problems What will be satisfactory in one section will not do in another, and something is still needed which will give the correct results over an entire railroad system.

As to the matter of analysis "otherwise," Mr. Tewkesbury showed that the qualifications of men may be determined. There is, he held, a scarcity of men capable of being made superintendents of car shops and this serves as a hint to general foremen and others to analyze themselves and acquire the one thing that they may find they lack.

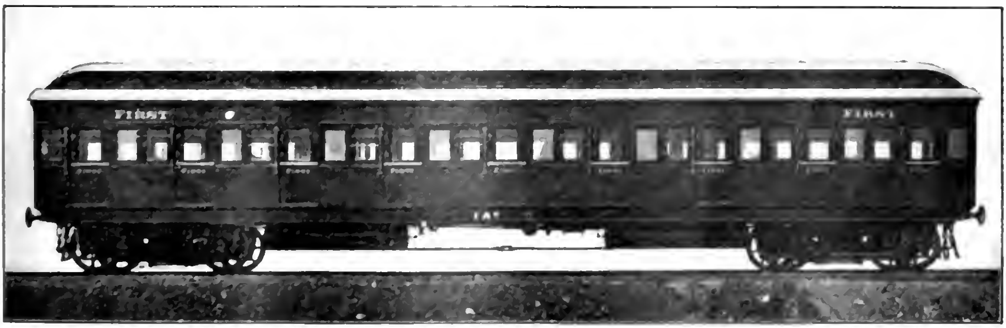
Explosion of Coal Dust.

The author of Bulletin No. 425, Geological Survey, is Mr. George S. Rice, chief mining engineer of the Bureau of Mines. In it he goes fully into one of the most serious and perplexing problems that the coal mines have had to contend with in the last few years, that is the explosion of bituminous coal dust. In the introduction Mr. Rice says "Only within comparative few years has the dry dust of bituminous and lignitic coal been generally recognized as an explosive agent more insidious, threatening and deadly to the miner than firedamp. In a dry mine, dust accumulates everywhere, and the blast from the ignition and combustion of bituminous dust may traverse miles of rooms and entries and wreck structures at the entrance of the mine.

INTERIOR OF SECOND CLASS COMPARTMENT TAIT SUBURBAN CARS

"The coal dust question in this country," continues Mr. Rice, "cannot be said to have awakened widespread interest among mining men until the terrible disaster of 1907, which resulted in the death of 648 men. In response to a demand by those interested in coal mining throughout the country, Congress, in 1908, made an appropriation for the investigation of mine explosions. The United States Geological Survey was charged with the [illegible] A testing station was [illegible] decided upon and was established at Pittsburgh, Pa. Tests made there were [illegible] ing that the question of the [illegible] no longer is 'Will coal dust explode?' but 'What is the best method of preventing coal dust explosions?'

"Experiments at Pittsburgh indicate that under ordinary conditions the dust must be from coal having at least about 10 per cent. of volatile combustible matter, though in certain foreign experiments it is claimed explosions were obtained with charcoal dust. Where there is a large amount of dry coal dust, a humid atmosphere has little effect on ignition of dust or propagation of an explosion. A long continuance of the humid conditions renders the coal dust moist and inert, but the presence of moisture in the air at the moment of explosion is not sufficient to prevent an explosion Probably with a low dust density, the realtive humidity of the air would be an important factor in tending to prevent the initiation of an explosion. However, the great purpose of artificially moistening mine air is that it may serve as a vehicle for carrying water to the dust."



[illegible] VIEW OF FIRST [illegible] CARRIAGE, VICTORIAN GOVERNMENT RAILWAY

Electric Turbine Locomotive Built at Glasgow

Electric-Turbo Engine.

This long, strange-looking locomotive, with smoke stack in the rear, cooler pipes in front, and the locomotive engineer and fireman in between, has just made its appearance in Glasgow, and has attracted widespread attention in railway circles. The steam is produced in its boiler, but instead of turning the driving wheels, it works a turbine which drives a dynamo, thus generating electricity for actuating the motors. The nominal power of the engine is equal to about 1,000 h. p. The locomotive not being dependent on live rail nor wires can travel over any railway. It has been called the electric-turbo locomotive.

Not long ago Mr. Hugh Reid, in his presidential address to the Glasgow Engineering Society, thus describes the steam turbine electric machine which is otherwise spoken of as the Reid-Ramsay locomotive. Steam is generated in a boiler of the ordinary locomotive type, which is fitted with a superheater, coal and water being carried in side bunkers and tanks. Steam from the boiler is lead to a turbine of the impulse type, running at a speed of 3,000 r. p. m., to which is directly coupled a continuous-current variable voltage dynamo This dynamo supplies current and pressures varying from 200 to 600 volts to four series-wound traction motors, the armatures of which are on the four main or driving axles of the locomotive. The exhaust steam from the turbine is condensed and eventually flows into the hot well carried on the engine.

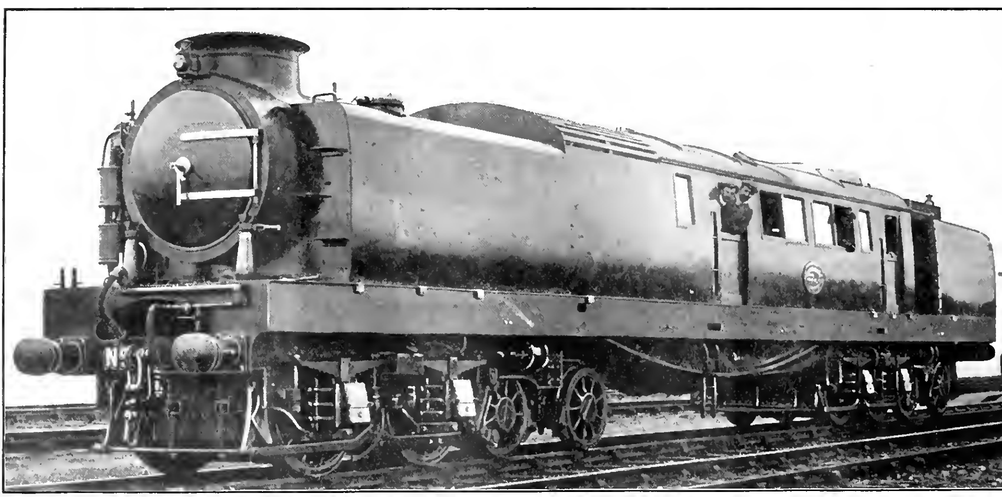
As the steam turbine requires no internal lubrication, the water of condensation is free from oil, and can be drawn from the hot well and forced into the boiler as required. The water evaporated by the boiler is therefore returned again to the boiler, and is practically simply the vehicle used in the cycle of change where the energy residing in the coal is made to do the work of turning the wheels and so moving the engine and train.

The condensation of the exhaust steam deprives the locomotive of the blast which stimulates the fire in ordinary locomotives. The forced draught is in this case provided by the use of a small turbine driven fan. This fan is placed within the cooler which produces a circulation of air in the electric generators. The fan, therefore, draws cold air into the cooler and delivers warm air to the fire.

The whole locomotive is mounted on a strong underframe, and is carried on two 8-wheel compound trucks, so built as to curve easily. The machine is intended for express passenger main line work, and is really a traveling electric power house on wheels.

In concluding this description of the novel locomotive, we may quote Mr. Reid where he says, "Most of the component parts of this steam turbine electric locomotive have already proved themselves effective and efficient in other applications, and the novelty lies in the combination of the different elements of which the locomotive is composed. It is only when the attempt is made to substitute an electric for a steam locomotive that we realize at what a very moderate first cost the steam locomotive can now be produced in up-to-date establishments with modern machinery and scientific organization in comparison with any arrangement involving the use of expensive electrical apparatus."

The engine has undergone preliminary trials on the Caledonian and on the North British Railways. One of our illustrations is made from a photograph sent to us by Mr. John MacIntosh, locomotive superintendent of the Caledonian Railway, and the other one from Mr. A. R. Bell, of London.



ELECTRO-TURBO ENGINE OR ELECTRIC POWER HOUSE ON WHEELS.

English Running Shed Practice.

At the recent meeting of the Institution of Mechanical Engineers in Birmingham, England, which was attended by the many members of the American Society of Mechanical Engineers who were guests of the British society, a very interesting paper on English running shed practice was read by Mr. C. W. Paget, general superintendent of the Midland Railway at Derby. Among other things he said, concerning the running shed buildings, they are of two types, those in which the roads are laid parallel, usually called straight sheds, and those in which the roads radiate from a center turntable, called round sheds. The straight sheds are economical in first cost and maintenance, but unless they are of the type known as "through sheds" they are awkward to work; the latter class are necessarily draughty. The center turntable type, though more expensive to build, possesses considerable advantages in working because engines can be easily got in and out without moving others. The radial arrangement of the pits also lends itself better to lighting and convenience of getting about. There is plenty of room towards the end of the pits for fitters to work at the bench between two engines, and the work of washing out boilers, flushing out pits and general cleaning can be done without inconvenience. To set against these advantages there is the objection that when the turntable requires lifting for repairs it throws all the pits served by it out of use while the repairs are going on.

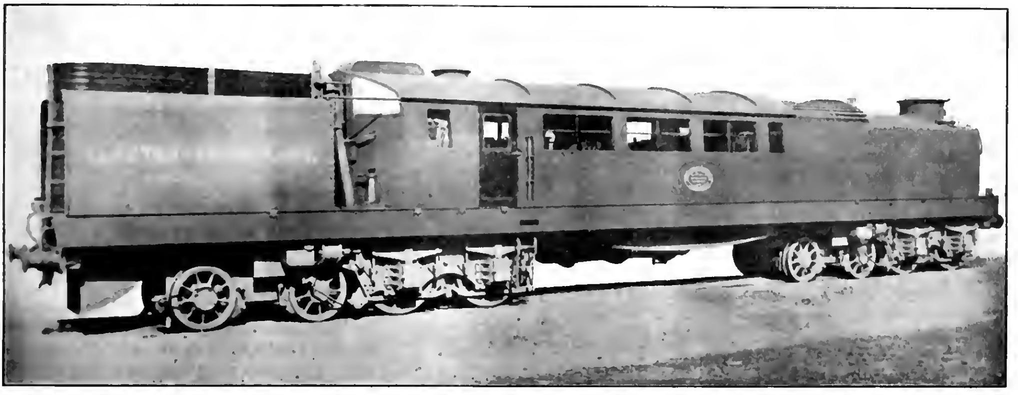
Attached to every shed of any size are sheer-legs capable of lifting one end of an engine so that the wheels and axle-boxes may be removed for examination or repairs. These legs were made almost universally at one time of wood, and of the tripod type, the single leg on one side of the rails being of extra strength and carrying the lifting gear. The disadvantage of this type, of which many are still in existence, is, that now that so many engines have extended cabs the legs have to be of great height in order to allow of the trailing wheels being taken out, as the cab top has not room to rise between the frame of the legs. This difficulty was sometimes overcome by forming the top of the legs of bow-shaped iron castings, whilst two wooden struts were placed on either side. The most modern construction is, however, to use a framework of steel joists, the top cross girders and gussets leaving sufficient head room for any contingency.

As the greater part of the cleaning of locomotives has to be performed during the night, the question of the lighting of locomotive sheds has received considerable attention on many railways. In the majority of cases where gas is available it is employed, as electric light, until the recent development with metallic filament lamps, has only been economical where arc lamps are used, and such large units of light are not required. In properly lighted sheds gas is usually employed, and this allows of adequate illumination at reasonable cost at the points required. Two considerations chiefly govern the successful lighting of a shed, these being that the boilers of the engines should be well lighted, and also that sufficient illumination should be shown on the motion work, the latter object being the more difficult problem.

Washing out is usually done with cold water, and mains with a good head of water are laid having hydrants at convenient places. Washing out with hot water, though very desirable, is not at present in general use. An engine is brought in with about 60 lbs. of steam still in the boiler, and by means of a flexible metallic hose-pipe, a connection is made between the blow-off cock on the engine and the blow-off line of piping to the tanks which contain the hot water for washing out and filling. The engine is then blown off, and the water and steam pass away to a separator on the top of the tank containing the washing-out water. The water falls down through a coke filter-bed, which arrests any scale, into the tank, and the steam passes away through a pipe to a chamber on the top of the tank which contains the filling water, where it meets pure cold water from the main water supply. This water is heated up by the steam and falls into the tank.

When the engine has been fully blown off, which occupies from ten to twenty minutes, according to the size of the boiler, the blow-off hose is disconnected and an armored hose wash-out pipe is connected to another line of piping through which the water from the wash-out tank is pumped, and the engine is washed out in the usual manner. A Duplex Worthington pump, capable of delivering 450 gallons a minute, is used for pumping the wash-out water, and this is automatically controlled so as to give a pressure of 60 lbs. per square inch. By means of the thermostatic valve the temperature of the wash-out water is maintained at 140 degs. Fahr., which is as high a temperature as can be conveniently handled by the men. When the washing out has been completed, and all the plugs and mud-hole doors have been put back, the hose is shifted on to another line of piping and the boiler filled up from the filling tank with water at not less than 180 degs. Fahr.

Few English railways have adopted water softening extensively, though several use it on a limited scale. The softeners in use may be divided into two groups, namely, continuous-flow softeners and intermittent-type softeners. In all softeners the chemical treatment is the same. The water is treated with a caustic alkali, usually milk of lime or lime water, which, by combining with the free and half-combined carbonic acid and decomposing magnesium salts precipitates the calcium carbonate and magnesia, and by the further addition of soda-ash and remaining calcium salts are decomposed and the removal of the scale-forming matter is completed. In the continuous-flow plants the chemicals are added to the water during its flow through the softener, and the precipitate is either collected on sloping plates arranged so as to divide the water into a series of shallow layers in which settlement takes place rapidly. These plants occupy the least ground, and the water loses very little head; they are best suited for waters which do not vary much in composition, such as those derived from deep wells or springs. In the intermittent-type plants the chemical treatment takes place in tanks in which a large volume of water is thoroughly mixed with the chemicals and allowed to remain quiescent until the precipitate has settled out and clear water can be drawn off, a continuous supply being obtained by using two or more tanks.



ELECTRO-TURBO LOCOMOTIVE, FRONT END TO THE LEFT IN THE PICTURE.

The Oxy-Acetylene Blow-Pipe.

By J. F. Springer.

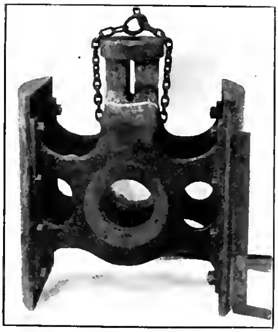
One of the most wonderful advances in the industrial world is in connection with the new process of burning a stream of mixed oxygen and acetylene. There are two tanks, one containing oxygen under strong pressure; the other containing acetylene, under a mild pressure, and the generating mechanism. Tubes from these tanks run to a tip or nozzle, the oxygen entering along the axis and the acetylene through four radial orifices. Pressures and dimensions are so arranged that 128 parts of oxygen enter to 100 parts of acetylene. These mix in the nozzle. As the stream comes forth, it is ignited and a wonderfully hot flame is the result. The whole flame is rather large. It really consists of two parts. The highest temperature is reached in the little inner flame next the nozzle. This is a brilliant white and is supposed to develop at its tip the wonderfully high temperature of 5000 degs. Fahr. With this tiny little flame, the wonderful "welding" operations are performed. The outer flame has its use. It is a protective covering.

When it is desired to make a weld, the following procedure is typical. The two edges are beveled off each at an angle of about 45 degs., thus making a V-shaped groove of 90 degs. The tip of the little white flame with its high temperature is now applied to melt the metal of the sides at the bottom of the groove. This molten metal is filled in to form this part of the joint. The metal further up is now melted, or rendered plastic, and new metal is added from a rod. The flame melts the metal of the rod just as if it were a stick of sealing wax. The groove is filled little by little. The heating of the sides is for the purpose of securing attachment for the new metal. As the filling goes on, the metal should be mechanically treated with a light hammer or otherwise. When all is completed, we have a single piece of metal. The joint is new material, and should ordinarily be identical with the old.

It might be thought by many that there is no need for such an excessive temperature. A little consideration will, however, make this clearer. The flame is a very small affair, usually much smaller than the metal in the immediate vicinity. Consequently, there is a great loss of heat by conduction and radiation. The flame makes up for this loss by its excessive temperature. The temperature to which the metal is raised is ordinarily less than half of 6000 degs. Fahr.

Because of the way the union is effected, a great many more metals can be welded than was possible by the blacksmith's methods. Cast iron can be united to cast iron. Cast steel can be joined to rolled steel. Steel and bronze can be welded. Further, because of the ease with which metal may be melted, the oxy-acetylene torch may be used as a "putting-on" tool. Suppose, a tooth to be broken off a gear wheel. By heating the surface of the fracture and then adding on new metal a solid knob can be readily built up. This may then be machined to exact shape. We thus reclaim from the scrap pile the whole gear wheel. Suppose a lug to have been broken off a casting or to be missing because of carelessness in molding. The missing part can be built up entirely or we can weld the piece on. In the latter case, we may use the broken-off piece, cast a new one or forge one, as the case may require. We can build up a part made of different metal. For example, it has been found desirable to construct a certain style of rear axle, on an automobile, partly of bronze and partly of steel. The two steel tubes may be united by the oxy-acetylene process to the bronze center piece.

A casting may have a crack in it, or develop a blow-hole. These defects are sufficient to send it to the scrap pile. The operator of the new process readily fills up the crack or blow-hole and saves the casting. In a certain industry, large cast kettles, weighing about 18,000 lbs. each,



CAST STEEL CROSS-HEAD WELDED ALONG WHITE LINE.

are employed in such a way that they sometimes develop cracks of a foot or two in length. As the metal is 2 or 3 ins. thick, this is an excellent test of the process. The process, as introduced by the Davis-Bournonville Co., 90 West street, New York, has successfully met this test and has effected a complete repair where the crack was about 2 ft. long.

When one considers that metal expands when heated and contracts when cooled, one can readily understand that difficulties will arise. When the large kettle has been turned upside down and the crack repaired by chipping it out to form the V-groove, we must get ready to offset the excessive loss of heat that is to be expected on account of the thickness of the metal and the great opportunity for radiation. A charcoal fire is usually built underneath the crack for the purpose of heating the adjacent metal. This will have the effect of reducing the loss of heat from the flame. But when a part of the work is highly heated by the fire, we have to look out for new cracks when cooling. Also, there is a tendency of the new metal and the old to part company. These matters require care and skill in operating. The difficulties are being understood and met by the fast accumulating stock of experience. When just the right proportions of oxygen and acetylene are flowing out of the nozzle, the little flame will be very perfect in form with a rounded tip. The operator judges with his eye. If too much acetylene is coming through, steel or iron will be carbonized. If too little, they will be oxidized. Either is bad, but, it is so easy to tell when all is right.

As to the probable cause of the high temperature, we may say, acetylene is an explosive gas. When it explodes, heat is set free. In part, it is composed of carbon. At a high temperature, carbon is very eager for oxygen. And so it comes about that the carbon liberated by the explosion immediately unites with the oxygen flowing along from the nozzle. We say immediately, but that is not quite correct, because after the explosion the highly heated carbon seems to flow along alone for a very short distance. While it flows alone and at a high temperature, it shines with brilliant whiteness. In a very short time it unites with the oxygen This union generates heat. We have heat from the explosion and heat from the union. The whole of this action is concentrated within the length of the tiny inner flame. Hence, the extremely high temperature.

This result is probably due to the fact that not enough oxygen is permitted to flow from the nozzle to completely burn the acetylene. It is ultimately all burnt in the outer flame. The explosion and this first combustion occur with marvelous rapidity, and this is probably the great reason for such an extraordinary concentration of heat.

A large gear wheel weighing about 15 tons developed a fracture across the rim. This was successfully filled in. The oxy-acetylene torch built up one of the teeth 5 ins. deep and 22 ins. wide.

Another interesting case was that a piston-rod 12 x 10 ins. was made 18 ins. long. How to effect such additions economically generally depend on the circumstances. Thus, it might seem more economical to cast or forge the portion of the piston-rod to be added and then to weld it on to the old portion than to build the whole by the torch alone. The application of these methods to railway work is fast being developed. We are told that it has been found possible to repair an old firebox by welding in new half door sheets and new side sheets. Care has to be exercised here because of the contraction subsequent to the high temperature necessary.

General Correspondence

Repairs to Turntable.

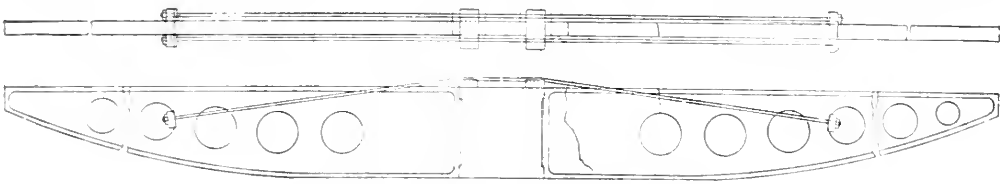
Editor:

The attached print will possibly be of interest to readers of Railway and Locomotive Engineering, as it has been most successful and is still in use at the old Chicago & North Western Railway roundhouse at Clinton, Ia.

The print shows how a 60-ft. cast iron turntable was repaired in 1899 when the heaviest engine turned on it weighed 212,000 lbs., and the table is still in use turning engines that weigh 280,000 lbs., and it shows no weakness whatever as far as the cracks are concerned. This table was repaired under the direction of Mr. H. T. Bentley, now assistant superintendent of motive power and machinery, when he was general foreman at the Clinton shops. The print, I think, gives full details and no further explanation is necessary.

Chas. Markel,
Shop Foreman.

Clinton, Ia.



REPAIRS MADE TO CRACKED LOCOMOTIVE TURNTABLE.

Setting of Tandem Piston Valves.

Editor:

We have a class of engines here known as the Santa Fe type tandem compound; piston valve, cylinders 19 and 32 x 32 ins., 225 lbs. working pressure; 234,580 lbs. on the drivers. There has arisen quite a controversy relative to the proper manner in which to set the valves. I claim that the proper method is to set the high pressure line and line, thus giving the low pressure $\frac{1}{8}$ of an inch lead. There are a number, however, who claim that the low pressure valves should be set line and line, claiming that when the valves are set in this manner that the engines give much more satisfactory service.

M. O. Stewart,
Division Foreman.

Las Vegas, N. M.

[We have ascertained that the original setting of these valves was: Travel, 6 ins.; lead H. P., o; L. P., $\frac{1}{8}$ in.; lap H. P., $\frac{7}{8}$ in.; L. P., $\frac{3}{4}$ in.; inside clearance of negative inside lap H. P., $\frac{1}{4}$ in.; L. P., $\frac{3}{8}$ in. From this it is evident that as the two valves are on one rod the L. P. must have $\frac{1}{8}$ in. more lead than the H. P., however set. Our correspondent does not say what kind of work the engines are said to be more satisfactory in when set $\frac{1}{8}$ in. blind H. P. and line and line L. P. Such setting is equivalent to a decrease in the inside clearance to $\frac{1}{8}$ in. H. P. and $\frac{1}{4}$ in. L. P. If the engine will work when so set without showing a loss on the indicator card from increased back pressure the valves should be altered accordingly so as to give lead H. P. o, L. P. $\frac{1}{8}$ in., lap H. P. $\frac{7}{8}$ in., L. P., $\frac{3}{4}$ in., inside clearance H P $\frac{1}{8}$ in., L. P., $\frac{1}{4}$ in., and the results should be carefully compared with the original performance. If the work is done at slow speeds, say below 10 miles an hour, possibly this change might produce somewhat better results, but at higher speeds there would be a loss which might be greater.—Editor.]

Valve Trouble.

Editor:

I notice on page 369 in your September paper that our friend on the C. & O. at Covington, Ky., is in trouble with a slide valve. If he will place the engine so it will blow, and then raise the steam chest on that side he will find that the valve has too much travel and opens the exhaust port. I have found this to be the case where reach rods were too long.

A Subscriber,
V. & S. W. Shops.

Bristol, Va.

Big Engineer on Small Road.

Editor:

I am enclosing a photograph taken a few days ago, of Spellman's performing bears already for a ride on the miniature steam railroad at Contoocook River Park. The picture may interest some of your readers this way, as the engineer, "Cobbie" Webster, whose avoirdupois tips 250 lbs., is standing back of the "dog-on" engine. He is a veteran Concord railroad engineer, and feels as proud hauling a load of passengers around the Knoll belt line as he did thirty years ago on a glaring McKay and Aldus when throwing wood speeding around Suncook Loop.

CONTOOCOOK RIVER PARK RAILROAD TRAIN

The screen on the car, behind the dog, protects the children from sparks or cinders, while an ingenious pipe extension, not shown, is attached to the stack to carry smoke high above. During the exhibition here one of the growlers viciously attacked the lady trainer, badly lacerating her neck and arm. The bear was promptly despatched to his last hunting ground.

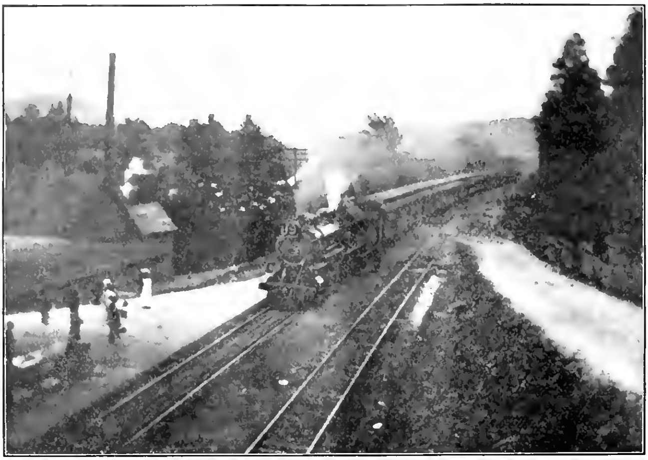
Concord, N. H. Subscriber.

Scenes on the C. & O.

Editor:

Enclosed please find an instantaneous photograph of Chesapeake & Ohio train No. 3 at full speed, entering Charleston, W. Va. The train is hauled by a Pacific type engine, No. 161. Also enclosed you will find a picture of the standard rock ballast roadway of the C. & O. These pictures were taken on my recent vacation in West Virginia. Having been a constant reader of, and subscriber to your valuable magazine, I take pleasure in sending these to you. Will you kindly publish them.

Indianapolis, Ind. C. W. Gorsuch.



C. & O. TRAIN 3, HANDLED BY ENGINE NO. 161.

Locomotive Lubrication.

Editor:

After reading the article on reduced locomotive lubrication in your September magazine, I would like to ask what is good lubrication of a locomotive? Is it good policy to cut down oil supply to valves, to the point that the reverse lever jerks a man out of the front cab window when he wants to cut her back or drop her a notch? Or when he shuts off steam the cylinders groan and the valves instead of cutting off square are badly out. Regardless of what oil experts may say, I claim that if valves are in good condition, the man that runs a locomotive, if he knows his business and keeps water at the proper level in boiler, knows more about when his locomotive is getting the proper lubrication than any of these experts who never rode a locomotive. The way a reverse lever handles is the best oil expert in the country.

Further, while six drops a minute will lubricate some engines it will not do so with others. Let some of these experts on oil take a trip of 16 hours over the road and pull the last pound that the engine will pull, as they are loaded now, and work the engine properly on one and three-quarters of valve oil, and see how he gets along. Let him shut off lubricator tight while standing still and throttle valve leaking, and see how nicely she will squeal and how the valves will sound when she starts out. Too many of our oil records are made in office chairs, with engineers on the road buying, stealing, bribing, etc., oil, tallow or graphite.

While it is true that some remarkable records on oil can be made with a light engine, or train running with a light throttle, etc. Try the same with the modern consolidation with 22x30 in. cylinders, with high pressure steam, with full throttle and reverse lever cut back on quadrant where she ought to work, and will work if valves have proper lubrication. What oil is saved is taken out of the coal pile, the fireman's hide and the machinery of the engine.

The proper way to lubricate with grease I have yet to see. With the grease plug you have all the pressure at one time and none at the other, and how often do you see the brass cutting around pins and when you take plug out find grease still in cup. Grease, to feed properly, should have a slight yet steady pressure on it. With the spring cup it feeds all right while grease is cool but as soon as the pin warms up, away goes all the grease, too much pressure. As to engine oil, how much engine oil should be used? Are the oil holes put on for fun or are they for use? Now take a consolidation engine. Oil the wedges, the wheel hubs, fill the four guide cups, the piston rod cups, put two table spoonsful of oil in the eight eccentric cups, oil the links and all the motion work, knuckle pin joints front end of main rods, don't put any on the engine truck, and see how much oil is left in a spout spring can, such as is usually furnished by railroad companies. It generally takes it all, and this is about the usual supply of oil for the whole trip. Now what have you to oil engine on road with?

Two spout cans full of oil for a trip of 150 miles should be allowed, and none would be wasted, the motion work would last longer and the guides and crossheads would not need lining and babbitting so often. The engine would not be in the shop, out of service so often. I don't believe in waste of oil or of anything in any service, but I do believe in enough and not in the penny-wise and pound-foolish way of doing business. Keep the valve square and the balance strips tight, grind in the other valves so they won't leak, keep the other parts of

STANDARD ROCK BALLAST TRACK, C. & O.

the machinery in good order and give oil enough to keep it so, and engines will be out on the road making money instead of in shop for repairs.

E. Rose,
Loco. Engineer.

Absolute and Relative Motion.

Editor:

I am writing to you to ask your decision on a subject of contention here at the shops. One party contends that the crosshead (likewise the piston) on a locomotive has only one motion, a forward one always; for this reason, that as the crosshead is directly connected to the crankpin by means of the main rod, and, as the line of travel of the crankpin is always forward on account of its eccentricity, likewise the line of travel of the crosshead. Is it not correct that the center of revolution of the driving wheel is at the point of contact with the rail, and not at the axle?

The second party contends that the crosshead has both a forward and a backward motion, as in a stationary engine not realizing, perhaps, that the center of revolution in a stationary engine flywheel is at the shaft. Is not the diameter of the driving wheel the radius of the circle of revolution?

The first party, therefore, asserts that at the admission of steam to the cylinder the cylinder is driven forward; the piston, meanwhile, momentarily remaining stationary up to the completion of the stroke, after which the piston is carried ahead again. This the second party denies.

Constant Reader.
Chicago, Ill.

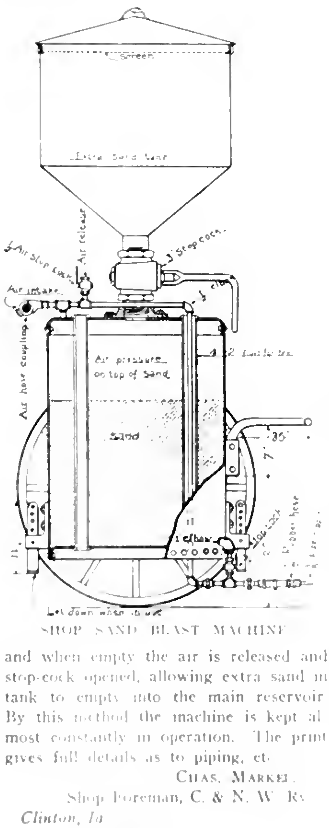
[This is practically a case of relative and absolute motion. The first party is right in thinking that the crosshead has a forward motion only. So it has with reference to the track, but it has a backward and forward motion as far as the guides, yoke, cylinders, etc., are concerned, and the second party is right on that point. Suppose you have an engine with 2 ft. stroke and a 5 ft. driving wheel. The engine runs forward at the rate of 15.7 ft. for every revolution of the driving wheel, and this is equal to the forward and the back stroke of the piston. For one 2-ft. stroke the engine moves over 7.86 ft., and on the forward stroke the crosshead moves 9.86 ft. ahead, and on the back stroke the crosshead moves ahead 5.86 ft. Take the average and you will find it comes out all right. In 100 revolutions the engine will have gone ahead 786 ft., and counting by forward and backward strokes, you will find 50 x 9.86 added to 50 x 5.86 will just make 786 ft.

You are right about the wheel and rail being the center of revolution of the driver, but as it changes from moment to moment it is called the instantaneous center of revolution.—Editor.]

Sand Blast Apparatus.

Editor:

The print I send you shows a home-made sand-blast apparatus that is used to sand-blast locomotive tenders, and the work accomplished by this machine in the hands of two laborers is surprising. The tender to be worked on is placed outdoors in an open space and the dust from sand is not noticed by the operator of the machine. The apparatus is made of an old main air drum with four additional 2 in. flues extending from head to head to support the pressure on the heads. A 3 in. stop-cock is screwed in flange on top head of drum and into this cock is screwed the extra sand tank, which is filled while the machine is emptying the main reservoir,



SHOP SAND BLAST MACHINE

and when empty the air is released and stop-cock opened, allowing extra sand in tank to empty into the main reservoir. By this method the machine is kept almost constantly in operation. The print gives full details as to piping, etc.

Chas. Markel,
Shop Foreman, C. & N. W. Ry.
Clinton, Ia.

The Making of Engineers.

Editor:

In recent issues you ask several questions and request your readers to give their views on the subjects.

First, in regard to books on machinery. Have them in railway libraries, Y. M. C. A.'s, etc., if possible, but have them at home by all means, and then study them after you get them there. I do not think it would be good policy for a railway company to furnish them free of charge either, for in ninety-nine cases out of a hundred they would not be appreciated. If you have to buy them, and if you are the "right sort," you will think more of them.

Second, as to a regular fireman or not? A regular fireman, by all means. A regular engine also if you can get her. The regular man knows just what to expect in regard to carrying his fire, when and where to start and stop firing, and he can save great quantities of coal over the extra man, who in the great majority of cases, does not know just where this man shuts off, or the next man opens up, or just what he can expect the engine to do, so his only alternative is to "keep her loaded" and take no chances. Then there are other considerations, your regular fireman, as a rule, takes considerable pride in "his" engine, he keeps everything at hand and ready if you are wanted in a hurry. He is careful of his flues, doesn't let her choke under the arch or let a pile of ashes accumulate on the dead grate so as to chill her flues and start them leaking, keeps his eyes and ears open, and if things doesn't seem right says so, and so on indefinitely.

Third, giving prospective fireman shop experience. Yes, by all means let him come up through the round-house or shop, for a multitude of reasons. The first one would be that a term in the round-house, with the dirty work, would keep anyone out of the service unless he was determined to make an engineer of himself, and would practically eliminate what may be called the "ornamental" fireman. Among other things, he has probably learned to handle a scoop, has a slight idea how to burn coal, and if he strikes the right kind of engine crew to "learn the road" with, he ought not to have to make many trips on probation.

In cases of breakdown the knowledge of machinery gained in the shop will be invaluable to him. After he has served his time at the scoop and stands for promotion, the mechanical examination will have no terrors for him, and it will be no stumbling block to explain "why" these things must be done. Most important of all, he will be able to inspect an engine thoroughly and make an intelligent work report. Altogether his shop experience will give him a knowledge of the machine he is running, which is practically impossible to gain in any other way. Men trained in this way ought to make "engineers," not what your worthy editor-in-chief calls "starters and stoppers."

Blue Grass.
Engineer on the B. & O.
Lexington, Ky.

Welding with Crude Oil.

Editor

The frame of engine No. 425 broke just ahead of the front jaw, on both the top and bottom rails of frame Fig. 1. I wish to state that this engine is of the consolidation type and weighs approximately 90 tons. The old frame being 4½ ins. square, but after considering the matter we thought it advisable to make the frame heavier at the weld, and for this reason a blank piece Fig. 2 was got out 5 ins. square, and it was necessary to get out this blank piece we deemed it advisable to do away with one of the welds. We therefore cut the old frame off in the center of the front jaw, Fig. 3. Where the old frame was cut off it was dressed and belled out very carefully and neatly.

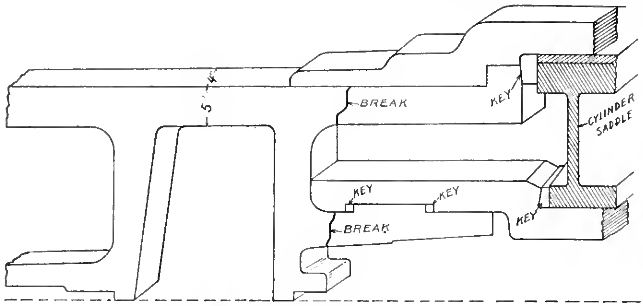


FIG. 1—FRAME OF ENGINE, NO. 425, SHOWING BREAKS.

A templet was made of the old frame where it was belled out, and the blank frame was made the male, and fitted to the templet very carefully, 3/16 of an inch being allowed for shrinkage. The blank frame was squared up in machine shop and finished so that there would be no work on it after weld was made. The frame was made 1 in. longer than it should be when finished. This was the allowance for welding. A like amount was taken off the front end of the new frame, so as to allow it to center up into its proper position. A wedge was made to drive in between front end of frame and cylinders to taper up from nothing to 1 in. in thickness, about 8 ins. long. The frame was bolted up with "U" bolts and a jack was placed under pedestal to hold same in place, after which we built a crude furnace with fire brick around the frame, leaving a space for welding in the furnace 2½ins. each way, with the exception of a place for the weld 6 ins. long. It took us about two hours to build this furnace.

After the furnace was completed we started our heat. Nothing was used but crude oil and air. The burner being a home-made affair, with two ¼-in. pipes connected to it, the air being in one pipe and the oil in the other pipe. These holes were connected by drilling down through the burner, the air entering one hole and the oil in the other, both holes meeting in about the center of the burner, which formed a syphon, the air rushing through drawing the oil. Heat was started about 9 o'clock a. m., and at about 10:20 a. m. the frames were heated sufficiently to make a nice weld, which was done by bunching bars on side, all being in readiness and the before-mentioned wedge between the frame and cylinder, and an ordinary ram butting up from back end of engine on frame. After the men

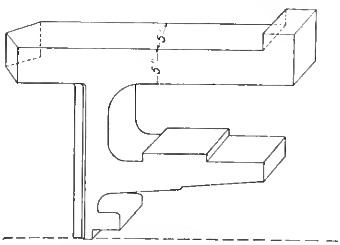


FIG. 2—NEW PIECE MADE AND WELDED IN PLACE.

started the weld a nice weld was made. In about twenty minutes and same was dressed off, completed, squared and ready for the only pair of wheels that was dropped at 1 a. m. same date. I think this was a remarkable job at our place, because had we gone to the trouble of taking frame down it would have cost in the neighborhood of $100, whereas it did not cost over $25 to do this job by welding frame while it was in its natural position. As I said before, it was only necessary to drop one pair of wheels, and it was one of our heaviest engines. I wish to state when trams were tried after frames were cold, no difference could be detected from what same was originally. We have one of our engines; namely, engine No. 427, welded in the same manner over a year ago. It has since then not given us any trouble. Trusting this information will be of some value to the readers of your magazine,

Cincinnati, O. B. F. Harris.
Gen'l Foreman, C. H. & D. Ry.

Several Sorts of Things.

Editor:

I am writing you to give you an idea of how we do some things at our roundhouse at Portage, Wis., on the Chicago, Milwaukee & St. Paul. Among other things are the duties of engine dispatchers. They have to see that the fire is maintained on arrival, blow the engine down at clinker pit with both injectors working, and fill up. Dampers and ash pans are closed after fire is knocked out or cleaned. They see that the turntable is lined up and prop smoke jack up to clear. They try the air and injectors. They note water height in the gauge glass and try the gauge cocks. Our rule is that injectors are not to be worked after fire is out unless absolutely necessary. Machinist also examines the air, tests signal, drains water out of reservoirs, examines and cleans triples, measures coupler heights, examines safety appliances, etc.

In the matter of coal consumption, the more simple performance sheets showing the amount of coal consumed in hauling 100 tons one mile, appeals to the men the best and quickest. The engines running out of this point are keeping up well by a good showing.

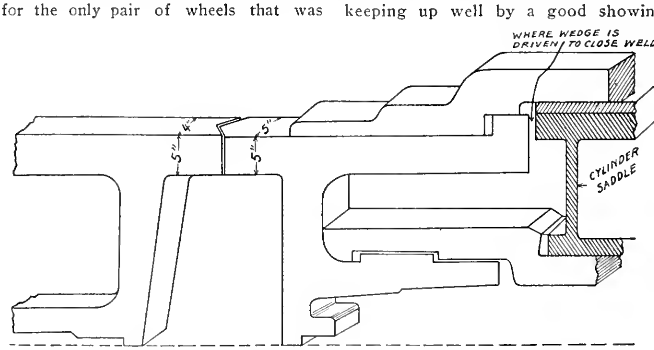


FIG. 3.—FRAME CUT THROUGH JAWS AND FRONT PART REMOVED.

Few of the compound engines are now at this point. In the matter of coal the compound, according to test of 1905, seemed to show up some 24 per cent. the best. Cost average, 5.5 cents per 100 tons hauled one mile. No superheaters have been tried as yet.

A few stokers are being used of the reciprocating plunger kind. Some of the firemen are doing good work with them, some are not. Sometimes we find the plunger in the fire box, mostly owing to too much steam being turned on at the start. Some complaints have been made that the stoker does not put the coal in the corners of the fire box. The removal of the stoker to knock out the fire causes a little more work for the house men. Experiments are now being made with the stokers on five engines, which are showing up better.

The drop bottom and slide bottom and a few side rake pans are used. The drop bottom seems to give the better service. While the former frequently drops away a little from the outlet seat, the latter warps at times and gets clogged with cinders, and freezes up or fills with ice and snow in the winter, as also the drop bottom ash pans do for that matter. All require constant watching, and need frequent adjusting. We have less trouble with flue work with the river water. The leaking flues were getting better on the previously used power, and are being improved on the present power. The engines with the large combustion chamber give the least work of any.

H. W. Griggs.
Roundhouse Foreman C. M. & St. P.
Portage, Wis.

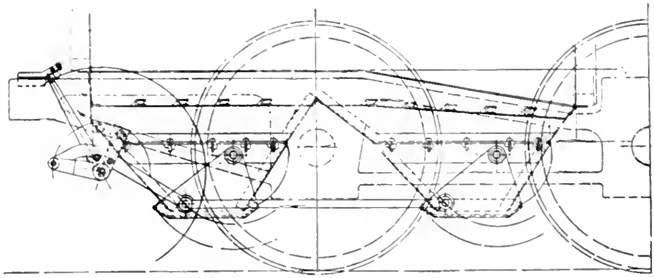
The Wine Ash Pan.

Editor:

In designing this ash pan to conform to the recent Federal law, the designer took into consideration the numerous fires which occur from losing cinders along the right of way, and endeavored to design a pan which would prevent the losing of cinders, and thereby eliminate the fires and other troubles occurring from this cause. It was also desired to have a pan which would not require machined or accurately adjusted parts.

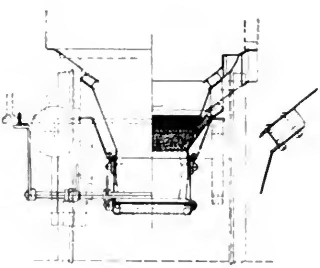
The air admission passages are so arranged as to prevent the escape of ashes through them, and are so placed as to supply the air at a point within the pan where it will be evenly distributed over the under side of the grate. These passages are also located a sufficient distance from the mud ring to prevent cold air creeping up alongside the firebox.

The hoppers are separate from the main body of the pan, and are held thereto by key bolts, so that when it is necessary for a workman to go into the pan the keys can be easily knocked out and the hoppers dropped down. The discharge doors dump by gravity and are made considerably larger than the bottom end of the hoppers in order to allow for irregularities in the workmanship and warping or buckling of the hoppers and doors. The edges are flanged upward and around the bottom end of the hopper, and stand off therefrom about ½ in. in such a way as to form an ash seal. It has been found in practice that the finer ashes will settle to the bottom and pack in the space between the door and hopper sufficiently to prevent the entrance of air.



THE WINE SELF-CLEANING ASHPAN, A. C. L.

If desired the injector overflow may be discharged into the pan, which, on account of the upward flanges around the bottom ends of the hoppers, will form an air-tight seal. The flanges serve the purpose of preventing the escape of ashes and cinders through the space between the door and hopper. By the flanges extending upward about 2½ ins. from the bottom end of the hoppers it will be observed that the upper edge of the flanges will have to move downward this distance before the ashes could escape over the top. Thus it will be seen that any reasonable wear in the pivotal connections will not effect the proper closing of the doors. It will also be noted that after the operating rigging has been once adjusted to the proper opening and closing of the doors there is never any need of readjustment. From the form of the supporting arms of the doors it is possible to allow this door to drop closer to the track than with other designs of doors. The arms being in the form of gusset plates, stiffen the doors against longitudinal strains, such as would occur should the engine be backed up after dumping the ashes and before the doors had been closed, due to scraping down the pile of ashes on the track.



END VIEW OF WINE ASHPAN.

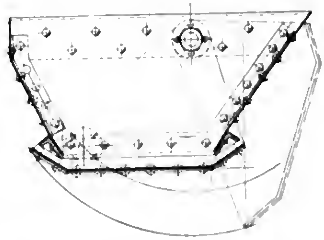
In cold climates where the doors are apt to become frozen up in winter, any successful arrangement for thawing out the doors of other designs is equally applicable to this design. The operating arrangement is such that in its closed position the crank arms are past the dead center, and any tendency of the doors to open is resisted in this way. There is also a latch which is a safety device to prevent the arrangement from unlocking. The operating arrangement is so designed as to give maximum leverage on starting to open the doors.

Over three hundred of these pans are in use on the Atlantic Coast Line Railroad, and are giving excellent results. Some of these pans have been in constant service since August, 1908. The accompanying drawings show the design used as standard by the A. C. L., and will give an idea of the mechanical construction and operation of the pan.

W. E. Wine.
Draughtsman, A. C. L.
Wilmington, N. C.

Smokeless Firing With Oil.

Having carefuly read and devoted some study in an attempt to digest the subjects contained in all of the latest works on locomotive engineering, the writer is now perusing the pages of one of the best books on the subject, called



DETAIL OF HOPPER DOOR A. C. L. ASHPAN.

"The Locomotive Catechism," being the 27th edition and published in 1908. On page 774, lines 18 and 22, the fifth and sixth questions read as follows:

Q. Does oil permit smokeless firing?

A. No; because it does not perfectly vaporize; the residuum causes smoke and soot; further, conditions change so often that perfect combustion cannot be maintained.

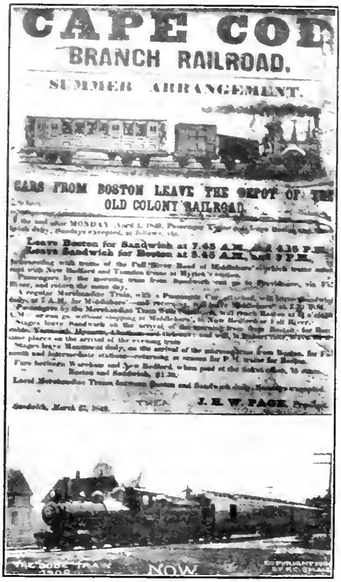
Q. Is oil firing easy?

A. From the physical point of view, yes; from that of wear and tear on the nerves, no; for the fireman has to keep his eye on the gauge and his hand on the oil throttle at all times.

The writer has had no experience in firing oil in Russia or in the United States, but has been fortunate enough to serve a little over three years firing liquid fuel in locomotive service in a sister republic, and cannot agree with the above. That an expert fireman has his hand on the oil throttle and eyes on the gauge at all times I do not believe. He does not do it a fourth of the time. I am convinced a fireman would have to acknowledge that the water glass and the smoke stack would have something of a monopoly in such instances. With oil, the proper temperature, and the necessary air pressure on it, burner adjusted to meet the requirements of the service, atomizer supplying the right kind and quantity of steam, the expert fireman pays little attention to the steam gauge and oil throttle, be the road ever so undulating, and the majority of roadbeds certainly are in this republic.

Every few seconds a glance at the water gauge, now and then a glance at the steam and air gauges, and the fireman's eyes are looking ahead with the smoke stack clearly within his vision. He sees almost every foot of the track as the train moves on, notes all the signals, switch-points and targets. His ears are open and he hears and notes every clink of the engine, but the stack is the thing he's watching. That's the fireman's gauge. It is now between him and the clear blue sky. Not a particle of smoke. Look back over the train—no smoke. That engine must be burning smokeless oil. Not at all; it's the same old, black, sticky chapapote. The expert fireman knows that perfect combustion of oil fuel is smokeless, and if it is otherwise it indicates to him that something is wrong. It may be temperature of oil or pressure of air, flues leaking, improper draft, adjustment of front end, flues or front end filled up with sand, brick work down, etc., but smoke on an oil burner is a sure indication of poor management somewhere, positively reducing the B. t. u.'s of heat and playing havoc with the condition of the flues and flue sheet. An engine requires sand, but feed it to her as one would relish the use of salt. Sand won't wear out the flues, much less cut the heads off of the crown bolts. But what would you think of a man who ate so much that he could not digest it, and then took a dose of salts to scour things up? Why then apply such an unskilled method to a locomotive? Her anatomy is similar, requires to be clean and in working order to be efficient; and such a condition cannot be maintained by smoking an oil burner.

Soot, which is a non-conductor of heat, will be deposited in the flues. The flue-sheet will become honeycombed and in many instances the entrance or mouth of many of the flues become partially or entirely closed, reducing the flue-heating surface sometimes by one-third and depriving the engine of the maximum and equal distribution of draft on the fire. It is quite true that no oil burner can be worked down in the corner for a time by smoking her to keep the steam pressure up, then using sand and pulling the Johnson-bar out of the corner before the water has fallen out of the bottom of the glass.



RAILROAD ADVERTISING IN 1840.
Sent by Mr. A. R. Boles, Engineer, N. Y., N. H. & H.

Such a method, however, may be classified under the heading of abuse, certainly not locomotive engineering, and we wonder why the flues in an oil burner don't last two years. The smoke simply indicates so much oil going out of the stack unconsumed, and the sand in the bottom of the box is nearer the top. On looking over his diary the writer finds that during the term heretofore mentioned he spent a little over one year in freight service and somewhat over two in passenger, firing twenty-three assigned engines, viz., 5 the first year, 16 the two following years, and 2 during a part of the fourth year, embracing 8 classes. They were: 8 and 10-wheeler, mogul and consolidation, equipped with all kinds and shapes of burners and fire-box arrangements, including the Booth-Wade, Baldwin, Von Baden-Ingles, M. C. R., a burner on the principle of the Johnson and other outside mixers, Price and other inside mixers, combined out and inside mixer with automatic triple feed spray, extremely simple and durable, certainly a twenty-first century burner, Hammel furnace, Baldwin, Heintzelman-Camp, back and front end arrangements, air sprays, direct and indirect heaters with and without superheaters, etc., mostly everything except the Rassoe-Rovekin.

The freight division was 120 and the passenger 180 miles, with grades of 1, 1½, 2¼, 3 and 4 per cent., the longest, 1½ per cent., being about 10 miles; 2¼ per cent. about 20, 3 per cent. 32 and 4 per cent about 6 miles long. To use Pat's expression, "Plenty of (h) ills and (h) ollers," and a snake could not excel in the number and degrees of the curves. However, there is no beauty in a straight line, and it can be stated there certainly was something doing and some bad feelings being nursed if any smoke puffed out of those engines, particularly so on the regular ones, and we are on earth to state that our nerves are not worn out nor eyesight ruined, and I could pin a hairspring in a watch with the same old ease as in days gone by. Therefore a fireman must not get it into his head that because the steam is trying to blow the pop off and the smoke is floating back in beautiful curls over the train that he is hitting the ball. He will simply have to knock out both or he will never get to first base.

It requires only a few weeks' careful practice to successfully manipulate the atomizer and firing throttle without looking at either. Did a fireman ever see an engineer take hold of the brake-valve handle and watch it to see how much air he let out? No. The engineer was looking ahead or hanging his head out of the window during such operation. Why? Experience has taught him the amount of reduction to make without looking at either the brake-valve or gauge. So experience teaches the fireman to know by the manipulation of the atomizer and firing throttle and by the manner in which the engine responds to both as indicated by the stack and gauge that his oil burning equipment is doing business. The acquisition of such knowledge, the ever-careful watchfulness exercised in knowing that each part is in and kept in proper working order and that the elements are of the proper pressure and temperature is where the fireman's work comes in; and if he allows himself to become careless about these things there will come a time when he will just sweat blood. The writer during his earlier oil-firing days has been caught by being over confident. Sailed along on level track. Fine! Came onto the foot of the grade. She began to go back. Another kilometer uphill, 140 lbs. of steam. I tell you it is then that the engineer and fireman get their heads together, open their hearts to each other, and pay compliments that would make one's dead mother-in-law quake within those sainted walls of Mother Earth.

Much depends on the oil-burning equipment and its capability of working efficiently and economically the kind and quality of oil used. The writer spent the best part of his lay-over days, ten per month during two years, perfecting an oil-burning equipment for locomotive and stationary boilers, and in partnership with a French mechanical and civil engineer who was expert in gas work, attempted to construct a system whereby the oil would be converted into gas on reaching the fire-box, and succeeded. There is nothing that so succeeds like success, but the consumption of oil was at a ratio of 2.87 to 1 in favor of the straight oil, and verily, there is nothing that makes a man feel so badly as a failure. However, much valuable knowledge was acquired, and the writer would be pleased to learn of some one interested and with means who would care to go on where he and his pal left off. Not that he considers success along these lines obtainable, but you know birds of a feather are wont to flock together. Whoever heard of a bird flocking all by itself except Lord Dundreary? Undaunted, the writer considered that it was up to him to turn the failure into success. Having at hand a high-pressure air compressor, experimental furnace the form and shape of that of a locomotive with all other necessary paraphernalia, copies of all patents granted, results of experimental tests made with liquid fuel in the United States by the leading railways, institutions and United States Naval Department, the completion of an oil-burning equipment has been obtained, one giving the most sanguine results at an expenditure of somewhat over $3,000, nearly all saved out of a fireman's wages in a little over three years

Brother engineer, don't go into the inventing business unless you have a taste for it, that you can well afford the expenditure, for you may start with $500 to do the deed and you have only started when that sum is gone. That you are positively sure you have a market, for, as a rule, general managers and motive power superintendents don't care to adopt the economical thing. The old tried and true that Christopher Columbus brought over to America does very well and for obvious reasons. An oil burning equipment installed on a locomotive that will perform the functions, give the results which the requirements of modern railroading demands must possess certain characteristics. Whatever the stationary or permanent parts are, the working parts must be few and simple. One movement of the lever adjusts the fire, without resort to the use of any auxiliary valves or levers. The movement of another lever adjusts the draft. The temperature of the oil and pressure of air must be controlled automatically. The oil must be separated from foreign matter and heated at a minimum cost, being delivered into the fire-box at a temperature which will insure perfect atomization and vaporization. The burner and furnace must harmonize, and so work together that all residuum is consumed within the walls of the fire-box. No control can be had over the quantity of gas generated from the oil, but the air supply must be so controlled as to furnish to the hydrocarbon gases that are distilled from the oil the necessary amount of oxygen, and when the temperature of the fire-box is up to the ignition point of the gases the result will be immediate diffusion and perfect, smokeless combustion. The oil supply must be atomized in the smallest quantity that will produce the greatest heat, and the temperature and weight of the oil supply must be such that the greatest quantity of gas would be generated simultaneously with adequate means of enabling the air to obtain access to it without any injurious effects of cooling.

A Voice From Mexico.

City of Mexico, Mexico.

Making of Good Engineers.

Editor:

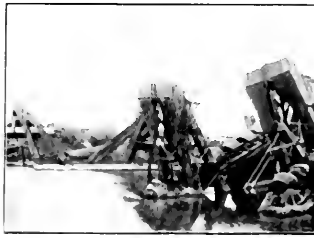
I notice in your valuable magazine an article which I firmly believe is of the utmost importance, viz., "The Making of Good Engineers." I am very pleased to see at last someone alive to the fact that firemen need some mechanical experience other than everlastingly handling the scoop. I would like to refer to question No. 9, expressing my opinion, that giving an overworked fireman shop experience, would be the most profitable method both for firemen and railway companies that I know of, to enable him to become a successful engineer. If firemen were allowed the privilege to work in the shops as machinists' helpers or fitters' helpers, it would enable them to become not only good all-round mechanics, but it would furnish them with the necessary education and experience essential to the making of them first-class engineers. Hoping to see other opinions on the subject, John Wheale.

Sutherland, Sask., Canada.

RAILWAY BRIDGE OVER THE FUGI RIVER, JAPAN.

Telephone Train Dispatching.

In discussing the change from telegraph to telephone Mr. J. D. Jones, chief dispatcher of the Lehigh Valley Railroad, said: "One of the greatest savings is in time in 'raising' the operator at the other end of the line. The dispatcher on duty at Cleveland is equipped just as is the exchange operator in a large business house. The only difference is that while the operator in a business house is giving you a connection with some one in Cleveland, the dispatcher there is talking directly with one or 30 or more agents between Bellevue and Conneaut. There is a telephone at every 'blind siding.' Each conductor carries a key and may at once get into communication with the dispatcher. The lineman may go out with a box and a fishpole arrangement and by throwing one end of a weighted wire over the telephone wire he can get the dispatcher's office anywhere and give any necessary information to headquarters.

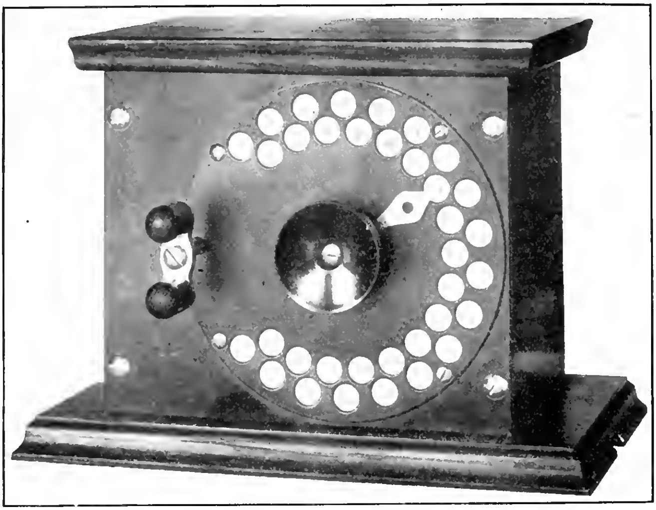


OLD FRENCH DREDGES AT COLON

Labor is discovered to be the grand conqueror, enriching and building up nations more surely than the proudest battles.—*Channing.*

Train Dispatching by Telephone

There is a steady and growing tendency on the part of many of our important railroads to change their system of train dispatching from the old-fashioned telegraph to the modernized telephone. Recent data compiled by the Block Signal and Train Control Board of the Interstate Commerce Commission, says that 295 railroads in the United States are dispatching trains by telephone over 26,344 miles of line. On approximately 20,000 miles of this, the selective system of telephone train dispatching is employed. One of the most ingenious mechanisms for this purpose is the Western Electric selector.



THE MASTER KEY FOR TELEPHONE TRAIN DISPATCHING.

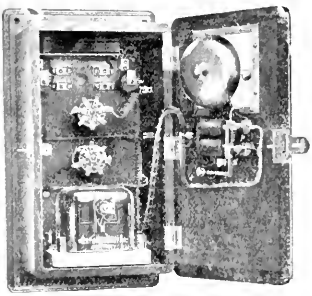
This selector is a high-speed, individual call mechanism and by its use any one of say 50 stations can be called separately or all can be called at the same time. The selector consists of two electro-magnets or relays which are connected in series across the line. These are of a very high impedance and the number which can be bridged across a telephone circuit without affecting transmission is practically unlimited. These magnets are mounted in a brass frame-work on the front of which the moving parts of the mechanism are fastened; the armatures of the two magnets are at the bottom of the selector. The circuit in all cases is metallic and the selector sets are so arranged that each one receives the same amount of current. This is accomplished by means of tapering resistancers. The high impedance of the selector magneto permits as many of these as may be desired to be connected across the circuit without affecting the telephone transmission in any way. As will be seen from our illustration, the moving parts consist of a ratchet wheel to which is fastened a contact; this wheel is stepped around by means of a pawl at the top. This pawl and a corresponding one on the under side of the ratchet wheel are connected directly to the armatures of the magnets and, therefore, as long as the magnets operate the pawls must move.

The contact fastened to the ratchet wheel is adjustable so that one form of selector is supplied at all stations. The position of this contact with reference to the ratchet wheel and to the stationary contact determines which station shall be called. The selector is normally operated on the central energy principle, that is, the battery for stepping it around as well as the battery for ringing the bell is in the dispatcher's office.

The method of calling up a station is as follows: In front of the dispatcher are a number of keys, one for each station on the line. Each one sends out a number of rapid direct current impulses on the line when it is operated. The number of impulses which are sent out can be regulated by adjustable cams on the rear of the key, and each is adjusted for the particular station desired. The impulses are made by a contact and spring which steps up and down over the teeth of a ratchet wheel on the key. The latest form of dispatcher's key, however, is of the master key style. In other words the dispatcher has only one ringing key for all his way-stations, and he calls the proper ones by adjusting a pointer on a dial and operating the ringing key. This does away with the necessity for one individual key for each selector.

The first impulse which one of these keys sends out is a long impulse, the first tooth being three or four times the width of the ordinary tooth. This impulse operates the magnet shown on the right hand of the selector, which is a slow acting relay; it pulls up the armature of this magnet, which in turn causes the two pawls to engage with the ratchet wheel. The remaining quick impulses which the key sends out operate the magnet on the left side of the selector but do not affect the slow acting magnet, which remains held up. It is really a brake and holds the ratchet wheel, preventing any backward motion. The quick impulses work the pawl which appears at the top of the selector and step the ratchet wheel around the proper number of teeth, at which point the two contacts make, and the bell in the station is rung. The operation of the selector bell at any way station automatically sends a distinctive signal out on the telephone circuit. This is familiarly known as the "answer-back," and serves to inform the dispatcher that the bell he called actually rang. It is one of the features peculiar to the telephone method of dispatching.

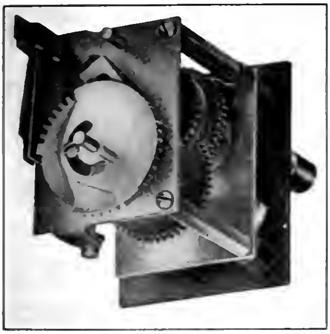
The remainder of the revolution of the key, after the signaling impulses are complete, keeps the contact closed and, therefore, keeps battery on the line during a period of about five seconds. As long as this battery is on the line, the bell at the way station rings. By installing a simple strap key, the dispatcher can hold this down and make the way station bell ring as long as he pleases, this strap key merely taking the place of the key contacts and keeping the circuit closed.



SELECTOR AND BELL IN STATION CABINET.

The selector requires approximately three seconds to call the thirtieth station on the line, and any one of the first ten stations will be called in one second or less. The selectors which we are describing are equipped for fifty stations, which would cover the majority of train dispatching districts.

As we pointed out before the selector is wired across the circuit. Retardation coils are employed to choke back any lightning which may get past the protectors at a station. A variable resistance is required at each selector, since each must receive approximately



DISPATCHER'S INDIVIDUAL KEY, SET FOR STATION.

the same current and voltage, and if this were not used, the high voltage near the dispatcher would give the stations adjacent to his office much more current than they should obtain.

There are on each selector two contacts. One is the station signal contact, which rings the bell at the station when the train dispatcher wishes to call the operator, and the other is a time signal contact which is operated by a special key in the dispatcher's cabinet and which makes contacts on all selectors simultaneously, along the line. The dispatcher can, therefore, with this key give all the way stations along his division a time signal whenever he may so desire. This permits of the calling all the stations at once on particular occasions. No special knowledge of the mechanism is required of dispatcher or operator as with the telegraph. The dispatcher not only pronounces all the words but spells the important ones as well as, "Train No. 42, F-o-r-t-y-T-w-o, meet No. 51, F-i-f-t-y-O-n-e, at Kingsland, K-i-n-g-s-l-a-n-d." The operator's repetition of the message is checked before the O. K. is given.

Fuel Economy.

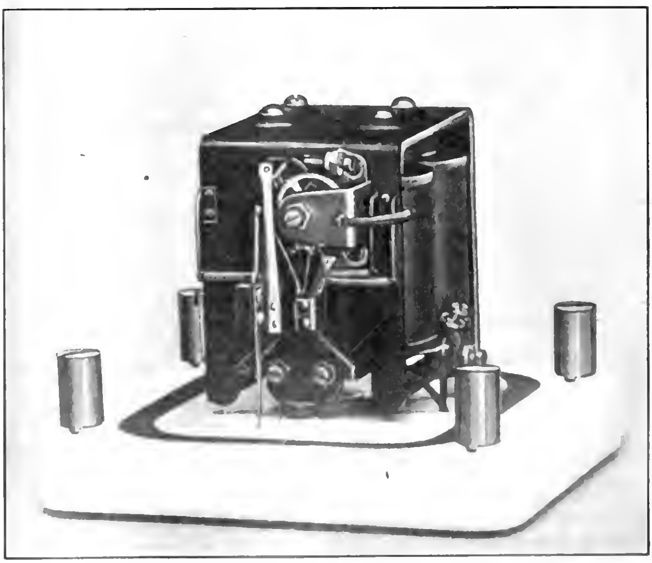
In discussing the paper on "Fuel Economy" recently read by Mr. E. M. Tewkesbury before the Central Railway Club in Buffalo, Mr. William Owens, fuel inspector of the Lehigh Valley, discussed the subject very thoroughly. He said: "There has been reference to educating firemen in the saving of fuel, which is very good, but a great deal can be done in the way of giving the fireman and the engineer proper tools to work with. I am sorry to say that these are not given to them by the majority of roads, for the reason, possibly, that competition in mechanical lines has become very strong and mechanical departments have been experimenting to see how poorly they could keep up the power, in order to curtail expenses; I am afraid the companies have paid for it in another form.

"In order to derive any benefit in fuel economy we must have a machine that is operated economically, and is in good condition. What I mean by good condition is tight boilers, steam pipes, cylinder packing, valves and valve square. I am sorry to say that there are a great many valves in this country today that are not square.

"Probably these conditions are brought about by the curse of cooling locomotives. The practice looks good on paper but does not show up very well in dollars and cents, as I see it. I may be somewhat prejudiced against pooling, but I am one of those men who want to see the mechanical departments of the railroads brought up to the very highest standard, as they should be. We are putting up today with very poor mechanical skill. Automobile builders, supply concerns, etc., are getting the talent which should be on the railroads. Statistics of 1908, as I heard them explained a few days ago, show about 90,000,000 tons of coal were used that year, and about 10,000,000 by reason of incomplete combustion, waste of gases going out through the locomotive stack unconsumed, ashes, etc., and about the same amount was wasted in building fires and blowing off steam.

"I am a crank on the waste of steam. Waste is very hard to regulate on a large locomotive which has a large heating service. We might have better skill in the way of firemen if the labor on the engines was not so hard; consequently, we have to take today physical strength as against skill.

"It may be said, too, that some of the waste of fuel can be attributed to the right-hand side of the engine by not working the engine up to a shorter 'cut-off' or otherwise taking advantage of the situation. It seems to me the pooling service and the conditions of today have discouraged the man on the right side of the cab to such an extent that he has lost all heart and pride in doing his work economically. Consequently, such men want more money for their work, or for putting up with the conditions that they have to face today, and you cannot blame them very much for it. I am inclined to think that if the railroads would make better conditions for the men so that they could live with some degree of comfort, such strong demands as have been known for more pay would not be made periodically.



THE SELECTOR. ONE OF THESE AT EVERY STATION.

Heat the Great Mover.

Every intelligent railway man is likely to be interested in everything connected with the production and application of heat. A person is very ignorant or devoid of observing faculties if he is not aware that heat is the actuating force that moves trains.

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances.

Published Monthly by

ANGUS SINCLAIR CO.

114 Liberty Street, New York.

Telephone, 984 Cortlandt.

Cable Address, "Loceng," N. Y.
Glasgow, "Locoauto."

Business Department:
ANGUS SINCLAIR, D.E., Prest. and Treas.
JAMES KENNEDY, Vice-Prest. and Gen. Mgr.
HARRY A. KENNEY, Secretary.

Editorial Department:
ANGUS SINCLAIR, D.E., Editor.
GEORGE S. HODGINS, Managing Editor.
JAMES KENNEDY, Associate Editor.

Boston Representative:
S. I. CARPENTER, 643 Old South Building, Boston, Mass.

London Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., 3 Amen Corner, Paternoster Row, London, E. C.

Glasgow Representative:
A. F. SINCLAIR, 15 Manor Road, Bellahouston, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid in the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribe in a club, state the name of the agent.

Please give prompt notice when your paper fails to reach you regularly.

Entered at the Post Office, New York, as Second-class Mail Matter.

Signal Apprentices.

The increasing demand for greater safety and facility in railroad operation has caused the Pennsylvania Railroad to institute a new plan of training men to maintain and operate signals. Accordingly, there have just been appointed four signal apprentices: Messrs. Jacob Bright, graduate of Lehigh, 1910; L. J. Phillips, graduate of Sheffield Scientific School, Yale 1910; A. W. Fisher, 1910 graduate of Pennsylvania State College, and A. H. Tasker, graduate of Yale, 1910, Sheffield Scientific School. The officers of the divisions of the Lines East of Pittsburgh have started signal schools where experienced signalmen give instruction to the division signal employees in regard to the proper operation and maintenance of the different signal and interlocking appliances.

The importance of this step is indicated by the fact that, whereas, in 1902 there were but 7,891 interlocking functions in operation on the Lines East of Pittsburgh in 1908 this number was 20,725, having just about tripled, in a period of six years. These 20,725 functions are operated by 8,792 levers. A total of 12,408 signals are in service, covering 3,385 miles of road, or over 70 per cent. of mileage.

Signal apprentices are to serve a three years' course. The first year will be spent on the mechanical part of the work with the repair and construction gangs, the second year in the office of the supervisor of signals, and the third year on outside work on electric and electro-pneumatic appliances.

Progress in Steam Economy.

For many years after the steam engine was employed to perform useful work, very little attention was given to questions of its economical use, for the people interested in developing the engine considered the most important business was the building of an engine that could be depended upon to work day after day and month after month without failure. Reliability was of greater importance than steam saving. A breakdown or any kind of failure that would keep the engine idle for days was often a calamity. Steam saving, which could be effected only by increasing the mechanism and augmenting the number of actuative parts, seemed to be a certain means of increasing the number of engine failures, so it is not surprising that the pioneer engineers devoted little attention to steam saving.

But years passed on and as the mechanism of the steam engine was gradually improved and breakdowns seldom troubled steam users, the demand for reduction of the coal bills overcame all other considerations and competition arose among engine builders and designers. With the pioneer steam engines no attempt was made at using the steam expansively and there was much difference of opinion concerning the value of expanding the steam while doing work as late as the beginning of the locomotive era. When lap was first applied to the slide valves of a locomotive engine and the result was found to be a free-running engine that did the work with less coal than any of the others, the improvement was by many of the motive power men attributed to the early opening of the exhaust. It took experience, experiment and scientific observation to demonstrate the plain facts about steam engineering that every intelligent engineer now regards as matters of commonplace knowledge.

The fundamental purpose of all successful improvers of the steam engine has been to convert as much as possible of the heat energy of the steam that passes from the boiler, into the mechanical energy available for performing mechanical work. The philosophical engineers who succeeded the purely practical pioneers have insisted that the developed principles of thermodynamics applied directly to steam engineering shows that the higher the temperature of the steam when it enters the cylinder and the lower it reaches before exhaust occurs the greater will be the efficiency of the engine, if the reduction of temperature has been caused by the conversion of heat into useful work. The engine that will best perform this function, transforming the energy of heat into useful work, will in the end prove most efficient.

The theory stated is doubtless sound but great difficulties have been encountered in carrying it into practice. Locomotive improvers have adhered very closely to a certain sound principle in steam engineering, and generation after generation have moved in cycles, working on the problem of admitting steam quickly into the cylinders at near boiler pressure, cutting it off at the shortest point consistent with the work to be done, and expanding it as low as practicable before opening the exhaust. That is, they do their best to provide for the maximum of expansion in the ordinary cylinders. Surprise has often been expressed that the maximum of steam expansion has failed to produce an economical engine. We believe that too little attention has been given to the discoveries of the Clark and of Isherwood on the behavior of steam in the cylinders. Very careful and exhaustive experiments made on locomotives by Clark led him to the conclusion that "expansive working is expensive working," the cylinder condensation wasting more heat than that gained by expanding the steam.

The discoveries made by both the engineers named were to the effect that the cylinder of a steam engine acted alternately as a condenser and as a boiler, condensing a portion of the steam during admission and re-evaporating the resulting water of condensation during the period of expansion and exhausts. This is due to the interaction of the metal of which the cylinders are made, and is inevitable with material that forms a good conductor of heat. When the steam becomes water in the cylinder it loses its power to perform mechanical work; therefore the steam that condenses, through interaction of the cylinder metal represents so much loss of power. A portion of the steam that condenses becomes spray and helps to dampen the steam entering the cylinder, vitiating its capacity for doing work.

The truth of this statement was slowly forced upon the minds of locomotive designers and builders and gave rise to a sentiment in favor of compound locomotives. It was reasoned that should a given volume of steam be expanded through two cylinders instead of through one there would not be the extremes of temperature that caused cylinder condensation. This seemed to be sound logic and it was supported by figures that seemed above falsehood, and so the sentiment in favor of compound locomotives flourished for a time till sad experience proved that rushing away from one evil the locomotive engineering world fell into a mire of unforeseen evils.

About the time that the sentiment in favor of compound locomotives began to look backward Mr. Schmidt, a German engineer, advanced the idea of mitigating the effects of cylinder condensation by using superheated steam. Proposals to do that had been made repeatedly and superheating had been introduced largely into stationary engine practice and marine service, but very few attempts had been made to apply superheaters to locomotives, as those had not been successful. Mr. Schmidt appears to have engaged in the solution of the problem in a highly intelligent and scientific manner, for he developed his superheater in stationary engine boilers where it was conducted through the experimental stages before being applied to locomotives. The result was that it proved a success from the first day it was applied to a locomotive on the Prussian State Railways. That success is responsible for the numerous steam superheaters that are finding their way to American locomotives. The indications are that this method of preventing the enormous heat losses due to cylinder condensation is the most satisfactory advance towards steam economy made since James Watt introduced his separate condenser.

Small and Large Fireboxes.

We have often wondered why our locomotive designers and master mechanics have paid so little attention to the teaching of the experience and experiments of D. K. Clark, who conducted wonderfully thorough investigations regarding the operation of locomotives many years ago. The discoveries he made were published in his well-known book, "Railway Machinery," which was a safe reference for several generations of railway engineers, but its injunctions seem to be a dead letter among the men who are most painfully in need of its precepts.

Clark devoted much careful attention to combustion of coal in the locomotive firebox and a famous deduction from his observations in that line reads: "There may be too much grate area for economical evaporation, but there cannot be too little, so long as the required rate of combustion per square foot of grate does not exceed the limit imposed by physical conditions." The meaning intended to be conveyed by these words was that the smaller the grate the better, so long as the necessary amount of coal could be burned upon it. What Clark recommended was an intensely hot fire that would burn up the volatile gases which contain the most valuable heat-producing properties of the fuel. It would be easy enough to carry this principle of heat concentration to the excess of intensifying the draft so that loss would result from spark throwing, but we believe the tendency of most of our locomotive designers has been to make the grate area so large that heat losses result from low firebox temperature. We have repeatedly known of cases where railway companies have improved the steaming qualities of certain locomotives by using dead grates to reduce the grate area. The improvement in steaming or in the quantity of coal burned were so marked that no person doubted that the grate area as originally provided was altogether too large. A current belief holds that large firebox area is a peculiar advantage in steam making and that belief, no doubt, influences designers to make the firebox as large as practicable, but we believe that this supposed advantage is largely overestimated.

We have been moved to discuss this subject owing to remarks made at the Railway General Foremen's Convention, where wide fireboxes received very hard knocks from several of the members. If this form of firebox does not promote economical combustion, there is no good cause for its use, for the weight of reliable evidence makes it out to be much more expensive to keep in order than narrow fireboxes. It seems to us that a thorough investigation of the relative merits of fairly small and of very large fireboxes would bring out information worth knowing.

The Ton-Mile-Per-Hour.

At the recent meeting of the International Railway Fuel Association held in Chicago a very interesting paper was presented dealing with "Methods of supervision, instruction and encouragement in locomotive operation to secure the greatest efficiency in fuel consumption." The committee was composed of Messrs. D. Meadows, chairman; W. C. Hayes and J. McManamy. Commenting on the paper when it came up for discussion, Mr. Meadows said:

"This paper which I read a short time ago brought out a pretty good discussion. I should like to say a word or two regarding the performance sheet, one statement in regard to which was criticised somewhat severely. That is what we are looking for. I noticed that there has not been a single speaker that has agreed with the committee when they stated that an "engine-mile," or a thousand-ton-mile performance sheet was of no value. There are quite a number of roads in the United States, roads running out of Chicago, where I can safely say a performance sheet on an engine-mile basis or a thousand-ton-mile basis is useless. There are roads, I stated, running from Chicago east, where they pull all classes of freight, from stock to scrap iron, and those trains are handled with a vastly wide margin of tonnage. Dead freight will start out with possibly 3,000 tons and will consume ten hours in passing over the division. The next engineer starts out with a train of perishables, timed to reach the eastern terminal at a certain time. He starts out with possibly 1,500 tons, one-half of the tonnage that the other engineer has. He passes over the road in possibly four hours. Will the engine-mileage basis show anything on that performance? I cannot see it. If it was computed on a ton-mile-per-hour basis you will get somewhere near the mark."

"On these roads that I have mentioned the engineers run this class of freight indiscriminately. They run, first in, first out. John Brown will come down to-day with a 3,000-ton dead freight train; he may come down next trip with 1,200 tons. The conditions on these roads are so peculiar that it is absolutely necesary to run the trains in that way. The train of perishable freight may leave Chicago carded to arrive at Buffalo or some other point in the east at a certain time, to make a certain connection. Should that train be delayed along the road at some of the terminals after leaving Chicago, the engineer must reduce the time regardless of his fuel showing. Years ago we used to look closely on some roads at fuel consumption. The result was some of our trains did not get over the road. On some of the roads the fast freight movement is looked after just as closely as the passenger service. It is easy to compare passenger trains on a mileage basis, or thousand-ton-mile basis, but where there is such a wide difference prevailing in freight I believe the committee was justified in the statements that it made."

The theory of the ton-mile-per-hour was very fully set forth in Railway and Locomotive Engineering for January, 1910, page 32. In the case cited by Mr. Meadows, assistant master mechanic on the Michigan Central at St. Thomas, Ont. One of the trains weighs 3,000 tons and goes over the division in ten hours, while a train of what Rudyard Kipling calls "costly-perishable-fragile-immediate," weighing 1,500 tons and occupying four hours to get over the same road. Assuming the division to be 100 miles long, the heavy freight makes 300,000 ton-miles and the light freight makes 150,000 ton-miles, and if the fuel consumption of the light, fast train even equalled that of the heavy, slow one the light train would appear to have burned more coal in doing less work than the heavy, slow train.

When viewed on the ton-mile-per-hour basis, it turns out that the light train made 37,500 ton-miles-per-hour, as against 30,000 ton-miles-per-hour made by the heavy train. The total coal burned on the trip by each engine when divided by the ton-miles-per-hour made by each train, gives a figure which represents in pounds of coal, if you like, the amount required to produce a ton-mile-per-hour for each train. The ton-mile-per-hour is a thing which varies, probably in some reasonable ratio with the coal burned, but the simple ton-mile does not vary, whether the miles are covered quickly or slowly or whether there is much or little coal burned.

We are in favor of the ton-mile-per-hour for use on the performance sheet, but we would like to hear from our readers what they think about it. If there is any flaw in the reasoning, where is it? If there is anything wrong with the ton-mile-per-hour, what is it?

Ice, Water and Steam.

"As cold as ice" is a very common form of speech, but that turns out to be only a very vague expression, for the simple reason that ice may have the temperature of just freezing water, viz., 32 degs. Fahr., or it may have any temperature down to the intense cold of interstellar space, which is the absolute zero of temperatures, such as would be experienced on the moon's surface. Suppose we have ice just ready to melt, or at 32 degs. Fahr., and we apply just enough heat to melt 1 lb. Science has found that the quantity of heat necessary to accomplish this result is 143 thermal units. Each such unit or each B. T. U. (British thermal unit) is the quantity of heat required to raise 1 lb. of pure water through 1 deg. as measured on the Fahrenheit thermometer. One thermal unit expresed in mechanical form is equal to the raising of 778.2 lbs. 1 ft. high.

It is evident from this that to melt 1 lb. of ice at 32 degs. Fahr., an expenditure of 111,282 foot-pounds of energy must take place. This is equivalent to the raising of 1 ton 55.641 ft. high. We now have 1 lb. of pure, cold water, with an actual temperature of 32 degs. Fahr., and just as cold as the ice had been but now liquid, instead of being solid. The whole of this expenditure of heat has been used up in changing the physical condition of the substance before us. Tyndall calls this the doing of internal work, and the usual, though hardly accurate way of saying that the heat has become latent is employed to mean that 143 B. T. U. were required for this work.

The next step in the process is to bring the cold water to the boil. The boiling of water appears to be a very simple thing; so it is if you have a convenient gas stove and a bright little aluminum kettle. Suppose you put this pint of pure water into the kettle and turn on and light the gas under it. Very soon the water begins to warm up. If you put a suitable thermometer into the water you can see the mercury rise as the water gets hotter. Under these circumstances this 1 lb. of water will have to be raised through 180 degs. or up to 212 degs. Fahr. before it will boil.

The amount of heat required to raise 1 lb. of water through 1 deg. Fahr. is, as we said before, equal to the raising of 778.2 lbs avoirdupois a distance of 1 ft. high, against the force of gravity. Now if 1 lb. of water is brought from 32 to 212 degs. Fahr., that is, through 180 degs., it follows that the mechanical energy expended is equivalent to $778.2 \times 180 =$ 140,076 foot-pounds. This equals the raising of 1 ton through a distance of 70.038 ft.

The continued boiling of the water does not show any rise in temperature on the thermometer, though the blue flame below the kettle burns steadily and we know it is delivering heat at the same rate as formerly. Experiment has proved that in order to boil this kettle dry with its 1 lb. of water, as much heat must be delivered to it as would raise 965 lbs. of water through 1 deg. Fahr., and as each one of these is a B. T. U. we have no difficulty in calculating the mechanical equivalent of the heat required to turn this 1 lb. of water at 212 degs. Fahr. into steam at the same temperature. It is $778.2 \times .965 = 750{,}963$ foot-pounds. This latter figure means that boiling the kettle dry, after you have the water at 212 degs. Fahr., is equivalent to the raising of 1 ton 375.4815 ft. high. The significance of these figures is that in order to boil off 1 lb. of water at 212 degs. Fahr., or, in other words, to turn 1 lb. of boiling water into steam, requires more than 5.36 times as much heat as it takes to raise 1 lb. of freezing water up to the boiling point at the ordinary pressure of the atmosphere, with the lid of the kettle open. In this case the 965 thermal units expended in turning water into steam from and at 212 degs. Fahr. is called the latent heat of steam, but the work done is in changing the liquid (water) into the gas (steam), each at the same temperature.

Reviewing the transformations which ice and water have passed through, we find that 1 lb. of ice at 32 degs. Fahr. received 143 thermal units to effect the change from ice to water. This was equivalent to 111,282 foot-pounds or amounted to the lifting of 1 ton, 55.641 ft. The raising of the cold water at 32 degs. Fahr. to the hot water at 212 degs. Fahr. required the expenditure of 180 thermal units or 140,076 foot-pounds, and this is equivalent to the raising of 1 ton a height of 70.038 ft. The transformation of the hot water at 212 degs. Fahr. to steam at the same temperature was effected by supplying 965 thermal units, this being equal to 750,963 foot-pounds or 1 ton raised 375.4815 ft. A further review of the case reveals the fact that the total number of thermal units required to change ice at 32 degs. Fahr. to steam at 212 degs. Fahr. amounted to 1,288 B. T. U. These, if brought to foot-pounds by multiplying them by the mechanical equivalent of heat, 778.2, we will have the total number of 1,002,321 foot-pounds, and this is equivalent to the raising of 1 ton 501.1605 ft. high. This amount of energy, if suitably expended, would be capable of raising one of the ordinary two-truck, open street cars, such as run in New York, to a height of 37,123 ft. above the rails.

So far we have been considering the boiling of water, or the generation of steam at the ordinary atmospheric pressure of 14.7 lbs. When the steam which is driven off from the water accumulates in a closed vessel in free communication with the water, a new condition is introduced. Water does not then boil at 212 degs. Fahr. When raised to a pressure of 195 lbs., as shown on the steam gauge, it has a temperature of 386 degs. Fahr. and about 1,200 B. T. U. have been required to produce the generation of steam, which is now 174 degs. Fahr. above the atmospheric boiling point of water. At the top of Mount Blanc in Switzerland, which is three miles high, water will boil at about 153 degs. Fahr., which is a temperature at which the white of an egg will not harden, and the egg may be boiled for hours without result. If the Alpine climber go higher he will find that the water may boil so easily that it is impossible even to cook an egg.

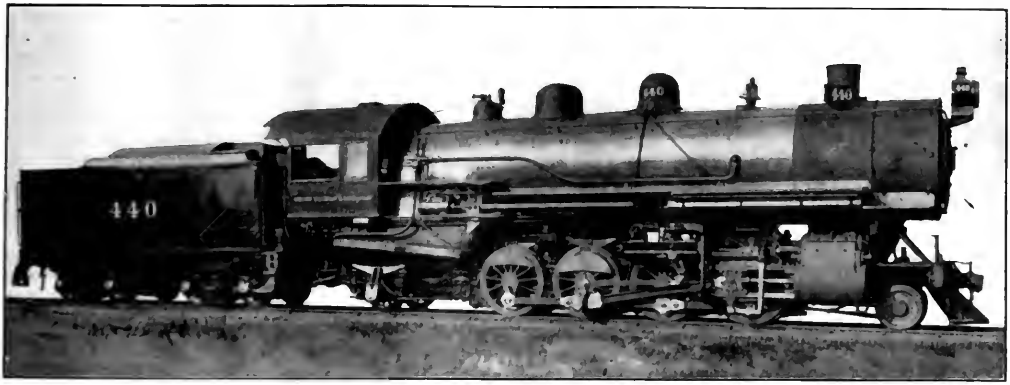
Book Notice

KENT'S MECHANICAL ENGINEERS' POCKET-BOOK, new edition revised and greatly enlarged. Published by John Wiley & Sons, New York, 1910. Price $5 net.

The eighth edition of this valuable work has just been completed. The Mechanical Engineers' Pocket-Book was first issued in 1895. The new edition is now ready for sale. It has been largely rewritten and entirely reset, and contains about 1,500 pages, or 340 more than the seventh edition, despite all efforts to condense the material into the smallest possible space. Much new material has been added in nearly every chapter, and the latest information on the most advanced engineering practice has been included. The book is one of the most comprehensive of its kind that we know of.

Simple 2-8-2 for the Oregon Railroad Navigation Co.

The Baldwin Locomotive Works have recently completed, for the Oregon Railroad & Navigation Co. a heavy Mikado or 2-8-2 type of locomotive, shown in our illustration. This engine exerts a tractive force of 45,300 lbs. and is in service on a difficult piece of track having grades of 95 ft. to the mile combined with compensated curves of 10 degs.. The fuel used is lignite. The Oregon Railroad & Navigation Co. uses locomotives designed in accordance with Harriman or Associated Lines standards; a large number of standard details have been embodied in this engine. Several important changes have been made, however, such as the use of the Walschaerts valve gear instead of the Stephenson, and the substitution of a radial stayed boiler for one of the crown-bar type.



2-8-2 FOR THE OREGON RAILROAD & NAVIGATION CO.

J. F. Graham, Superintendent of Motive Power. Baldwin Locomotive Works, Builders.

The boiler is built with a straight top, while the throat, back head and roof sheets are inclined. The barrel seams have butt joints of the diamond type on the top center line, and the plates are welded at the ends of the seams. Flexible stay bolts to the number of 400 are placed in the outer rows in the sides and back of the fire-box, and in the upper corner of the throat. The fire-door opening is formed by flanging both sheets outward and riveting them directly together.

The grate is composed of table bars having narrow draft openings to suit the fuel. The bars are arranged to shake in four sections, and the drop plates are placed in the rear of the furnace. The ash-pan has two hoppers and is fitted with drop bottoms. A brick arch is provided and it is supported on four 3-in. water tubes. The front is extended and contains a single nozle of moderate height. The diaphragm plate is in rear of the nozzle, and is backed with netting to aid in breaking up the sparks. The stack is cast iron, with an internal extension and a diameter of 18½ ins. at the choke. A cinder pocket is provided. The general arrangement of the grates and front end shows similarity to the designs adopted by the Chicago, Burlington & Quincy Railroad for lignite burning locomotives.

The cylinders are designed in accordance with Associated Lines practice. They are cast from a 25-in. pattern and bushed down to 23¾ ins. diameter. The steam distribution is controled by 12-in. piston valves, which are set with a constant lead of ¼ in. The motion is transmitted from the combining lever to the valve rod through a specially designed cross-head having offset lugs. This arrangement was adopted since the steam chest centers are placed 4 [illegible] ins. inside the cylinder centers. The present plan is a satisfactory method of avoiding the use of rockers. The valve gears are controlled by the Baldwin power reverse mechanism.

DETAIL OF PEDESTAL BINDER, O. R. & N.

The frames have separate rear sections and double front rails, the main and rear sections being of cast steel, while the front rails are of forged iron. The pedestal binders are designed in accordance with the Collins patent. This binder fits into slots cut in the lower ends of the pedestals and is prevented from dropping out by washers which rest on lips formed on the outside of the pedestal jaws. Double nuts held in place by cotters are screwed on each end of the binder. With this arrangement the usual form of wedge adjustment can be placed on the frame center line, as is not the case with a binder consisting of a distance piece and separate tension bolt. The equalization system in this locomotive is divided between the second and third pairs of driving wheels. The front truck is of the usual center bearing type, while the rear truck has outside journals and jointed spring hangers. The springs are rigidly seated on the boxes, while the hangers take the side swing. All the driving tires are flanged.

The tender is of the Associated Lines standard type, with 9,000 gallon water bottom tank. The tender wheels and front engine truck wheels are of forged and rolled steel, and were manufacturer by the Standard Steel Works Co., of Philadelphia. The suitability of the Mikado type for heavy freight service, especially where low grade fuels are burned, is indicated by the increasing use of these engines, especially on Western lines. It has been fully proved that lignite can be used successfully in locomotive work, and the present engine embodies in its construction features which have proved satisfactory in practice. Some of the principal dimensions are appended for reference:

Cylinder, 23¾ ins. x 30 ins.
Valve, balanced piston.
Boiler—Diameter, 82 ins.; thickness of sheets, ¾ in.; working pressure, 180 lbs.; fuel, lignite; staying, radial.
Fire Box—Material, steel; lengh, 120 ins.; width, 84 ins.; depth, front, 87¼ ins.; back, 74 ins.
Thickness of sheets—Sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube, ½ in.
Water Space—5 ins. all around.
Tubes—Material, iron; thickness, 0.125 in.; number, 495; diameter, 2 ins.; length, 20 ft. 6 ins.
Heating Surface—Fire box, 235 sq. ft.; tubes, 5,292 sq. ft.; firebrick tubes, 54 sq. ft.; total, 5,559 sq. ft.; grate area, 70 sq. ft.
Driving Wheels—Diameter, outside, 57 ins.; journals, main, 10½ ins. x 12 ins.; others, 9 ins. x 12 ins.
Engine Truck Wheels—Diameter, front, 30½ ins.; journals, 6 ins. x 10 ins.; diameter, back, 36 ins.; journals, 8 ins. x 14 ins.
Wheel Base—Driving, 16 ft. 0 in.; total engine, 34 ft. 8 ins.; total engine and tender, 64 ft. 7 ins.
Weight—On driving wheels, 204,450 lbs.; on truck, front, 24,100 lbs.; on truck, back, 34,550 lbs.; total engine, 263,100 lbs.; total engine and tender, about 425,000 lbs.
Tender—Tank capacity, 9,000 gals.; fuel capacity, 10 tons; service, freight.

Permanent Front End Fixtures.

At the Traveling Engineers' Convention recently held at Niagara Falls, the subject of fuel economy was very fully discussed. The subject had been placed before the members in the form of five questions, the first of which was, "Value of present draught appliances; can they be improved so as to effect fuel economy?" Mr. F. P. Roesch, master mechanic on the El Paso & South Western System, at Douglas, Ariz., spoke on the question just quoted, and not only brought out some new points, but commented very interestingly on the several important phases of the matter. We give Mr. Roesch's remarks as follows:

The subject of fuel economy is one so broad that you can attack it from any angle and make an impression, as well as effect an economy. It was for this reason that, as chairman of the committee on subjects, I requested the committee to divide the paper under five headings, and as I felt that by dividing the subject we might be able to call out a better discussion and perhaps get some new ideas. The committee, as you will notice, have handled their subject in a very able manner, and deserve our thorough commendation. They have, however, as was perfectly proper, left several items open for discussion, realizing that no one man, or no one committee, could cover a subject as broad as this from every point of view.

I do not care to dwell on all the different heads covered by this paper, but simply to make a few remarks on the first heading: i. e., "The value of present draft appliances and can they be improved to effect fuel economy?" And, under this head, I wish to say that, in my opinion, the present Master Mechanics' standard front end, while a step in the right direction, is yet far from being perfect. The Master Mechanics' standard front end was designed primarily to afford an equal distribution of draft over the entire grate surface, and at the same time prevent the emission of large sparks from the stack. While there is no question but what the front end as recommended by the Master Mechanics' Association fullfills the above requirements, it yet contains a feature that makes it, in my opinion, undesirable and uneconomical.

I refer to the fact that none of the adjustments are permanent. I have no doubt that quite a number of you will take issue with me on this matter, as every traveling engineer, as well as engineer, has an inborn longing, or hankering, to monkey with the adjustment of the front end, in order to see if he cannot improve the steaming qualities of the engine. It is this very feature that, in my opinion, should be eliminated. A fireman firing the engine, or the engineer running the engine, knowing that the draft appliances are capable of adjustment to suit his whims and fancies, is too apt to place the burden of poor steaming on the front end adjustment, instead of at the wooden end of the scoop, or some other part of the locomotive, where it properly belongs.

There is no reason why the front end cannot be designed in which the draft appliances are permanent fixtures, and a locomotive so designed and so fitted, after once being proved a steamer, does not steam on a certain trip, the trouble must be either in the fuel, the manner in which the engine is fired, the manner in which the engine is handled by the engineer, or caused by some defect about the valves or cylinders, whereby steam is wasted. If we know the front end is right and cannot get out of order, we will look for the real trouble instead of spending time and money altering the front end, and wasting coal every trip while doing so.

With an adjustable front end, the engineer or fireman can tell you that the engine is not burning the fire level, while the fact is that the fireman is probably not firing level. With a permanently adjusted front end, the fireman will soon realize that the fault lies with him. There is no question but that the Master Mechanics' front end met the requirements at the time the tests were conducted, and also gave us invaluable information in regard to the proper lines to follow in future experiments, but this committee would not have the temerity to say that the results they found must be accepted as final for all time; that they had reached the omega of experimentation, and that further tests were useless.

At that time engines having a front end diameter of 80 ins. or over, as obtains at present, were rare; therefore, the front end as recommended was no doubt the best that could be devised to meet the conditions. But times have changed, as well as the size of engines, and we now find that owing to the increasing height of locomotives, we can no longer apply the height of stack, as recommended, above the smoke arch; therefore, we must extend it downward, or, in other words, put it inside of the arch. Now assuming that the draft is created by induced current, we find quite a similarity in the action of the steam expelled from the nozzle, to the action of the steam expelled from the steam-nozzle of the injector, and as it is possible to produce an injector that will operate satisfactorily under varying steam pressures, it should be possible to so adjust a front end as to eliminate all desire to raise the petticoat or lower the draft plates, etc.

In some recent tests conducted by the Pennsylvania Railroad, it was proved conclusively that the adjustable petticoat pipe, as well as the adjustable diaphragm, were unnecessary. Although the primary object sought in the above tests was a front end that was practically self-cleaning, yet the end obtained was, in my opinion, far more valuable, as it proved conclusively that it was possible to design a front end in which all adjustments were permanent; a front end that not only embodied all the good features of the Master Mechanics' front end, but also one that almost eliminated all possibilities of derangement, and at the same time proved equally as economical in fuel consumption. If the Pennsylvania Railroad have found this to be possible on certain types of engines, and other railroads have found it possible on engines where necessity compels them to use the inside extension, there is no reason why the same idea cannot be applied to all locomotives. It is simply a matter of careful experiment to obtain the necessary ratios.

We have all heard all kinds of arguments in regard to the utility, or necessity, of the adjustable draft or petticoat pipe, and there have been just as many different opinions as there were speakers. Has the thought never occurred to you that if the draft of a locomotive depended to such a large extent on the fractional adjustment of a petticoat pipe, that there would be more unanimity in regard to it. Yet we hear one man condemn it, he throws it on the back of the tank as a useless appendage—the vermiform appendix of the locomotive, we might say:—while another thinks it such a good thing that he uses three of them. I must confess that I belong in the former class, and consider the adjustable petticoat pipe as a vermiform appendix; a survival of necessity in the time of the diamond stack, but something that lost its usefulness with the advent of the extension front end. Let us therefore follow the medical profession, and "cut it out." It is simply a fruitful source of trouble and expense, prolific of engine failures. The more movable or loose parts you have in a front end, the more you increase the liability of one of them to get out of adjustment when least desired; so let us get away from loose parts and go to something permanent. I fully believe that the time is not far off when all front ends will be adjusted in the drafting room on a drawing board, instead of in the roundhouse. I believe a low nozzle stand, a permanently set, inside extension, possibly formed as an integral part of the stack, together with a solid non-adjustable deflector plate, will and should constitute the entire front end draft appliances of the future locomotive.

Apparatus for Setting Return Cranks.

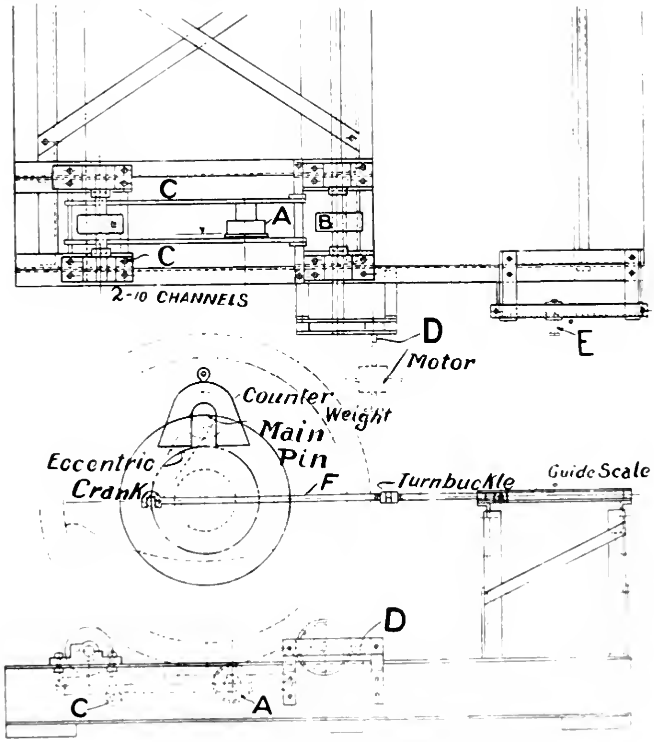
A very ingenious time-saver which does accurate work with a minimum of labor, is to be seen in the Trenton, N. J., shops of the Pennsylvania Railroad, over which Mr. H. H. Maxfield, the master mechanic, presides. The machine is securing the throw of the return crank on an engine having the Walschaerts valve gear. Our illustrations show that the machine is a home-made one and is not very expensive or difficult to set up.

It consists principally of a frame or stand in which the driving wheels of a locomotive are placed and revolved by the operation of a small electric motor. There is also a crosshead guide scale rigidly attached to the main frame of the machine and a pin travels under the scale with needle point on top of scale so that the movement of the pin may be accurately gauged.

The method of using the machine is briefly as follows: The length of the return crank must first be accurately checked up from the blue print which comes from the drawing office. If the return crank is of the correct length the wheels may be rolled into the machine. When the wheels are in place they are supported on rollers B B (the flanged rollers A, A, are intended for flangeless tires). All these rollers are driven by the electric motor on spindle marked D, and they are raised and lowered by the movement of the eye-bolt C.

When the wheels are in position the wheel counter balance is in the lowest position and the crank pin is on what may be called its top quarter, a leaden counter weight is let down over the crank pin and this when held in place assists to balance up the wheel so that the work on the motor will be lighter. The next operation is to adjust the crosshead guide pin E to the height of the center of the wheel, or in other words level up connecting rod F. This is easily done, as the stand carrying this pin is capable of vertical adjustment. The length of the connecting rod F is next adjusted to equal the distance between center of the wheel and the zero mark on the guide scale.

The return crank pin is now moved any distance away from the center of the axle, and the wheels are revolved. The movement or throw of the return crank is at once indicated on the guide scale. Suppose the required throw was 6 ins. and the first experimental movement of the return crank pin by the operator was far enough away from the axle center to produce a travel of 8 ins., this would be shown on the guide scale and by reducing the throw the exact travel could easily be had. Then the return crank is secured in that position and the work is done. The use of this ingenious machine permits accurate work to be done easily and promptly as it settles the position of the return crank pin and proves it to be right, while the wheels are in the hands of the operator in the shop.



MACHINE USED IN SETTING RETURN CRANKS.

Good Lamp Performance.

On the Baltimore & Ohio Railroad, where the system of automatic electric lighting of lamps on the approach of trains has been in operation for several years, a test of an ordinary lamp has just been completed. This lamp was put in operation on Aug. 1, 1906, and the filament burnt out on Aug. 5, 1910, after continuous service of over four years. This lamp was lighted and extinguished, automatically, 73,200 times. It was a 2 c. p., 11 volt lamp, and was purchased at an automatic supply store. It was in operation on automatic signal No. 94, at Elkridge, Md., and it is thought that the performance of this lamp is well worth recording, it never having failed to light up during its period of service. The automatic lighting of lamps on automatic signals in this territory on the B. & O. operates in conjunction with the normal danger system of signaling, but the lighting system can also be applied with the normal clear system of signaling.

Every heart that has beat strong and cheerfully has left a hopeful impulse behind it in the world, and bettered the tradition of mankind.—*R. L. Stevenson.*

Rise! to work! If the knowledge is real, employ it, wrestle with nature; test the strength of thy theories; see if they will support the trial; act!—*Aloysius.*

Locomotive Running Repairs

VII. Grinding Valves and Cocks.

It is a good rule to establish, that at the time that boilers are washed out the check valves should be examined, and the caps removed, and pains taken to observe that the passages in the checks are perfectly clear, and that the joints are properly adapted to the seats. In is particularly noticeable that in boiler washing, scale and other impurities are very apt to become located in the check valves, and if allowed to remain, not only will the valves begin to leak, but they will at once affect the free working of the injectors.

Should the check valves require regrinding, it will readily be found that finely powdered grindstone mixed with soap till it has the consistency of paste, will be of better service than emery and oil. The peculiar hardness of emery renders it very apt to cut even the hardest brass. Even with pulverized sandstone of the finest kind it is necessary after a few half turns to lift the parts away from each other slightly in order that the wet material may continue to flow freely between. In the event of the faces being cut, it is best to reduce the surfaces to as nearly a fit as possible by smooth filing before beginning the grinding operation. When the two surfaces are apparently ground to a fit, they should be thoroughly dried with cotton waste, and then rubbed together tightly until the surfaces are polished. Should any unpolished parts remain visible, the grinding should be repeated, and the re-polishing continued until a complete fit is made.

The same remarks apply in a general way to blow-off cocks and others of the lesser boiler mountings. In the care of the blow-off cock it is advisable to remove the cock from the boiler, and in the absence of any specially designed apparatus, the plug may be readily held in the vise by the large end, and the shell may be ground on the plug, taking care as usual, to lift the shell a little away from the plug after each half-turn, continuing the operation for ten or twelve talf-turns. Both shell and plug should then be carefully cleaned and rubbed together. The bearing will readily show itself by lines of contact, and on these lines the paste should be applied, and the rubbing continued until the entire length of the plug and shell show an equal bearing. An application of beeswax and tallow will greatly aid in the free working of the plug in the cock.

It may be added that in some of the best equipped shops there are now clever devices that reduce the amount of manual labor in grinding cocks, the most effective being appliances where the plugs are held firmly while the shells are attached to mechanism making a partial revolution, and are lifted at short intervals by an eccentric contrivance from beneath, a spring meanwhile bearing lightly on the top of the shell. An extensive apparatus of this kind is in operation at the Burnside shops of the Illinois Central Railroad, at Chicago, and the results are said to be of the most satisfactory kind.

The refitting and the readjustment of the safety valves are operations that are to be anticipated among the necessities of locomotive service. Impurities in the water are apt to be caught on the occasion of the shutting of the valves. The springs vary in their tension on account of the heating and cooling to which they are subjected, the tendency being that after a few weeks' service the point of pressure at which the valves will open and allow the steam to blow off will decrease, rendering a readjustment necessary. Coincident with a contemplated change in the tension of the safety valve springs, it is well to be assured that the steam gauge has not also undergone some change in the recording of the steam pressure. One is as likely to run into error as the other, and the brief time taken in testing a steam gauge is time well spent preparatory to the readjustment of the safety valve springs.

In the safety valves there are usually two small holes drilled in the upper surface of the valve, into which a two pronged fork, with attached handle like a boring brace, can be readily applied and the grinding proceeded with as in the case of a check or angle valve, care being taken that the valve should be lifted at short intervals. Drying and polishing will readily show the nature and extent of the bearing. If much grinding is required to fit the joint, the tendency to form a shoulder on the valve is very great, especially when the coarser kind of emery is used, but protuberances may readily be removed by filing without the necessity of reducing the shoulder in the lathe.

In adjusting the safety valves, care should be taken that the valve stem does not press against the sides of the hole in the spring cap. The holes in the cap should be large enough to admit of some slight variation from the exact center without the possibility of the stem rubbing against the sides, any pressure of this kind readily affecting the opening and shutting of the valve. In adjusting the pressure on the safety valves it is well that the valves should not be both set at exactly the same pressure. A variation not exceeding five pounds, many roads make it two or three, is advisable, as it is not necessary that both valves should open unless in cases of rapid increase in steam pressure. All steam escaping from the safety valves is a waste of energy, and on the opening of the first valve, set to the lower pressure, the experienced engineer knows to put the injector in operation or open the furnace door or institute some other method of utilizing the overplus energy, or diminishing the fuel consumption, which is always a vital as well as a burning question in the economical use of steam as a motive power. In the setting of the safety valves at a varied pressure it is also an item of economy to set the best working valve where a difference is discernable, at the lightest pressure. It will be readily noted that both valves rarely close with the same degree of rapidity, and the quick closing valve is, of course, the more economical.

With regard to the gauge cocks, many clever devices have been tried to facilitate the self-grinding idea, which would be an excellent improvement if it worked as well in practice as in theory. Their tendency to leak is very great, as they are constantly being used by the careful engineer and fireman, and scale or other impurities readily lodge between the joints of the stem and seat. In many roundhouses a supply of gauge cocks is kept on hand, and in the period of boiler washing, or on other occasions, when the boiler is partially cooled, the gauge cocks that may be leaking can be quickly exchanged, and the refitting of the valves performed under favorable conditions.

VIII. Injector and Lubricator Troubles.

There is much more likelihood in troubles arising with the injector connections than there is about the injector itself. The pipes leading to and from the injector should never be smaller in size than the injector connection. Nearly all injectors used on locomotives are known as the lifting type. In order that the injector may be conveniently reached in the cab of the locomotive it is usually placed higher than the water in the tank, and consequently the water must be lifted the amount of difference between the surface of the water and the injector opening. In order to lift the water, a vacuum is produced in the pipe leading from the tank to the injector, by admitting steam into the injector and allowing it to pass through into the overflow pipe. The interior of the injector is so constructed that the steam finds its way into the overflow pipe much more readily than it does into the pipe leading to the tank. The air in the pipe leading to the tank is induced to mix with the steam and pass out at the overflow pipe, while the weight of the atmosphere on the surface of the water in the tank forces the water into the vacuum thus produced. The joints forming the connection between the injector and the tank should be of the most secure kind, as a leak in this pipe will greatly diminish, if it does not altogether stop the operation of the injector. In some experiments where injectors are placed below the level of the water in the tank the improvement in the working of the injector is of a marked kind.

In all injector troubles the failure of the water to reach the injector is the most common, and if there is water in the tank and the surface be not frozen, as it may readily be in winter, the trouble will likely be by reason of a leak in the suction pipe or by clogging of the strainers. A heated suction pipe also often refuses to supply water in sufficient quantity for the effective use of the injector. In cases where the injector lifts the water and fails to force it into the boiler, the trouble should be readily evident by the behavior of the injector. If the steam should blow back into the tank it will either be caused by reason of the overflow valve being partly closed, thereby preventing a ready escape for the combined steam and water which is necessary until the mixture of the two bodies have accumulated sufficient momentum to pass through the check valve opening into the boiler, or it may be caused by the sticking of the check valve which, though rarely the case, sometimes happens in instances where impurities in the water tend to form solutions that are particularly adhesive in their nature, acting like glue in joining the check valve to the valve seat. A slight tap on the check will sometimes relieve a sticking valve.

Some simple remedies there are that may be temporarily effective as in the case of clogged strainers or obstructions in the suction pipe. In such cases the overflow valve should be closed and the steam blown back through the suction pipe into the tank This may clear the pipe but the tank and the strainer should be cleaned as speedily as possible, as the tendency to accumulate impurities in the tank is very great, and nearly all strainers in use in locomotive tanks not only collect impurities but hold them at the entrance of the suction pipe where detached particles sooner or later find their way through and so increase the chances of injector troubles.

As is well known, the degree of perfection to which the mechanism of the injector has attained has been the result of very extensive and careful experiments, the taper openings compressing the mixture of steam and water faciliating and reducing the current in one direction and retarding or entirely checking it in another, are not subject to improvement by changes in their relation to each other, therefore the repairing of injectors should be intrusted only to the most proficient mechanics—specialists familiar with the parts. Specialists do not spring like Athene fully armed from the brow of Jove, but acquire their knowledge by long and careful practical experience. Parts furnished by the original constructors are usually nearer perfection in detail than rough and ready substitutes, and the trained mechanic will prefer their use when a replacing of worn parts is necessary. Much may be saved by a systematic cleaning of injectors, especially where deposits of carbonate of lime are formed. Injectors may be readily cleared of all incrustations by immersing them in a bath of benzine or diluted muriatic acid, the mixture being ten or twelve parts of water to one of acid.

In taking an injector apart it will often be found that the joints have acquired a degree of tightness which almost renders them liable to distortion by reason of the force required to loosen the joints. In such cases it will be found that slightly heating the joints aids greatly in their liability to slacken, as brass expands rapidly in heating. In many shops a supply of injectors, cleaned, repaired and tested, are usually kept on hand, so that when an injector is reported to be defective it can be disconnected and another put in its place, thus avoiding delay and allowing the skilled mechanics to examine the injector under favorable conditions and with proper tools at hand. The practice of striking injectors with hammers and other hardened tools is a very objectionable one. The blows rarely have the effect of dislodging any obstruction in the chambers or tubes of the injectors, while the fine appearance of the injector is irretrievably destroyed

Lubricators.

The almost universal application of lubricators to the locomotive is one of the most useful attachments ever applied to the steam engine. Like the injector, its perfection has not been the work of a day. A constant supply of oil to the running parts of an engine accurately ganged to the requirements of the service was something almost beyond mere human possibility of accomplishment The application of steam or compressed air to the oil was an important step, culminating in the introduction of a series of force pumps supplying a positive and regular supply of oil, which had hitherto been impossible to the parts where the back-pressure of steam interfered with the free and constant flow of the lubricant. Obstructions, of course, may interfere with the flow of oil at any time, and if from any cause the appliance ceases to perform its functions, the best method is in the case of the common lubricator to open the bottom cocks and allow a full pressure of steam to blow through. If the trouble continues, the glass tubes should be removed and the small feeders carefully examined, when it will likely be found that the small openings have been choked with some substance easily removed. If the openings are perfectly clear, the top chamber should be removed, when the feed pipes may be readily observed. Their liability to break or become stopped up is not great, but it is possible, and they should be occasionally cleared and tested. The quality of the oil is also of considerable importance in the working of the lubricator, as well as in the lubrication of the machinery and it is generally discovered that the cheapest lubricant is nearly always the worst.

Questions Answered

DRIVER BRAKE RUBBING WHEEL.

62. R. K., Indianapolis, Ind., writes: How can you keep the brake shoes from rubbing continuously on the tires with cam-driver brakes? A.—The continuous rubbing of these brake shoes is generally caused by the shoe not being properly balanced as it is suspended by a pin in the hanger. A piece of heavy bent iron wire or a small bent iron rod placed between the shoe and the hanger will keep the point of the shoe away from the wheel and not in the least interfere with the application of brakes

END PLAY OF DYNAMO SHAFT.

63. G. B. S., Three Forks, Mont., writes as follows: In a baggage car containing a dynamo for train lighting, which has a shaft placed lengthwise of the car. When the car is maintaining an even speed of forty miles an hour on level track dynamo running, will the shaft be carried in its bearings the same as when train is standing, or will it crowd the rear bearing causing hub friction? If so, how much with 3½ in. shaft, 8 ft. long, bearings 6 in. long, shaft and attached weighing 850 lbs.?—A. The shaft will rotate in its bearings just as if the train was at rest. A good proof of this is a passenger seated in a car traveling at high speed. The passenger does not feel any tendency to move forward or back. If, however, the

train slackens suddenly he will be thrown forward and when a start is made if the acceleration is rapid he will be thrown against the back of the seat. So it is with the shaft. Change of train velocity will make the shaft crowd to one end or the other but the bearings are so designed as to take care of this movement and when the shaft is rotating rapidly under the influence of the motor there is always a certain magnetic attraction between the armature and the field coils which tends to keep the shaft from showing any end play.

LEAKY ROTARY VALVE

64. K. N., Wheeling, W. Va., writes.—What is the proper thing to be done in case an engine equipped with the H 6 brake is out on the road and the independent brake valve rotary starts leaking so badly that the brake shoes keep dragging on the wheels? A.—In case the brake applying is due to a leak past the rotary valve and seat or through the pipe bracket gasket of the independent brake valve, the first thing to do would be to unscrew the regulating nut of the reducing valve so that air pressure would be cut off from the independent valve, afterward a long stick should be whittled off at the end so that it can be forced into the exhaust port of the independent valve for the purpose of preventing the escape of application cylinder pressure when the brakes are applied. The reason the plug should be in the form of a long stick is so that it can be removed instantly should the driving wheels pick up and slide during an application of the brake, and also that it will be seen and removed when the proper repairs are made in the shop.

BRIDGE IN EXHAUST NOZZLE.

65. C. F. G., Horace, Kan., asks which is the best way to put in a bridge in a nozzle to give the best results. Would you put it in parallel to the rails or parallel to the ties?. A.—It makes no difference how you put the bridge in. A bridge in an exhaust nozzle is not a good thing. If the nozzle has to be made smaller it ought to be bushed or a smaller tip applied. The bridge splits the jet of steam, and may throw it so that part will not get out of the stack direct, but may hit the top of the smoke box, and so partly spoil the draught.

BREAKAGE OF WALSCHAERTS VALVE GEAR.

66. R. McR., Memphis, Tenn., writes: Is it necessary or advisable to uncouple the valve-rod in the event of any breakage of any part of the Walschaerts valve gear? —A. There is no need of disconnecting the valve rod, as is the case in breakages of the Stephenson valve gear. All that is necessary is to disconnect the radius rod from the combination lever and suspend the loosened end of the radius rod by a chain or otherwise to the valve crosshead. Blocks of wood should be placed in the link so that the link would be supported in a central position on the link block. The valve should also be centrally blocked. The disconnecting of any other part will depend largely on the nature of the breakage. As a rule, breakages of the Walschaerts valve gearing are extremely rare.

GAUGE GLASS AND WATER LEVEL.

67. B. R. T., Los Angeles, Cal., writes: Is the movement of water in the gauge glass of a locomotive an infallible sign of the true water level in the boiler?—A. No, it is not an infallible sign because something may be wrong and yet let the water move. If the opening into the boiler at the bottom of the glass is closed or stopped up, the water will remain at a constant level, and this level will be, of course, utterly unreliable as an indication of the true level of water in the boiler. If the top valve is closed or the top passage is stopped up or even clogged, a quick stop of the engine may take some of the water out of the gauge glass, and later on some of it will flow back, and slight fluctuations may be noticed in the glass, but the movement will be comparatively slow, and the height of the water in the glass will be utterly unreliable. Safety and good practice demand that the glass water gauge and the gauge cocks as well be frequently blown out and the gauge glass level tested by the flow from the cocks.

SPEED OF GRINDSTONE.

68. C. K., Santa Maria, Cal., asks: What is the proper speed that a grindstone should revolve at that the best results may be obtained?—A. This depends largely on the size of the grindstone. When the speed is sufficient to make the water fly in drops or small streams on the surface, it should give satisfactory results. In the case of a grindstone three feet in diameter, about ninety revolutions per minute will be found to be very serviceable. This will give a surface velocity of nearly 850 ft. per minute, which would be a fair standard for any other size of stone.

FAILURE OF THROTTLE PACKING.

69. R. K., Indianapolis, Ind., writes: If the packing should blow out of the throttle stuffing box what would you do? A.—If the packing gave out when there was a high pressure on the boiler the quickest and best thing to do would be to cover up or wrap up the stuffing box with overalls or sacking or something which would prevent the danger of being scalded with hot steam and get off main line into first convenient siding, blow down steam pressure and repack.

SUBDUING NOISE.

70. J. L. M., Saratoga, N. Y., in a long descriptive letter asks us: What is the best method of subduing the noise of the Eames brake ejector and safety valves of a locomotive?—A. The solving of this problem occupied the brightest minds of the New York Elevated Railroad for many years. In the early 80's they provided the locomotives with small cylindrical receptacles with a capacity of about two cu. ft., filled with glass beads. This gave some, but not much, relief. After several years a method of inserting a number of small pipes about one-quarter of an inch in diameter in the receptacle was tried with better results.

BLOWER PIPE DISCONNECTED.

71. R. K., Indianapolis, Ind., asks: If the blower should become disconnected how would you create a draught on the fire? A.—If the air pump exhaust was piped to go up the smoke stack you might make a slight leak in the air-brake system just enough to keep the pump going long enough to stimulate the fire as much as might be necessary.

Proceedings of Fuel Association.

The proceedings of the second annual convention of the International Railway Fuel Association held at Chicago in May of the present year has just been published and forms a volume of over one hundred pages. In point of importance of the subjects discussed and the general high standard of value of the facts and opinions brought out in the various debates, the volume is of exceptional value and should be in the hands of all who are interested in the supervision and encouragement in locomotive operation to secure greater efficiency in fuel consumption. In this connection the paper read by Mr. D. Meadows was received with much favor. Some striking remarks were made by Mr. Meadows on the ton-mile, the method adopted by the committee of which Mr. Meadows was chairman being to send out a series of questions to the officers of a number of the leading railroads, and the replies were condensed by the committee and presented in brief form. Major Hine, of the Union Pacific-Southern Pacific, gave a very able address on the subject, which appears in full in this volume. A copy of the revised constitution and by-laws is appended to the volume. Those desiring copies should apply to the secretary, Mr. D. B. Sebastian, 703 La Salle street station, Chicago, Ill.

The intimate mixing of hydrocarbon gas with the oxygen of the air produces an explosive combustion that gives the power for driving a gas engine.

Air Brake Department

Conducted by G. W. Kiehm

Brake Pipe Pressure Charts.

The two charts printed in this issue will serve to illustrate the difficulty encountered in forcing compressed air into and with drawing it from the brake pipe on a long train of cars. It is generally supposed that if one end of the brake pipe is opened to the atmosphere the pressure will fall very rapidly throughout the train, but this first chart shows that with no triple valves assisting in the brake pipe reduction the brake pipe pressure can be withdrawn from the 100 car train about as quickly with the valve handle in service position as it can in the emergency position.

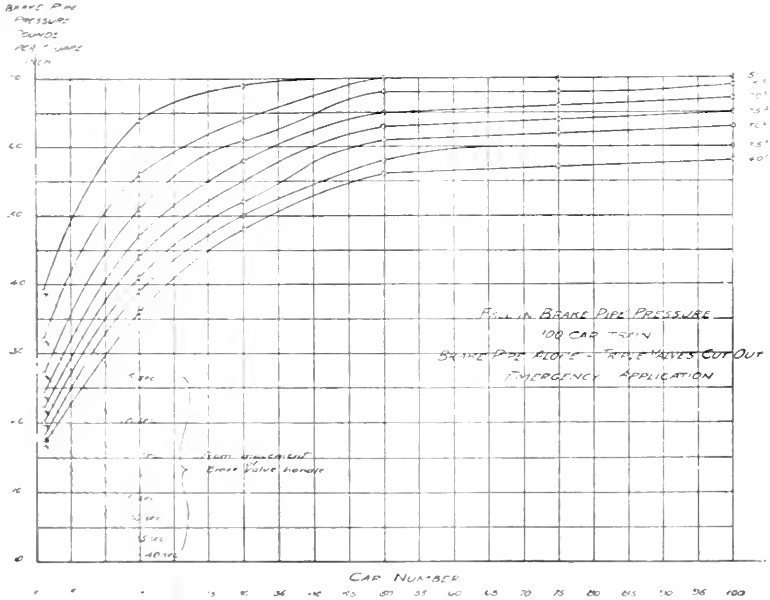
The time that would be required to get the rear brakes in a 100 car train applied with an emergency application, if the triple valves did not assist in making the reduction is shown, as well as the necessity for the quick service feature in applying brakes. It will also be observed that enlarging the exhaust opening of a brake valve could not hasten the application of the rear brakes of a train, as the fall of pressure is shown with one end of the pipe practically wide open.

Withdrawing the compressed air from the brake pipe is a matter of expanding a certain volume of compression which requires a certain amount of time, and added to this is the pipe friction encountered when there is but one opening from which the air pressure can be expanded.

By referring to the charts it will be seen that the fall of pressure on the first car is very rapid, being to 39 lbs. in the first five seconds, while the pressure back of the 40th car had not been disturbed. Fifteen seconds after the movement of the brake valve handle the brake pipe pressure on the first car had fallen 43 lbs. and on the 100th car 1 pound, and it will also be noted that this difference of 42 lbs. pressure between the 1st and 100th car remained for 40 seconds, or to state it differently, at the end of 40 seconds' time from brake valve movement the brake pipe pressure on the first car was 17 lbs. and on the 100th car 58 lbs.

The second chart requires no further comment or any explanation, it shows the brake pipe pressure on the 1st, 15th, 30th, 50th, 75th and 100th cars of the train from which the first chart was obtained.

The charts were, of course, obtained by the use of the chronograph, which is electrically attached to register simultaneously the various pressures during tests, and is absolutely accurate and reliable, and Mr. W. V. Turner is pleased to state the fact that those charts were not made by the hand of man.



FIRST CHART. BRAKE PIPE PRESSURE, POUNDS PER SECOND.

Brakes Sticking.

What may here be said concerning "stuck" brakes or brakes "sticking," has no reference whatever to the term "brakes creeping on," that is, the brake applying when both valve handles of the H 6 brake or the valve handles of any brake valves are in running position, but what is said will have particular reference to the No. 6 distributing valve with the quick action cap.

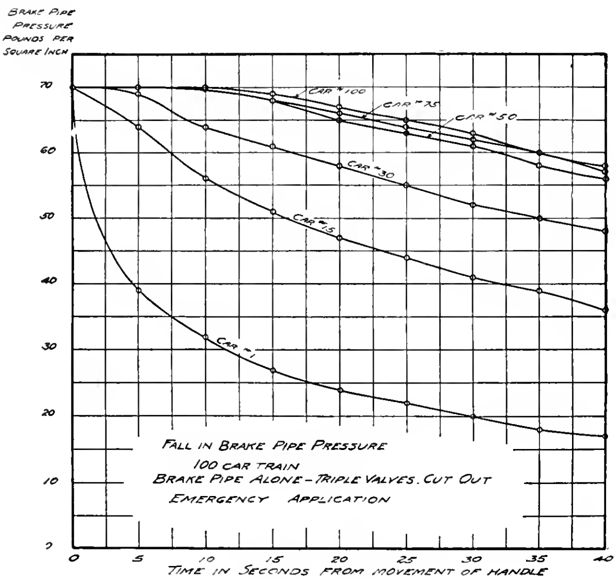
The automatic operation of the distributing valve, like a triple valve, depends entirely upon the creation of differentials in pressure upon the opposite sides of the equalizing valve piston, and once having succeeded in applying the brake or moving the equalizing valve by lowering brake pipe pressure below that in the storage chamber, it is evident that if the brake is to be released with the automatic brake valve the condition must be reversed, that is, the brake pipe pressure must be built up beyond that which has remained in the pressure chamber or this pressure must be reduced below the pressure remaining in the brake pipe after the application.

It is, of course, understood that this differential in pressure can be created under certain conditions without resulting in any movement of valves or the release of brakes, but the brake can not be released automatically unless the required differential is obtained.

By automatically releasing is meant the application cylinder pressure escaping through the exhaust cavity of the equalizing valve or in the case of a triple valve the brake cylinder pressure escaping through the exhaust cavity of the slide valve.

It is also understood that there are many causes for a brake refusing to release. Sometimes brakes will remain applied regardless of any action of the distributing valve or a triple valve, as in the event of levers in the foundation brake gear catching somewhere and holding the shoes against the wheels or a brake may not release due to a hand brake being set or due to a retaining valve being turned up or closed with dirt.

There are therefore, several things that must be observed in cases of brakes failing to release, before there is any effort made to determine whether or not the differential in pressure necessary to release the brake, has been created, and in the event of the brake failing to release on a locomotive having the No. 6 distributing valve, the handles of both brake valves being in running position, we have the advantage here of being able to note by the hand on the cylinder gauge whether brake cylinder pressure has fallen or escaped and if it has and the shoes do not fall away from the wheels or if a piston does not return to the end of its stroke an examination of the brake rigging, fulcrum castings or a test of the release spring is necessary to locate the trouble; but if the pressure does not escape from the brake cylinders when the handles are placed in their running positions it is necessary to investigate the amounts of air pressure employed and the automatic action of the distributing valve.



SECOND CHART.

It would first be necessary to know that the brake can be released by means of the independent brake valve, if it cannot we would know that either the application piston has "stuck" in application position, possibly on lap position, or that pressure cannot be exhausted from the application cylinder, due to some obstruction in the ports leading to the application cylinder or in the application cylinder pipe.

If the brake can be released by means of the independent brake valve but cannot be with the automatic brake valve, it will be noted that application cylinder pressure does not escape at the automatic brake valve and the red hand on the cylinder gauge does not fall and it is evident that for some reason the equalizing valve has not moved to release position or that there is some obstruction in the small ports of the distributing valve or in the release pipe that is preventing the escape of application cylinder air.

To find out whether the brake remaining applied is due to an obstruction in the release pipe, the quickest method is to disconnect the release pipe at the union connection near the distributing valve, and if application cylinder pressure then escapes and the brake releases it indicates that the equalizing valve has moved to release position and that there is some obstruction in the release pipe or in the branch between the brake valves, possibly in the body of either one of the brake valves.

If no pressure escapes as the release pipe is disconnected and as the brake still remains applied, it is evident that there is an obstruction in the exhaust ports of the equalizing valve preventing the escape of application cylinder pressure or the equalizing valve and piston cannot be moved to release position, and an examination of the distributing valve is necessary in either case.

In the stopped up release pipe the same effect as a stopped up port in the retaining valve of a car brake is encountered, and the equalizing valve fails to move to release position from the same causes that a triple valve fails to, and with an unobstructed exhaust port we could at this time expect to find a stuck equalizing valve or a stuck and badly leaking packing ring on the equalizing piston that would permit the pressure chamber to charge without moving the equalizing valve.

Again the equalizing piston may not be moved to release position because of a partial stoppage which does not allow the increased brake pipe pressure to become effective on the equalizing valve or because the pressure chamber has become charged to a pressure that is higher than the adjustment of the brake pipe feed valve.

The foregoing test to determine the cause of a brake sticking would be considered as a shop or roundhouse test, or it might be observed to some extent while on a side track, but when hauling a train of cars there is no time to investigate the cause of brakes sticking, the idea is to get released by some method as quickly as possible and at the same time keep the train in motion.

If the brake on an engine applies and releases promptly when influenced by light brake pipe reductions, and if proper pressures are maintained there can be but very little opportunity for the engine brake to stick after coupling to the train, but should this occur there are some other actions of the distributing valve which should be noted at the same time the brake will not release, and a close observance will lead to an immediate discovery of the reason of failure to release.

If after an application of the brake the engine brake cannot be released with either brake valve the stop cock in the distributing valve supply pipe would be closed and the brake cylinder hose disconnected or a union fitting loosened in order to bleed the pressure from the cylinders.

This is meant for a time when the cylinder hand shows a high pressure, but if the shoes are merely dragging on the wheels and there is a low brake cylinder pressure regardless as to whether the gauge shows it or not, it is an indication that the application piston has moved to lap position before brake cylinder pressure was entirely exhausted.

This could occur only through a combination of defects seldom encountered.

If there is excessive frictional resistance to the application pistons movement in connection with a release pipe restricted in the opening to such an extent that brake cylinder pressure can fall faster than application cylinder pressure the application piston may assume lap position near the end of the release, trapping a light brake cylinder pressure.

Again leakage from the brake cylinders into the application cylinder in conjunction with slide valve friction may produce the same effect, but in either case a light application from the independent brake valve, followed by a prompt movement to release position, will effect a release of the engine brake.

It is assumed that the brake can be applied and released by means of either brake valve when an engine leaves the roundhouse, and this being known by the engineer it might be discovered that the engine brake cannot be released when an attempt is made to alternate the engine and train brakes upon descending grades or if the engine brake cannot be released by means of the independent brake valve while the train brakes are applied the engineer is confronted with a situation that requires immediate attention.

This trouble is the result of wrongly connected air pipes. The application cylinder pipe will be found connected to the distributing valve at the point the release pipe should be, and the engineer should realize that such is the case, as it is not likely that the application cylinder pipe could become entirely closed during a trip.

When this disorder is noticed under the circumstances mentioned, a union connection in the release pipe branch between the brake valves should be loosened, and if the pipes are crossed a leak will start here and the engine brake will release, the union should then be disconnected and the independent brake valve used in connection with the automatic brake valve in applying the brakes until such a time that the pipes can be properly connected without causing any delay. If this trouble of crossed application cylinder and release pipes is not discovered until a time when the driving wheels were to pick up and slide during application of the train brakes some damaged driving wheel tires would result. The only way the engine brake could be released is along with the train brakes, unless the engineer was to instantly realize what was wrong and close the stop cock under the brake valve and place the automatic brake valve in running position, however, the only people who can think that fast and as accurately during emergencies are dime novel heroes, and the flat wheels, due to improper piping, are up to the engine house for an explanation.

Under ordinary conditions, if the brake could be released with the independent valve and could not be released with the automatic there would be no course left open but to release with the independent valve and keep the train in motion, and when the opportunity presented itself the drain plug could be removed from the pressure chamber of the distributing valve reservoir, and if it is possible to move the equalizing valve to release position it will occur when the brake pipe is charged with the pressure chamber open to the atmosphere. This proceeding would prevent any further application of the automatic brake and the independent valve would be used to operate the engine brake.

If the brake was operating perfectly during all service brake pipe reductions and occasion for using the brake valve in emergency position occurred and the brake valve remained in this position for any length of time, should the brake refuse to release when the valve handle was returned to release and running positions, it would indicate that the pressure chamber of the distributing valve had become overcharged while the handle was in emergency position.

The brake should then be released by means of the independent brake valve, and in a short time an equilibrium of pressure will be restored.

An action of this kind is made possible by an inoperative safety valve or when the safety valve is apparently set at 68 lbs.

An incorrect air gauge and a sluggish feed valve would also aggravate this trouble, which originates from the flow of air from the main reservoir to the application cylinder of the distributing valve. If the pressure chamber became charged to a higher pressure than the feed valve was adjusted to maintain in the brake pipe the equalizing valve would not move to release position until brake pipe pressure was increased or pressure chamber pressure lowered.

If at such a time, due to a variation in the gauges, the pressure chamber were to contain about 72 lbs. pressure and the cylinder gauge were to show but 68 lbs., and if the brake pipe actually contained say 68 lbs. and the gauge were to show 70 lbs., it is evident that the equalizing valve would not move to release position, but a quick movement of the automatic brake valve to release and back to running position will effect a release of the engine brake, but if the pressure chamber were to become charged to main reservoir pressure because of an inoperative safety valve the brake would have to be released with the independent valve.

If after an emergency application of the brake, either from the train or from the brake valve, should the brake on the engine fail to release when a release was attempted, but instead a heavy blow should occur at the distributing valve exhaust port and continue until the car brakes have re-applied, it would indicate that brake pipe pressure was escaping by the way of quick action cylinder cap.

This would be caused by the slide valve remaining in its open position after a quick action application, and if tapping the cap lightly would not reseat it, the angle cock on the rear of the tender should be closed and the brake pipe disconnected from the distributing valve and plugged or a blind gasket inserted in the union, as there is no stop cock located in the brake pipe branch, and cutting out the distributing valve in the regular way would not alter the situation.

The reader will distinguish the difference between this effect and ordinary leakage from the exhaust port of the distributing valve, and in the event of more than one brake sticking, or rather if a number of brakes are sticking in any part of the train, it would not be reasonable to expect it to be caused by a triple valve, but rather an investigation as to main reservoir pressure, volume, pump capacity, leakage, and the manipulation of the brake valve is in order, and the ability to get air back into the brake pipe and maintain the pressure must be known at all times, regardless as to whether brakes are sticking or not.

Of course an emergency valve in a triple valve remaining open could cause other brakes to apply, but by creating a brake pipe leak only.

In case of a number of brakes on the head end of a train applying after a release the distributing valve will also be affected and a quick movement of the automatic brake valve to release and back to running position is the proper method of releasing them, provided of course, that there is an excess pressure stored in the main reservoir.

Accident Record Three Months 1910.

According to accident bulletin No. 35, issued recently by the Interstate Commerce Commission, 1,100 persons were killed and 21,232 injured by the the steam railroads of the United States in January, February and March, 1910.

This is an increase of 466 killed and 6,110 injured as compared with the same period last year. These figures deal only with employees on duty and passengers. There were nineteen killed on electric railways and 669 injured.

The number of casualties is unfortunately made greater by two great disasters—an avalanche in the State of Washington and a derailment in Iowa—both in March. In these two disasters 141 persons were killed and fifty-two injured.

Inferior Handwriting.

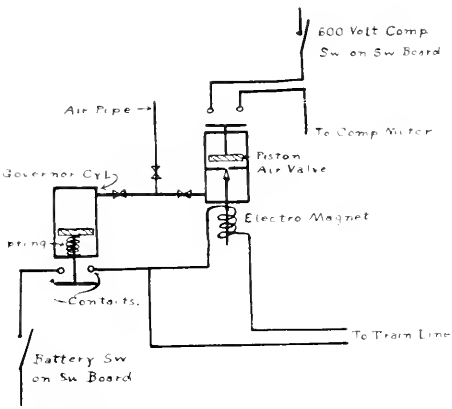
The indications are that railway train service is becoming safer year by year, yet there is much to be desired in the prevention of accidents. Mistakes in orders continue to be the cause of many fatalities. Two fertile causes of fatal accidents receive too little attention from officials. They are inferior telegraph operators and illegible handwriting.

Electrical Department

Air Compressor Governor.

By W. B. Kouwenhoven.

The air compressor on a steam locomotive is supplied with a governor yet in many cases it may run practically all the time. With the compressor on an electric motor car, however, the case is different. It is supposed to cut in automatically when the pressure falls to a certain value, say 120 lbs., and run until the pressure is brought up to say 130 lbs. and then automatically cut out. The motor car compressor is not built for continuous duty and cannot run all the time. One difficulty that arises in the operation of electric motor trains not met with in steam practice is that if all the governors on the cars that make up an electric train are not set to cut in at exactly the same pressure, then the compressor whose governor is set lower than the others will cut in first and be overworked. That this is a fact is apparent to the passenger who understands what the continuous steady "chug, chug" of the compressor of the car he is riding on means. This causes very rapid deterioration of the motor and compressor.



PIPING AND WIRING FOR ELECTRIC GOVERNOR.

This difficulty is met by making two additions to the ordinary governor. The ordinary or simple governor consists of a cylinder fitted with a piston above which is admitted the air pressure from the train line. Below the piston in the bottom of the cylinder is a spring which holds the piston against the pressure of the air. When the pressure falls in the train line, the pressure in the cylinder also falls and the spring shoves up the piston until it closes two contacts in the 600 volt compressor circuit and starts or cuts in the compressor motor. In the arrangement for preventing one compressor doing all the work, instead of the governor closing the two contacts for cutting in the compressor; it closes two contacts which energize an electro-magnet valve with current from the storage batteries which supply the low voltage current to the motor control apparatus, and at the same time energize a wire in the train line.

The magnet when energized opens a valve in a second cylinder, containing a piston, and admits air from the air line to the lower side of the piston. This raises the piston until it touches or meets with two contacts and closes the circuit between them, and cuts in the compressor motor. Simultaneously the electro-magnet valves on the other cars in the train are energized through the wire in the train line, and cut in the compressor motors on all the cars at the same time. With this system, if the governor on any car in the train happens to be set a little lower than the others, the compressor on that car will not be overworked, because all the compressors on the train will cut in together.

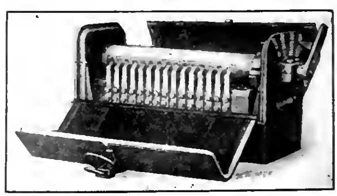
The Emery Lubricator.

By W. B. Kouwenhoven

Any one who has had to do with air pumps or electrically driven cars knows the difficulty of keeping the leather washers or leathers, as they are generally called, soft and pliable and in condition to hold their suction. All railway men who are connected with the shops of a railroad, either steam or electric, know the importance of keeping the leather washers in the air brake equipment and those in the multiple unit switch equipment soft and pliable. Unless they are kept greased they are sure to dry out, crack and give trouble.

One way of taking care of them was to soak them with grease when the car was overhauled, and trust that they would not dry out before the next time the car came to the repair shop. If the time between visits to the repair shop is short, such a method may be satisfactory, but this is seldom the case. Leather when used in air pumps and in apparatus through which compressed air passes, dries very rapidly.

The Emery Lubricator is probably the best method for maintaining the leather washers on an air brake equipment and on the unit switch apparatus in good condition. This form of lubricator supplies the necessary amount of grease to keep the leather soft and pliable all the time. They must, however, have been thoroughly greased when the car was overhauled. This lubricator is manufactured by the Westinghouse Company and is supplied with their multiple unit equipments on electric motor cars. It is placed in the pipe line leading from the control reservoir to the unit switches. The Emery Lubricator in form reminds one of an inverted T-pipe connection. A stick of graphite is placed in the vertical part of the T and is fed down by spring pressure into the horizontal part. The air on its way from the control reservoir to the multiple unit switches passes through the horizontal part of the inverted T, and in doing so is forced to pass close around the stick of graphite, picking up the small particles of graphite and carrying them along with it. These small particles of graphite are sufficient to keep the leathers soft and completely prevents their drying and cracking. The rate at which the graphite stick is fed down into the air space can be easily adjusted. This lubricator affords a very simple, efficient and inexpensive method of keeping the leather washers and valves in good condition. There are no parts to get out of order and the only attention required is to insert a new graphite stick when the old one is used up.



MOTOR CONTROL CUT-OUT, OPEN CASES.

Telephone Instead of Bell Cord.

In order to reduce whistling and hand or lamp signals, the Pennsylvania is working on a new plan. A train was equipped with two telephones, with wires between the engineer and the train caboose. These telephones were placed in reach of the engineer and the men occupying the caboose.

General Foremen's Department

General Foremen's Proceedings.

The proceedings of the International Railway General Foremen's Association has just come from the press. It contains the full text of the papers read at the sixth annual convention held last May at Cincinnati. It also contains the discussions thereon, the list of officers elected and the full list of active, associate and honorary members. The list of subjects for 1911 is given below and we desire here to say that we will be glad to have the views of any of our readers on the subjects chosen. The full expression of opinion and the information which can be brought out in the columns of our paper may very materially help in the preparation of papers for the 1911 convention.

Subject No. 1.—"How Can Shop Foremen Best Promote Efficiency?" F. C. Pickard, chairman, M. M., C. H. & D Railway, Indianapolis, Ind. Subject No. 2.—"Why Is It Necessary to have Wheel Fit, Engine Truck and Driving Wheels Larger than Diameter of Journal?" Stephen A. Motta, chairman, general foreman Nationale de Mexico Railway, Aguascalientis, Mex. Subject No 3.—"Shop Kinks," H. D. Kelley, chairman, general foreman C. & N. W. Railway, Chicago, Ill. Subject No 4—"Method of Shop Organization," D. E. Barton, chairman, general foreman L. D. A T & S. F. Railway, Topeka Kan.

Location of Water Delivery.

Some light was thrown on the important subject of the location of the point of water delivery in a locomotive boiler by a paper read by Mr. A. F. Bradford, general foreman of the Big Four at Urbana, Ill. Among other things Mr. Bradford said:

"The location of the point of water delivery in a boiler has until recently been little thought of, and only until the check valve was placed above the water line was there much discussion on this subject. One place where I think the water should never enter the boiler is near the firebox, as this is the hottest part of the boiler, and the forcing of cold water against the extremely hot surfaces would cause considerable damage, resulting in cracked sheets. At the present time many roads are experimenting with the method of injecting the water into the boiler above the water line, the injected water being sprayed in, and by the time it reaches the water line it is hot. It is readily seen that by this method there will be no trouble with flues on account of forcing the cold water in against them, but, will the boiler steam as well and operate as economically as where the water is fed in below the water line? Some say the engines steam better, and also that it is more economical. As for steaming, I cannot say, but I should think that the steam would be of poorer quality, and also that more economy is gained by placing the feed water inlet below the water line on the side of the boiler back of the flue sheet.

"By feeding the water in below the water line a better quality of steam would be obtained; for if the cold water were sprayed in the steam, it would make the steam wet or of poor quality and dryness of steam is quite a factor in the operation of a locomotive. Even if the spray is not placed close to the steam dome, it is plainly visible that the steam would not be of the same quality as if no water were mixed with it. Another, and more important, result is the short duration of the staybolts and the flues, due to the water being put into the boiler at such a low temperature when the boiler is forced to its greatest efficiency, and has led to a vast number of experiments as to the best point of delivery to obtain a saving in fuel, and to eliminate flue, staybolt and sheet failures.

"If it were possible to feed an ordinary locomotive boiler with an injector with water under high temperature, it would not, in my opinion, signify much as to what point the water was delivered into the boiler; but as it is not possible to get satisfactory work out of an injector with water at a temperature much above 100 degs. Fahr., it is best, I believe, to deliver water at a point as far removed from the firebox as it is possible to have it, and also to deliver it at a point high up, if not on top of the boiler. The old (and generally accepted) practice of introducing the feed water into the boiler below the high water level, still prevails in the majority of cases, although in some cases the water is introduced into the steam space of the boiler, particularly where check valves of the Phillips pattern are used, on top of the boiler."

In the paper on the same subject, written by Mr. C. W. Seddon, superintendent of motive power of the Duluth, Missabe & Northern at Proctor, Minn, the writer went into the subject very thoroughly. We give a few extracts, as follows:

"It is a well known fact that where cold water mixes with hot water, the cold water will fall and settle to the bottom of the lowest point of a boiler; which in a locomotive would be around the water leg and bottom flues. Now with the old method, the custom is to deliver the water in a locomotive boiler in a 2-in. solid volume, the boiler check being located in the front course of the boiler, about midway up, so that when the engine is working hard, using both injectors, there are two solid streams of cold water being forced into the boiler, mixing with the hot water already therein. What is the result? The only possible thing that can happen to this cold water is to settle around the water leg and bottom of tubes, cooling this part of the boiler. This variation in temperature is bound to contract the sheets and tubes, causing them to leak, and in many cases causing the side sheets to crack and staybolts to break. Is it not reasonable to suppose that if this feed water is heated to the same temperature as the water in the boiler, that a great deal of flue and firebox trouble can be eliminated?"

Speaking of two engines which would not steam, Mr. Seddon said he came to the conclusion that the feed water delivery had a good deal to do with it. He experimented accordingly. He says:

"We first connected an elbow to the boiler check on the inside of the boiler and carried the feed water as near to the surface of the water level in the boiler as possible, before discharging it. After trying this we found we were able to make about two round trips without engines failing. Previously that had failed in one. This experiment proved conclusively that there was an improvement and that the trouble was due to feed water conditions. I then decided that (if what we had done was an improvement) to deliver the water into the steam space in a spray. To do this I placed on each side a copper pipe, connected to the boiler check, extending about 18 ins. inside, with 1/8-in. holes drilled on the upper side, so as to keep the water in suspension as long as possible, allowing the feed water to absorb heat from high pressure steam before mingling with other water in the boiler. After supplying feed water in this manner, the boiler trouble on these engines entirely ceased, and from that day to this we have not had a minute's delay charged against these engines, on account of tube or boiler trouble. Later on we had another engine giving trouble from tubes leaking, and in order to further demonstrate what could be done, I decided to change the feed water arrangement and deliver it to the boiler in the same manner as in the other cases. After the engine came in leaking badly, we made the change and sent the engine out without permitting the boilermaker to go inside to make repairs, the engine going out in the same condition as when she came in. The result was the tubes immediately dried up, and from that time until the engine went into the shop, some six months later, we never found it necessary to send a boilermaker into this engine's firebox. This convinced me beyond any doubt that the old way of water delivery was entirely wrong, and I immediately ordered all our locomotives to have feed water delivery tubes applied in the manner described. This order was put into effect about July, 1907, and in the spring of 1908 we had all of our engines so equipped."

The few extracts which we have given from these two excellent papers serve to show the importance of the subject. We would like to hear from any of our readers who have had any experience with the effect of the location of the point of feed water delivery.

The Cleaning of Ash Pans.

At the recent General Foremen's Convention at Cincinnati, the discussion which followed the reading of the paper on the method used by the Great Northern to clean ash pans to comply with the Interstate Commerce Law was direct and to the point. Dealing with the time required, Mr. C. W. Moats, round house foreman on the Pittsburgh & Lake Erie at Beaver Falls, Pa., said: "When it comes to the question of the time it takes to clean ash pans, my experience is that it takes longer to thaw them out than to clean them. The hostler can clean three fires while the ash pit man is cleaning the hopper. It all depends on the condition of the engine. We wet the ashes down and in the winter time we have to take them out. We have all kinds of trouble with whitewashing the engines, as we call it. The engines are covered with fine white ashes, and our main object is to prevent this by wetting down the ashes. With the hopper bottom the most difficult problem is to get it open. In really cold weather the ashes become solid and it takes considerable hammering to get them out. We have spent an hour and a half getting the ash pan open and cleaning it, but in good weather we clean the whole fire and fix the engine up in 15 minutes."

One of the members, giving his experience on this point, said: "During the last year I made quite a study of these requirements, and I believe I realized what the railroads are up against. In the first place, they must recognize the law. They have got to meet conditions. I do not know what the proportion is, but perhaps 25 per cent. of the engines in this country have the narrow, shallow pans, and there are a great many inconveniences. One of the most vital things is draughting the engine. If you use a different method from the ordinary damper, it will destroy the air. I believe, because of this condition, we have not been required to meet it as the law intended we should. One person asked me what he could do with the draughting of the engine. If you have a 7 or 8 or 9-in. ash pan you cannot destroy much of that space by lowering the ash pan and taking air under the mud ring. Two of the most essential things to be considered are time and the draughting of the engines. A gentleman spoke of the pan freezing up and the time required to clean it. I have not found a condition but it is possible to meet it in 15 seconds."

Mr. J. E. Buckingham, master mechanic of the Union Stock Yards Company at Chicago, said: "Although we are a small terminal road, we have to take into consideration the dropping of fire. We work for the packing-house and stock yards and there is more or less hay in the cars there, which makes it necessary for us to keep our dampers down. We have drilled holes in the ash pans and have covered them with netting. We have a damper in the firebox. We do not clean our ash pans on the road, but only as they come in on the pit. We have a 1¼-in. bushing that we have adopted, placed in the side sheet, about four rows above the mud ring, running down over the back axle. We put in four nipples each way. We find it thoroughly cleans out the pan. The Union Pacific have adopted that system and they run theirs out of the side sheet above the running board. They clean them the same way on the shallow pans. Our pans are about 15 ins. deep."

Handling Men.

Many very pertinent remarks were made at the recent convention of the International Railway General Foremen's Association as the various topics came up for discussion. Among these may be quoted a few words by Mr. J. A. Bayden, general foreman of the Erie Railroad at Cleveland, Ohio. He said:

"In handling men, the general foreman should watch the language used by the foremen among their men. We hold a meeting with the representatives of each one of our departments the first Monday of every month. It is held in my office. All foremen are barred. These representatives get the grievances of all the men if they have any. Our first question is what they have for the betterment of the service. After we have gone through that we ask each individual what personal grievance he may have, and it would surprise you to know what we get through these meetings. They are well worth holding. Sometimes a fellow will come in with a big story about some foreman. Lots of times it amounts to a great deal, and part of the time it is a waste of time to investigate. We do not have any unions, and I think that the way we handle men is satisfactory to the men."

Mr. T. H. Ogden, president of the association, at this meeting said: "The idea that Brother Boyden has started is a topic that we need to pay more attention to than to some new invention or process. We have got to get next to our men, or they are going to get away from us. Some of our foremen are not acting in harmony with their men, and they lose prestige by the manner in which they address them. We ought to take up in our conventions the different methods of handling men. Anything that will bring them together."

N. Y. C. Shops at Corning, N. Y.

One of the most thoroughly equipped roundhouses of recent construction has just been completed by the New York Central at Corning, N. Y. It is situated in a picturesque valley among the hills near the city of Corning, N. Y. The main building is a semi-circular structure of substantial and elegant design, the walls being of brick resting on massive blocks of gray granite, the supporting columns and roof girders being of steel. There are thirty stalls capable of accommodating the largest locomotives with ample passageways at either end, the entire flooring and pits being solidly cemented. Six of the pits are furnished with drop pits into which driving wheels and trucks may be expeditiously lowered, and the locomotives moved backwards a sufficient distance to admit of the removal of the wheels. This section of the roundhouse extends a distance of more than 20 ft. outwards from the main line of the building, and turning tables are placed at the end at each of the six pits on which the wheels may be readily moved to a track leading under a covered way to the adjoining machine shop.

It may be stated that during the removal of wheels or trucks, the trouble arising from the moving of the locomotive a considerable distance, occasioning as it might do, the escape of smoke and gases into the building, is provided for by an extension of the smoke jacks in the roof of the building whereby the smokestacks are kept enclosed in the extended jack. This, however, is only one of the lesser improvements enhancing, as it does, the general efficiency and consequent comfort of the men engaged in the roundhouse. Near the base of each of the columns of the building there is attached a number of valves and other devices. Two of these are attached to steam pipes having a constant pressure of 110 lbs. Two others are attached to pipes leading to the compressed air reservoir, the pressure being at 100 lbs. There is also an electric light attachment in a neat cabinet. This is for the convenience of the mechanics and others who can readily attach a coil of electric wire and proceed with an incandescent bulb to any part of the locomotive requiring their attention.

To the columns are also attached a very complete system of pipes and valves comprising a boiler emptying, washing, and filling system. When the locomotive arrives in the roundhouse for the purpose of having the boiler washed out, a connection is made with the boiler to one of these pipes and the water is rapidly sucked out of the boiler and conveyed through a filtering apparatus into a tank from which the boilers are refilled. As soon as the boiler is emptied and the wash plugs removed, a new connection is made to another system of piping, and a stream and encircle the entire inner substructure of the building. There are also several large openings in the pits into which the hot air is injected so that the roundhousemen at Corning can contemplate the coming winter with equanimity.

About 120 locomotives, 65 of which are freight engines, are regularly attended to at Corning. The coaling appliances consist of two alternating buckets working in a steel and concrete tower. The action of the buckets is simple and automatic. The descending bucket on nearing the bottom of the shaft opens the coal chute and the bucket is filled from the supply bin. On raising the bucket, the chute is securely closed and on reaching the top of the tower the emptying into the locomotive tank is also automatic. Two men manage the entire mechanism, one man running the motor and the other attending to the regulating of the supply of coal. A sand furnace is also at hand, and pumps all of the latest and best designs, the entire equipment forming altogether a model modern house

There are quarters fitted up as an hospital which is supplied with medical requisites for the sick and injured, and with telephone connection to two local medical men.

We had the pleasure of meeting Mr. John Howard, the superintendent of motive power, who has given much personal attention to perfecting the details of the new roundhouses, and we were glad to learn that his plans embrace the beautifying of the grounds, which are already so well adapted to this treatment by location. In a short time the buildings will be surrounded in a way not common to roundhouses. Mr. Howard has been peculiarly fortunate in choosing assistants worthy of the new establishment Mr. G. B. Walsh, general foreman, and Mr. D. Stimson, are familiar with the con-

NEW YORK CENTRAL RAILROAD ROUND HOUSE AT CORNING, N. Y.

of water at 110 degs. Fahr. and 100 lbs. pressure is turned into the boiler. After a thorough and systematic washing and inspection, still another attachment is made with a hot water tank where a constant supply of water at 212 degs Fahr. is maintained. The heating of this water is a matter of little cost, as we have already stated the hot water from the boilers is, after being cleared of impurities, retained in this tank, and but little of the original heat is lost

In addition to these appliances there is a portable fuel kindling apparatus combining a strong jet of compressed air and crude oil A jet from the kindling machine is let loose upon the coal in the fire box and the white flames are filling the flues, and the safety valves are trembling into activity in a few minutes. The fire-proof oil hose and other appliances are all carefully safeguarded, and all combine to render the washing of a boiler a matter of brief and easy accomplishment

This reminds us of the heating appliances which are of the warm air kind, and a suction apparatus conveys the dried sand in pipes to suitable attachments over the three inspection pits. These pits are cemented, and are over 4 ft deep and about 90 ft. long. Every locomotive coming in or out of the roundhouse passes over one or other of these pits, and is thoroughly inspected.

Proceeding to the machine shop under the covered way, we find a very select and complete assortment of machines suited for roundhouse work embracing one wheel lathe, one slotter, two planers, one shaper, a hydraulic press, and pipe and flue cutting machines, five lathes and two drill presses, bolt cutting machines and boring mills, and emery wheels. These machines are driven by two electric motors of thirty horse power each. There are also two forges and a very complete copper and tin smithy

In the adjacent power house there are two high speed horizontal steam engines of 150 h p each. There is also a compressor with a capacity of 1,800 ft per minute, besides an assortment of dynamos struction of every detail of the works, and in their hands, the skilled mechanics, of which there are already about 150 employed, will give a good account of themselves and maintain a high standard of efficiency in the running reports of the hundreds of locomotives that call in at Corning. The works are an important addition to the thriving city, and many new buildings are already being erected in the vicinity.

Theory Practice.

There has always been undue importance attached to the ability to impart technical instruction. In the colleges where book learning concerning engineering matters is given to young men, the ability to teach that line of knowledge is valued much higher than the ability to give instruction in manual operations; yet the ability to instruct in the practical mechanic arts is much more rare than the ability to explain the theory of the same

Heavy Pacific for the Vandalia.

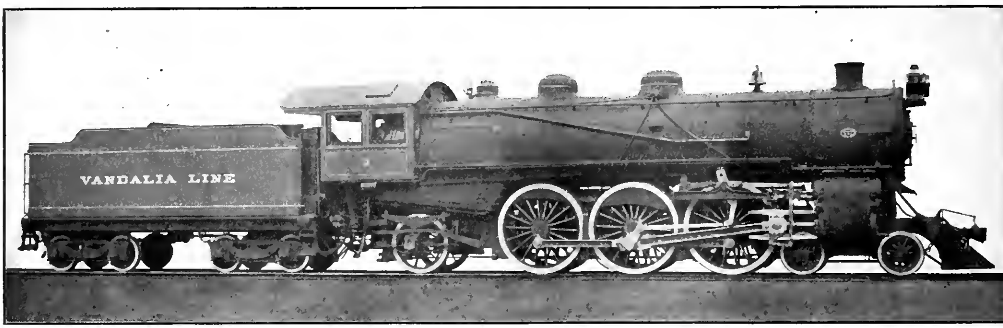
Until recently an Atlantic type locomotive having a total weight of 185,000 lbs., and a weight on drivers of 107,500 lbs., cylinders 21 x 26 ins., and a maximum tractive power of 24,650 lbs., has been the standard class of passenger locomotive used on the Vandalia Line. During the past few years, however, the requirements in passenger service have increased to such an extent that a heavier class of power than can be provided in the Atlantic type of locomotive is now needed to handle certain of their trains. In consequence, in ordering new passenger equipment from the American Locomotive Company in December, 1909, the officials of the Vandalia Line purchased four heavy Pacific type locomotives. Prior to the advent of these engines the Vandalia was one of the few important roads in the country on which the Pacific type locomotive had not been adopted for at least the most difficult passenger service.

The engines which we here illustrate have been in service for two months on the St. Louis division. Although designed for fourteen-car trains, they have not so far had to handle more than twelve cars to a train. Officials of the road say that the work with some twelve-car trains has been very satisfactory and no difficulty is anticipated in the more severe conditions encountered in the winter. In their report the officials make particular mention of the easy riding qualities of the engines, stating that they ride very smoothly at 60 miles per hour and upward. The engines operate under easy grade and curvature conditions. There are several portions of the road of from three to ten miles long where the curves are numerous; but the sharpest curve on the division is only 3 degs. 48 mins.

As to the grades, the profile shows that the total rise between St. Louis and Summit, a distance of 217.8 miles, is only 474 ft. This rise which is against east-bound traffic is accomplished by a series of short, easy ascents over rolling country with long stretches of practically level track in between. Practically the only grade of any consequence against east-bound traffic lies between Reelsville and Almeda, where in a distance of approximately 8 miles the total rise is 216 ft., giving an average gradient of 0.503 per cent. Going in the other direction, the grade conditions are still easier, there being several long, easy slopes in favor of westward traffic. When the engines were first put in service it was necessary to make some minor changes in the front-end arrangement, which was the Vandalia standard. After that the engines steamed freely and no trouble was experienced.

From a table furnished by the railway showing some typical runs made by one of these engines it is apparent that the engines had no difficulty in maintaining the train schedules. An examination of the figures for the coal consumption indicates that the engine was not pushed to the limit of its capacity on any of the runs. The highest rate of coal consumption per square foot of grate area per hour (which was calculated from the data furnished by the railroad company) is only 74.5 lbs. The figures for the total amount of coal used per trip, in view of the tonnage and speed maintained, are also very creditable.

Although the engines incorporate no new or unusual features, they form an excellent example of a straightforward, well-proportioned design carefully worked out to meet the particular conditions of service. That the engines are well adapted to meet these requirements is shown by the train records in the table referred to above. The design is entirely new and follows in general the builders' standard practice. As far as the cylinders and running gear are concerned, it is practically identical with the engines of the same type built by the American Locomotive Company for the Pennsylvania Railroad, the use of which on the Vandalia road was practically prohibited by the limit of 55,000 lbs. for the allowable load per driving axle. The principal difference between the two designs are a reduction of the boiler pressure from 210 to 200 lbs., and the use of a smaller boiler and firebox, the boiler of the Vandalia locomotives being 76½ ins. in diameter outside at the first ring, while this dimension in the Pennsylvania locomotives is 79¾ ins. The boilers of both locomotives are of the straight-top type, and the tubes in each case are 21 ft. long. In regard to the firebox, that of the engines here illustrated is 108⅛ ins. long by 75¼ ins. wide, having a grate area of 56½ sq. ft., while that of the Pennsylvania locomotive is 111 ins. long by 80¼ ins. wide, and has a grate area of 61 8/10 sq. ft. These modifications in design result in a reduction of 14,000 lbs. in the total weight of the locomotive.



SIMPLE PACIFIC TYPE PASSENGER ENGINES FOR THE VANDALIA.

W. C. Arp, Superintendent of Motive Power. American Locomotive Company, Builders.

Cylinder, type, simple piston valve, diameter 24 ins.; stroke 26 ins.; tractive power, 31,800 lbs. est.

Wheel base, driving, 13 ft. 10 ins.; total, 35 ft. 2½ ins.; total, engine and tender, 66 ft. 5 ins.

Weight, in working order, 256,000 lbs.; on drivers, 162,000 lbs.; engine and tender, 401,000 lbs.

Heating surface—Tubes, 4,195 sq. ft.; arch tubes, 194 sq. ft.; total, 4,389 sq. ft.

Grate area, 56½ sq. ft.

Driving journals, main, 10½ x 14 lbs.; others, 10 x 14 ins.; engine truck journals, diameter, 6½ x 12 ins.; trailing truck journals, diameter, 8 ins.; tender truck journals, diameter, 5½ ins.; length, 10 ins.

Boiler, type, straight top, O. D. first ring, 76½; working pressure, 200 lbs.

Firebox, type, wide; length, 108⅛ ins.; width, 75¼ ins.; thickness of crown, ⅜ in.; tube, ½; sides, ⅜ in.; back, ⅜ in.; water space, front, 4½ ins.; sides, 4½ ins.; back, 4½ ins.

Tubes, Total 383; diameter, 2 ins.; length, 21 ft. 0 in.; gauge, No. 11 B. W. G.

Brake, pump, No. 11 on left hand side, one reservoir, 20½ x 114 ins.; other reservoir, 24½ x 48 ins.

Engine truck, 4-wheel center bearing.

Trailing truck, radial with outside journals.

Tender frame, 10 ins. and 12 ins. steel channels.

Tank, style, water bottom; capacity, 7,500 gals. 12 tons.

Valves, type, Wilson piston, 14 ins. diameter; travel, 6½ ins.; steam lap, 1¼ ins; exhaust clearance, ⅛ in.

Setting—1-16 in. forward gear; 7-16 in. lead back gear; ¼ in. lead middle gear to equalize at 6½ cut off.

Wheels—Driving diameter outside tire, 80 ins.; material, cast steel; engine truck, diameter, 36 ins.; kind, spoke center; trailing truck, diameter, 55 ins.; kind, spoke.

Items of Personal Interest

Mr. H. P. Abbey has been appointed purchasing agent of the Missouri, Oklahoma & Gulf, with office at Muskogee, Okla.

Mr. C. C. Anthony has been appointed purchasing agent of the Denver, Northwestern & Pacific, with office at Denver, Colo.

Mr. C. M. Stansbury has been appointed master mechanic of the Ocean Shore Railway, with office at San Francisco, Cal.

Mr. H. J. Riddle has been appointed assistant road foreman of engines on the Vandalia Railroad, with headquarters at Terre Haute, Ind.

Mr. C. A. Brandt has been appointed mechanical engineer of the Cleveland, Cincinnati, Chicago & St. Louis, with office at Indianapolis, Ind.

Mr. H. L. Jace has been appointed master mechanic of the South Dakota Central, with office at Sioux Falls, S. D., vice Mr. C. A. Swan, resigned.

Mr. J. H. Guess, general purchasing agent of the National Railways of Mexico City, has had his jurisdiction extended over the Pan-American Railroad.

Mr. A. H. Brown has been appointed assistant road foreman of engines on the Illinois division of the Baltimore & Ohio Southwestern. This is a new office.

Mr. J. E. McLean has been appointed master mechanic of the Kansas City Southern, with office at Pittsburgh, Kan., succeeding Mr. G. S. Hunter.

Mr. C. Harder has been appointed mechanical engineer of the Kansas City Southern, with office at Pittsburgh, Kan., succeeding Mr. R. L. Langtim.

Mr. B. W. Venamon, has been appointed district car inspector on the Northern district of the Rock Island Lines at Cedar Rapids, Ia., vice Mr. C. E. Priest, promoted.

Mr. J. L. Cunningham has been appointed master mechanic on the New York, Philadelphia & Norfolk at Cape Charles City, Va., vice Mr. G. W. Russell, promoted.

Mr. G. W. Russell, master mechanic of the New York, Philadelphia & Norfolk at Cape Charles City, Va., has been appointed general equipment inspector on the same road.

Mr. Percy R. Flanagan has been appointed general agent of the Chicago Great Western Railroad, with headquarters at Spokane, Wash., vice Mr. W. E. Pinckney, resigned.

Mr. J. C. Brown, formerly traveling engineer on the Cotton Belt, has resigned to accept the position of railroad mechanical expert with the Pierce-Fordyce Oil Association of Texas.

Mr. E. F. Tegtmeyer has been appointed master mechanic of the Nebraska and Colorado divisions of the Rock Island Lines, with office at Goodland, Kan., vice Mr. D. H. Speakman, resigned.

Mr. S. A. Rogers has been appointed road foreman of engines of the Baltimore & Ohio Southwestern, with office at Seymour, Ind., vice Mr. Richard Mallen, appointed trainmaster at Seymour.

Mr. Chas. Drury, general foreman of the Atchison, Topeka & Santa Fe, at Albuquerque, New Mexico, has been appointed division master mechanic at Arkansas City, Kas., vice Mr. W. J. Hill, transferred.

Mr. C. E. Priest, district car inspector on the Northern district of the Rock Island lines at Cedar Rapids, Ia., has been appointed car foreman, with office at Inver Grove, Ia., vice Mr. A. M. Crain, assigned to other duties.

Mr. W. J. Hill, formerly division master mechanic of the Atchison, Topeka & Santa Fe Railway at Arkansas City, Kan., has been appointed division master mechanic at Amarillo, Tex., vice Mr. J. R Cook, resigned.

Mr. W. A. Buckbee, formerly road foreman of engines on the Rutland Railroad, at Rutland, Vt., has resigned his position to accept services with the Locomotive Superheater Company, 30 Church street, New York.

Mr. O. E. Stump, who has been a locomotive engineer for a number of years on the Kansas City Southern Railway, has accepted the position of traveling engineer on the same road, with jurisdiction from Mena to Port Arthur.

Mr. J. Snowden Bell, one of the leading patent attorneys of New York, announces the association of Mr. Edward A. Wright in his practice of the law pertaining to patents. The offices of the new firm are in the Singer Building, No. 149 Broadway, New York.

Among our personal notices last month we stated that Mr William Hill succeeded Mr. C. E. Gossett as master mechanic of the Iowa Central. By an error the name was spelled with H instead of G. It is Mr William Gill who has become the Iowa Central master mechanic at Marshalltown, Iowa.

Mr. F. D. Wynne, who has been chief clerk and secretary to Mr. Fairfax Harrison, former vice-president of the Southern, now president of the Chicago, Indianapolis & Louisville, has been appointed purchasing agent of the Southern. Mr. H. B. Spencer takes the office on the Southern vacated by Mr. Harrison.

The following officers of the Chesapeake & Ohio have had their authority extended over the Chesapeake & Ohio of Indiana: Mr. J. F. Walsh, general superintendent of motive power; Mr. T. M. Ramsdell, master car builder; Mr. Charles Stephens, signal engineer, and Mr. J. M. Staten, general inspector of bridges, all with offices at Richmond, Va.

Mr. Lucius Tuttle has resigned the presidency of the Boston & Maine Railroad. Mr. Charles S. Mellen, president of the New York, New Haven & Hartford Railroad, succeeds him. The retirement from office of the man who for seventeen years had been at the head of the great railway system of northern New England took place at the regular monthly meeting of the board of directors of the Boston & Maine. Mr. Tuttle retires because of ill health and because he also believes the New Haven company should assume the direct responsibility of the administration of the Boston & Maine.

Mr. Thomas Fraser has been appointed traveling engineer on the St. Louis Southwestern system, with headquarters at Tyler, Tex., vice Mr. J. C. Brown, resigned. Mr. Fraser is a Canadian by birth, and hails from the Capital City of the Dominion. The general opinion of Mr. Fraser was aptly put by a brother member of his lodge. "There is not a better man in the world than Tom Fraser. We of the B. & L. E. are proud of him. We know he will make good. He has never failed yet, and the Cotton Belt is fortunate in securing his services. Of course we are honored by having a man who merits the position."

Mr Charles H Hogan has been appointed assistant superintendent of motive power of the New York Central at Albany to succeed Mr. D. R. McBain, who has gone to the Lake Shore. Mr. Hogan has for a number of years been division superintendent of motive power at Depew and previously was master mechanic of the shops there. He has come up from the foot plate, having gained prominence years ago for the courage and capacity with which he has made fast runs on the Empire State Express with engine 999. He is noted for his modest, thoughtful mind and practical ideas, and his promotion has been one of the most popular on the road.

The committee of the New York Railway Club appointed at the first meeting of the season to nominate candidates for officers for the ensuing year, presented the following ticket: For president, Mr. H. S. Hayward, superintendent of motive power of the Pennsylvania, Jersey City; for vice-presidents, Mr. Frank Hedley, vice-president and general manager of the Interborough Rapid Transit; Mr. W. J. Harahan, assistant to the president of the Erie; Mr. E. Chamberlin, chairman freight car repair pool of the New York Central Lines; for executive member, Mr. George Wildin, mechanical superintendent of the New Haven; for member of Finance Committee, Mr. Charles Shults.

Mr. Edward H. Barnes, of Atlanta, Ga., has been appointed representative of the Southern district for S. F. Bowser & Co., Inc., manufacturers of oil storage systems, Ft. Wayne, Ind. Mr. Barnes has been in the railroad supply business for many years, and was recently associated with the Bass Foundry and Machine Co., Ft. Wayne, Ind. While in their employ he looked after their railroad interests, and is well known to a large circle of supply men and railroad officials. Previous to his engagement in this line he was for many years employed in the operating department of the Southern Railway. He is a man of broad experience in railroad work, and his many friends will undoubtedly be interested in his success with the Bowser Company.

Obituary.

Mr. Charles Talbot Porter, honorary member of the American Society of Mechanical Engineers, died on Aug. 28 at his home in Montclair, N. J., at the age of 81. Mr. Porter was the recipient last year of the John Fritz medal for his work in advancing the knowledge of steam engineering and in improvements in engine construction. Among his many claims to distinction in his profession, it was said that he was the first to recognize the advantages to be derived from making a crank shaft rotate at high speed whereby the weight of the motor per horse-power is reduced. It is from the development of this thought that we have the modern design of motor for self-propelled vehicles and for the aeroplane. Mr. Porter was born in 1829 and has been out of active professional work since 1890. In 1867 he installed the only high speed engine exhibited at the French Exhibition.

It is with feelings of sorrow that we are called upon to chronicle the death of E. M. Roberts, of Ashland, Ky. He was a railroad man of many years' standing. Mr. Roberts was born in Wales and was descended from an old New England family. He enjoyed the ordinary advantages of education and early developed the marked mechanical tastes and talents which distinguished his business career. He came to this country with his parents when a lad, and almost from youth up he has been employed with the various railroads. He was for many years master mechanic and superintendent of the Ashland Coal and Iron Railway and also master mechanic and superintendent of motive power of E. T. & Va. Railroad at Atlanta, Ga., and more recently he was superintendent of South Carolina Railroad at Charleston, S. C.

G. J. De Vilbiss, superintendent of motive power of the Hocking Valley Railway, Laurence C. Engler, road foreman of engines, and George Milbourne, engineer, were killed in the wreck of passenger train No. 33, north bound, on that road near Lemoyne, about eleven miles south of Toledo, on Sept. 12.

Blacksmiths' Convention.

The eighteenth annual convention of the International Railroad Master Blacksmiths' Association was held in Detroit, Mich.,last August with President George W. Kelley in the chair, and with a very large number of members in attendance. Papers on tools were read and also the making of formers; frame welding, the oxy-acetylene welding process, spring making. casehardening and several other subjects, all of which were fully discussed.

At the close of the session the following officers were elected for the ensuing year: Messrs. John Conners, A. & W. P. R. R., Montgomery, Ala., president; F. F. Hoeffle, L. & N. R. R., Louisville, Ky., first vice-president; J. T. McSweeney, B. & O. R. R., Baltimore, Md., second vice-president; A. L. Woodworth, C. H. & D. R. R., Lima, Ohio, secretary and treasurer, and G. H. Williams, Boston, Mass.

The next place of meeting will be at Toledo, Boston or Denver.

Railroad Testing Department.

The New York Railroad Club opened its fall and winter season by listening to a paper on the "Testing Department of a Railroad Company," by Mr. H. S. Hinckley, engineer of tests on the New York, New Haven & Hartford Railroad. The paper dealt with the testing department, the establishment and maintenance of which, he said, in itself showed that money can be saved by maintaining such a department. It was only recently that this department had been considered of any value to secure possible economy of operation. Today a live railroad without such a department is a rarity. Primarily, it works hand in hand with the purchasing department, and in this connection he said:

"The basis of all the work of an analytical and testing laboratory is the preparation of the specifications for the material. In this class of work it is of the utmost importance for the buyer to bear in mind that nothing should be embodied in the specifications that will tend to increase the cost to an amount over a price at which a satisfactory grade can be bought in the open market. There are many manuufacturers and contractors by whom the word 'specification' is uttered with a feeling of irony. They consider specifications unnecessary, discriminating, and very frequently unfair. The engineering profession alone is responsible for this feeling, for the reason that so many specifications have been prepared without proper regard for the interests of the manufacturer or contractor, and are intended to conserve only the interests of the buyers."

Admitting that many classes of material are bought more economically on a guarantee basis, the speaker said he was unable to see its value "if it is everybody's business to see that the guarantee is fulfilled." Citing as instances rubber goods and paints as among supplies that may be so bought. Mr. Hinckley said that in the manufacture of these materials "there are perhaps secret tricks of the trade which give to a particular brand its own characteristic, and a chemist may never be able to reveal just what treatment is given outside of mixing together various quantities of the separate ingredients which he is able to discover.

"Testing departments on the railroads of this country are small compared to what they should be. He believed that the department should be independent of mechanical or engineering departments, for the best results are secured only by giving freedom to the department of tests.

"The department should show up defective material, not only at the factory and mill, but after the material has reached its destination and been applied in service. The department should follow up the service of material and apparatus applied to locomotives and cars, or bridges and buildings. It should be free to state plainly wherein one device or another was not economical, although possibly that device might be in the opinion of the motive power department or the chief engineer, the best for the purpose."

Mr. Hinckley urged as a measure of economy that testing departments should be given full charge of the fuel supply of railroads, the inspection of bridge material, new equipment, etc., owing to the many advantages and benefits which he thought might be so obtained. He also stated that a testing department with its laboratory records can prevent lawsuits.

C. & O. Shops at Huntington, W. Va.

By L. W. Householder.

The Chesapeake & Ohio Railroad Co. have recently changed their shops at Huntington, W. Va., from line shaft, driven by reciprocating engines to electric drive, thereby availing themselves of the greater flexibility and efficiency of the electric drive in addition to effecting a saving in space and in operating expenses. The shops were formerly operated from four independent stations equipped with locomotive boilers and reciprocating engines belted to line shafts in the different shops and also to one TH arc machine which supplied power to a few open arc lamps about the shops and roundhouse.

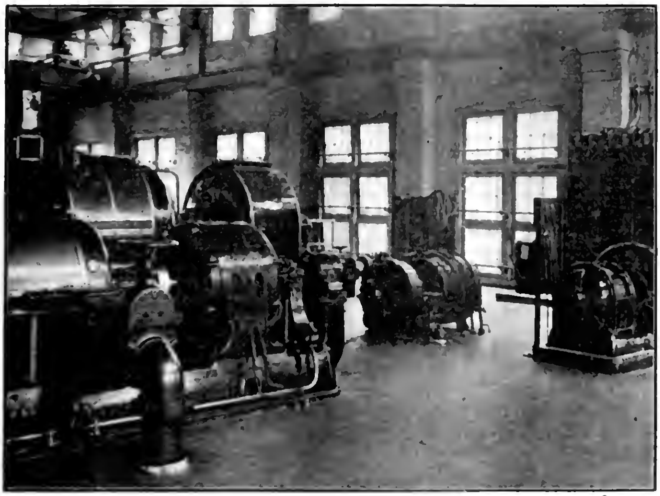
The new powerhouse is an all-turbine station, the only reciprocating machinery besides the boiler feed pumps being 2 two-stage air compressors. These supply compressed air at 100 lbs. pressure for the pneumatic drills, hammers and hoists about the shops.

The turbine equipment consists of 1 two-bearing, overhung, non-condensing turbine, speed 3,600 r. p. m., connected to a 25-kw., 125-volt direct-connected exciter; 1 four-bearing, three-unit, 100-kw set, consisting of 1 non condensing turbine, speed 3,600 r. p. m., 1 three-phase, 60-cycle, 480-volt, 100-kw generator and 1 four-kw., 125-volt, direct-connected exciter; 1 three-bearing, four-stage condensing turbine, speed 1,800 r. p. m., connected to a 750-kw., three-phase, 60-cycle generator. All of these turbines are equipped with oil pumps geared direct to the main shaft of the turbine, and the bearings are fitted with oil rings. The 750-kw. and 100-kw turbines are equipped with cross head mechanical valve gear, driven direct from the main turbine shaft. The 750-kw. turbine is connected to a Westinghouse-Le Blanc jet condenser and the circulating and rotary air pumps which are driven by a 75-h. p. induction motor. The injection water is cooled by a natural draft-cooling tower. This arrangement maintains a vacuum of 27 to 28 ins.

The boiler equipment consists of five 275 h. p. water-tube boilers which are equipped with shaking grates and are hand fired. Ashes are shoveled from the ash pits into cars and conveyed to a dump. The smoke-stack is reinforced concrete, 200 ft. high, and is provided with a damper regulator. Bituminous coal is used and it is delivered in railroad cars on a trestle just outside of the boiler-room and is dumped into coal bunkers and conveyed through chutes to a point within easy reach of the fireman. The condensing and boiler feed water is supplied from a pumping station outside of the shops. The feed water is pumped from an open feed-water heater to the boilers by two duplex pumps. The piping is so arranged that the feed water may be pumped direct from the hot well of the cooling tower. The engine-room is spanned by a 7½-ton hand crane.

The switchboard is a standard General Electric board, consisting of eight dull finished slate panels, two machine panels, two exciter panels, four three circuit feeder panels and one half panel on which a voltage regulator is mounted. The instruments are of the General Electric standard switchboard type.

About 1,000 h. p. of General Electric induction motors are distributed throughout the planing mill, tin shops, pipe shops, machine shop, boiler shop and roundhouse, ranging from 15 to 100 h. p. each. These are used to drive the different tools, such



VIEW OF POWER PLANT, C. & O. SHOPS, HUNTINGTON, W. VA.

as band saws, wood planer, lathes, circle saws, drill presses, boring mills, shapers, metal puncher and rolls. Most of the motors are belt driven. The large planers, turning lathes, drill presses and boring mills are equipped with individual motor drive. The planing mill is equipped with a sawdust and shaving eliminator driven by a 100-h. p. induction motor which conveys the shavings through tubes into the furnace under the boilers. The station for charging storage batteries for signals and passenger coaches is equipped with a motor generator set. The dismantling shop is spanned by a 120-ton, four-hook electric crane, and equipped with four variable speed induction motors of the slip-ring type.

The buildings are heated by the exhaust steam from the two air compressors, boiler-feed pumps, 25-kw. and 100-kw. turbines, and the condensation from the system is pumped into the boiler feedwater heater. This arrangement puts a back pressure on the exhaust header of from 4 to 8 lbs.

The changes made in this plant brought about a considerable saving in coal, due to the lower steam consumption and in part by the obliteration of large shafting and belting losses. A saving in the labor required to operate the plant was also effected. This was due partly to improved methods of handling coal and ash and partly to the few men required to operate a turbine station. Besides the saving in coal and labor, this change has increased the capacity of the shops.

During the month of April the shops turned out 34 locomotives, this being the largest number ever repaired in one month. The electric drive has also increased what may be called the flexibility of the shops, any section can be operated independently of the rest. There is power all the time and the shops are better lighted so workmen can work at night with greater satisfaction.

Saunders' Sons' Catalogue.

We have received an illustrated and descriptive catalogue from D. Saunders' Sons, Inc., of Yonkers, N. Y. This well-known firm make special machines for pipe mills, tapping and drilling machines, hand stocks and dies for pipe taps, reamers tongs, hand pipe cutters, pipe vises, etc., for steam fitters' use.

In presenting this catalogue and price list the manufacturers say that they desire to call attention of the public to the fact their machines for working wrought iron and steel pipe are made from carefuly-studied designs which are fully able to stand up to the exacting conditions of modern railroad shop work as well as in other establishments where this sort of work is done.

The catalogue contains 130 pages, has a good index, and the illustrations and letter press describing the various tools is full and clear and free from intricate technicalities. The variety of tools made by this firm is very extensive and there is not an operation connected with the threading and jointing of pipes which has not been "covered" by the Saunders' machines. Write to them direct at Atherton street, Yonkers, N. Y., if you would like to have their comprehensive catalogue and price list, and they will send you one free of charge.

Heroic Engineer.

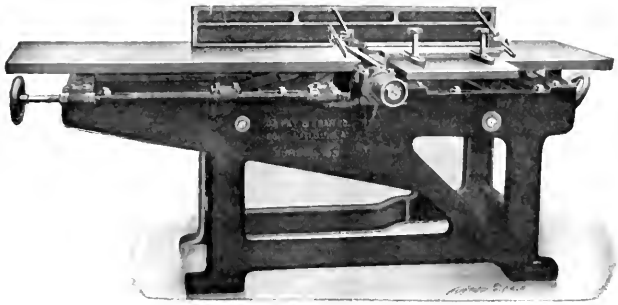
Engineer Frank Stewart, of the Colorado Midland, is a hero. Bandits attempted to rob the train that Frank was pulling and he inflicted a fatal wound on the chief robber by means of a rock aimed with deadly accuracy. It was a primitive sort of weapon, but it did not miss fire and its effect relieved a crowd of passengers and the trainmen from brutal treatment at the hands of violent ruffians. Long may Frank follow the peaceful calling to which he is a credit, and may he never again be called upon to display his valor on train robbers.

Wireless Telephoning in England.

Wireless telephoning from a moving train was accomplished on Tuesday-week for the first time with complete success on a stretch of railway line four miles in length between Horley and Three Bridges, on the Brighton Railway. Mr. Henry von Kramer, the inventor, who conducted the experiment, is an electrical engineer, trained at Munich, and now engaged in business at Birmingham. For four years he has been working out the system in his private workshop. For the purpose of the experiment a double line of wire was laid along the sleepers between Horley and Three Bridges. One telephone apparatus was placed in the brake-van of the 2:03 p. m. train from London Bridge, the other was in the signal box at Three Bridges. As the train entered the circuit at Horley, Mr. von Kramer placed the receivers to his ears and conversation took place while the train was running at forty miles an hour. A railway official then took the telephone, and, talking to an inspector at Three Bridges, asked him to repeat the message. This was satisfactorily done. And the inventor then had another succesful conversation. The fact which distinguishes Mr. von Kramer's system from any other previously tried in England or America is that there is no contact by brush between the moving train and the stationary wires. The electric impulses travel between the "bridge" on the carriage and ground wires through an open-air space of eighteen inches.—*English Mechanic and World of Science.*

Pattern Shop Tool.

On this page we illustrate J. A. Fay & Egan Co.'s No. 195 hand planer and jointer, which will be found a most serviceable tool for pattern work in car shops. This machine is said to accomplish perfectly any work to which it may be applied in the pattern shop, such as planing straight or out of wind, cornering, chamfering, beading, grooving, rabbeting, gaining and making plain, convex and concave glue joints. The hand wheel at the left end of the machine is an attachment for "angling" the front table to give the desired draft on pattern work, and this is a feature which appeals strongly to pattern makers.



NO. 195 HAND PLANER AND JOINER.

The machine is made in three sizes, 20, 24 and 30-in widths. The tables are planed and perfectly finished, giving a large true surface to properly guide whatever material is being worked. They are each vertically adjustable on four inclines, each of which has an independent adjustment for aligning the tables. A ratchet lever is also provided whereby both tables can be quickly drawn away from the head, giving an opening of 7 ins. An extending arm is attached to the front table to support material when being rabbeted. The fence can be adjusted to any point across the width of the table and set to any angle from vertical to 45 degs., and it can be securely locked when set. The column is substantially made, and is well proportioned. It is cast in one piece, the journal bearings being embodied in this casting. For further information regarding this machine, you are invited by the manufacturers to write for large illustrated circular. The address of the manufacturers is Cincinnati, Ohio.

Celebration at Vienna Works.

The Locomotive Works at Vienna, known as the Actien-Gesellschaft der Locomotiv Fabrik in Wiener Neustadt have just celebrated the completion of their 5,000th locomotive. In connection with the celebration a souvenir catalogue of 60 pages has been issued, containing fine illustrations of the various types of locomotives constructed at the works, beginning with the locomotives built by Mr. L. W. Gunther in 1842. This locomotive has a very strong resemblance to Stephenson's "Rocket," but the departure to a particularly different type is soon manifested, and various forms of locomotives appear equipped with the Walschaerts valve gear about 1870. Some of these appear with massive eccentrics outside of the driving wheels. The latest variety shows locomotives equipped with double boilers or a steam receptacle set over the usual form of boiler. A fine view of the works shows that they are situated in an admirable locality in the open country.

Graphite Lubrication.

The Joseph Dixon Crucible Company of Jersey City sends us the following item as of probable interest to our readers: "A certain manufacturer had an order for a machine that included three hollow gun-metal rollers, one weighing 1,386 lbs., the other two weighing 752 lbs. apiece. These rollers are heated by gas to a temperature of about 700 degs., and it was found that any oil or grease would bake and cut the journals in a very short time. In this predicament is was suggested that the builders of this machine use graphite on the rollers. This was done and a suggestion was made for the use of Dixon's Flake Graphite, and some months later the makers wrote the Dixon Company:

"The method of applying the graphite to the journals is very simple, the channels for conveying the lubricant to the journals are cut in the boxes about $\frac{3}{8}$ in. wide and $\frac{1}{4}$ in. deep, one on top and one at a little above and on each quarter. Besides this, a spiral groove of the same dimensions is cut for about two turns, commencing at about 1 in. from the other end of the box and near the bottom. These grooves are half round in section. Into the top straight groove, a ½-in. pipe hole is drilled and tapped, a piece of ½-in. pipe screwed into this with a reducing socket on the top end to 1¼-in. pipe, a 1¼-in. nipple with a 1¼-in. cap complete the cup. A piece of 3/16-in. round steel with one end on the journal and the other end up near the top of the cup. The journals take about a dessert spoonful of graphite every day to each journal, the machine attendant occasionally removing the cap from the cup, churning down a little of the graphite with the 3/16-in. rod."

McKeen Motor Car.

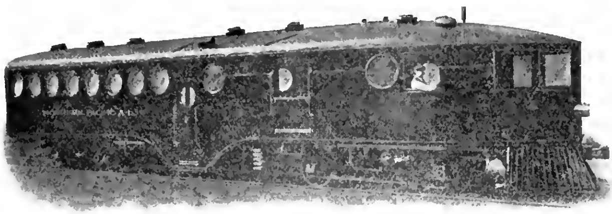
The Pennsylvania Railroad have just received one of the gasoline McKeen motor cars, built at Omaha by a company which the late E. H. Harriman caused to be organized. This car is of steel, accommodates 70 passengers, weighs 34 tons and is capable of making 60 miles an hour. It will be operated on some one of the company's minor divisions. One of the same kind of cars has been running on the Smyrna division.

The McKeen gasoline motor car was designed for steam branch line and interurban railroad service. It is also being used with success as an adjunct to steam lines, feeders and interurban steam roads belonging to the Union Pacific Railroad.

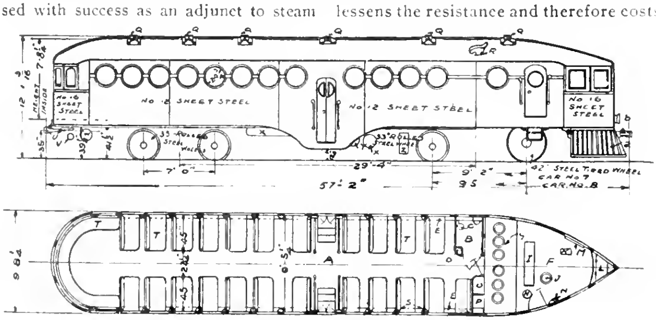
The exterior lines of the design are somewhat similar to an inverted boat, the car having a wedge-shaped front end and semi-circular rear end, with semi-elliptic roof and round windows, which resemble port holes. The car is an all-steel structure on two four-wheel trucks. The side entrance is also a distinguishing feature.

The standard car is 55 ft. long, of which the engine room and operator's compartment occupies 12 ft. at the front end, thus leaving about 42 ft. for passengers. This has a total seating capacity for seventy-five persons. The seats have built-up veneered wood frames, upholstered in leather, and will accommodate three persons each. The semi-circular seat at the rear of the car has a seating capacity of ten persons. The standard 55-foot car is equipped with a 6-cylinder 200 h. p. gasoline engine, which readily developed 250 h. p. at four hundred revolutions per minute on water brake test. The engine is mounted on the front truck and is independent of the car body, which relieves the latter of vibration.

By numerous tests it has been proved that the wedge-shaped car surpasses the square or rounded end car in that it lessens the resistance and therefore costs less to operate. In fact, by accurate data obtained from a test, it was shown that it takes 40 per cent. more gasoline to run a car with blunt front end, at high speeds. The McKeen motor car is quite similar to a racing yacht. In proof of the efficacy of the wedge-shaped front end the McKeen Company say that in a drifting test made with Motor Car No. 18 on a 6-



THE McKEEN MOTOR CAR ON THE NORTHERN PACIFIC.



ELEVATION AND PLAN OF THE McKEEN MOTOR CAR.

service out of main terminals. The first motor car was completed in March, 1905, under the direction of Mr. W. R. McKeen, Jr., then superintendent of motive power of the Union Pacific Railroad. The conception of the gasoline railway motor cars had its origin in the desirability of a light, economical, and, at the same time, reliable means of transportation for branch mile gradient and where all conditions were equal, the car with the wedge-shaped end started at the top of the hill at a speed of forty miles per hour, and at the bottom of the hill had developed a speed of fifty miles per hour, making the trip in nine minutes. The car with the blunt end started at the top of the hill at the same speed, but it was necessary to clutch in the engine and use power 1⅛ miles from the station, and it took thirteen minutes to make the same distance.

The round window used in this car is air-tight, water-tight and dust-proof; the window sash is made of aluminum, hinged at the top, and when not in use can be swung overhead, giving a full opening. The chief advantage of the round windows is the gain in strength and safety of the car framing, as it permits the utilization of the car side as a combination plate and trussed girder. The side entrance is an innovation in car structure, which adds to the comfort of the traveling public. It permits a stronger car frame, does away with the accumulation of ice and snow on the car steps and there is no longer any need of the step-box. In a rear-end collision the side entrance opens a way of escape for passengers, which is not possible with the end vestibuled car. It also aids handling of passengers, for it allows them to enter and distribute both ways through the car. The upper deck and old style sash ventilators in the clear-story have been dispensed with and adequate ventilation is secured by means of roof ventilators, which exhaust the air by suction from the inside of the car, fresh air being taken in from the top of the car in front and delivered to interior of car at the floor line. A complete change of air can be secured every four minutes.

Horizontal Cylinder Borers.

The Barrett Machine Tool Company of Meadville, Pa., have issued a very comprehensive catalogue showing the various forms and styles of the horizontal cylinder boring machines manufactured by them. The catalogue is well illustrated, having a series of excellent half-tones with the descriptive letter press concerning each, on the same page. There are twenty-four of these tools shown, some motor driven and others with the ordinary belt drive. The range and variety of the work done by the Barrett boring machines is truly remarkable, and the list of railroad and other users of these tools, given at the back of the catalogue, shows how extensively the company's product is known. Write direct to the makers if you would like to get a copy.

To strive at all, involves a victory over sloth, inertness and indifference.—*Dickens.*

Superheated Steam.

Superheated steam is generated by the addition of heat to saturated steam which is constantly at the dew point ready to revert into water. The behavior of superheated steam is similar to that of gases; it is a very bad conductor of heat, and has the special peculiarity of being able to lose a certain amount of heat without becoming saturated or wet steam. The thermal capacity of steam is only 0.48, therefore very little heat is required to superheat steam; but as the steam loses its heat as quickly as it acquires it, every passage conveying superheated steam must be well covered with non-conducting material. This, of course, does not apply to pipes located in a smoke box or other place where the surrounding heat is greater than that of the steam.

Although there is some loss when using superheated steam on account of heat radiation, it is very much smaller because the loss of heat from superheated steam has lower calorific value than the latent heat of saturated steam.

New J.-M. Officers.

Owing to the increase of business in the vicinity of Atlanta, Ga., and Rochester, N. Y., the H. W. Johns-Manville Co., of New York, have recently opened a new office in each of these cities. The Atlanta office is located in the Empire Building, in charge of Mr. W. F. Johns, who has been traveling that territory for the company for a number of years, and the Rochester office is located at 725 Chamber of Commerce, in charge of Mr. H. P. Domine, formerly with the Buffalo Branch of the company.

The "P.C." Brake Equipment.

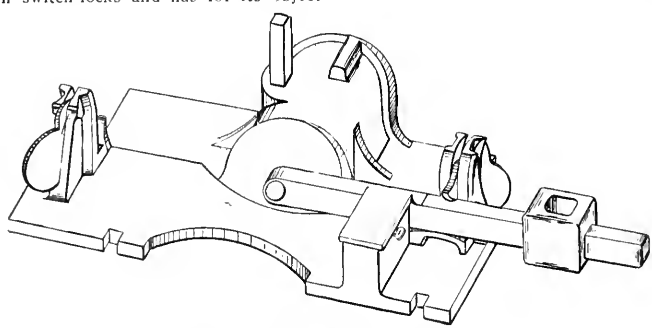
The Westinghouse Air Brake Company, of Pittsburgh, Pa., have issued a pamphlet explanatory of their "P.C." or passenger control brake equipment for use on heavy passenger cars, etc. The company points out that the advent of all steel coaches, dining, sleeping, observation and private cars of extreme weight, and the attempt to brake these cars as previously done at once revealed some new conditions. The braking power of the latest single cylinder 18 ins. was inadequate even when multiplied by a leverage of 9 to 1, the maximum permissible with the standard equipment. To use a larger brake cylinder was not only impracticable for simple reasons pertaining to manufacture, but undesirable because involving concentration of excessive weight and very heavy braking effort at one point beneath the car.

The "PC" passenger control equipment marks the latest development in the art of braking heavy passenger trains. This equipment differs from the standard passenger brake in that two brake cylinders are employed, one for service and both for emergency, multiplied through the same leverage system. A "passenger control" valve, identical for all weights and classes of passenger cars, performs automatically the functions of the triple valve, and, in addition, provides other new and substantial features of value. The usual details, which always go with passenger brakes, complete the equipment.

This new apparatus was designed fundamentally to provide an adequate brake for the heaviest passenger cars now operated or which may be built. At the present time car weights have exceeded the capacity of the latest single cylinder arrangement, and the "PC" equipment not only obviates the necessity of applying two single cylinder schedules per car, but has been made to correct certain factors and conditions inherent with the standard brake design and which tend to reduce brake efficiency to an important degree, when applied to heavy cars.

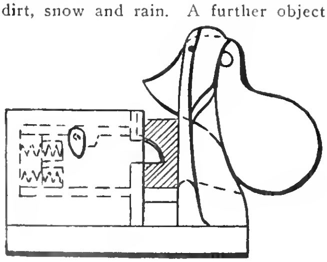
Automatic Switch-Locks.

This device relates to improvements in switch-locks and has for its object



SCHROYER'S AUTOMATIC SWITCH LOCK.

to provide means whereby a switch may be easily operated and locked, and to provide a guard which is connected to and operated with the switch lever and which is adapted to fit over the locks to protect them from dust, dirt, snow and rain. A further object



DETAILS OF THE LOCK.

is to make a switch-lock in which the parts may be easily removed and new ones substituted in case of breakage, all parts being extremely simple and durable.

Briefly described, the device consists of a suitable base with the lock arranged to engage with and lock the switch lever in the closed position. A cover is connected to the switch lever and moved with it. The cover fits over the lock when the switch is closed and fully protects it from dust, dirt, etc. A keeper is provided for locking the lever in the closed position in case the lock proper is broken. This keeper assists in holding the lever in the closed position. The perspective view shows the automatic switch-lock with the Odenkirk switch-stand and lever in the closed position. The end view shows the lock as it is in the inside of the case. This lock is so arranged that it will work with the New Century, the Automatic, or the Odenkirk switch-stands.

Hanna Stokers for the Q. & C.

The Cincinnati, New Orleans and Texas Pacific, more commonly called the Queen and Crescent Route, of which Mr. J. P. McCuen is superintendent of motive power, have recently placed an order for twelve antomatic stokers of Hanna type. These will shortly be installed and later some valuable information will be forthcoming as to their performance, which will, no doubt, very materially aid the standing committee of the Master Mechanics' Association, which has the matter of mechanical stokers in charge.

Descriptive Pamphlet.

The Pennsylvania Railroad Station in New York, it is announced in an official pamphlet distributed by the company, has been finished. "The New York Improvement and Tunnel Extension of the Pennsylvania Railroad" is the title of the official booklet. It contains 23 photographs illustrating both the interior and the exterior of the station at Seventh avenue and 33d street, as well as views of the tunnels, the interior of one of the tubes, the approaches thereto and a picture of the "Pennsylvania Type" electric locomotive. The company's pamphlet contains

the history of the work. This history is inscribed on two tablets which have been placed on the sides of the main entrance of the station on Seventh avenue. At the head of the stairway leading from the arcade to the general waiting room there stands the statue of the late A. J. Cassatt, who was the president of the company at the time when the whole tunnel scheme was worked out. He was, as the pamphlet says, the dominant personality in the Pennsylvania Railroad tunnel and station project.

Large Interlocking Plant.

It is stated that the Indiana railroad commission has approved plans and specifications for a very extensive interlocking system of signals. The structure is to be erected on the Indiana-Illinois state line, and will be used by a number of railroads, including the Michigan Central, Chicago Terminal, Chicago Junction, Kensington & Eastern, Erie, Monon, Nickel Plate, Indiana Harbor Belt, and the Wabash.

Office and Store Moved.

The L. S. Starrett Company, of Athol, Mass., announce that their Chicago store is now permanently located in new and larger quarters at No. 17 North Jefferson Street. Their friends are cordially invited to call and inspect the complete stock of fine mechanical tools made by them and also to see the much better facilities which have been provided for giving the trade prompt and efficient service.

A New Light Alloy.

A new metallic alloy which appears to combine strength and lightness in a remarkable degree has been invented in Germany. It has been named Ruebel bronze, after its inventor. The main ingredient is magnesium, to which certain proportions of zinc, copper and aluminum are added. Reubel bronze is a fine-grained, homogeneous alloy of considerable strength and low specific gravity. This combined strength and lightness should make it a valuable material in the construction of airships and aeroplanes. It has been calculated that if the metal work of the Zeppelin airship had been of Ruebel bronze it would have weighed $3\frac{1}{2}$ or 4 tons less.

Moving Pictures on Moving Trains.

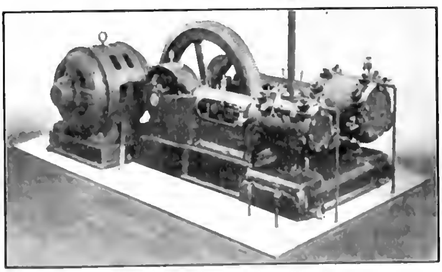
It is said that in the near future the Canadian Pacific will give consideration to the use of moving pictures in a special theater car on its trans-continental train in the prairie provinces and in British Columbia.

It is intended that these pictures shall serve a double purpose. Travelers will be shown world famous scenery through which they are passing, but cannot see during the night, and at the same time the C. P. R. and the Dominion of Canada will be given a big advertisement.

It is also intended that the pictures shall be reproduced in the principle centers of Great Britain and the United States, as well as other countries, illustrating the daylight rides in particular and showing Canada's greatness. The proposition was made by the Edison company, which has had a kinetograph out on the road since last June getting the necessary pictures.

Motor-Driven Air Compressor.

A good example of the simplicity, convenience and efficiency of electric motor drive, is the application shown in our illustration. It is a 50 h. p. alternating current Westinghouse type, "MS" mill motor, direct connected to a two-stage air compressor. The compressor has a 14-in. low pressure, and a 9-in. high pressure air cylinder; an 11-in. stroke and is fitted with a mechanical valve. This valve, which is connected with the high pressure cylinder by means of a ¼-in. pipe, stops the compression when the air has reached a pressure of 85 lbs. The air is used in operating the interlocking switches in the yards of the Union Railroad, near Bessemer, Pa.; the riveters, drills, etc., used on the repair tracks, and for testing the air brakes on the cars. The compressor runs twenty-four hours every day; during this time the switches are in operation continuously, and the repair men work ten hours a day. During the summer time, box cars are painted with a pneumatic sprayer. It takes fifteen minutes to paint a car by this method. The Westinghouse motor runs at 725 r. p. m. on a three phase, 25 cycle, 440 volt alternating current. The compressor runs at 175 r. p. m. We are informed by the makers that Mr. A. F. Coulter, general foreman of the Union Railroad, has stated that the equipment has been in continuous operation for six months with no more attention than an occasional cleaning and oiling.



MOTOR DRIVEN AIR COMPRESSOR.

Fast Time on the P. R. R.

Locomotive No. 732, a new type of the Pennsylvania, designed to reduce running time of express trains between Camden and Atlantic City to 50 minutes, recently covered 4½ miles in 2½ minutes between Egg Harbor and Abescon, a rate of 108 miles an hour. The train it hauled was made up of twelve heavy steel cars. The new engine appears to be bearing out the claims of traffic managers that the 57 miles from Camden to the shore, can be made in 50 minutes instead of 56 minutes in perfect safety.. When the 50-minute schedule goes into effect the train will run at 69¼ miles an hour.

Rotary Snow Plows.

With the fall season the railroad man's thoughts turn to the approach of winter and in order to guide these thoughts in the right direction the American Locomotive Company have issued Bulletin No. 1005 which deals with the rotary snow plows as manufactured by them. The bulletin is well illustrated, showing the snow plow in detail with and without its covering, also the details of the flanges, of the plow itself and the form, with cylinders, boilers, carriers, etc. Many of the illustrations show the rotary hard at work in deep snow and the letterpress gives a great deal of information about the work of these plows on various roads.

The American Locomotive Company will be happy to send this bulletin to anybody who is desirous of obtaining information concerning the best method of keeping a railroad open during the severe winter.

Westinghouse Publication No. 9015.

The title of this bulletin is "Brake Operation and Manipulation in General Freight Service," and is by Mr. W. V. Turner, chief engineer of the Westinghouse Air Brake Company. Portions of this paper were read and discussed at the second session of the Air Brake convention. The Westinghouse Company have issued the paper in question, it having been presented originally before the Western Railway Club in Chicago on Sept. 21, 1909. It is not only a very interesting paper, but it is instructive in its review of some of the causes and conditions which produce shocks and break-in-twos.

Railroad Unions Urge a Raise in Rates.

A mass meeting of representatives of four of the leading brotherhoods of railway men employed on roads running to New York met in the Amsterdam Opera House on Sept. 25, and adopted resolutions urging the Interstate Commerce Commission to increase freight rates.

Over 3,000 delegates were present and the proceedings were of the most enthusiastic kind. Grand Chief Warren S. Stone, of the Brotherhood of Locomotive Engineers, delivered an able address on "Self Preservation," and in the course of his remarks insisted that the proper place to settle questions affecting labor was at the ballot box. Whatever the political affiliations of the delegates might be, they should not let party lines blind them to their true interests. Mr. Stone stated that the movement was not in any sense a political one. A series of questions will be prepared and presented to candidates for office so that their position will be clearly defined. Mr. Stone presented some startling figures in regard to the methods of middle men and retail merchants generally, placing the cause of high prices on many commodities on freight rates. Such statements were grossly misleading, the freight rates in America being the lowest in the world, and the the need of an increase a justifiable necessity.

Mr. Denis McCarthy, a retired locomotive engineer, from Providence, R. I., ably supplemented Mr. Stone's address, and from a lengthy experience gave many illustrations of the decrease of the purchasing power of money. Mr. McCarthy pointed out very clearly that much of our economical and industrial troubles were not owing so much to high prices as to low wages and the unequal distribution of the burdens of labor.

Mr. A. R. Garretson, president of the Conductors, stated that if it is reasonably shown in the hearing before the Interstate Commerce Commission that the railroads cannot earn returns on the present value of their property, so as to give good service, equal with safety appliances, and pay proper wages, they should be allowed to put into effect such increases as would meet these necessities.

The resolution will be presented to President Taft, the Interstate Commerce Commission, and all railroad and law making bodies, embodying the statement that 350,000 railway men, represented at the meeting, propose to continue to insist from their employers higher wages, more favorable working conditions, shorter hours and adequate compensation for their membership injured or killed in the service, and that they are not unmindful of the fact that in order to secure their benefits the employers must be accorded sufficient earning power to meet these demands. The investor has the right to protection and consideration as well as the employee.

The committee will proceed to Washington at an early date and present the memorial to the proper authorities.

Life, with all its pains and pleasures, is largely what we make it by our thought. —*Dresser.*

In learning true knowledge we also learn our own ignorance, and the vastness, the complexity and the mystery of nature. —*Kingsley.*

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances

Vol. XXIII. 114 Liberty Street, New York, November, 1910. No. 11

The St. Gothard Railway.

Forming a connecting link for the railways of Western Germany, Northern and Eastern France, and through them for the immense volume of travel from the United States and England, with the lines of Italy and the South, and traversing a region of unsurpassed

TRAIN DE LUXE LEAVING THE ST. GOTHARD TUNNEL

beauty and grandeur, is the Gothardbahn. The use of the St. Gothard Pass for communication between Switzerland and Italy dates from the thirteenth century when Albert von Stade, a monk, published an account that it was possible to reach Lucerne from Bellinzona in three days. An earlier knowledge of the route doubtless existed, but records are not available. In 1820 the Swiss Federal Government constructed a postroad over the pass and this was followed by the St. Gothard Railway. The latter great work was commenced in 1872 and completed in 1882. The great tunnel from Goschenen on the Swiss side to Airolo on the Italian side is in itself a gigantic achievement, being 9¼ miles long. Mr. Louis Favre, the engineer, unfortunately never witnessed the completion of the tunnel. Death overtook him while inspecting its progress.

Leaving the handsome central station at Lucerne, the northern terminus of the railway, at an elevation of 1,437 ft. above sea level, the line runs round the town partly in tunnel, touches the lake side and makes a long detour to avoid the well-known Rigi, then following the shore of Lake Zug it reaches Goldau, from whence a gradual ascent with grades of 1 in 100 brings it to Erstfeld, a village beautifully situated among grand Alpine scenery, 38 miles from Lucerne.

At Erstfeld the mountain climb begins, the train entering the wild and narrow gorge along which rushes the foaming river Reuss. This torrent is crossed and recrossed several times by the road and it rapidly ascends the mountains over grades of 1 in 38 and

1 in 40. Tunnels are here close together; 21 in all are passed through before Goschenen is reached, including some wonderful spirals wherein the train makes complete circles or portions of turns within the rugged mountain side. At Wassen the line winds round loops to get a gradual ascent, and three lengths of the same railway are in view at the same time, one below the other. At Goschenen all trains stop, the lamps are lighted in the cars, and preparations made on the locomotives for the long run through the great tunnel under the St. Gothard Pass and the Kastelhorn, which rises 6,076 ft. above the center.

TWO LEVELS NEAR WANEN.

The grade of the tunnel ascends at 1 in 172 for about two-thirds of its length and southward, after which it descends at 1 in 500 to the Airolo entrance, 3,754 ft. above sea level. The tunnel is double tracked throughout and has lamps burning day and night, placed at regular intervals and numbered.

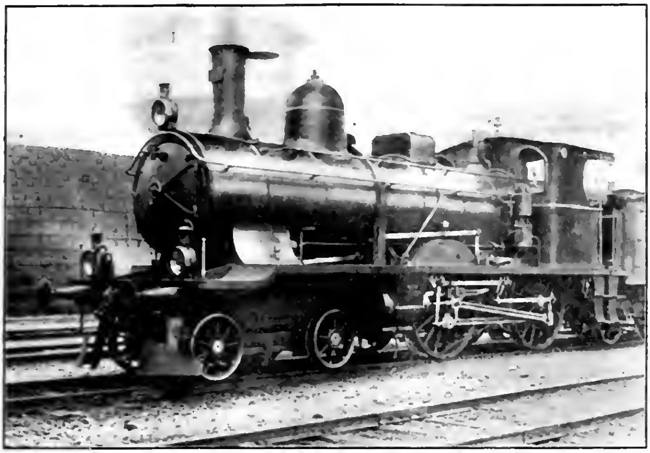
From Airolo down to Bellinzona 40 miles, the inclines are very steep, reaching their maximum between Giornico and Bodio at 1 in 37, and numerous tunnels are passed, some being spirals as on the other side of the mountain barrier. Past Bellinzona the line rises again on a grade of 1 in 38 to cross another mountain by means of the Monte Cenere tunnel, after which it runs down via Lugano to the southern terminus at Chiasso, close to the Italian frontier. The entire length of the line from Lucerne and Zug to Chiasso and Locarno measures 172 miles and is divided into three sections. Exclusive of the tunnels there are 1,384 structures along the system, 324 being bridges and viaducts. Journeying over this road the traveler cannot help but admire the precision and determination displayed by the engineers entrusted with the work. The locomotive and passenger rolling stock is of the most up-to-date character, and every comfort is afforded to travelers.

Skirting the lake of the four cantons, as Lake Lucerne is called, the road gradually ascends to Kuss nacht, then to Immensee, passing the spot where Gessler was shot by an arrow from the bow of William Tell, there being a monument erected on the lake side to commemorate the event. From Immensee, still following the shores of the lake, the line passes many places of interest, including the ancient town of Schwyz, from which Switzerland takes its name, on to Fluelen, which is at the head of the lake. This was formerly the terminus of the railway, Lucerne being reached by steamboat. From here the railway follows the valley of the Reuss, through the town of Altdorf, after passing which the grander scenery commences, and the mountains loom on either side. The valley narrows with a gorge and the rails in many places are laid along narrow precipices. At Amsteg at the foot of the Bristenstock, a series of seventeen tunnels are passed through, also a succession of bridges are crossed, three being over one stream. Once in the St. Gothard tunnel, the traveler can ride for from 18 to 20 minutes and arrive at Airolo and out into the daylight again, or he can take the alternative and go by coach over the historic pass and spend from three to five hours on the journey. Previous to the completion of the railway, upwards of sixty thousand travelers annually passed over the latter route. In passing through the tunnel it is interesting to know that one goes under the village of Andermatt, 1,000 ft. above. The grade in the tunnel rises from both ends to the highest point, 3,750 ft. above sea level. There are two tracks through it, the width being 26 ft. and the height 20 ft. Work was carried on from both sides of the mountain, an average of 2,500 men being employed daily, and on Feb. 29, 1880, communication was opened between the two ends. It is estimated that 2,000,000 lbs. of dynamite were used in blasting, and 3,800,000 lbs. of oil were consumed for illuminating purposes. Since 1899 the tunnel has been artificially ventilated by the Saccardo system, the power being obtained from a mountain stream.

Although still in Switzerland when one arrives at the Airolo end of the tunnel, everything has changed, the architecture, costumes and people are all Italian; even the station is a "stazione" instead of a "bahnhof." The scenery on the south side is quite as beautiful as that on the north, circular tunnels and bewildering precipices are rather more frequent. Leaving Airolo the railway crosses the Ticino and passes through the narrow Stalvedro Pass and on through the Dazio, Freggio and Prato tunnels, the two latter being circular ones, then crosses the Polmengo bridge, through the tunnel of the same name, and finally crosses the Ceresa before reaching Faido, the capital of the Ticino valley. Leaving here one travels through the Biaschina Gorge to Giornico, where a halt for a fresh sup-

RUNNING SHED AT LUCERNE, SWITZERLAND.

ply of water is made. The speed of all trains on the down grade is limited to 60 kilometers per hour, and a speed indicator on the footplate enables the driver to adjust the air brakes and keep



TWO CYLINDER COMPOUND ON THE ST. GOTHARD RAILWAY.

to exactly the required speed. At Brasca the mountain scenery is less prominent, cultivation is more evident, and continues so on to Bellinzona and the Italian lakes. Charmed by the wild fastnesses of the St. Gothard, one feels that it gives to the memory a magnificent view of the wonders of Nature's grandeur and of man's ingenuity.

Chambers Journal on Angus Sinclair.

About a year ago Dr. Andrew Carnegie delivered a most interesting address at Peebles, Scotland, on the occasion of the jubilee of a great institute founded by William Chambers in 1859. The Chambers have done immense service in the cause of popular education in Scotland. Dr. Carnegie sent a copy of this address to our Chief, who, in acknowledging its receipt, told particulars of benefits he had derived from the Chambers publication. A recent issue of *Chambers Journal* contains communications concerning the help that the *Journal* had been to many people who were striving to help themselves. Among them is the letter which Dr. Sinclair wrote to Dr. Carnegie, and introduced thus:

The first letter suggested by Mr. Carnegie's address is from Mr. Angus Sinclair, who in his career presents another object-lesson on the lines of the address. Mr. Angus was born at Forfar, Scotland, but was reared in Laurencekirk, where his father had removed following the construction of the Aberdeen Railway. He worked as telegraph clerk, shop apprentice, fireman and engine driver, as he relates, and after he went to the United States, while engaged in running a locomotive, took special studies in chemistry in Iowa University. He has been engaged in literary and editorial work since 1883, and is now editor and proprietor of a monthly periodical, RAILWAY AND LOCOMOTIVE ENGINEERING. He has published books on "Locomotive Engine Running," "Twentieth Century Locomotives," "Combustion in Locomotive Fire-Boxes," "Combustion and Smoke-Prevention," and "Development of the Locomotive." A Mallet articulated compound locomotive, built for the Erie Railroad, is named "Angus Sinclair." Two years ago Purdue University conferred the degree of Doctor of Engineering upon Angus Sinclair.

RAILWAY AND LOCOMOTIVE ENGINEERING,
114 Liberty Street,
New York, Feb. 3, 1910.

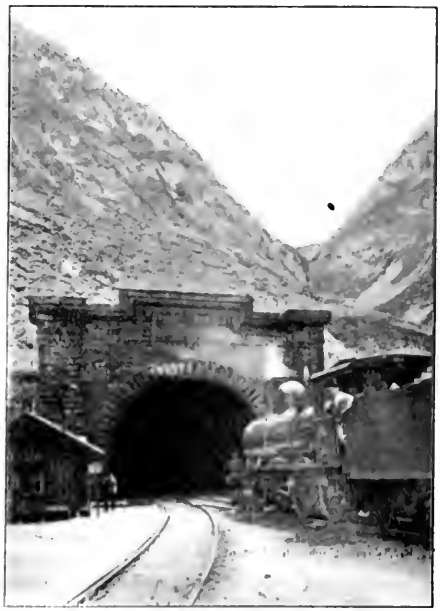
"My Dear Mr. Carnegie: I have received so much enjoyment from reading your address on William Chambers that I regard it as my duty to tell you something about how much I have been personally indebted to Chambers.

"I began work as ticket and telegraph clerk at Laurencekirk Station when I was only thirteen years old, having received a very defective education. Two years later I went to be telegraph clerk for the locomotive superintendent at Arbroath, with the agreement that I should be worked through the shops. After about a year I entered the boiler shops as an apprentice, then the machine-shop, with lots of breaks to do office work. The first boiler-shop work I did was carrying a tool-box for Willie Laurie, a celebrated firebox patcher. I remember on the first morning when I was assigned to the boiler-shops the men lounging about the gate waiting for the bell to ring began discussing the alluring subject of what they liked best to drink. All sorts of mixtures were discussed, when Laurie's preference was asked. 'Well, men,' he said, 'when I have my option I prefer a glass of whisky mixed with another glass of whisky.'

"That was my first mentor, and, curiously enough, he exercised a wonderfully good influence upon me. When we emerged from the first firebox we worked in he asked, 'How many fire-bars are in that box?' Of course I could not tell, and he made me guess, jeering at my poor estimate.

"That was the beginning. Every job we worked on he had some questions to ask—the number of stay bolts, the size of the different parts, etc., till I was forced to observe all kinds of details as a sort of self-protection. The habit of observing things grew upon me, and I have found it very helpful.

"My connection with the office brought me into contact with officials whom I believed to be perfect in engineering knowledge. 'How can I come to know theories of engineering?' that became a burning



ENTERING THE FAMOUS BORE.

question. There was an old dominie in Arbroath who kept a night class for teaching sailors navigation. To him I went, and he wished to enroll me in his navigation class. I steadily refused, and he conceived the idea that instruction in moral philosophy would help me. The result was that I devoted two winters to the study of Dugald Stewart's 'Outlines of Moral Philosophy.' At the time I was getting discouraged over Dugald Stewart I found a copy of Chambers' 'Information for the People.' I went at once to the public library and examined the back numbers. Then I managed to subscribe for it. I began trying to study an hour every evening; but that was beyond persistence, and I finally settled down to twenty minutes every night, which was kept up for years. After a time I went firing, and was fearfully overworked, but I kept up my study of Chambers, and Clark's 'Railway Machinery,' which had also come into my possession.. I have come in after being out more than twenty hours on the engine and when washing and preparing for bed did my twenty minutes of study. So you see I have good reason for thanking William Chambers and his brother for part of the capital that raised me from the footboard to the editor's chair.

"I am ashamed of my long screed, but I look upon it as a testimony to the friend whose life-story you have told so well.

"Your old friend,
"Angus Sinclair."

Supersensitive Thermometer.

An electrical thermometer which is very sensitive to slight fluctuations of temperature has been put out by a German company for medical use to determine the degrees of fever. It consists of a coil of platinum wire enclosed in a quartz glass tube, through which a current is passed from a four-volt storage battery.

Engines for the St. Louis South-Western

The Baldwin Locomotive Works have recently delivered sixteen freight locomotives to the St. Louis Southwestern Railway. These engines are divided into two classes, six being of the ten-wheel type, and the remaining ten of the consolidation type. The latter are the heaviest engines thus far supplied to this road by the builders, and are similar to ten locomotives built for the same company in 1909. The success of the Walschaerts valve gear may be judged from the fact that all the locomotives comprising the present order are fitted with this style of motion.

TEN-WHEEL LOCOMOTIVES.

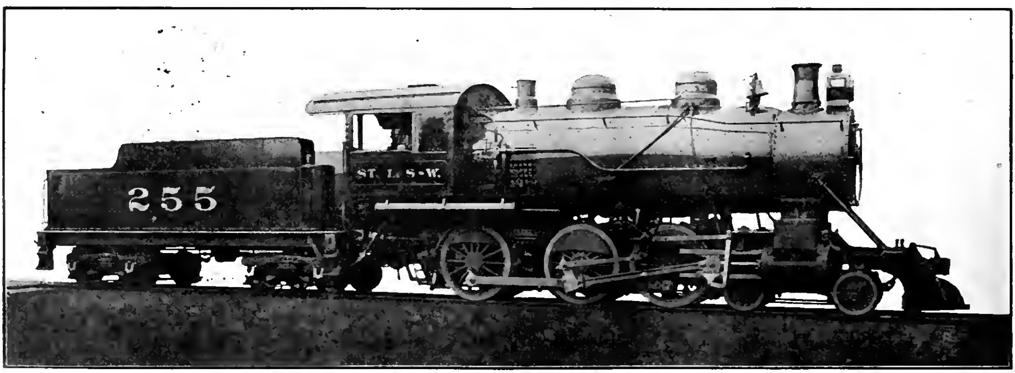
These engines exert a tractive force of 33,800 lbs., and as the weight on the driving wheels is 147,050 lbs., the ratio of adhesion is 4.35. The locomotives should, therefore, be able to exert full tractive force under ordinary conditions of service. The boiler is of the extended wagon top type, with a long firebox placed above the frames. The barrel is composed of two rings; the first ring is tapered, with a butt seam on the top center line, while the dome is placed on the second ring The firebox has a vertical throat and back head, and is radially stayed. A total of 310 flexible stay bolts are placed in the upper corners of the sides and throat, and the top row in the back head. A feature of this boiler is the liberal spacing of the tubes, which are set with 1 in. bridges. While this arrangement apparently restricts the tube heating surface, it promotes circulation. In the same way, while the grate area appears small when compared to that of many other boilers of the same nominal capacity, the firebox is deep and of ample volume, and it possesses a large amount of heating surface. This form of firebox has given satisfactory results on the heavy engines of the St. Louis Southwestern.

The grates are of the rocking type, arranged to shake in two sections, with a drop plate at the rear. The ash pan is self-dumping, with two hoppers and cast iron bottoms. It has draft openings in the front and sides. The front end has a short extension. The spark arrester consists of a perforated plate, and the adjustable diaphragm is placed back of the nozzle. The stack is tapered, with a diameter of 14⅝ ins. at the choke.

The steam distribution is controlled by balanced slide valves, driven by a simple arrangement of Walschaerts motion. The valves are set with a maximum travel of 6¼ ins., and a constant lead of ¼ in. A cast steel brace, which spans the frames between the first and second pairs of driving wheels, supports both the link and reverse shaft bearings. The valve rods are supported by brackets bolted to the top guide bars, and are pinned directly to the combining levers. This arrangement places practically all parts of the gear in the same vertical plane.

The driving tires are all flanged on this locomotive, and the truck has a rigid center. The truck bolster, side frames and center plate are of steel, cast in one piece. The main engine frames are also of cast steel, with double front rails of forged iron. The frames are supported, at the back end, on inverted leaf springs, which are suspended from the yokes placed over the rear driving boxes.

A feature included in the equipment of these engines is an arrangement of piping for washing sand off the rails back of the rear driving wheels. The pipes are connected to a cock, conveniently placed on a level with the middle gauge cock. The resistance of a train is materially increased when hauling it over sanded rails. By the use of this simple arrangement train resistance is not increased, while the full tractive force of the engine can be developed on a slippery rail. The tender has a U-shaped tank, and the frame is of

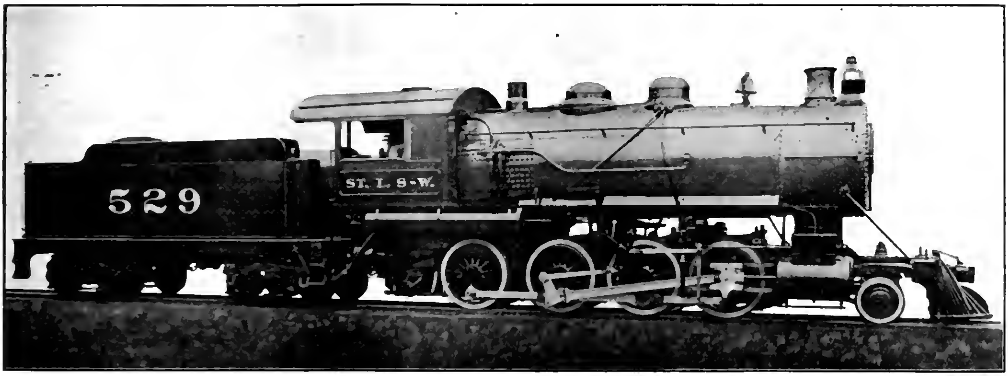


T. E. Adams, Superintendent of Motive Power. 4-6-0 FOR THE ST. LOUIS SOUTH-WESTERN. Baldwin Locomotive Works, Builders.

cast steel, in one piece. The trucks are of the equalized type, with bolster, side frames and center plate combined in a single steel casting. The engine and tender truck wheels are of forged and rolled steel, and were manufactured by the Standard Steel Works Company.

CONSOLIDATION TYPE LOCOMOTIVES.

These engines were built, as far as possible, to the same specification as the ten-wheelers, and the two classes have many features in common. The consolidation type develops a tractive force of 44,800 lbs., and is suitable for heavy and comparatively slow service. A description of



2-0-8 FOR THE ST. LOUIS SOUTH-WESTERN.

T. E. Adams, Superintendent of Motive Power. Baldwin Locomotive Works, Builders.

these engines would be largely a repetition of what has been said above. Attention may be called to the fact that, while the boilers are straight topped, the dimensions in a number of important particulars are identical with those of the ten-wheelers. For example, the fire-boxes are so nearly alike that the grates are interchangeable, except for a slight difference in the shaker rigging.

The cylinders of the consolidation locomotives are duplicates of those used on similar engines equipped with the Stephenson link motion. The location of the steam chests, therefore, necessitates the use of rockers, whose bearings are bolted to the guide yoke. The valves have the same setting as those used on the ten-wheel engines The tenders used with these two classes are practically alike, except that, in the case of the consolidation engines, the tank capacity is increased from 7,000 to 8,000 gallons.

TEN WHEEL TYPE.

Cylinders, 21 x 28 ins.; valve, balanced slide.
Boiler.—Type, extended wagon top; material, steel; diameter, 72 ins.; thickness of sheets, ¾ x 13/16 in.; working pressure, 200 lbs.
Firebox.—Material, steel; length, 120 1/16 ins.; width, 39¼ ins.; depth, front, 75½ ins.; back, 72 ins.; thickness of sheets, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube, 9/16 in.
Water Space.—Front, 5 ins.; sides, 4 ins.; back, 4 ins.
Tubes.—Material, steel wire gauge, No. 11; number, 115; diameter, 2 ins., length, 14 ft. 1¾ ins.
Heating Surface.—Firebox, 200 sq. ft.; tubes 2310 sq. ft.; total, 2,510 sq. ft.; grate area, 32.7 sq. ft.
Driving Wheels.—Diameter, inside, 62 ins.
Wheel Base.—Driving, 13 ft. 2 ins., total engine, 24 ft.; tender, 56 ft. 4 ins.
Weight.—On driving wheels, 147,050 lbs.; on truck, front, 35,300 lbs.; total engine, 182,350 lbs.; tender, about, 320,000 lbs.
Tender.—Tank capacity, 7,000 gals.; fuel, 15 tons; service, freight.

CONSOLIDATED TYPE.

Cylinders, 22 x 30 ins.; valve, balance slide.
Boiler.—Type, straight; material, steel; diameter, 78 ins.; thickness of sheets, ¾ and 13/16 in.; working pressure, 200 lbs.
Firebox.—Material, steel; length, 120 1/16 ins.; width, 30¼ ins.; depth, front, 83 ins.; back, 80 ins.; thickness of sheets, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube, 9/16 in.
Water Space.—Front, 5 ins.; sides, 4 ins.; back, 4 ins.
Tubes.—Material, steel; wire gauge, No. 11; number, 346; diameter, 2 ins.; length 14 ft. 1¾ ins.
Heating Surface.—Firebox, 224 sq. ft.; tubes, 2,537 sq. ft.; total, 2,761 sq. ft.; grate area, 32.7 sq. ft.
Driving Wheels.—Diameter, outside, 55 ins.
Wheel Base.—Driving, 16 ft.; total engine, 24 ft. 6 ins.; tender, 57 ft. 7½ ins.
Weight.—On driving wheels, 173,000 lbs.; on truck, front, 22,000 lbs.; total engine, 195,000 lbs.; tender, about, 360,000 lbs.
Tender.—Tank capacity, 8,000 gals.; fuel, 15 tons; service, freight.

School of Telegraphy.

The Pennsylvania Railroad has put forth an effort to increase interest in the telegraph school at Bedford, Pa. It is the broadest distribution of a pamphlet describing the work which is being done by that institution. The number of students enrolled, up to Sept. 1 of this year, was 243, of which number 151 have graduated and are now employed as telegraphers, and the railroad expects to increase this number materially by its campaign.

The students at the Bedford school are taught practical railroading. The regular railroad telegraph wires are run through the school and train orders and telegrams are received and transmitted in the same way as is done in regular practice. An automatic sending machine, with a transmitter that can be set at any speed, has been installed in the school. This machine is used to teach the students to receive messages, and as it transmits at a uniform speed, it is of great advantage. The school is also equipped with a library, as well as a miniature railroad with a perfect block signal system. In addition to learning telegraphy, the students are taught the duties of station agents in order that they may be prepared to take charge of stations immediately upon graduation.

In view of the use of the telephone in train dispatching on the Pennsylvania Railroad, the latest innovation at the Bedford school is a course in dispatching trains by telephone. This road now uses the telephone on a number of branch lines as well as the low grade freight line.

In the pamphlet which the company has just issued it is announced that the school of telegraphy was established for the purpose of educating young men to become telegraph or telephone operators, and, to make it as easy as possible, only a nominal fee is charged. Students graduate in from 6 to 8 months, and, as the pamphlet states, "all graduates are given positions on the Pennsylvania Railroad, with the assurance that if they are faithful in the discharge of their duties they will have steady employment, and will be placed in line for promotion to higher positions."

Fast Running.

The Michigan Central Railroad has long been noted for making real fast runs with passenger trains—not runs merely made on paper. On September 27 one of the passenger trains on this road ran 1.12 miles in 92 seconds.

The train which made the run is known as "No 3," is made up of eight coatches, and is drawn by one of the new Atlantic-Pacific type of locomotives.

Part of the distance in that run was negotiated at the rate of 98.5 miles an hour.

The portion of the road over which these fast runs are made lies in the long level stretches between St. Thomas and Windsor, Ont.

P. R. R. Floating Equipment.

In order to facilitate the handling of dressed meats, provisions and other perishable freight in New York Harbor the Pennsylvania Railroad has inaugurated a refrigerator barge service. This innovation was adopted after much experimenting as to the best method of handling this kind of traffic where it is impracticable to make delivery in the original car and where the company must furnish protection against heat in summer and cold in winter. Ordinarily this protection has been afforded by refrigerator cars. The situation at the port of New York, however, differs from other Atlantic ports in the fact that steamships have no rail connections at their piers, and freight must be delivered by floats. It was to supply this need that the Pennsylvania Railroad inaugurated its refrigerator barge service. Our illustration shows one of the P. R. R. floating equipment.

REFRIGERATOR BARGE USED BY PENNSYLVANIA RAILROAD.

L. I. Shops at Richmond Hill.

A visit to the shops of the Long Island Railroad at Richmond Hill, L. I., reveals the fact that there are some clever mechanics there. In locomotive repair shops generally everybody is so busy in a sustained effort to attend to that which must be attended to that there is literally no time to think of new and better methods. Mr. G. C. Bishop, the superintendent of motive power, has the good sense to encourage the inventive faculty of those under his supervision, and the result is very gratifying.

SLOTTER CUTS TEETH.

Our attention was first called to the unusual spectacle of a small slotting machine cutting the teeth in the rims of two wheels 88½ ins. in diameter to replace two worn-out gear wheels on a wheel lathe. The lathe had seen long service but with the exception of the worn and broken gear teeth the lathe was otherwise serviceable. There were 175 teeth in the rims, and no indexing machine could cope with a wheel of such dimensions. Mr. E. H. Sweeley, the general foreman, devised the means used for bolting the two new rims together and marking off a pentagon divided the spaces into thirty-five equal parts. The rims were carefully leveled on temporary trestles and held in position by brackets in which the rims moved. A fixed marker attached to the slotter indicated where each succeeding center punch mark should be set at, and the work proceeded with a degree of rapidity and accuracy that could not be surpassed. A few strokes of a smooth file and the teeth looked as if they had been formed from a fixed center in a large machine. Sixteen studs attach the geared rims to the lathe and the machine is as good as new.

BORING OUT ECCENTRICS.

In the boring out of eccentrics, after the bolts are fitted holding the two straps together they are placed on the boring mill and held in position by three adjustable knees, and are bored and faced above and below without removal. The brass bushings for the straps are turned out of a hollow casting and after being cut in two are shrunk into position in the straps. The steel straps and bushings are all interchangeable. Attaching the straps and boring and facing occupy less than forty minutes.

PISTON AND VALVE ROD PACKING.

Piston and valve rod packing were being turned off at the rate of 150 complete sets a day. The portions of metal were placed on a suitable mandrel, the outer end of which was threaded, the nut being small enough to admit the pieces of metallic packing to pass over the nut, the packing being held in place by a horseshoe-shaped steel washer. A broad-faced tool with a projecting angle on its outer edge and a few revolutions of the lathe were sufficient to perfect the packing rings with the proper bend on the outer piece. The nut was loosened and the slidable washer removed and the three or four pieces of packing were in rapid rotation being added to the growing pile.

The planing of rod brasses at perfect right angles was not, as usual, left to the haphazard chance of the rough edges of the castings. A revolving jig with four double sets of steel pins held the brasses in the exact positions, and the finished faces were planed absolutely true.

The exact boring of cylinders, tires and other work is brought to perfection by the use of a micrometer on the end of a steel rod. Over the pointer of the micrometer there is a removable steel sheath of a certain known thickness. This hardened sheath is not liable to wear from contact with other metallic substances, and when the exact point of adjustment of the cut is attained the sheath is removed until its further services is required.

THE BLACKSMITH SHOP.

We cannot close our brief notes without some reference to the blacksmith's shop. Mr. C. A. Slinker, the foreman blacksmith, is a master in metal. His bulldozers are turning out excellent work. The eccentric jaws, and brake rod ends, and shaking grate lever sockets, and eye bolts, and castle nuts, and cylinder cocks, and fire hooks, and other work have the elegant finish of castings, and we hope to have an early opportunity of furnishing illustrations in the pages of RAILWAY AND LOCOMOTIVE ENGINEERING of some of the work that these ingenious devices produce.

Conventions for Atlantic City.

The joint meeting of the executive committees of the Master Mechanics and the Master Car Builders' Associations recently met in Washington to decide upon the place of meeting for the railway associations next June. Atlantic City was decided upon as the meeting place, and Young's pier will be where the exhibits will be placed and where the sessions of the societies will be held. Saratoga made an unsuccessful bid for the conventions. The conventions have steadily grown in numbers attending, and the space for exhibits must necessarily be very large.

General Correspondence

Valve Trouble.

Editor:

In the September issue of your valuable paper the question was asked as to what ailed a blowing valve and in the October issue of RAILWAY AND LOCOMOTIVE ENGINEERING, page 405, some good brother attempted to explain what the difficulty was. If this gentleman will consult the question again, he will find that it was stated that the valve had 5½ ins. travel. Now in order for the valve to uncover the steam port fully it would be necessary for the valve to travel 2 times the sum of the lap and lead.

1⅝ × 2 = 3¼ ins. width of steam port and ⅞ × 2 = 1¾ ins. outside of lap of valve, and 5 ins. is the total travel of valve.

It is true that the valve over travels ½ in., however, it would be necessary for the valve to have 8 ins. travel in order to have the exhaust port uncovered. The valve travel in this case has been looked into thoroughly and it is equal in forward and backward motion, the reach rod being the proper length. I thank the brother for his information, but he has another guess coming. SUBSCRIBER.

Covington, Ky.

Slide Valve Trouble.

Editor:

In September issue of RAILWAY AND LOCOMOTIVE ENGINEERING a subscriber, C. & O. Shops, Covington, Ky., states that they are experiencing trouble in placing the cause of a blow in slide valve, and to which you add a footnote saying you will be pleased to hear from anyone who can explain cause of trouble. Before doing so it will be necessary for you to give correct dimensions of valve, as same given in cut allows the valve 2¾ inches steam lap, the width of valve being given as 14¼ inches. Perhaps this should have read 11¾ inches, which would allow ⅞-inch lap. J. H. LOW.

Medicine Hat, Alta

[We will be pleased to have our subscriber from Covington, Ky., say if sizes given in our September paper are correct. Our illustration was made from sketch sent us.—Editor.]

Slide Valve Trouble.

Editor:

Referring to slide valve trouble in your September issue, we once had an engine that acted the same way and she had the Allen-Richardson ported valve. I measured the back end of valve rod and found it lower when rocker arm was on center, than the stuffing box in steam chest. My belief was that when in full gear the valve rod would come down still lower, clamp the valve in the yoke and raise the edge of the valve off its seat, and after steam got under the valve it would help to hold it up. In starting full gear she would blow very hard. By hooking her up 3 or 4 notches she would not blow so bad, and by hitting the valve rod with a block of wood the valve would drop to the seat and blow would cease. Nothing was done to this engine; only a block of wood was driven in the front of the guard seat and later she went to another division. F. O. HILLMAN.

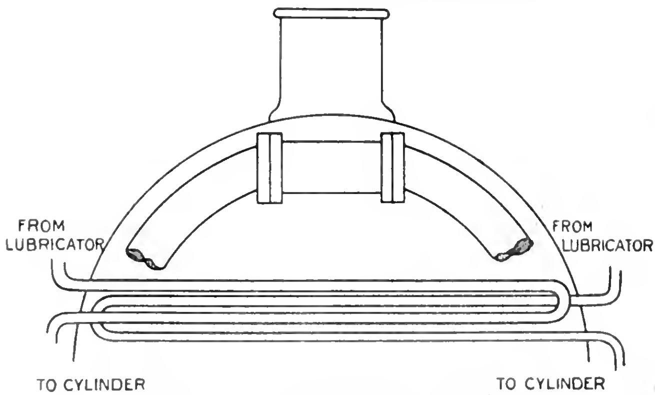
R. H. Foreman, C., G.-W.

Red Wing, Minn.

Locomotive Lubricating Device.

Editor:

I know you are always interested in something new; therefore I send you this little item. I have recently designed a little device and applied it to the lubricating system of a locomotive which revolutionizes the present practice. As you are aware, the past records for cylinder lubrication under present methods average in freight service from 60 to 90 miles to one pint, and in passenger service from 90 to 140 miles, varying somewhat according to the diameter of the cylinder.



OUTLINE SKETCH OF WATTERS OIL HEATER.

The oil from the lubricator is passed through superheating pipes which are located in the front such as shown in sketch. The temperature of the oil is raised above that of the saturated steam and is carried in suspension by the steam resulting in perfect lubrication.

With my arrangement I have just completed a test on a locomotive running 192 miles per day. This engine has made 530 miles to one pint of cylinder oil, including the lubrication of the air pump. If you know of a record that will beat this let me hear from you. As soon as my patents are allowed I will put the device on the market. Yours truly,

J. H. WATTERS,

Ass't M. M. Georgia Railroad.

Augusta, Ga.

Making of Good Engineers.

It has been said that any man can do a job with good tools, but it takes a mechanic to do a good job with poor tools. Perhaps this is the reason why the Traveling Engineers' Association is working so hard on the subject. Some of the tools are "awful"—reasons, retrenchments, monthly allotment system, shortage of power, etc. Education is what we all need and the companies or persons operating the railroads should recognize this fact, besides the Traveling Engineers, and take steps toward establishing the proper schools for this purpose. When one rides one of the present-day freight "hogs" it is easy to see why it is hard to obtain the material from which to make good engineers. Who is desirous of taking a job at manual labor, shoveling from ten to twenty tons of coal per day of possibly sixteen hours and after eight or ten hours (not rest) "off duty," go right at it again, in the meantime absorbing an education relative to the business with a view to becoming an engineer?

Since the 16-hour or "bird law" went into effect the officials say the men belong to them after eight or ten hours off duty, as the case may be. Every man should take pride in educating himself in the line of business which he follows for a livelihood. The principal question seems to be that of getting men husky enough to meet the manual requirements and have enough gray matter to absorb enough knowledge of the "hog" to pass the necessary examinations. More inducements are offered to men to become trainmen. The pay is almost as good, no hard labor, comfortable caboose, not one-half as much to learn before being capable of being promoted. The Traveling Engineers on each individual system should compile a series of questions and answers relative to the work, as required by the company employing them, for the education of the men over whom they have authority. Are there any better men for this purpose than some of them, like Mr. C. B. Conger, who have had experience? Is there anything better, more education, to the point or more easily understood than Mr. Conger's writings?

There should be talent enough on each large system to do the work of producing the necessary educational matter for the system according to their rules. To educate the men to make use of the "low grade" coal spoken of in the president's message or address is a horse of another color. Some one should be educated to draft the locomotives, so that the "low grade" coal will remain on the fire long enough to give up its heat before passing out of the smokestack. Enough coal is wasted by never touching the fire to buy enough oil to oil the engine indefinitely. Mine owners in loading "run of mine" coal usually seize the opportunity to clean up the "gob" or work off a lot of "bug dust" for good money, producing what an official once called "not poor coal but fine coal." Of course, a fireman must be educated to fire this good coal—the engineer how to haul maximum tonnage without "hanging up" and with a "due regard to economy in the use of fuel, etc."

One of the best educational mediums which I have so far found and can recommend to the T. E. A. is RAILWAY AND LOCOMOTIVE ENGINEERING. The question of vital importance to some hundred odd thousand of engineers and firemen is the making of good officials. So many men with "paper records," "pull," "hold on the company through accident," ability to "bulldoze," as well as "soft soap." The men get the positions where life is made a misery for the subordinates who are compelled to take their orders or abuse. However, we have many officials who are gentlemen in every sense of the term, thank the Lord. Let the millenium come.

AUGUSTINE HOLTZKOPF.

Wheeling, W. Va.

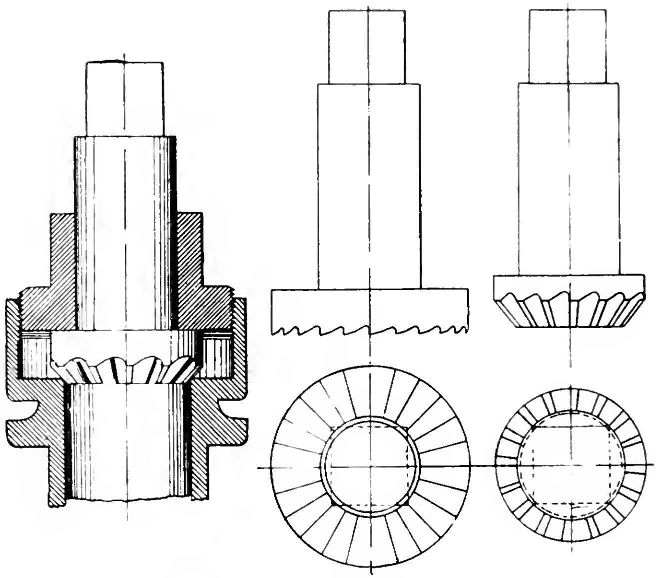
Reseating Safety Valves.

Editor:

The print I send you shows our method of reseating safety valves without taking them from boiler. This method does first-class work and we have no occasion to remove safety valves until they are worn out. The facing and reseating tools are held central by brass nut, as shown in section, and a few turns of each tool completes the work. This tool will interest any one who is removing safety valves for reseating.

CHAS. MARKEL,
Shop Foreman, C. & N. W. Ry.

Clinton, Ia.



APPARATUS USED FOR RESEATING SAFETY VALVES.

Identification and Schedule Fulfilled Signals.

Editor:

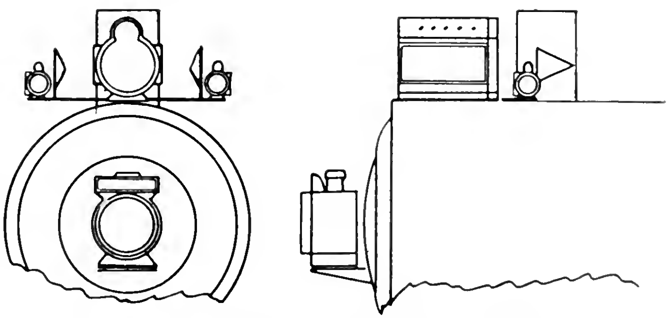
Much has appeared in print in the sundry railway magazines and journals during the past three years, pro and con, relative to the necessity of identification and schedule fulfilled signals. While all writers on the subject are in unison as to the place of location for a identification signal or indicator, viz.: That it should be carried on the front end of a train, which would be on the front end of the engine. There is much diversity of opinion as regards the location and kind of signal which would prove of value as a schedule fulfilled signal or signals, especially so in the case of trains consisting of, or composed of sections. There is no question but that the engineer would prefer a positive signal to a negative one, likewise an experienced train crew, and the value which a positive signal would be to the inexperienced train crew is inestimable. The front end of an engine is now taken up with headlight, classification lamps, flag-staffs and marker stands. Where is there room for more? Simply by placing or arranging these appliances so that their greatest utility and benefit to the service will be derived. The writer has heard of the remark of a brother engineer, which was to the effect, "That to place a headlight in front of the numberplate or just above it spoils the appearance or beauty of the engine," but does it spoil the beauty of the light?

Headlights on modern engines are placed too high, and a little experimenting on the part of the unbeliever will prove the correctness of this assertion. Locate the headlight in front of where the number plate now is, or a little above it, according to the height of the boiler, and a much better light is thrown ahead upon the track. Switch points, targets, etc., are the more clearly seen and at a greater distance, and the light penetrates the darkness a greater rail distance, enhancing its value. Therein the beauty lies. Take a bull's-eye lantern into the darkness, hold it above the head, then at the waist; objects are plainer and at a greater distance with the lamp in the latter position. It's no optical illusion, simply the result of a natural law. Therefore an engineer cannot see as well with a headlight located above his direct line of vision, as he can with the one which is placed below it. We then place the headlight in front of the smoke-box where it gives the best results.

In so doing we must try to please our confreres and therefore must not rob the engine of her beauty nor symmetrical appearance, so we place, in a sense, a dummy headlight where the headlight ought to be, to preserve her beauty, and make its length as great as beauty will permit, with a ground or painted white glass in front, over which the numbers of, or letters indicating the kind of train are attached. The numerals and letters for such being kept, while not in use, in a section or compartment at the back of the dummy. On each side apertures with glasses are provided for the number of the engine and the dummy is lighted with an electric lamp, gas burner, or oil gauge lamp. The classification lamp and flags, the latter can be made of tin painted, if preferable, and kept with the numerals and letters when not in use, on each side of the dummy and on the same plane. We can now at a glance read the kind and number of the train or both, number of engine and classification signals if any. There is no chance nor excuse for a mistake, except where engineers and train crews might take a figure 3 for a 5 or 8, or a figure 5 for a 6 or vice versa. The numerals can be made from 5 to 8 ins. in height, and if such mistakes are possible make use of those numerals and letters as cannot be mistaken such as 1, 2, 3, 4, 6, 7, 9, and 0. X could not be taken for anything but x by a man who was awake. Sketches illustrate the foregoing. The writer holds caveats issued under the regulations of the International Patent Convention which will be allowed to expire. You, therefore, are at liberty to make use of the above described device. A Christmas present for the needy; small favors thankfully received, larger ones in proportion.

Now for the schedule fulfilled signal. Rule 19 of the revised code of 1906 says, "That markers shall be carried, showing by night a green light to the front and sides and red to the rear, and by day green flags at the rear end of a train. Referring to the code, a section is a part of a train, but it carries markers indicating it to be the rear end of the train, not the rear end of a section. Rule 19 was not changed when sections became fashionable; correctly the markers should indicate the rear end of the leading section or sections and not the rear end of the train. It is not consistent that we should here cite different opinions based upon an hypothesis regarding the intention of this or that rule in the code. The vocabulary of the English language is sufficiently large that both the wording and intention of all rules be the same. Therefore should markers showing by night, red to the rear and white to the front and sides, ground or painted glasses being used to show a dull white, with the number of the section attached over the glasses to the front or sides, indicating the number of the section; and by day, white flags, made of tin painted and with number of the section stenciled thereon, carried at the rear end of the leading section or sections, and the regular marker of green and red carried to indicate the rear of such a train composed or consisting of sections and fulfilling a schedule, a much needed and necessary want would be filled.

When meeting trains, where masking the headlight is practiced, the dummy or train indicator is of great value to the train crew and particularly so to the engine crew. Its light is entirely different from all other signals, and with the numerals or letters indicating the kind and class of train, it cannot be mistaken for any other signal than that which it indicates. And in passing or meeting moving trains, where the headlight almost blinds the crew of the opposing train or trains, the use of the dummy and the position of the other signals ensures to all concerned that clearness of reading such signals with that ease and certainty, absolutely necessary in the operation of modern railway trains. In the case of a regular or extra train, not consisting of sections, the dummy headlight or train indicator and markers provide two distinct schedule fulfilled and



PROPOSED ARRANGEMENT OF LOCOMOTIVE SIGNALS

positive signals, likewise with a train consisting of sections, a crew would know when the last section was met or passed. The markers or signals on the rear end acting as a check on those of the front end.

Experienced railroaders prefer the Double Order System, so let's have it in something more than on paper, and it is up to, not only brotherhood organizations, but fraternal societies as well, to see to it, that their members individually and collectively are given means for such protection. It's as good, if not better, than more life insurance, especially from the careful and thoughtful engineman's point of view. Question!

W. Allan Odell.

Apartado 1319,
City of Mexico, Mexico.

Fast Repair Work.

Editor:

In connection with article on page 386 of your valuable paper relative to quick work on C. H. & D. locomotive No. 384 and request from our mutual friend of the C. & O. in connection with handling of this, let me say, first of importance in connection with the handling of locomotive shops, it must be borne in mind by officers in connection therewith that they are upon the ground to serve a duty. The principal is to furnish to the transportation department locomotives for the greatest use they can possibly have with the least mechanical delay at terminals. With this in view we endeavor, at our larger terminals, to cut it down to the minimum. In order to do this we must have the closest co-operation of all concerned, from our highest official down to our least roundhouse employee.

At this terminal there is called to order a meeting, in my office, every Monday at 10 a. m. We have a form which shows dispatch of power, and any unusual delay is taken up and discussed thoroughly by the foremen of various departments to see where we can better the condition. It may be for a great many reasons that the engine was delayed longer than necessary in the roundhouse. Important information as to increasing the efficiency of the department is brought about in this manner. With the same view the back shop engines are handled accordingly. We figure that every hour an engine is lying around the terminal that the company is being deprived of an earning unit. The handling of the engine of which we speak is no uncommon occurrence with our organization. We handle this matter month in and month out.

The solicitation of one of your representatives, which happens to be one of our engineers, thought it would be of interest to some readers of your paper on prompt handling of such matters and I see that it has been quoted. Engine 384 has 20 x 26 in. cylinders; has 314 2-in flues 14 ft. long; is of the 10-wheel type with drivers 57 ins. outside of tires.

weighing 127,700 lbs. on drivers and 24,300 lbs. on truck; tender 116,052 lbs. At this point I would call the attention of readers of my remarks before General Foremen's Association, page 386 of your September issue, which relate to this subject. We build an extra back end of boiler, including firebox that joins the boiler at the throat sheet, this being so arranged by the boiler department that it will be ready for application about the third day that the engine is in the shop, therefore avoiding all this delay of lying around, and putting engine in service more promptly. We also have shoes and wedges and driving boxes for this class of engine on hand before the engine is taken into the shop, and you will see by this method it is very easy to keep your engines in service and do a large amount of work upon locomotives of this description in a very short time.

Personally I attribute the prompt handling of this matter to the system of cards which we have on file in the general foreman's office. We know each engine that is going to occupy the pit in the back shop three months before she is due. Our roundhouse foreman, traveling engineer, engine inspectors, boiler inspector file in this card system reports covering the work that will be required by the locomotive two and three months before she is ready for the back shop. The storekeeper consults these at different intervals and sees that he has material on hand for making such repairs. This way we do not get any surplus material on hand, only that which is required for the repairs to locomotives in the back shop, and our work is handled promptly. The system is worthy of investigation.

F. C. Pickard,
Master Mechanic C. H. & D.
Indianapolis, Ind.

Big Four Engine 361.

Editor:

I notice in the September number a request for information regarding Big Four Atlantic type locomotive No. 361. I take it that our German friend is not familiar with American practice with regard to painting engines—nearly everything black. The smokebox, pilot, coupler and wheel centers are a dull black; the remainder of the boiler, tender and cab a gloss black; wheel rims, light gray; name of the road and striping on tender, gold.

Although not a Big Four man, I was, nevertheless, quite familiar with this engine, as I used to see her often. She was built, with two similar engines, at the Brooks Works of the American Locomotive Company, and was originally intended for service on the Peoria & Eastern division, and was known as No. 574. A good half-tone and description of locomotive No. 574 appeared in Railway and Locomotive Engineering for December, 1903, page 547. For some reason the three locomotives were transferred to the Big Four proper and No. 574 became No. 361. Several years ago, when the Big Four equipment was relettered to "New York Central Lines," No. 361 again received a new number, and it is now known as No. 6928, class I-62-a. The model of the engine shown by Mr. Schuyler is a fairly good representation of the engine, although the pilot details are lacking.

I regret that an error was made in giving the new class of the old class "O" Pennsylvania engine, described on page 366 of the September number. It should read D-8a instead of D-10a. The D-10a locomotives are larger and have Belpaire boilers.

Robert C. Schmid.
Fort Wayne, Ind.

Position of Pivot Point.

Editor:

In sending question to you re 2-6-2 class engine I found when too late to recall letter that I hadn't given you sufficient information about same. The question I would like answered is:

A 2-6-2 class engine weighs 60 tons, pony trucks front and rear, 6 wheels coupled drivers. The main drivers carry 16 tons weight, which is one ton more than leading or trailing drivers, whose weights are the same, 15 tons on each. Pony trucks have equal weights, 7 tons on each. Compensated throughout. Total wheel base, 28 ft; rigid wheel base, 14 ft. How would you proportion your compensating holds to give these weights?

F. Williams.
Sydney, New South Wales.

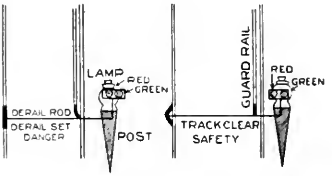
[In answering this question, as you have stated it, several things have to be assumed, as you have not given them. We will suppose the length of the equalizer is 4 ft. and that at present the pivot is exactly in the center of the equalizer. Take, for example, the leading and the center wheel. The front equalizer gives 15 tons to the leading wheel and 15½ tons to the rear wheel. Working out this problem our way involves solving a simultaneous equation, which it is not necessary to give here. The result, however, is that in order to produce equal weights on the wheels it is necessary to move the pivot of the equalizer away from the center wheel a distance of a little over 25/32 of an inch. This is a thirty-second more than ¾ in. The fraction as worked out in decimals is 0.78699. The approximate distance would be about 25/32 of an inch, full.—Editor.]

Signal for Derail.

Editor:

A matter of particular interest was introduced at the Brotherhood of Locomotive Engineers' union meeting in Chicago, July 31, 1910, the subject being a new safety derail signal, the simplicity and ingeniousness of which caused the meeting to unanimously pass a vote of confidence and support therein. The subject was introduced by myself, being the inventor of the new derail signal. The description is as follows:

My automatic protective signal for derail at railroad interlocking plants, which shows position of derail at night, is composed of a fixed white or other suitable color light and shield, light showing white automatically when track is clear



DERAIL SIGNAL.

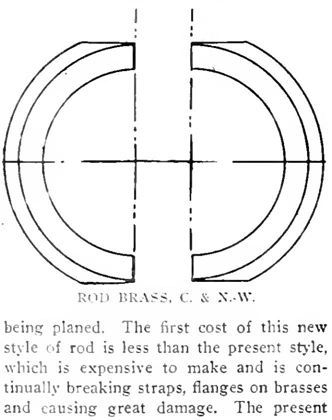
and covered by shield in which the danger color shows when derail is set. Two colors may be used in the shield when white is not used for clear. The shield is secured to the derail rod or bar and moves automatically with the movement of derail. The lamp is an ordinary bullseye light, kerosene burner, secured on short wood or cement post set in ground, showing in front of an approaching train. This light does not displace or take the office of the regular interlocking plant signals, but is an additional signal which does not require a long distance movement or connection.

C. J. Teare,
Loco. Engr. Div. 96, B. of L. E.
Chicago, Ill.

New Style of Main Rod, C. & N. W.

Editor:

I am sending you a blue print of a new style main rod that does away with straps, bolts, set screws and flanged brasses machined in shaper, then hand fitted after



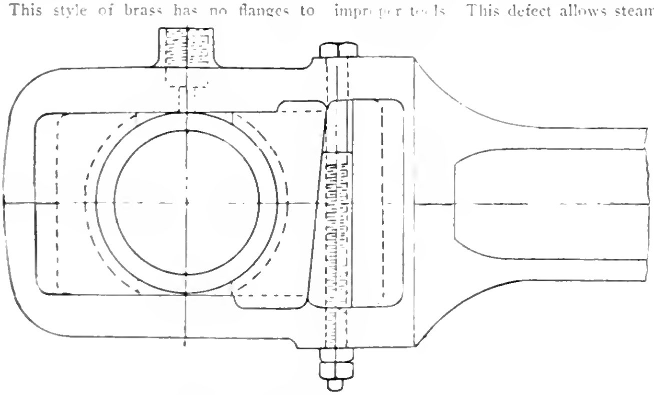
ROD BRASS, C. & N.-W.

being planed. The first cost of this new style of rod is less than the present style, which is expensive to make and is continually breaking straps, flanges on brasses and causing great damage. The present style is very expensive as to renewals such as straps, bolts, brasses, etc.

The filling blocks and wedge as shown are cast steel made from patterns allowing enough stock to finish up. All work is done in jigs, which makes all parts duplicate of one another, and the cost is not excessive. The two filling blocks that hold the brasses are made in one piece by simply planing on both sides; then placed on a boring mill they are bored and counterbored for brass fit, then planed on both ends. When planing top and bottom for rod fit it cuts itself in halves. These two filling blocks will last for years, as there is no wear on them. The only part that requires renewing is the brass, which is quickly made, as it is lathe work, and six of them can be turned up while shaping one of the old style flanged brasses. To make this brass, it is bored out to fit crank pin, then placed on mandrel and turned up to fit bored out hole in filling blocks, then planed top and bottom to fit opening in rod, which prevents the brass from turning.

This style of brass has no flanges to break off and is ½-in. thicker than the present brass we use, which means longer life and better service. It also has 33 sq. ins. more bearing surface than the present brass. The front end brass on this rod has round turned up brass in place of the present brass, which is all shaper and hand work. I believe this bit of information will be of interest to your readers.

W. J. SHADLE,
General Foreman, C. & N. W. Ry.
Clinton, Ia.



NEW STYLE MAIN ROD, C. & N. W. R.

Injectors, Their Defects and Remedies.

Editor:

Injector troubles attending those injectors of lifting type can be divided into two classes, viz.: Not lifting water and lifting water, but failing to deliver it to boiler.

Defects causing failures of first class, and most commonly met with, are as follows:

1. Water failing to reach injector due to frozen pipes, closed tank valves, tank hose with collapsed linings, screens filled with ballast or burst pipes and low water in tank.

2. Steam failing to reach injector in sufficient quantities due to partly closed valves or valves having the ends off and lying over passageway. On very rare occasions an obstruction may get into these pipes, such as rivet heads or waste, especially after the boiler has undergone heavy repairs.

3. Overflow pipe stopped by ice, or coal and ashes when the pipes empty into ash pans.

4. Any leak in the feed-pipe to the injector will cause defective vacuum to be formed. The closer to the injector the more serious. Pipes not lining up properly or collars pulled loose from pipes. These collars do not show large cracks when pipe is disconnected, but develop when in place and under stress of the unions.

5. Dirt in inlet valves or valves corroded and galled or stem bent by use of improper tools. This defect allows steam to flow directly back on top of the water from the feed-pipe.

6. At times cracks will develop in the injector body under the steam nozzle, and allow steam to enter into the the feed water and destroy vacuum. This defect is a tricky one, as an injector may work with a low steam pressure and fail with a high pressure of steam, which forces more steam into feed water than the low pressure did.

7. The outside nozzle will work off the steam nozzle and fall down over the small forming jet holes, causing steam to blow back into the tank just as a brokern overflow valve will.

8. On rare occasions I have seen the end break off the steam ram and be held in place in the steam nozzle, while the spindle was forced out, permitting steam in great quantities to flow out of the overflow pipe and back to the tank.

In treating the first set of defects the remedy is obvious; remove the obstruction. A word might be dropped here in reference to tank hose linings. In examining the hose have them in such a position that a light, such as a small piece of waste on a wire, may be run through them from end to end, affording the repairman a good chance to examine them. Washers or gaskets, with insufficient opening, might also be mentioned.

Burst pipes may be patched up by tightly bandaging a piece of gum on the crack with rope or wire until a terminal is reached.

Pipes not lining up properly at joints may be temporarily repaired by wrapping the joint with lamp wick or string, so as to make a joint which will be slightly expansive and tend to fill the larger space where the pipe gaps. A cracked collar also can be wrapped with string when the pipe is disconnected; then when coupled the nut will pull the string tight into the crack.

Dirt may be removed from inlet valves and galled valves moved by closing overflow valve, removing tank hose and flowing stream back through feed pipe. In doing this, open and close steam ram rapidly. If you hear a sharp report, as of a firearm, you may be certain there is no dirt present. On some classes of injectors, such as the Simplex, a small plug cock in the body of the injector allows the inlet valve to be cut out. This reduces the amount of water discharged, however, and if an injector can be made to work with it cut out, it is not bad practice to cut the valve in while the injector is not working, and try to wash out the foreign matter.

The remaining defects need special tools and an experienced man to remedy. The only thing a man along the road can do in event of these defects arising is to close his water and steam valves and use the other injector.

Bad boiler checks do not interfere so much with the later types of injectors as they did, although a bad boiler check, a steam nozzle leaking through its seat in the injector body, or a steam ram leaking through its seat on the nozzle, will make an injector of these late types slow to prime.

Injectors failing to force water may be caused by any of the following defects: (1) A partial cutting off of the water or steam supply. (2) Line check valve in injector broken or stuck. (3) Insufficient lift in boiler check. (4) Obstruction in delivery pipe. (5) Obstruction in delivery or combining tubes of injector. (6) Combining tube worn at smallest diameter by action of steam, water and foreign matter. This defect causes injector to waste water at overflow when a part is entering boiler. (7) In renewing steam nozzles, seats are often reamed out in the body and faced off the nozzle, allowing the nozzle to too closely approach the combining tubes.

These first two defects may be remedied on the road sometimes, as may the fourth one. Partially closed steam valves and tank valves opened and screens cleaned may be done by any one.

Line check valves may be opened when stuck by closing the overflow valve at the same time the injector handle is pulled out. Some injectors have lubricating plugs for emergency cases of this kind placed just over the feed-pipe connection. To use this, remove the plug from the injector, which will cause a strong draft into the hole and carry the oil well into the injector; then replace the plug. In replacing plug be careful, as sometimes the steam flies out in good supply as soon as the vacuum commences to form in injector. The remaining defects call for experienced aid.

In reference to the last two defects it would be well for the repairman to closely acquaint himself with the dimensions of the tubes of their different class of injectors. Also learn the distance from end of delivery tube to seat of steam nozzle. In case there is any deviation from standard measurements this can be remedied by having a liner of the desired thickness turned up and placed on the injector steam nozzle seat where it screws into the injector. In diameter this liner should be the same as the nozzle on the outside, and on the inside just large enough to snugly pass the threaded portion. Care should be exercised to prevent the liner dropping out of place and preventing the nozzle seating properly on the barrel.

S. S. O.

Harrisburg, Pa.

Test for Loose Wheels.

An accident due to a loose wheel on the London, Brighton and South Coast Railway has of course been investigated by the railway department of the Board of Trade, Col. Von Donop presiding. It appears that the only records of similar accidents were on the Great Western, and in the report of the L., B. and S. C. accident, the precautions now taken by the Great Western Railway are referred to by way of giving an example of what very careful and high-grade shop practice is.

The Great Western people, after pressing a wheel on the axle, make a practice of applying a back test pressure of 50 tons on all wheels fitted up in the shops. They also have a tape record of the pressure during the whole process, which makes an automatic record, and thus any variation or fluctuation in the constant pressure applied is easily discernible. The 50 ton back pressure is applied to see if the wheel can be started after finally home on its seat. The London, Brighton and South Coast Railway have adopted the back pressure test for wheels since the accident.

Observations on Disconnecting.

By F. P. Roesch.

We are all more or less the slaves of precedent; a custom once established, regardless of the cause that called it into being, becomes in the course of time sacred, gospel law—a law perhaps that carries with it no other penalty for violation but universal condemnation, but none the less one that but few have the temerity to gainsay. The origin of the law may be obscured in the dim and mystic past; the reason for its existence may rest upon no firmer foundation than the expressed opinion of some long since dead and forgotten individuals; but the opinion as expressed by constant repetition gains strength and volume, like a snowball rolling down hill, until it becomes accepted as an uncontrovertible fact, and as such becomes a law. In the infancy of railroading, before the strength of material was calculated to the nicety and exactness that it is at the present, or before the mechanically dependable material of to-day was obtainable, the failure of the various parts that enter into the construction of the locomotive was of such frequency that successful disconnecting of the parts that would enable a man to bring his engine to the terminal under her own steam, with part of the train, and eliminate all possibility of further damage, became almost an exact science. Every successful method of disconnecting was discussed, written up, commented on, until it became established as correct practice and the proper thing to do under the circumstances.

Some of the methods still obtain and can still be claimed as good practice; some others have been stationary while the locomotive has been going through a period of evolution. Our disconnecting practice, through respect for the sacredness of old established laws, has not in all cases kept pace with the march of progress. Only in cases where the enlargement of parts or revised construction compelled it was any deviation from established practice made, and even then the violation of the old law was approached in fear and trembling and the experimentor felt as if the sword of Damocles was suspended above his head until repeated successful ventures proved the correctness of his views.

Time was, and not so long ago, either, when the engineer who did not disconnect his main rod in all cases where the valve stem was disconnected might just as well call for his time on arrival; he was almost sure to be discharged anyway, not for any real or fancied damage to the cylinders, but for violation of established precedent. Times have changed, however, with the advent of the 1,000-lb. main rod; and yet it took years to break away from this practice, and then only because necessity compelled it.

Among the hoary and time-honored laws that still maintain an all-unwarranted existence none looms more prominent than the disconnection of side rods, and it is to lead up to this particular subject that this long preamble has been written.

The old law reads, "In case of failure of a side rod the corresponding section on the opposite side should be removed also."

Law No. 2 reads, "In case of a failure of main connection on an engine having three or more connected drivers, all side rods on both sides should be removed and the engine brought in with the main rods up only."

Law No. 3 reads: "In case the main crank pin breaks off close to the wheel, all side rods should come down on both sides and the engine brought in with but one main rod up."

The question that will at once arise in an investigating mind is, "Why?" Take law No. 1, for instance, "in case of a broken side rod the corresponding rod should come down also." This is undoubtedly good practice, where the side rod involved is the front or back section on a consolidation locomotive, or the side rod on an 8-wheel engine, but even in the latter case the question will arise, is it necessary and is it good practice? While there is no question as to the correctness of the practice, as applied to front and back sections on consolidation locomotives, and ordinarily on 8-wheel locomotives, yet there may be times when it might be well to deviate from the established practice in case of an 8-wheel engine. The hauling capacity of every locomotive is governed largely by the adhesion of the drivers, the ratio of adhesion or tractive power being usually as 4 is to 1, or 4.5 is to 1. In other words, for every pound of tractive power developed in the cylinders we have from four to four and one-half pounds of adhesive weight to hold the drivers to the rail and prevent the engine from slipping.

Take now an 8-wheel engine with a broken side rod where both side rods are disconnected and only the main rods left up. In this case our ratio of adhesion to tractive power would probably be as 2 is to 1, and, consequently, it would be almost impossible to hold the engine to the rail or prevent slipping; therefore, if the engine was coupled to a passenger train heavy enough so that it required considerable effort on the part of the engine to start it, the probabilities are that with an engine disconnected in this manner the train could not be handled at all, and yet, if instead of a broken side rod the engine broke a valve stem so that one side of the engine was inoperative, the engineer would have no hesitation in trying to handle the train with his engine on one side, and no doubt he could handle it successfully. In this case, if the engine was disconnected in the old manner—that is, both side rods taken down—the probabilities are that it would be necessary to send for another engine to handle the train. For this reason, would it not be better to disconnect the main rod on the same side where the side rod was broken and leave the side rod up on the other side, thus virtually putting the engine on one side and thereby leaving it its total ratio of adhesion so as to eliminate all possibility of slipping?

Considering Law No. 2, "failure of main connection," there are some types of engines, notably switch engines, which have the main rod connected to the rear pair of drivers and the eccentrics on the intermediate pair. In case of failure of a main connection of an engine of this type, if the corresponding side rod on the opposite side were taken down also, the engine would be totally disabled. This also applies to some types of consolidation engines where the main rod is connected to one pair of wheels, while the eccentrics are mounted on the axle of the preceding pair, and in this case, same as the one above mentioned, in case of the failure of the main connection on one side it would be necessary to take down all side rods on both sides according to the old methods of disconnecting, which would totally disable this engine just the same as the previous one. While there cannot be such serious objection to the old methods of disconnecting in case of an 8-wheel engine, yet we believe that in modern practice different methods should be employed, as, for instance, in case of the failure of the main connection on any type of engine where the main rods are connected to one pair of wheels and the eccentrics are mounted on another axle, instead of totally disabling the engine by disconnecting all side rods, the side rods should be removed only from the side where the main connection is broken, but, in addition to this, the main rod should be taken down on that side also. This would put the engine on one side, and not only enable it to handle itself, but to handle about one-half of its usual rating.

Again, take the case of a broken main connection on an ordinary mogul or 10-wheel or consolidation engine, where the eccentrics are mounted on the same axle to which the main rods are connected. In this case, if the main connection on one side broke, established custom would have you remove all side rods from both sides, bringing the engine in with the main drivers only. If this were on a consolidation engine, we question whether the engine would handle itself with but the main drivers operative, as in this case the ratio of adhesion to tractive power would be as 1 to 1, and, consequetntly, the main wheel would simply slip instead of propelling the engine. A 10-wheel engine disconnected in this manner would necessarily have to give up its train, whereas, if on a passenger train and disconnected by the new method, it could handle its train to the terminal and possibly make running time.

Considering Law No. 3, "in case of a broken main crank pin close to the wheel," this, under the old method, would mean take down all side rods on both sides and bring the engine in with one main rod up only. In case of anything larger than an 8-wheel engine it is question whether the engine would handle itself or not, and even if it did handle itself, which would only be possible on a level road, it could not handle any portion of its train. In our opinion, therefore, the proper method of disconnecting would be to take down the main rod and all side rods on the disabled side, leaving the main rod and all side rods up on the good side. This would not only enable the engine to handle itself, but if on a passenger train to handle the passenger train, and if on a freight train to handle about one-half of its rating. Another point in favor of the new method of disconnecting is that on nearly all modern engines larger than the 8-wheel type it is necessary to disconnect the back end of the main rod before the side rods can be taken down; therefore, under the old method, after the side rods were taken down, it would be necessary to connect the back ends of the main rod up again. This would involve a possibility of getting liners mixed up, thereby lengthening or shortening the main rod so that in addition to the broken side rod or crank pin, as the case might be, you would probably have a broken cylinder head, if not a broken cylinder.

We fully realize that objections will be heard from all sides against the proposed method of disconnecting, some of the objections being that with one main rod up only and all the side rods up on the same side there would be a possibility of some of the drivers slipping, so as to throw the rods in strain, breaking either the rods or the crank pins. A moment's thought, however, should convince anyone that the wheels will not slip going down hill when the engine is drifting, and cannot slip when working steam, for the simple reason that, as stated before, the ratio of adhesion to tractive power is usually as 4 or 4.5 is to 1 when both main rods of the engine are connected. With only one side of the engine up the ratio of adhesion would be more than double; consequently, the one cylinder would not develop enough power under any circumstances to slip the drivers. Cases will no doubt be cited where damage was done by leaving the side rods up on one side and disconnecting same on the other. A careful investigation of these cases would no doubt develop the fact, however, that in all such instances either both main rods were left up or else the main rod was left up on one side and the side rods on the other. In view of the ever-increasing dimensions of locomotives, with a corresponding increased difficulty in handling heavy rods, we can see no reason why we should not depart from the old-time methods and adopt methods more in line with modern railroading. The subject is now open for discussion.

Inventions That Are Not Pushed.

When any new invention or process has been brought out people in the regions of modern civilization strive to improve it in every way they can think of. The various peoples from whom we inherited the germs civilization were deeper steeped in a spirit of contentment than we are, and they did not harass themselves to better things that served their turn in a modest manner.

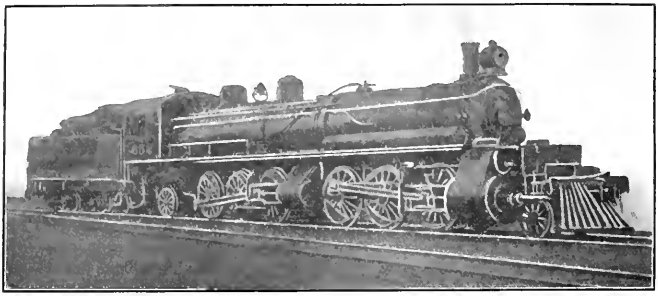
Take steel making, for instance. The natives of India made Wootz steel two thousand years before Huntsman, the reputed inventor of cast steel, was born. The Indian blacksmiths made their cast steel in small lumps by a very crude process, but their product was the steel from which the famous Damascus swords were made; so its quality was seldom excelled. These Indian blacksmiths are making their steel by the old process today, but the output is so limited that railway companies in Hindustan cannot get enough native steel to supply their machine shops with cutting tools.

Then take butter making. This useful article of diet was first made in Syria and was discovered by accident. A sheik noted for the number of his flocks and herds preferred milk to the juice of the grape as a beverage, and he had a supply of milk carried in goat-skins. The jolting of the camels churned the milk and the resulting thick substance was at first thrown away, but by degrees the people found that the thick stuff had merits all its own, and butter had come into use. The Syrians—Arabs—have not improved on that process of making butter, which in those parts continues to be more of a liquid than a solid.

Most of our readers are no doubt familiar with Lamb's story of how the Chinese learned to cook roast pig. But that is a ridiculous story, illustrating habits of primitive people.

Mallet Compound Made of Simples.

The Chicago Great Western Railroad have recently built a Mallet articulated compound engine, and have used one of their F-3 or prairie type (2-6-2) for the rear or high pressure unit of the combination. The front unit was built by the Baldwin Locomotive Works, and the details were made interchangeable with those of the rear section as far as possible. The engine was converted in the Oelwein shops of the road, where Mr. G. M. Crownover is the master mechanic.



MALLET COMPOUND ON C. & G. W.

The boiler extension consists of a feed-water heater. The tender has an 8,000-gallon tank, the tender having been built at the Oelwein shops. We are informed that the converted engine is showing considerable economy, with largely increased power, and it is likely that other similar conversions will be made, as the increasing business of the company is making larger demands upon the mechanical department. We are indebted to the courtesy of Mr. J. G. Neuffer, superintendent of motive power of the road, for the photograph from which our illustration is made and for the information concerning the conversion of the engine.

Some of the dimensions of the engine are appended for reference:

Heating Surface.—Firebox, 154 sq. ft.; tubes, 4,924 sq. ft.; total, 5.078 sq. ft.
Number of Tubes. 352; 2 ins. diameter, 16 ft. 8⅞ ins. long.
Number of Tubes, feed water heater, 400; 2 ins. diameter, 8 ft. 11 ins. long.
Firebox.—Inside, 74 x 96 ins.
Grate area, 49.3 sq. ft.
Steam pressure, 200 lbs.
Cylinders.—High pressure, 21 x 28 ins.; low pressure, 35 x 28 ins.
Size of Journals.—Main, 9½ x 12 ins.; others, 9 x 12 ins.; radial truck, 7 x 12 ins.; engine truck, 6 x 12 ins.; tender, 5½ x 10 ins.
Rigid wheel base, front unit, 11 ft. 7 ins.; back unit, 11 ft. 4 ins.; total driving wheel base, 33 ft. 3 ins.
Weight.—On drivers, back, 135,000 lbs.; front, 130,000 lbs.; on front truck, 20,000 lbs.; rear, 30,000 lbs.
Total wheel base, 80 ft. 6½ ins.
Total weight of engine and tender.—Empty, 367,500 lbs.; loaded, 466,000 lbs.
Tractive power, 52,100 lbs.
Capacity of Tender.—Water, 8,000 gals.; coal, 16 tons.
Total length of engine and tender, 90 ft.
Height from top of rail to top of stack, 14 ft. 11 ins.

Wonderful Instances of Durability.

Chemistry and physical science have long enunciated the theory that the ultimate component particles of matter have a fixed size and shape known as an atom. Recent discoveries indicate that the atom, small as it is, is susceptible of division. The atom is such an infinitely small entity that the strongest magnifying apparatus has failed to show its form, but one of the most amazing demonstrations of science is the capacity that certain substances have for divisibility. Some instances are worthy of mention.

A chip of marble may be broken and crushed to fine powder. The smallest particle of this powder discernible to the naked eye when examined under a microscope is seen to be a block having all the qualities of the original marble.

The thinnest part of a soap bubble just before it bursts was shown by Newton not to exceed 2,500,000th part of one inch in thickness. Yet it is evident that the ultimate particles of water must be of much less diameter.

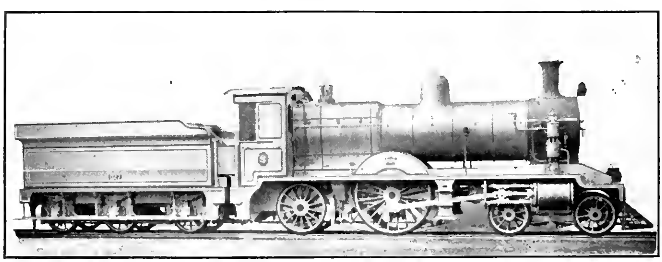
The gold beater's art shows extraordinary examples of how finely gold can be divided. The gold beater produces leaves so thin that there are 382,000 in a pile one inch thick. In making the gilt silver wire used in embroidery, a rod of silver is covered with a small proportion of gold and then drawn out into a fine wire in which the gold retains the same proportion to the silver as at first. A portion of this wire, on which the gold is only the 432,000,000,000th part of an ounce, may be seen by a microscope to be covered with a continuous coating of the metal having all the appearances of solid gold.

The microscope has revealed the existence of animals a million of which would not occupy more space than a grain of sand. Yet these animalculae have limbs and organs and display all the appearances due to vitality. How shall we conceive the smallness of the tubes through which their life fluids circulate?

Single Driver for China.

A rather unusual type of express locomotive has recently been constructed for the Shanghai-Nanking Railway of China by Messrs. Kerr, Stuart & Co., of Stoke-on-Trent, England. In consequence of exceptional requirements to meet the increased traffic brought about by the Nanking Exhibition the engineers specified very urgent delivery, and the order was completed within record time. The first engine was in steam within 47 days from the receipt of order.

The design of these engines is exceptional, as can be seen from our illustration, so far as Chinese railways are concerned, and the proportions are so remarkable as to constitute a novelty even for the 4-2-2 type. An inspection of the picture would scarcely indicate that the driving wheels are 7-ft. in diameter, as the great height of the boiler center, and the total height tend to dwarf them into comparative insignificance. The leading dimensions are: cylinders, 18 by 26 ins.; diameter of wheels, bogie 3 ft. 6 ins., driving 7 ft., trailing 4 ft. 9 ins.; boiler—length of barrel 12 ft. 10½ ins., diameter 4 ft. 9½ ins., height of center above rails 9 ft., working pressure 180 lbs. There are 188 tubes; heating surface—firebox, 182.61 sq. ft.; tubes, 1,467.39 sq. ft.; total, 1,650 sq. ft.; grate area, 28 sq. ft.; weight of engine in working order, 56 tons 1 cwt., and of tender 42 tons 13 cwt., the tender having a capacity for 7 tons of coal and 3,500 gallons of water. The wheel-base of the engine alone is 25 ft. 2 ins., and of engine and tender 48 ft. 9 ins., the total length over couplers being 57 ft. 3¾ ins., and the height to chimney cap 15 ft.; the extreme width over steps is 9 ft. 10¾ ins.



SINGLE DRIVER ENGINE FOR CHINA.

Westinghouse Companies Exhibits.

BRAKE EXHIBIT

The principal exhibit of the Westinghouse Traction Brake Company at the American Street and Interurban Railway Association was an exhibition rack representing the complete equipment of a 10-car subway or elevated train of motor and trailer cars, furnished with the latest electro-pneumatic brake system and Westinghouse governor synchronizing system for distributing the labor of supplying the compressed air equally among all compressors in the train. The electric control of the brakes is so superimposed upon the pneumatic apparatus that, while the brakes are being operated electrically, the pneumatic brake proper remains fully charged and ready for immediate application should power go off the line or other accident cause the electric control to become inoperative. This feature has been characteristic of all electro-pneumatic brake systems to a greater or less degree; but in the above electro-pneumatic equipment the electric control has also been extended to the emergency features of the brake, so that an emergency application originating at the brake valve, or at any other point in the train, is transmitted electrically, therefore the brakes on each car apply instantly and to full pressure. At the same time, the pneumatic emergency features are kept equal in efficiency to the most advanced type of purely pneumatic emergency brake.

The demonstration rack was accompanied by two illuminated charts showing curves of stops as actually made with the old-style pneumtic brake of ten years ago and the stops now made with the new electro-pneumatic brake. Another demonstration equipment represented the complete equipment of a five-car train fitted with the company's type "AMM" automatic brake equipment for interurban service, operating either in single cars or trains.

There was also an exhibit including a panel of six electric pump governors for services ranging from ordinary city car service to high-voltage, heavy-duty installations, like the New York, New Haven & Hartford and the St Clair tunnel electric locomotives. Other exhibits included the Westinghouse automatic car and air coupler and the American automatic brake slack adjuster, made by the American Brake Company, St. Louis, Mo.

ELECTRIC EXHIBIT.

The Westinghouse Electric & Manufacturing Company had on exhibition a complete working outfit of its new type "HL" multiple unit control, for street and interurban lines, connected to two 40-hp. railway motors, which were loaded by Prony brakes. One of these motors is the familiar type No. 101-B-2 40-hp., non-interpole motor; the other is a type No. 307 40-hp interpole motor. A large number of detail parts of the control apparatus was also shown. A type K-34 drum type controller for operating four 75-hp. motors was part of the exhibition.

The standard railway motors displayed included the No. 303-A 100-hp. motor for high-speed interurban service; Nos. 305 and 306 motors, rated at 50-hp. and 60-hp. respectively, for lighter cars; and No. 321 90-hp. motor, for 1200-volt service.

Of particular interest were the No. 101-B-2 motor parts, including shaft, bearing housing, field coils, brush holders, etc. Many of these parts were cut in sections so that the good points of their construction could be more readily appreciated. The noted No. 3 motor, now 20 years old, was also on view. A welded sheet steel gear case showed one of the coming possibilities for reducing the weight of equipments. The Westinghouse single-phase system was represented by the

WESTINGHOUSE COMPANIES' EXHIBIT

No. 135 motor, which has a capacity of 75-hp. when operated on 25 cycles and 90-hp. when operated on 15 cycles. This is the motor used by the New York, New Haven & Hartford Railroad Company. The Boston & Maine Railroad also has recently decided to electrify the Hoosac Tunnel with the same system. The rest of the exhibit included a complete line of material; A.C. and D.C. motors for shop machinery; transformers and incandescent lamps, etc.

MACHINE EXHIBIT.

The Westinghouse Machine Company showed a Westinghouse-Leblanc condenser with air and circulating pumps direct connected to a 15-hp. Westinghouse steam turbine. The capacity of this turbine is 7,200 lbs. steam per hour with 70 degs. cooling water, producing 28 ins. vacuum. This condenser was shown with the top half of the turbine, for operating same, removed, and with the revolving part of the water and air pumps placed on the outside of the casing, showing in detail the construction of the different parts of this piece of apparatus.

LAMP EXHIBIT.

The Westinghouse Lamp Company had on exhibition one of each size of their 110-volt wire type tungsten lamps. These lamps were burning on two large ornamental iron fixtures mounted in the exhibit. This company had another exhibit of lamps, which consisted of all types, sizes and voltages of lamps for railway work, and included lamps with both tungsten and metalized filaments.

The following officers of the companies were in attendance: Westinghouse Air Brake Company—Messrs. A. L. Humphrey, general manager; Jos. R. Ellicott, eastern manager; E. A. Craig, southeastern manager; W. S. Bartholomew, western manager; E. L. Adreon, southwestern manager; W. B. Turner, chief engineer.

Westinghouse Electric & Manufacturing Company—Messrs. L. A. Osborne, 2d vice president; S. L. Nicholson, sales manager; C. S. Cook, manager railway and lighting sales; G. B. Griffin, manager detail and supply sales; J. C. McQuiston, manager department of publicity. The exhibit was in charge of W. Barnes, Jr., of the department of publicity.

Westinghouse Machine Company—Messrs. F. H. Sniffin, sales manager; L. L. Brinsmade, eastern manager; H. Van Blarcon, manager Pittsburgh district; H. F. Longwell, consulting engineer.

Railway & Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances.

Published Monthly by

ANGUS SINCLAIR CO.

114 Liberty Street, New York.

Telephone, 984 Cortlandt.

Cable Address, "Loceng," N. Y.
Glasgow, "Locoauto."

Business Department:
ANGUS SINCLAIR, D.E., Prest. and Treas.
JAMES KENNEDY, Vice-Prest. and Gen. Mgr.
HARRY A. KENNEY, Secretary.

Editorial Department:
ANGUS SINCLAIR, D.E., Editor.
GEORGE S. HODGINS, Managing Editor.
JAMES KENNEDY, Associate Editor.

Boston Representative:
S. I. CARPENTER, 643 Old South Building, Boston, Mass.

London Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., 3 Amen Corner, Paternoster Row, London, E. C.

Glasgow Representative:
A. F. SINCLAIR, 15 Manor Road, Bellahouston, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid in the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribe in a club, state the name of the agent.

Please give prompt notice when your paper fails to reach you regularly.

Entered at the Post Office, New York, as Second-class Mail Matter.

First Aid to the Ambitious.

All our readers know the aims and objects of RAILWAY AND LOCOMOTIVE ENGINEERING and they also know of the work accomplished among railroad men in the presentation of useful and helpful information given to the best of our ability in readable form. We have an Air Brake Department which is up to the highest standard in every way. We have an Electrical Department in which the practical side of operation and tests of railway electrical apparatus has been a marked feature. Our General Foremen's Department contains matter of interest not only to general foremen but to all foremen and to those who have to do with railroad shops and round houses.

There is another department which will begin in the January, 1911, issue. We have called it the "First Aid to the Ambitious." It contains a series of questions such as any one of our large trunk line railways uses as a basis for an examination for promotion. We give the answers to these questions and we intend to so conduct this department that it will be what its name implies. The careful study of the answers given will materially assist those who are ambitious to get on in their chosen calling. Questions relating to simple physical science will also be handled in this department, and it is believed that they will tend to help in the understanding of the whole subject. Dr. Sinclair will give special attention to this new and helpful department.

We wish to say to our readers that our correspondence columns are open to all our readers. We want your views on current railroad topics and we want "shop kinks" and we will pay for them.

Standing Shoulder to Shoulder.

In the October issue of RAILWAY AND LOCOMOTIVE ENGINEERING we presented a report of the meeting of the four leading brotherhoods of railway men which was held in New York City on Sept. 25. As we stated, nearly 3,000 delegates were present, and the meeting has generally been characterized as the most momentous since the establishment of the various unions of railway employees. It embodied the first outspoken declaration that the interest of the employers and employees are identical, and it was the first time that these thoroughly organized unions have ever united to support the railway companies in asking from the government fairer and more liberal treatment in the matter of transportation rates.

The spirit of fairness which characterized the stirring addresses of the various speakers showed how carefully the subject had been considered in all its bearings, and the unanimity of approval with which the lucid arguments were received showed that the speakers reflected the matured thought of the delegates present. It was in many ways a new departure among railway men. It is an evidence that the time has come when that vast body of men engaged in the railway service realize that their interests are one and are prepared to stand shoulder to shoulder with their employers. It is also evident that in the strenuous activity essential to the performance of their multiplex duties as railway men they have overlooked the important matter of giving some time and attention to the science of government. The industrial revolution which the introduction of transportation by the steam engine has produced was not brought about without much heroic self-sacrifice and much work of a kind that can never be overpaid. The rewards in some instances have been great, but never in any sense out of proportion to the benefits bestowed on the work accomplished. It will be generally admitted that it should be the duty of a just and equitable government to foster and advance the interests of these great enterprises so that the good work of projecting railways into every available portion of our great land should go on and that the men engaged in the hazardous occupation should be properly and fully rewarded, as is becoming to their important position as a contributing factor to our national prosperity.

The delegates represented more than 350,000 railroad men employed east of the Mississippi River, and it is not an overestimate to state that they, in a large measure, represented at least 2,000,000 voters who are more or less dependent for a livelihood on the railroad companies. The deliberations took the form of a memorial to the President of the United States, the Interstate Commerce Commission and all other National and State lawmaking bodies. A set of strong resolutions was prepared supporting the proposal of the railroad companies that they be permitted to make a reasonable increase in rates, as in their opinion the rates for transportation now permitted are too low to enable the companies to make a fair profit, pay fair wages, or to continue to provide high-class service to the public. There will be no kind of political agitation, but candidates for office will be requested to answer questions concerning their attitude on the matter involved.

We are confident that the problem now taken up by the railway men themselves will be thoroughly considered and that some substantial good will come of it. Wages are not advancing in the same ratio as the price of commodities, and there is a crying need for a general increase of wages, not alone among the members of the four leading brotherhoods, but also among every class of railway worker and none more so than those engaged in the various sections of the mechanical department.

Dispatching by Telephone.

The Grand Trunk Railway System have recently placed in commission on their Northern Division in Ontario, Canada, two telephone train dispatching circuits. One of these is between North Parkdale Jct. and Burlington Jct. via Allandale, a distance of 145 miles, and another circuit between Allandale and Nipissing Jct., a distance of 165 miles. Train dispatchers on each of these circuits work at Allandale.

On the circuit between North Parkdale Jct. and Burlington Jct. there are twenty-one way stations, and on the circuit between Allandale and Nipissing Jct. there are twenty way stations. These circuits are constructed of No. 9 gauge hard-drawn copper wire, transposed at intervals of every half mile through the open country and as much more frequently as is necessary in the vicinity of high voltage power lines, in order to avoid inductive influences and to render the telephone circuits absolutely quiet. The station equipment consists of a swinging arm transmitter and head band receiver for each way station, thus giving the operator the free use of his head, hands and body while using the telephone; the apparatus is swung to one side out of the way while not in use.

The train dispatching office is equipped with a selector system for calling offices and the duration of the ring in each way station is controlled by the dispatcher, who plainly hears the ring through his receiver. Any office on the line can be signalled within eight seconds and as the signal bell in each office consists of a 4-in. gong there is little doubt that the operator on duty will hear his call, even though he may be outside of the office and at a distance from it. The dispatcher has absolute control of the circuits and way stations must obtain his co-operation when desiring to communicate with one another.

The telephone is considered as being superior to the telegraph as a medium for dispatching trains, both as a factor of safety and saving of time. By telephone each station and numeral is first pronounced and then spelled out letter by letter by the dispatcher for verification when an order is issued, and repeated in like manner by the receiving operator, while by telegraph stations the numerals can only be spelled out in Morse characters.

During the past three years the telephone has made rapid strides on trunk line railways in the United States and Canada for train dispatching purposes and today over thirty thousand miles of railway is being so dispatched. While the expense for constructing and equipping telephone circuits greatly exceeds that of constructing telegraph lines, the railways have obtained so much better results with the telephone that they feel justified in spending the money. We understand that it is the intention of the Grand Trunk Railway System to extend the use of the telephone over its more important lines in the near future. The new system has met with the immediate favor of the dispatchers and operators, the transmission being so excellent that the work is being transacted in fully 50 per cent. less time and in a more personal and satisfactory manner than is possible with the telegraph

---

The Brick Arch.

The experiments made by Mr. F. F. Gaines, superintendent of motive power of the Central of Georgia Railroad, which we print on another page, will be read with much interest by thousands of men engaged in the mechanical departments of railways It is an important contribution to the railway literature of our time in regard, not only to economy in fuel and in boiler construction and repair, but also to the still more important subject of smoke abatement, which has come to be a burning question, especially in the larger cities. Many of our readers are doubtless aware that there is now a complete city department in Chicago, of which Commissioner Bird is the head, devoted to the question of the abatement of smoke in that city. In Philadelphia steps are being taken in a similar direction. Property owners claim that the smoke from the increasing traffic of locomotives has diminished the value of property, and in certain localities has produced an almost tenantless quarter in that city. The reports of interested politicians are apt to be exaggerated, but when we see legal enactments enforced in Washington compelling the burning of coke in locomotives within the city limits, and lawsuits being instituted in the vicinity of New York for alleged damages by the smoke of locomotives, it is useless to ignore the fact that there is a strong national movement looking towards a better clearing of the atmosphere of the smoke emitted from locomotive smokestacks.

In regard to the brick arch, we have long held the opinion that while the experiments on the smoke boxes of locomotives have been conducted with an intelligence and a zeal that have been altogether admirable, and with most gratifying results, more might have been done in the way of experiments on the firebox. The complete prevention of smoke in the burning of coal is a physical impossibility. The reduction to a minimum of the amount of smoke is not only possible but is gradually, although slowly, being accomplished.

We had opportunities of observing the successful work on the Boston & Maine Railroad looking towards smoke prevention. The furnace fires are so skilfully managed that on approaching Boston and other large cities there is no smoke visible. The care and attention that is given to the use of the brick arch in the locomotive fireboxes on that road doubtless has much to do with the result, but we are of opinion that the fine training of the firemen has also added much to the result.

It should be noted that the cost of the brick arch is much less than might be anticipated On the railroad that we have referred to the cost of material and construction of the arch does not exceed five dollars, the period of service of the arch being measured by the mileage made by the locomotive In the case of the heavier freight engines the limit is 6,000 miles. In the case of the passenger locomotives the distance run is extended to 6,500 miles. This service extends to a period of between thirty and forty days, so that each locomotive will require from nine to twelve new brick arches each year The arch has grown in favor since its introduction into the locomotives of the Boston & Providence by Mr. George Griggs fifty years ago.

Boiling of Water Under Pressure.

In describing the boiling point of water some of the older text books on physical science used this form of expression: "Water boils when the tension of its vapor equals the superincumbent atmospheric pressure." Put in this general form the definition is not easily understood, but a simple experiment may be made by any one with suitable apparatus, which will fully explain the meaning of the scientific language.

To perform the experiment a very frail vessel may be used. A cylinder of tin will suit the purpose, but the tin walls should be quite thin, and in the upper end of the vessel a stop cock should be placed. A little water introduced into the vessel may be boiled over a spirit lamp, and steam issuing from the open stop cock will prove that the space above the water in the vessel is filled with steam at atmospheric pressure, viz.: 14.7 lbs. If the stop cock be shut the steam in the space above the water becomes imprisoned. If now the spirit lamp be removed and cold water be poured over the thin-walled tin cylinder, the steam in the space above the water will be condensed and a partial vacuum formed within the vessel. The internal pressure will fall below that of the atmosphere and the required demonstration may be found by observing that the thin walls of the vessel are crushed in.

In commenting on this experiment Tyndall points out that with an atmospheric pressure of 14.7 lbs., resting on every square inch of the surface of water boiled in an open kettle, it is very wonderful to see how so exceedingly frail a thing as a bubble of steam can exist at all on the surface of boiling water. The reason is that the steam inside the bubble has exactly the same pressure as that exerted by the atmosphere outside it, and by the exact and even balance of these two pressures the fragile film which forms the walls of the bubble is not injured.

If the steam pressure inside the bubble exceeded the atmospheric pressure by ever so little the bubble would explode or burst outwards. If the external pressure of the atmosphere predominated by the merest fraction of an ounce the bubble would be crushed in and broken. The exact balancing of these opposing forces leaves the bubble intact.

Going a step further we may find that the same law holds good whether the external pressure applied to bubble is produced by the presence of air, steam or water If we boil water in a strong vessel closed at the top, so that steam will accumulate even when so low a pressure as 5.3 lbs. has been produced by the imprisoned steam, bubbles will not form until they are hot enough to sustain an internal pressure of 20 lbs. That is 14.7 added to 5.3 lbs. The pressure on the outside of the bubble will of course be exactly 20 lbs., or else the film of the bubble would be destroyed. The bubble may easily be broken and probably does break by striking a side of the vessel, or by contact with the eddies caused in the circulation of the boiling water, but the bubble is not broken by unequal pressure inside and out. It could not have formed in the water at all unless its internal pressure had equaled that applied by the surrounding water, which was determined by the steam above.

In order to produce a bubble of steam having an internal pressure of 20 lbs. absolute, or above vacuum, a temperature of 227.9 degs. Fahr. is necessary. Thus a 5.3 lb. gauge pressure of steam requires a rise in temperature of 15.9 degs. Fahr. above the usual 212 degs. Fahr. at which water boils in an open vessel. At a gauge pressure of 103 degs. Fahr., or 115 degs. absolute, the temperature required is 337.8 degs Fahr., or a rise of 125.8 degs. Fahr. above the normal boiling point. On water boiled in a locomotive which shows a guage pressure of 203 lbs., or about that carried on many of our modern engines, steam bubbles cannot form until the water has been heated up to 387.7 degs Fahr., and this is 175.7 degs. Fahr. higher than the boiling point of water open to the air.

In all these examples the same law applies, and the true boiling point of water is that at which the inside and outside pressures on the walls of the bubble of steam are equal. The text book definition uses the word atmosphere, but in its wider application it means the pressure applied at the surface of the liquid, and this determines the pressure below the surface of the water. The bubble may be broken by the uprush of other bubbles in a free steamer, but its destruction is not due to the inequality of pressure within it and upon it.

The Equity of the Derail.

In our correspondence columns this month a reader of Railway and Locomotive Engineering sends us a communication concerning an invention of his which gives a day and night indication of the position of a derail, and this invention he tells us was endorsed at the union meeting of the Brotherhood of Locomotive Engineers. The rail is generally laid so that the wheels on one side which have been compelled to leave the track shall traverse a trough containing sand, the object being to cause a brake application to be more effective, and also to bump the leading portion of the train over the ties and so stop it in order that a worse calamity may not befall the train. A derail at the entrance to a swing bridge may halt a train very effectively by the moral effect of its presence or it may also bring a train to rest when derailed before the rear portion, containing passengers, is thrown into the river. The question of signaling a derail is one to which nearly all signal engineers would probably give a negative answer and would say that with a danger signal in evidence, an indication on a derail would not be necessary. Our correspondent has, however, a right to his view of the matter.

A locomotive engineer with a derail open in front of him so that the train will infallibly leave the track is in the presence of a most powerful agent for compelling respect for the stop signal given. No one will deny that, and probably no one would, from a theoretical standpoint, would say that the object in view by those who put the derail in the track was not eminently right and proper. A stop before an open swing bridge is imperative and the derail merely automatically and mechanically interposes a severe penalty for the infraction of the rule.

On the other hand a derailed train in motion is a dangerous thing. Even if no lives be lost the engine and rolling stock suffer, the roadway is damaged and the line more or less effectively blocked for some time. In certain cases injury to persons may result or even loss of life may take place. Terror is aroused in the minds of everyone on the train who is conscious of the derailment, and grave discomfort, if nothing worse, takes place.

It is a nice point in equity or general fair play, as we may say, whether or not travelers should be subjected to the discomfort and possible danger involved in the use of the derail. Innocent people may be frightened or hurt for the sin of a man they cannot control.

For our own part we believe that the general average locomotive engineer is a careful man, anxious to do his duty faithfully, and that in nine cases out of ten he does hot require the drastic penalty of derailment to make him comprehend the seriousness of a situation he may be called on to face. The derail is a good thing to catch a chancetaker, but we do not believe that the rank and file of locomotive engineers belong to this class of railroad men. We are all making progress, and the chancetaker is not finding the modern properly operated railway a good place to do business.

If we must have the derail, the effort of our correspondent to clearly indicate its position is a good one, but something better can no doubt be devised which will be equally effective. In these days of progress, as we have indicated, where sensible men are taking thought of their responsibilities as locomotive engineers and who want to do the right thing, and are trying to do the right thing to the best of their abilities, the situation needs revision.

A good, workable, reliable and efficient stop signal will eventually be substituted for the derail. Such things have been invented and have been tried.

On subway and elevated railroads, where snow and ice do not interfere with the operation of stop signals, they are in use. Efficient devices which set the brakes in emergency, and on electrically propelled trains cut off the power, are in daily use, and be it said to the honor of the men running those trains the stop mechanism is rarely called into action. The moral effect of the stop signal is as good as the derail, and the effect, when it does operate is not nearly so dangerous. Our hopeful prophecy is that the growing feeling which we see pervading all ranks of railroad men—the desire to make American railroads the safest in the world—will in time completely eliminate the chancetaker, and in time the derail will make way for the effective, efficient and harmless stop signal.

We would like to have an expression of opinion from engineemen on the derail question. What do you think of the derail; is it necessary? In this issue we have a good article from Mr. F. P. Roesch, on Disconnecting. What do you think of his methods? Mr. F. F. Gains uses a hollow arch and combustion chamber on the Central of Georgia Railroad. What do you think of that?

Book Notices

Conservation of Men. An Address to the Operating Men of the Chicago and Northwestern Railway on the Prevention of Accidents. By Ralph C. Richards. 90 pages. Paper cover.

Mr. Richards presents in a forceful and logical way many convincing reasons why it is better to cause a delay than to cause an accident. He recounts a number and variety of startling incidents of actual occurrence, many of which might have been avoided had a greater degree of care been exercised. The address would well repay a perusal by every man in the mechanical as well as in the operating department, and we are hopeful that some means may be taken to circulate the address freely among railway men.

Rules and Formulæ, with Suggestions Pertaining to Good Practice. Endorsed and adopted by the International Master Boilermakers' Association. 65 pages. Cloth. Price, $1. Published by the Association, 95 Liberty street, New York.

This little book contains much of the best obtainable matter in regard to the designing and inspecting of steam boilers, generators and other receptacles adapted for internal pressure. The work was endorsed at the annual meeting of the Association held at Louisville, and is the result of the labors of an efficient and painstaking committee, of which Mr. Charles P. Patrick, a well-known boiler expert, was chairman. The section on staybolting flat surfaces with screw stays is especially interesting. Comparisons are made between different types of boilers and rules, and much valuable matter is presented in a concise and handy form.

Combustion Chamber and Hollow Arch, on the Central of Georgia

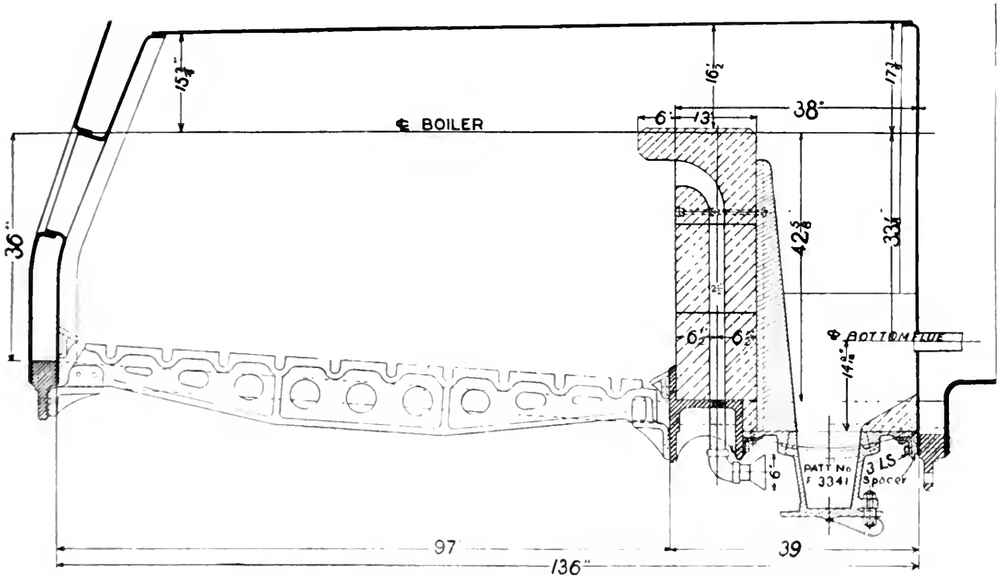
The value of a particular style of brick arch and a combustion chamber is receiving very close attention on the Central of Georgia Railroad. Mr. F. F. Gaines, superintendent of motive power of the road, has designed a boiler with a long firebox and has made a combustion chamber in it by building up a brick arch a short distance in front of the flue sheet. The whole arrangement is very clearly drawn in our illustration. Speaking of the hollow arch and combustion chamber boiler Mr. Gaines says:

"Several years' experience in the anthracite district of Pennsylvania caused me to become quite familiar with the combustion chamber, both the original, as applied to the Wootten type of firebox, and the modified form as used to some extent without the brick wall. While there were mechanical objections to this device, there is no question but that it attained its proper end and did improve combustion, and proved very economical in the burning of fuel. Further, the life of the tubes was greatly prolonged, and in no case during the life of the tubes was there nearly as much trouble given as in the ordinary type of engine.

"The Wootten type of boiler has been for years standard on the Philadelphia & Reading Railway, and very justifiably so from the results obtained. Other roads have used it somewhat in a more or less modified form, and within the last few years several roads have been applying it to engines using bituminous coal as a fuel. As far as I have been able to ascertain, the results have been uniformly successful.

"The form of firebox with combustion chamber as heretofore constructed has several mechanical defects which render it more or less objectionable. In the first place, it is almost impossible to prevent having a large number of seams on account of the junction of the different plates coming at the throat of the combustion chamber. Where the brick arch is used it is necessary, about once a week, to draw the fire and allow the arch to cool; put a man behind the arch to shovel out the accumulation of cinders to prevent stopping up the flues.

"Knowing the desirable features of the combustion chamber as regards saving of fuel, diminution of smoke, longer life of flues and better steaming engine, I made a very careful study of the whole matter to see what could be done to get the advantages of the design in question and eliminate the objections. With this end in view I finally evolved the idea of building a boiler with an abnormally long firebox, and partitioning off sufficient space at the front end, by a vertical brick



LONG FIREBOX WITH HOLLOW BRICK ARCH AND COMBUSTION CHAMBER.

Engine	Coal A: Pounds Coal Consumed per 1,000 Ton Miles.	Coal A: Pounds Water Evaporated per Pound of Coal.	Coal A: Relative Efficiency.	Coal A: Per Cent. of Excess Coal Consumed Based on Engine 1014 as unit.	Coal B: Pounds Coal Consumed per 1,000 Ton Miles.	Coal B: Pounds Water Evaporated per Pound of Coal.	Coal B: Relative Efficiency.	Coal B: Per Cent. of Excess Coal Consumed Based on Engine 1014 as unit.	Coal C: Pounds Coal Consumed per 1,000 Ton Miles.	Coal C: Pounds Water Evaporated per Pound of Coal.	Coal C: Relative Efficiency.	Coal C: Per Cent. of Excess Coal Consumed Based on Engine 1014 as unit.	General Average of All Coals: Pounds Coal Consumed per 1,000 Ton Miles.	General Average of All Coals: Pounds Water Evaporated per Pound of Coal.	General Average of All Coals: Relative Efficiency.	General Average of All Coals: Per Cent. of Excess Coal Consumed Based on Engine 1014 as unit.
*1014 ..	102	8.10	100.00	.....	100	8.12	100.00	...	96	8.25	100.00	....	99	8.15	100.00	.....
†1020.	152	5.70	67.11	49.02	141	5.63	70.93	41.00	139	5.93	71.95	44.79	144	5.76	68.76	45.46
‡1719 (1)	108	8.57	94.45	5.88	...	...	.....	.....	...	..	.....	....	108	8.57	91.67	9.09
§1715 ...	119	7.72	85.72	16.67	114	7.11	87.72	14.00	110	7.66	90.92	14.58	114	7.61	86.84	15.15

*Engine 1014—21 x 32-in. Cooke Consolidation, with new firebox and combustion chamber, with hollow brick well and provision for mixing hot air with burning gases. Total heating surface, 2,987.33 sq. ft.

†Engine 1020—Same class engine as 1014, but with original boiler unchanged and no brick arch. Total heating surface, 3,022.29 sq. ft.

‡Engine 1719—22 x 30-in. Baldwin Consolidation, wide firebox and Wade Nicholson hollow arch. Total heating surface, 3,230 sq. ft.

§Engine 1715—Same as Engine 1719, but without brick arch. Total heating surface, 3,230 sq. ft.

(1)—Engine 1719 out on test of Coals Nos. 2 and 3 account of arch burnt out and no material on hand to repair.

wall, to form a combustion chamber, thus allowing me to put an ordinary spark hopper in the bottom of same for the withdrawal of sparks. I believed that the admission of heated air at a point near the top of the bridge would be of advantage in approximating complete combustion. To accomplish this the brick wall in question was made hollow, with passages through it so that air might enter from the outside, go through the wall itself, which, being hot from the high temperture of the firebox, would also heat the air and turn it loose to mix with the gases at top of bridge, the idea being that they would mix and burn during their passage from that point to the flues.

"This design eliminates the trouble involved in removing sparks which gather in the combustion chamber and stop up the flues. It also admits highly heated air at the most desirable point for complete combustion. It also protects the flues from any cold air, no matter at what point in the fire there happens to be a hole.

"The grate area of the new firebox was made identically the same as that of our 22 x 30-inch class consolidations, which are free steamers and economical on fuel. The combustion chamber was made shorter than would have been used if the boiler had been designed new for the engine. It was necessary, however, to design a back end that would go on the old boiler and suit the running gear of the present engine, which somewhat modified the design from what would have been considered best practice. Nevertheless, this engine has now been in service some fifteen months, and so far we have yet to have the first trouble from leaking flues, although the engine is running in a district where other engines are giving us trouble more or less all of the time, and where the average life of a set of flues is about 30,000 miles. It has been found that this engine will steam with grades of fuel that other engines cannot use, and this arrangement appears to be of advantage in utilizing low-grade fuels, and would probably prove very stisfactory in burning lignite.

"This engine, No. 1014, so far has made 37,832 miles, and apparently the flues are in as good condition as the day they were applied. The engine will soon be due for general overhauling, but it is not the intention at that time to do any work whatever on the flues.

"It has also been found that whatever small amount of sparks accumulate in the combustion chamber can readily be removed through the spark hopper at the bottom, but as a matter of fact the amount of sparks carried over the bridge wall is very small. This is probably due, in the first place, to the use of a large nozzle, 6½ inches, the modified mild exhaust not lifting anything but the smallest particles over the bridge. As these small particles are lifted over the bridge, such as are combustible are probably burned before they strike the flues, and the only sparks that are found in the combustion chamber or front end are very fine particles of slate, and very few of these. It has also been noticed by all who have ridden on this engine when working, that the amount of smoke emitted is noticeably less than on the other engines. The fuel consumption has been considerably less, and the engine in every way has proved extremely satisfactory.

"A resumé of test of the first engine equipped is given on the preceding page. In this test the train was composed entirely of cars of company coal of 100,000 lbs. capacity, and the same train was used throughout the whole series of tests, thus eliminating any error from difference in class of work or weights used during the test. Three grades of coal were used, and they are designated as A, B and C, from three different mines, and the average of all is summarized. Engine 1014 is the engine with the combustion chamber; engine 1020 is a sister engine, of the same class, but with the original boiler not equipped with a brick arch; engine 1719 is an engine of better design, wide firebox, with Wade-Nicholson hollow brick arch; engine 1715 is the same class as the 1719, but without the arch. The showing over the other engines made by the 1014 was very stisfactory and substantial. In making the tests all coal used was weighed and put up in sacks.

P. R. R. Tunnels Inspected.

Mr. W. W. Finley, president of the Southern, accompanied by a large party of officials of the Southern Railway Company and affiliated lines throughout the Southeastern States, spent a recent afternoon inspecting the tunnel system and New York passenger station of the Pennsylvania Railroad, which will be the New York terminal of the six through passenger trains operated by the Southern Railway between New York and the South. The visit of the Southern officials was made on the invitation of Second Vice-President Samuel Rea, of the Pennsylvania. After thoroughly inspecting the great station, the party was taken by special train and was carried through the tunnels leading to the Jersey side and Long Island. Preceding the inspection trip President Finley entertained the visiting representatives at luncheon.

Though quite informal, the luncheon was marked by a speech by President Finley, in which he expressed high appreciation of the courtesy of the Pennsylvania Railway officers in affording this opportunity for the inspection, and he also paid tribute to the great achievement of the Pennsylvania Railway Company in providing facilities by which the Southern Railway will be enabled for the first time to land passengers from all parts of the South in the center of New York City without a change of cars. Judge Elbert H. Gary, president of the United States Steel Corporation and a director of the Southern Railway Company, made an address in which he told of his great confidence in President Finley and of his high opinion of the organization of the Southern Railway, and predicted a great future for the Southern.—*Washington Herald.*

Mallet Compound for the C. & O.

The Chesapeake & Ohio Railroad Company have recently placed an order with the American Locomotive Company for twenty-four Mallet Compound locomotives of the 2-6-6-2 type of wheel arrangement. In July last, this road received a Mallet compound locomotive of this type of wheel arrangement from these builders. This locomotive was purchased for trial purposes, and upon its successful service the present order was contingent. It goes without saying, therefore, that the performance of the experimental locomotive here illustrated has fully met the expectations of the railroad officials. This engine has been used in regular road service for which the new lot is also intended. Their purchase indicates the growing tendency in this country toward the adoption of the Mallet type as a road engine for heavy freight service.

This locomotive was put in service on the division between Handley and Allegheny. From the former place to Ronceverte, a distance of 106 miles, it is a continuous easy up-grade varying from a minimum of 2¼ ft. to the mile to a maximum of 21 ft. to the mile. The average grade from Thurmond, 38 miles east of Handley to Ronceverte, being 19 ft. to the mile. From this last point to Allegheny, the summit of the division, there is a 13 mile grade, 30 ft. to the mile.

Prior to the advent of this Mallet locomotive, a consolidation type of locomotive having a total weight of 190,300 lbs., weight on driving wheels of 169,600 lbs., cylinders 22 x 28 ins., and a theoretical maximum tractive power of 41,120 lbs., had handled the freight traffic over this division. The rating of this class of engine was 1,800 tons from Handley to Ronceverte, from which point a pusher was required to assist in handling this tonnage up the 0.57 per cent. grade to Allegheny. Passing the summit, the road runs down the other side of the hill into Clifton Forge, 16 miles of this distance being on an incline of 60 ft. to the mile.

In ordering heavier equipment, it was the purpose of the Chesapeake & Ohio officials, not so much to dispense with the pusher service on the 0.57 per cent. grade on the western slope of the hill, but to increase the maximum train load over the division. It was a question between the adoption of the Mikado, or 2-8-2 type, or the Mallet, for this service. In the former type, a locomotive suitable for the track conditions capable of handling 2,250 tons between Handley & Ronceverte could have been provided, but it would have required the assistance of a helper to handle this tonnage on the grade between the latter point and Allegheny. The Mallet, on the other hand, offered the opportunity of introducing a class of engine capable of handling 3,000 tons without the aid of a pusher over the summit of the division. It was, moreover, thought that because of the economy in fuel consumption due to compounding, the Mallet locomotive could handle its tonnage on less coal than the 2-8-2 type would take to haul the 2,250 tons.

The locomotive which we here illustrate was designed to haul 3,000 tons at a speed of 15 miles an hour on the grade of 21 ft. to the mile, and at 12 miles an hour on the grade of 30 ft. to the mile combined with a minimum curve of 5 degs. 45 min. uncompensated The traffic consists of hauling steel hopper cars loaded with coal from Thurmond to Clifton Forge, and returning with the empties.

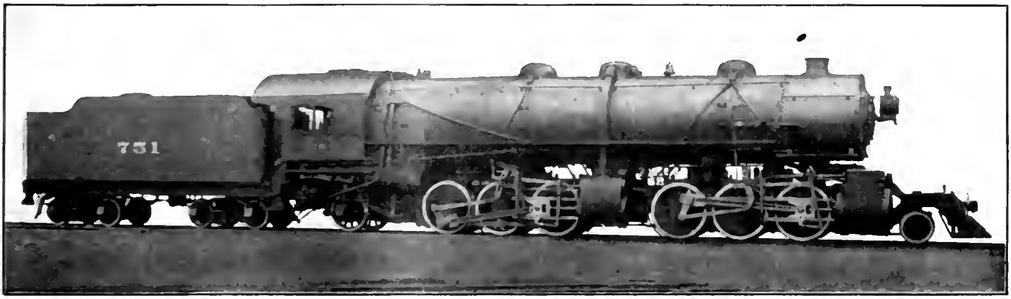
In service the Mallet has exceeded its estimated capacity, and has handled alone 3,492 tons east over the division. With a load behind tender of 3,033 tons made up of 45 steel hopper coal cars, speeds of 20, 22 and 24 miles an hour have been maintained on the grades up the river between Thurmond and Ronceverte It has made the run over the division, 114 miles, in 5 hours and 37 minutes, including the time necessary to turn the engine, the actual running time being 4 hours and 57 minutes.

As far as the design is concerned, one of the principal features of interest lies in the boiler construction The boiler incorporates a combustion chamber of 6½ ft. long This course was added in order to increase the length of the boiler so as to bring the firebox back of the rear driving wheels, thereby making it possible to obtain a good depth of throat sheet, without increasing the length of the boiler tubes to an excessive amount As a result, the depth of the throat sheet is 18 3/16 ins., giving a distance between the top of the grate and the lowest boiler tube of 26½ ins Ordinarily, where the firebox is carried over the driving wheels the bottom tube is only from 19 to 20 ins. above the top of the grate. At the same time the boiler tubes are 24 ft. long, which length is not exceptional. Ample water space of about 9 ins. on both bottom and sides is allowed between the combustion chamber and the shell to which the combustion chamber is stayed by radial stay bolts.

Another departure from previous practice in Mallet locomotives of the 2-6-6-2 type of wheel arrangement is the use of the builders' latest style of outside bearing radial trailing truck, similar in design to that successfully applied to a number of their recent pacific type locomotives. In practically all previous articulated compound locomotives of this type of wheel arrangement built by this company, both the leading and trailing trucks have been of the radial swinging bolster type with journals inside of the wheels. The type of trailing truck here used gives a wider supporting base at the rear of the locomotive, and tends to add to its stability. The leading truck is of the same design as that applied by these builders to other locomotives of the same wheel arrangement.

That portion of the weight of the engine which is carried by the frame of the front system is supported by two sliding bearings, both of which are normally under load. In accordance with the builders' practice in the articulated locomotives where both sliding bearings support weight, the "trim" bolts connecting the upper rails of the front frame with the lower rails of the rear frame are provided with a spring under the nut at the lower end in order to relieve any excessive load which would otherwise be on the rear bearing because of the inequalities in the level of the track or similar conditions. Except for the features particularly mentioned the design in general follows the builders' standard practice. The general features are shown in our illustration and the general specifications are given in the appended table.

Cylinders, 22 and 35 ins.; stroke, 32 ins.
Tractive power, 82,000 lbs.
Wheel Base.—Driving, 10 ft.; total, 48 ft. 3 ins.; total, engine and tender, 80 ft.
Weight.—In working order, 392,000 lbs.; on drivers, 324,000 lbs.; engine and tender, 555,200 lbs.
Heating Surface.—Tubes, 5,646 sq. ft.; firebox, 344 sq. ft.; arch tubes, 23 sq. ft.; total, 6,013 sq. ft.
Grate Area.—72.2 sq. ft.
Axles.—Driving journals, 9½ x 13 ins.; others, 9 x 13 ins. engine truck journals, diameter, 5½ ins.; length, 10 ins.; trailing truck journals, diameter, 7½ ins.; length, 14 ins.; tender truck journals, 5½ ins.; length, 10 ins.
Boiler.—Type, conical; O. D. first ring, 83⅞ ins.; working pressure, 225 lbs.; fuel, bitum. coal.
Firebox.—Type, wide; length, 108⅛ ins.; width, 96⅛ ins.; thickness of crown, 7/16 in.; tube, 9/16 in.; sides, 7/16 in.; back, ⅜ in.; water space, front, 5 ins.; sides, 4½ ins.; back, 4½ ins.
Crown Staying.—Radial.
Tubes.—Number, 401; diameter, 2¼ ins.; length, 24 ft.; gauge, No. 10 and No. 11 B. W. G.
Brake.—Pumps, two 8½-in. cross comp.; reservoirs, one 28½ x 84 ins.; one 22½ x 60 ins.
Tender Frame.—13-in. steel channels.
Tank.—Style, water bottom; capacity, 9,000 gals.; capacity fuel, 15 tons.
Valves.—Type, H. P. piston; L. P. double ported slide type; travel, H. P., 6 ins.; L. P., 6 ins.; steam lap, H. P., 1 in.; L. P., ⅞ in.; ex. lap, H. P., 3/16 in. lead, 5/16 in. ex. cl.; L. P., 3/16 in. lead, 5/16 in. ex. cl.
Setting.—H. P., cut off, 87 per cent.; L. P., cut-off, 90 per cent
Wheels.—Driving, diameter outside tire, 56 ins.



MALLET ARTICULATED COMPOUND FOR THE CHESAPEAKE & OHIO.

J. F. Walsh, General Superintendent of Motive Power. American Locomotive Company, Builders.

Definition of Force.

Professor Balfour Stewart, F.R.S., at one time professor of physics at Victoria University, Manchester, Eng., thus defined force. "Now what is it that sets in motion anything that was previously at rest? Or what is it that brings to rest a thing that was previously in motion? It is force that does this. It is force that sets a body in motion, and it is force (only applied in the opposite direction) that brings it to rest Nay, more, if it requires a strong force to set a body in motion, it requires also a strong force to bring it to rest You can set a cricket ball in motion by the blow of your hand, and you can also stop it by a blow, but a massive body like a railway train needs a strong force to stop it. That which is easy to start is easy to stop; that which is difficult to start is difficult to stop You see now that force acts not only when it sets a body in motion, but as truly when it brings it to rest. In fact, that which changes the state of a body is called force, whether that state be one of rest or of motion.

Locomotive Running Repairs

IX. Leaky Steam Pipe Joints.

Among the troubles that are to be expected in locomotive operation there are very few more certain of appearing in due time than leaky steam pipe joints and leaky flues. The one seems to follow the other, as if there was some corelation between the separate parts. The cause and effect of these troubles are not far to seek. In the case of the steam pipes, the changes of temperature and the varying pressures to which they are constantly subjected are not only a severe strain on the bolts holding the pipe joints in place, but the pipes and rings are structurally affected by the sheer pressure of the bolts, and in time the lugs of the steam pipes will bend slightly where the continuing pressure of the bolts occur. The occasional tightening of the bolts increases the slight distortion of the rings, and by and by the tightening of the bolts will fail to stop the leaking of the joint, for the reason that the pressure of the bolts will be largely on that portion of the rings adjacent to the lugs, while it will sometimes be found impossible to stop the leaking by the mere processes of pulling and hammering.

When this occurs it is csutomary to send for the machinist who originally fitted up the pipes, so that he may have the opportunity of being an eye-witness to his alleged incompetency, and walk back to his bench through a valley of humiliation, resolving in a blindly bewildered way to be a better mechanic. It need hardly be said that the machinist is entirely blameless. If the steam pipes were tight at their first trial of steam pressure his work was the work of a master.

It will speedily be observed that when a steam pipe joint is leaking, especially if the escaping steam is blowing toward the flues, the effect on the fire is of a disturbing and dampening kind. A certain number of flues cease to be of any service; the blast of escaping steam, if it be of any considerable volume, will be much stronger than the strongest kind of draft that passes through the flues; consequently, the number of flues affected cease to be operative. The train of evils culminate in the leaking of the flues.

It is not unusual at this period of decadence to send for some overworked boilermaker, when some official, clothed in temporary authority and with an image of importance sitting on his frowning forehead, delivers a short, sharp lecture that is calculated to do the boilermaker good. The boilermaker knows better; but he is accustomed to loud noises, and they pass in at one ear and out at the other.

It should be borne in mind, however, that the original fitting of the steam pipes is a matter of considerable importance in the reliability of the joints during their period of service. The faces of the joints should be adjusted to stand as nearly parallel to each other as possible. Slight variations in the castings should not be permitted to affect the exact squaring of the joints. Concave bearings and convex rings afford a considerable degree of flexible adaptability, but it is observed that the tendency of the joints to leak is much greater in the case of these fittings where there is an obliquity in the relation of the joints, the leak almost invariably occurring in that portion of the joint where the adjoining castings may be furthest apart from each other.

It will also be found that rings that are comparatively thin have a greater tendency to leak than those that are of more substantial dimensions. In ordinary practice the rings should at least be one inch in thickness. Even the quality of the metal composing the rings is of some consequence in the reliability of the joints, the harder brass or bronze being more likely to resist the bending pressure of the bolts than the softer and more ductile alloys.

When the tendency to leak in the steam pipe joints has become persistently chronic it is good practice to take the earliest opportunity to refit the joints. With proper tools in the hands of an experienced workman the operation is not nearly as serious as it looks. The time occupied in facing the rings in the lathe is time well spent: and it should be noted before taking the steam pipe joints apart whether there are any marked variations in the relation of the joints to each other, as a portion of the face of the bearing on the steam pipe should be removed in order to more properly adjust the bearings to square with each other. This, of course, may necessitate the use of a thicker ring in refitting of the joint.

It should not be expected that the job of refitting can be well accomplished while the locomotive is in a heated condition. All good work requires that it should be performed under good physical conditions, and the most skilled workmen are generally very susceptible to extreme conditions. A careful refitting of the steam pipe joints will in the end be much more conducive to good railway engineering than any amount of repeated efforts to compel joints to remain tight with the application of roundhouse wrenches.

In the fitting or grinding of a steam pipe joint the general practice is to have cylindrical blocks of wood from four to six inches in length, one end of the block being slightly tapered and fitted so that it will bind itself in the ring without projecting through the ring. On the other end of the block a cross piece of wood may be attached, which may serve as a handle for turning the ring during the grinding process. The application of emery and oil will speedily clean the joint, when the ring and bearing should be carefully dried and rubbed together. The polished parts will show the exact extent of the bearing, and in instances where the bearing shows on two or more separated spots an application of the beveled cutting tool used in forming convex bearings will save time and labor in grinding. In fact, the grinding of steam pipe joints need occupy but little time if the rings and bearings are properly fitted to each other.

In the fitting up of new steam pipes it may be worth while to observe that there is very seldom the amount of care taken that there might be in marking off the exact line of the face of the bearing. It is just as important to draw a line carefully around the entire fitting projection on the steam pipe as it is to mark off the fitting space of the saddle before beginning to remove the superfluous metal. The steam pipe should be hoisted into position with the T-head properly bolted into place. A flat piece of wood, representing the thickness of the ring, should be placed between the two castings and the pipe held in place by a clamp or other temporary attachment. The bottom of the pipe should also be centrally blocked in regard to its relation to the opening in the saddle, and it is good practice to chalk the edges of the bearing strips on the pipes and with hermaphrodite calipers draw a line as nearly as possible all around the part of the pipe to be planed off. This will insure a good beginning and avoid the troubles that naturally arise in all mechanical contrivances where skew bevels are permitted to show their distorted faces. If the faces of the joints are square to each other, and carefully fitted and securely bolted, this is as good as can be, and the work of which the mechanic need never be ashamed.

Look out not in;
Look on—not back;
Loop up—not down,
And lend a hand.
—*E. E. Hale.*

Questions Answered

SUPERHEATED STEAM.

72. R. L. B., Chicago, writes: I belong to a club that discusses practical railroad questions, and I have noticed that much difference of opinion prevails concerning the advantage of using superheated steam and of the temperature best conducive to economy. Some of the members say that unless an engine has 200 degrees of superheat it is useless; others hold that economy results from any superheat above 50 degrees. What do you say?—A. The utility of superheated steam depends on circumstances. We have known in marine service that about 50 degrees of superheat effected decided economy; but those having reliable experience with locomotives using superheated steam say that a temperature lower than 150 degrees of superheat will not be felt in fuel saving.

OIL IN WATER IN BOILER.

73. C. C. S., Palestine, Tex., writes: Is there anything in ordinary signal oil that will cause the water in a boiler to foam if the oil should get into the engine tank or boiler?—A.—We may say that as a general principle it is the safest way to keep all oil out of a boiler if you do not want to be troubled with foaming. Mineral oils are as a rule not as bad as animal oils, but none are desirable. The cause of foaming is the difficulty experienced in mechanically breaking the film which surrounds the bubbles of steam as they form. The pressure will not break them; it is generally done mechanically by the uprush of other bubbles or the eddies of the water or by striking against the sides of the boiler or the throttle valve. If they are heard to break great quantities are carried over with the steam and when broken are water. Read article in another column of this issue on the boiling of water under pressure.

WRONGLY CONNECTED AIR PIPES.

74. A. B., Youngstown, writes: Please say that if the application cylinder and release pipes of the H 6 brake are crossed or wrongly connected it is not usually discovered until some trouble along the road results from it and that the shop is responsible, when, then, should this disorder first be noticed? A.—During the daily trip inspection. On the subject of roundhouse inspection of the E. T. locomotive brake, the air brake department, page 445 of the October, 1909, issue contains the following: "The gauge should then be connected to the brake pipe hose and with the automatic brake valve in train brake release position, the test gauge, both hands of the large air gauge and the black hand on the cylinder gauge should register the same pressure, the brake pipe pressure should then be drawn down a few pounds and the handle placed in running position, the brake should remain applied." If the brake does not remain applied under the conditions mentioned the air brake inspection would be continued until it was known that there was no leakage from the pressure chamber to the atmosphere or from the brake valve into the brake pipe or from the application cylinder or application cylinder pipe, then if the brake released after the manipulation described, application cylinder pressure escaping at the automatic brake valve exhaust port it would indicate that either the application cylinder and release pipes were crossed, or that the graduating valve in the distributing valve was leaking. To ascertain which part is at fault without tracing the pipes, reduce brake pipe pressure below the point of equalization, say, to 45 lbs. if the feed valve is set at 70 lbs., then close the brake valve cut-out-cock and return brake valve handle to running position. If the brake then remains applied it indicates a leaky graduating valve, but if it releases, with application cylinder pressure escaping at the brake valve exhaust port it means that the application cylinder and release pipes are wrongly connected.

TEMPERATURE OF STEAM.

75. L. L. G., Meadville, Pa., writes: When I wish to know the temperature of steam at any pressure I turn up the steam tables in your valuable book, "Twentieth Century Locomotives," as the information is reliable, but sometimes I wish to know the temperature of steam in places where no steam tables are at hand. Can you give me an easy rule for figuring the temperature of steam?—A. One formula that is simple and correct enough for all practical purposes is t = temperature in degrees Fahr.; p = gauge pressure in pounds per square inch.

$$\text{Then } t = 14 \times \sqrt{p} + 198 - \frac{(p - 100)}{11}$$

Take 200 lbs. pressure, we have p = 200.

The square root of 200 is 14.15; this multiplied by 14 = 198.1, and 198.1 plus 198 = 396.1; 396.1 minus pressure minus 100 divided by 11 = 9.1 or 200 minus 100 = 100, which divided by 11 = 9.1; then 396.1 minus 9.1 = 387 degrees, the temperature of the steam at 200 pounds.

FIRST TUBULAR BOILER LOCOMOTIVE.

76. "Fireman," St. Paul, Minn., writes: We had a discussion in the lodge last week about locomotive questions, and one of the members said that the early engines had a round furnace without flues. No one knew when tubes first came into use. Can you enlighten us?—A. Tubeless boilers were never used in America for locomotives. The first native locomotive was Cooper's "Tom Thumb," which had tubes made of gun barrels. Stephenson's "Rocket," built for the Liverpool and Manchester Railway, was the first foreign locomotive equipped with boiler tubes. Particulars can be found in Sinclair's "Development of the Locomotive Engine."

WEAR OF FLANGE.

77. J. B. R., Elkhart, Ind., writes: An engine only a short time out of the shop has begun to cut one of the back driving wheel flanges, and there has been a good deal of talk over the matter in the roundhouse. What, in your opinion, is the cause of such rapid flange wear at one point?—A. Cases of this kind are usually caused by a weakening of the springs at some point. The height of the engine at the point near the flange showing rapid wear should be noted and compared with the height that the engine stands from the other driving boxes, and any variation should be rectified. If the engine is level it would be well to look for the cause in the dimensions of the driving boxes or wedges on hub liners, if any. As a rule, the cause is on account of the engine being lower at some point, the extra flange wear always occurring at the low point.

WEAR ON WHEELS.

78. E. G., Sherbrooke, Que., writes: What thickness of flange is allowed to run on steel-tired engine and tender truck wheels with 4½ x 8 ins. journals.—A. About 1⅛ in. is usual practice. 2. What thickness of flange is allowed to run on cast iron wheels with 5 x 9 in. journals.—A. Cast iron wheel defects, such as sharp, worn, shelled out, etc., are specified with limiting gauges in the M. C. B. Code of Rules governing the condition of and repairs to freight cars. For a copy apply to Mr. J. W. Taylor, secretary M. C. B. Association, Old Colony Building, Chicago. There is a nominal charge on the book.

BANK AND LEVEL FIRING.

79. "Fireman," St. Paul, Minn., writes: Some time ago there was some discussion in the railroad papers about the merits of what was called bank firing as compared with level firing. I understood that some of the leading railroad systems in the East intended to experiment on a testing plant with the two forms of firing, but the thing seems to have dropped out of sight. Can you tell anything about it?—A. The tests referred to were made by the Pennsylvania Railroad, as reported on to the Master Mechanics' Convention of 1909. Particulars can be found on page 103 of the annual report for that year. It was proved clearly that level firing was most efficient.

SOLUTION FOR CLEANING BRASS.

80. R. McR., Kingston, Pa., writes: I was looking over several annual volumes of your magazine; as I recall it you gave a solution for cleaning and brightening brass castings. I am unable to find it and would esteem it a favor if you would republish the particulars in regard to the solution.—A. There are a variety of mixtures used in cleaning brass, the most common in the case of cleaning rough brass castings being a mixture of sulphuric acid and water, two parts of each, to which is added one part of nitric acid. The sulphuric acid and water should be mixed together first and allowed to cool. The nitric acid may then be added. The castings should not be allowed to remain in this strong solution but should be dipped rapidly and repeatedly until they are clean and bright. They should be rinsed in water and dried in sawdust. In the case of cleaning and brightening finished work, such as oil cups, injectors, lubricators and the like, it is usual to make a still stronger solution, consisting of three parts sulphuric acid, two parts of nitric acid and adding a handful of salt to each quart of the solution. A solution of this kind should be held in a vitrified or glazed receptacle. The articles should be dipped and withdrawn at once and cleaned in water.

THERMOMETER SCALES.

81. C. L. F., Cincinnati, O., writes: The practice is becoming so common of giving centrigrade readings of temperature that a simple method of converting one from another would be convenient. Could you give me such a rule?—A. To change a temperature given by Fahrenheit scale to centigrade scale, subtract 32° from Fahrenheit degrees and multiply the remainder by 5-9; the product will be the centrifugal degrees. To change a temperature given by the centigrade scale into Fahrenheit figures multiply the centigrade degrees by 9-5, and add 32 to the product.

TUBE HEATING SURFACE.

82. F. M. M. L., St. Louis, Mo., writes: Will you kindly advise me whether the external surface of tubes is used in figuring tube heating surface? Although Kent, page 196 in the 1906 edition, says the surface in contact with the gases, inner, is to be taken in case of locomotive flue tube, I have understood it is the builders' practice to take the external surface. This also makes my figures agree with data given in proportions of "Twentieth Century Locomotives" by the Angus Sinclair Co. —A. You are right, the outer surface of the tube is taken in computing the heating surface of the tubes in the locomotive boiler. That is the surface which radiates the heat to the water.

THE VIRTUE OF STICKING.

83. "Ambition," Buffalo, N. Y., writes: My highest ambition is to be a locomotive engineer, and I am depending upon you to help me into the road that will lead to that position. When I left school I went into a brass foundry as an apprentice, but three months' experience among the dirt and gas made me quit. Then I went into a grocery store, which was cleaner, but had no future, so I found a job as waiter in a restaurant. From that I went to be a car conductor, and here I am, with my eye on our engineer's job. Please put me in the line for getting there.—A. We would answer this man in the words of Josh Billings, when he said: "Konsider the postage stamp, my son. Its usefulness konsists in its ability to stick to one thing until it gets there."

MATTER AND MOTION.

84. C. A., Thayerville, Md., writes: I work in a shop where I have to help, on all sorts of work, but I am picking up skill on machine work and I will be able to bloom out as a regular machinist some time. I am ambitious to learn the technical part of the business and I am writing to ask if you will recommend suitable books for a lad who has to paddle his own canoe.—A. Try "Machine Shop Arithmetic," sold in this office for 50 cents. After that try a school book on the general laws of matter and motion. This office will supply that, too.

WASH-OUT PLUGS.

85. C. C. G., Montreal, Que., asks what is a good thing to put on wash-out plugs as you screw them in so that they will readily come out again next wash day. Oil is no good.—A. Black lead and tallow was the old-fashioned recipe and it never failed; but to-day, when a railroad man hardly knows what tallow looks like, Dixon's Graphite Paste is the thing. Write the firm for information. Their address is Joseph Dixon Crucible Company, Jersey City, N. J.

INSIDE VALVE LAP.

86. B. C., Minneapolis, Minn., writes: When studying a valve motion I have never been able to find out any advantage from giving a valve inside lap. Can you tell me any advantage that comes from the practice?—A. The purpose of inside lap is to delay the release of steam so that increased work may be obtained from expansion. When the piston speed is high the effect of delaying steam release is to increase back pressure. Our experience with the steam engine indicator convinces us that inside lap is a detriment unless in very slow-working locomotives.

OILS, GREASES AND LUBRICANTS.

87. C. C. S., Palestine, Tex., writes: The information I desired on oils, greases and lubricants was, etc., etc., etc.—A. We would advise you to write to F. S. Bowser & Co., of Fort Wayne, Ind. Tell them who you are and what you want and why and they will be able to give you full information on the qualities and tests of oils.

UNEVEN WEAR OF RUBBING SURFACE.

88. "Machinist," Des Moines, Ia., writes: Can you explain why it is that crank pins and eccentrics wear more on one spot than they do on the other parts of the rubbing surface?—A. These parts wear most at the places where the work puts on the greatest stresses.

Gift to University.

The General Electric Company of Schenectady and New York have recently presented the University of Illinois with a recording steam meter, a device which has been in successful use as a means of determining the quantity of steam passing through any pipe to which it may be attached. The gift was transmitted on behalf of the General Electric Company by its sales manager, Mr. F. G. Vaughen, to Professor Ernst J. Berg in charge of the Department of Electrical Engineering. This is the second magnificent gift that the General Electric Company have made the University of Illinois during the past year, the first consisting of a 100-kilowatt Curtis steam turbo-generator, which now constitutes a part of the equipment of the Department of Electrical Engineering.

Fuel Association.

We have received word from Mr. D. E. Sebastian, secretary of the International Railway Fuel Association, that by order of the excutive committee the third annual convention of this association will be held in Chattanooga, Tenn., on May 15, 1911. It will be a four-day session. The headquarters of the association will be at the Hotel Patten, where the meeting will be held. The officers of this association are: Mr. W. C. Hayes, president, Erie Railroad, New York, N. Y.; Mr. S. L. Yerkes, first vice-president, Queen & Crescent System, Lexington, Ky.; Mr. T. Duff, Smith, second vice-president, Grand Trunk Pacific Railway, Winnipeg, Can.; Mr. D. E. Sebastian, secretary, C. R. I. & P. Railway, 703 La Salle Station, Chicago; Mr. J. McManamy, treasurer, Pere Marquette R. R., Grand Rapids, Mich.

The velocity of steam is found by the well-known rule relating to falling bodies. The velocity of steam is as the velocity of a body falling from a height equal to the column of steam represented by the steam pressure.

Air Brake Department

Conducted by G. W. Kiehm

Calculating Air Pressures.

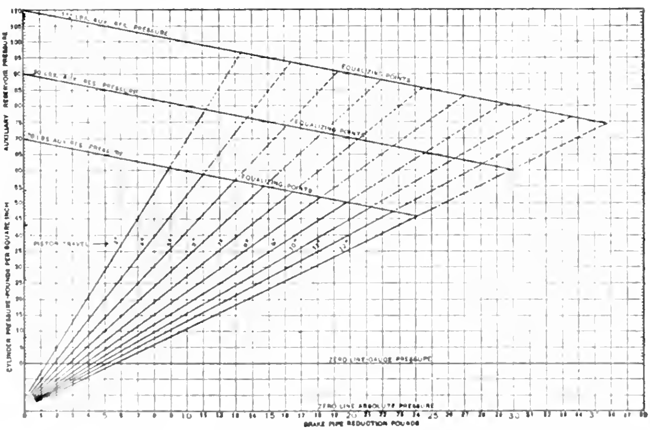
Judging from the questions asked on the subject it is evident that, as the student of the air brake learns its operations and construction, he becomes interested in the calculation of air pressures.

As nothing concerning this subject has appeared in these columns recently, the following will deal with a few simple calculations to determine approximately the amount of free air required to charge a reservoir to different gauge pressures, to determine the pressure that will result from an equalization when compressed air is admitted from a reservoir into another air-tight chamber, and the pressures that would result from admitting but a portion of the compressed air from the reservoir to the air-tight chamber.

Those calculations, which are only approximate for reasons that will be explained later, will, however, enable the student to get a fair idea and figure very closely the time required to charge a main reservoir and the brake pipe on a train of cars, the amount of free air the pump will be required to compress, the brake cylinder pressure resulting from an equalization of auxiliary reservoir pressure, or that pressure resulting from a light eduction from various brake pipe and reservoir pressures.

The calculations are necessarily somewhat different, but the flow, action and value of compressed air is practically the same under all conditions, and in this connection the terms pressure and volume are most frequently used, pressure is merely a condition, volume is relied upon to do effective work, and a reservoir containing 1,600 cu. ins. of compressed air at 70 lbs. pressure is capable of creating a force of 2,500 lbs. on an 8-in brake cylinder piston, while a reservoir of 10 cu. ins. containing 500 lbs. pressure per sq. in. would likely fail to displace the piston.

That the calculations are somewhat uncertain is due in a measure to the variation of the temperature of the compressed air during compression an expansion. In compressing air, forcing the fine particulars of air together creates a friction, the friction generates heat, and the heat tends to expand the compressed air. While being unable to expand it into a greater space it consequently increases the pressure per square inch in the limited space into which it is compressed.



VARIATION IN BRAKE CYLINDER PRESSURE FOR VARIOUS REDUCTIONS.

The degree of heat encountered in compressing air is spoken of as the natural heat of compression, although artificially heating a reservoir full of compressed air increases the pressure because of the tendency of the heat to expand it, while actually expanding it into another vessel lowers the temperature, or rather expanding the compressed air into another vessel cools it; cooling it contacts it, consequently lowering the pressure per square inch; cooling it artificially would also lower the pressure.

Ignoring entirely the variations due to any changes of temperature and assuming that we have a reservoir of 60,000 cu. ins. capacity filled with compressed air at 70 lbs. per sq. in., and wish to find how many cubic inches of free air it contains, it is only necessary to know the number of atmospheres it contains and to multiply the capacity of the reservoir into cubic inches by the number of atmospheres.

Atmospheric pressure, 14.7 lbs., is referred to as one atmosphere; 14.7, or 15 lbs. gauge pressure, as two atmospheres, 30 lbs. gauge pressure is therefore 45 lbs. absolute pressure, and in 70 lbs. pressure there is contained almost 6 atmospheres, and as the reservoir contained one atmosphere before the compressor was started, the compressor would only be compelled to compress about 5 atmospheres or 5 times the reservoir's capacity in cubic inches to raise the pressure to 70 lbs. per sq. in.; 60,000 × 5 = 300,000 cu. ins. of free air, or 300,000 ÷ 1728 = 175 cu. ft.

To do this the 9½-in. pump at a speed of 120 strokes, or 60 cycles, per minute would compress about 28 cu. ft. of free air per minute against a pressure of 70 lbs., and to compress 175 ft. would require about 175 ÷ 28 = 6.25, or 6¼ minutes. The 11-in. air pump under about the same conditions can compress 45 cu. ft. of free air per minute and would require 175 ÷ 45 = 4, or a little less than four minutes.

To compress air to 90 lbs. requires about 7 atmospheres, to compress 110 lbs. requires over 8 atmospheres and to compress 140 lbs. over 10 atmospheres.

To note the time it takes the pump to compress air from 70 to 100 lbs. pressure and from 100 to 130 lbs. would apparently contradict the foregoing, but any marked difference in the time is due to the capacity of the pump and leakage. Compressed air escaping from an opening represents more free air when at a high pressure than when at a low pressure, and there is on every stroke of the pump a small amount of space in the end of the cylinder from which the compressed air cannot be forced into the main reservoir, and thus on the following stroke is free to expand in the cylinder, and the amount of free air in this space increases with the increase of pressure.

The same is true of packing ring and

air valve leakage. Very often a pump is in such condition that it will compress air to 100 lbs. pressure if given time enough, and fail entirely to compress air to 130 or 140 lbs. pressure.

Suppose now that we have a reservoir of 60,000 cu. ins. capacity filled with air pressure at 100 lbs per square inch and wish to know at about what figure it will equalize if admitted to a train of say 50 cars. Assuming that there are a number of 10-in. equipments among them, and at a rough estimate the brake pipe and auxiliary reservoir on each car has an average capacity of 3,000 cu. ins. In this simple calculation it is only necessary to multiply the capacity of the reservoir in cubic inches by the pressure, which would give a result that is termed cubic-inch pounds.

If the brake pipe and auxiliary reservoir on each car has a capacity of 3,000 cu. ins. the space to be filled with compressed air is 3,000 × 50 = 150,000 cu. ins., and the number of cubic-inch pounds contained in the main reservoir divided by the total space in cubic inches to be occupied by the compressed air will give the number of pounds pressure per square inch that it will equalize at, the entire calculation would be 60,000 × 100 = 6,000,000 cu.-in. pounds, 3,000 × 50 = 150,000 cu. ins. in the brake pipe, 150,000 + 60,000 = 210,000 cu. ins. total reservoir and brake pipe space, 6,000,000 ÷ 210,000 = 28 lbs. gauge pressure, in which atmospheric pressure is not taken into consideration, as the brake pipe and auxiliaries contained atmospheric pressure before air was admitted to them from the main reservoir.

If the brake pipe and auxiliaries on a train of this kind contained 50 lbs. pressure after an application of the brake and it is desired to know at about what pressure the main reservoir at 100 lbs. will equalize with it, it would then be necessary to also reduce the brake pipe pressure and volume to cubic-inch pounds, and divide the total cubic-inch pounds by the total space to be filled as before. 60,000 × 100 = 6,000,000 reservoir cu.-in. lbs, 150,000 × 50 = 7,500,000 cu.-in. lbs. in brake pipe, 60,000 + 150,000 = 210,000 total inches space to be filled, 6,000,000 + 7,500,000 = 13,500,000 cu.-in. lbs, in all, 13,500,000 ÷ 210,000 = 64 lbs. gauge pressure at equalization.

The most frequent inquiry is concerning the number of pounds brake cylinder pressure that results at different piston travels from various brake pipe reductions. To find the pressure that will be developed in a brake cylinder at different piston travels or from any manipulations of the brake valve an air gauge is attached to the brake cylinder, the piston travel changed as desired, and a gauge attached to the brake pipe or auxiliary reservoir will show accurately the brake cylinder pressure developed, while a calculation in figures is only approximate owing to losses that occur during the movement of the triple valve piston and brake piston. However, a calculation will answer for practical purposes, and if we wish to find the brake cylinder pressure that will result from a full service application or equalization of auxiliary reservoir and brake cylinder volumes in a 10-in. brake cylinder from a 70-lb. brake pipe pressure, it is first necessary to understand that the brake piston must be moved and the space in the cylinder created and filled with a an atmospheric pressure before an air gauge would register any pressure, or, rather, if the piston were drawn out by some other source and admitting no atmosphere, a vacuum would result which must be destroyed by atmosphere; therefore atmospheric pressure must be considered in this calculation and the auxiliary reservoir containing 3,030 cu. ins. at 70 lbs. gauge pressure would contain 70 + 14.7 lbs. atmospheric pressure, or 85 lbs. absolute pressure, which, multiplied by 3,030 cu. ins., would be 3,030 × 85 = 257,550 cu. in. lbs. The space to be filled is found by squaring the diameter of the cylinder and multiplying by the decimal fraction .7854, 10 × 10 = 100 × .7854 = 78.54 sq. ins. area; at 8 ins. piston travel we have 78.54 × 8 = 628 cu. ins. space to be filled when the piston is out. Now, assuming that the space between the cylinder head and follower plate, the port through the head and the space in the triple valve that contains atmospheric pressure before the application, to be 100 cu ins., we have 628 + 100 = 728 cu. ins. brake cylinder space to be filled and the cubic-inch pounds wherewith to fill it is 257,550 + 1,500; the latter is the atmospheric pressure in cubic-inch pounds in the space mentioned, or 100 cu. ins. × 14.7 = 1,500 + 257,550 =259,050 cu.-in. lbs. in all.

After the application the entire space filled with compressed air is 3,030 + 628 + 100 = 3,758 cu. ins., 259,050 ÷ 3,758 = 69 lbs. absolute pressure, or about 54 lbs. gauge pressure.

An air gauge attached to the brake cylinder would likely show about 50 lbs. As no notice is taken in this calculation of any losses that occur, the losses will be referred to in the following.

Suppose that the brake pipe reduction was but 10 lbs. and we wish to know how much brake cylinder pressure should piston travel 8 ins.

With a 10-lb. reduction, 10 lbs. of compressed air will leave from each cubic inch of the reservoir's capacity, 3,030 × 10 = 30,300 cu.-in. lbs., and from the space previously mentioned and estimated at 100 cu. ins., 100 × 14.7 = 1,500 additional cu.-in. lbs, 30,300 + 1,500 = 31,800 cu.-in. lbs., and the space to be filled 628 + 100 = 728 cu. ins., 31,800 ÷ 728 = 42 lbs. absolute pressure or 42 — 15 = 27 lbs. gauge pressure.

Now, we know that the first 10 lb. reduction of brake pipe pressure will not result in 27 lbs. gauge pressure in the brake cylinder, and the calculation of the equalization of both pressures indicates a loss of about 4 lbs. in actual practice; that is, the calculation shows that 54 lbs. should be the point of equalization, and an air gauge attached to the brake cylinder would no doubt show about 50 lbs., and the same loss would naturally occur during the 10-lb. reduction, so that 27 lbs. less 4 lbs. would indicate that a 10-lb. reduction would develop about 23 lbs. brake cylinder pressure.

It might possibly develop less, should the packing leather allow any of the incoming pressure to pass it before being set firmly against the wall of the cylinder. The first 10 lb. reduction must force the piston out and fill the space vacated, leaving the second 10 lb. reduction to do more effective work, as it would not suffer any loss from the cause mentioned and should equalize the brake cylinder and auxiliary reservoir pressures.

The losses which make the result rather uncertain are slight, and are due to the fact that some of the auxiliary reservoir pressure escapes through the feed groove into the brake pipe as the triple valve piston starts to move, and as it is moved to application position the space vacated enlarges the auxiliary reservoir volume slightly and the expansion would lower the pressure.

There is also a loss through the brake cylinder leakage groove as the piston is displayed and there is also a natural loss due to the expansion of auxiliary reservoir pressure during the application which lowers the temperature, consequently the pressure.

In the distributing valve of the E. T. equipment those losses, although slight, are not so noticeable; the first reduction does not suffer the losses cited above to such an extent, as the application cylinder is filled with atmospheric pressure before the application, and the application piston does not vacate so much space in proportion to the 8-in. brake piston travel; therefore, the first 10 lb. reduction from the distributing valve reservoir results in about 25 lbs. brake cylinder pressure, and results in about 2½ lbs. brake cylinder pressure for every pound of brake pipe reduction.

Electrical Department

Motor Trains on Long Island Road.

By W. B. Kouwenhoven.

The Long Island Railroad, one of the many roads owned by the Pennsylvania Railroad, has just inaugurated its electric motor car service through the Pennsylvania tunnels under the East River to the latter's great terminal in New York City. The motor cars that the Long Island Railroad is using for this service are equipped with the Westinghouse Electric Pneumatic Multiple Control System. The control is of the automatic or auxiliary type and is similar to that used on the Brooklyn Rapid Transit elevated lines, the New York subway and many other roads. It, however, possesses several new and interesting features. In this system of control the motorman simply turns on and off the power, the automatic feature attends to the notching up and entirely regulates the rate of acceleration of the train.

The motor control apparatus on each motor car can be divided into two separate parts, namely, the main motor control equipment and the master or auxiliary control equipment. The main motor control carries the electric current at 600 volts from the third rail to the motors and comprises the two motors, the switch group, the resistance grids, line switch, reverser, main switch, four third rail shoes with their fuses, and a system of supply mains, properly protected by fuses, including a line called the bus line, which runs the length of the car and ends in jumper sockets. The auxiliary or master control carries a current at 14 volts supplied by storage batteries and includes the two master controllers, the train line running the length of the car and ending in jumper sockets, line relay, series limit switch, two storage batteries, the interlock switches and the electro-magnet valves for actuating the main control. With the exception of the main switch all the apparatus belonging to the main motor control is located underneath the car floor, while all the master control apparatus except the train line, the electro-magnet valves and the interlocks are to be found in the car. The main switch, the limit switch and the line relay are mounted on a switchboard located in one of the two cabs provided for the motorman. The Long Island trains are usually made up of motor cars with trailer cars, as they are called, sandwiched in between. A trailer car is one that has no motor equipment. On the trailer cars the only equipment is that necessary to continue the bus and train lines throughout the length of the train, and consists of a bus line with its jumper sockets and a train line with its sockets.

The main motor control and the auxiliary control are joined together at the switch group by the electro-magnet valves which control the admission of compressed air to the cylinders operating the switches of the switch group, and by the interlocks which automatically control the order in which the switches close. When the motorman advances the master controller handle he energizes certain wires in the train line. These wires in turn energize certain electro-magnet valves which close the corresponding switches of the switch group by admitting compressed air to the proper cylinders. When a switch closes it also closes its interlock, which is simply a small switch, whose closing excites the electro-magnet valve of the switch next in order and closes that switch. The compressed air, which is supplied by the control reservoir, is really the link which joins the 14-volt auxiliary control system to the 600-volt main motor control system.

The current for the main motors at 600 volts is collected from the third rail by four third-rail shoes, two being mounted on each truck. From the shoes the current passes through the shoe fuses, which are also mounted on the trucks and are of the cartridge type; to a main or wire which connects to the bus line wire through the bus line fuse, which is a piece of copper ribbon with a hole in the center to reduce it to the proper cross-section. Then the current goes through the main switch, which is a three-blade, single-pole, quick-break knife switch mounted on the switch board, through the main fuse, which is also a copper ribbon, to the line switch, and from there through the switch group and resistances to the motors and then to the track for the return circuit.

The line switch, like the switches of the switch group, is operated by an electro-magnet, and has an air cylinder with piston and piston rod, but it differs from them, as it has two sets of contacts which form a double break in the circuit, that is, it breaks the circuit in two places simultaneously. The switch carries the entire current for both motors and is opened and closed by a small switch in the motorman's cab called the line switch cut out switch.

The switch group consists of 12 separate switches usually spoken of as unit switches, which are all mounted together on a common frame. Each unit switch has an air cylinder with its piston and piston rod and electro-magnet valve for controlling the admission of compressed air to the cylinder. A compressed air chamber is mounted on the back of the frame supporting the unit switches. The switch contacts which handle the 600-volt electric current are two "L" shaped pieces of hard-drawn copper, one of which is stationary while the other is movable and is bolted at the piston rod. When the electro-magnet valve of one of the unit switches is energized and compressed air is admitted to the cylinder, the piston is forced up and contact is first made on the tips of the L-shaped pieces. As the switch closes there is a rolling or sliding motion between the contacts until the switch finally closes on the heel of the "L"-shaped contacts under full air pressure. This produces a positive closing of the switch and gives very good contact.

Back of each switch is a powerful blow-out coil. These blow-out coils depend for their action upon the fact that when an electric spark is formed in front of a magnet the magnetism coming from the magnet will blow away the spark, that is, tend to blow it out. If the magnet is a very powerful one the electric spark will be instantly extinguished, just as any one can blow out a match. The blow-out coil is simply a powerful electro-magnet which carries the current that passes through the unit switch and is placed in such a position that its magnetism is most effective for blowing out the spark which is formed between the two contacts when they open. The normal position of the unit switches is open and if for any reason either the storage battery current, which energizes the electro-magnet valves or the compressed air should fail the switches will immediately open and cut off the 600-volt current from the motors.

Each switch group also includes two overload trips or circuit breakers, one at each end, one being for each motor. These overload trips are worked by the magnetic pull exerted by the blow-out coil at each end of the group. One of these blow-out coils and its unit switch are in each motor circuit and therefore each trip is set for the current of one motor. These trips are so constructed that when the motor current exceeds the proper value an iron plunger is drawn in by the magnetism produced by the excessive current in the blow-out coil and held locked there. The drawing in of this plunger opens the storage battery circuit of the electro-magnet valves of the unit switches and of the line switch also, thus causing them to open and cut off the current of both motors. The overload trip is held in until reset by the motorman closing the overload trip reset switch in his cab, with the master controller handle in the off position.

The interlock switches, which form a part of the master or auxiliary control system, are also attached to the unit switches of the switch group, and therefore when a unit switch closes it also closes its interlock. The interlock switches are simply small light switches having spring contact fingers that are connected in the circuit with the electro-magnet valves of the unit switches, and it is through their closing that the automatic action is obtained. On a steam locomotive the engineer opens his throttle a few notches at a time until it is wide open and his train running ahead at a good speed, but on a Long Island electric motor train, when the motorman wishes to start the train he has only three speeds at his command, slow speed, half speed and full speed. If he puts the controller handle on the first notch, the first unit switch will close and the train will start with all the resistance in series with the motors, and the control will remain in this position. But if he moves the handle to the full speed position at the start, the first unit switch will close as before and the train will start ahead with all the resistances in circuit again. When the first unit switch closes, however, it also closes its interlock; this completes the circuit for the electro-magnet valve of the next unit switch in order, and that closes, cutting out some resistance. The second unit switch also closes its interlock, which completes the circuit for the third switch in line, and in this way it continues until all the switches have closed and the power is full on. The last switch, of course, has no interlock, there being no more unit switches to close. It is through these interlocks that the automatic notching up is obtained. If the motorman desires, he can arrest the progress at the half speed notch as mentioned above.

From the switch group the current for one motor passes through the series limit switch before it reaches the motor. An engineer on a steam locomotive knows that if he opens his throttle in a series of notches, one following the other in rapid succession, that the drivers will spin around and lose their grip on the rails. The very same thing would happen on a Long Island Railroad motor train if the unit switches were allowed to close one right after the other in rapid succession. The rate at which they close and therefore the rate of acceleration is entirely controlled by the series limit switch. This switch is mounted on the switchboard, and consists of a magnet made up of a few turns of heavy copper wire which carries the current for one motor, as stated. Inside the coil is a plunger, to the lower end of which it attached a copper disc which normally rests upon two contacts. When the motor current exceeds the limit for which the switch is set it lifts the plunger, raises the disk, and opens the circuit between the two contacts. These two contacts are in the battery circuit leading to the magnet valves of the unit switch group, and no more switches can close as long as the disk is held up; however, the switches already closed remain closed. When the motor current falls the disk is released and closes the circuit again, thereby allowing the next unit switch to close. When a train starts, and at each successive notch, there is a rise of the motor current above the value for which the limit switch is set, causing it to raise its plunger and retain it for from a few seconds to a few minutes, depending upon the weight of the train, the grade, and similar factors. As the speed increases the motors themselves reduce the current until it falls below the value of the limit switch, causing the plunger to fall and complete the circuit again, allowing the next unit switch to close. In this manner the closing of each unit switch is retarded until it is the proper time for it to close. Thus the series limit switch takes the notching up of the control, entirely out of the hands of the motorman, and does it more regularly and in a much better manner than the motorman himself could do it.

The current on its way from the switch group to the motors passes through the resistance grids. There are 14 resistance grids, and each grid is made up of 29 cast iron plates or grids which are mounted in a frame. The two motors are of the regular railway type. The direction in which the motors revolve and train runs is controlled by the reverser, which consists of a movable switch mounted on a rod between two cylinders. The admission of compressed air to each cylinder is controlled by a separate magnet valve so arranged that only one can be excited at a time. Wires from the armatures and fields of the main motors are connected to two sets of fingers, these fingers make contact with metal strips mounted on the movable part and so make the proper connections for forward and backward travel. The rod is continued through one cylinder, and on its extreme end is mounted an interlock which locks the reverser with the switches of the switch group and prevents the closing of any switch in the group unless the reverser is in either one extreme position or the other.

There are two master controllers, one in each cab. The master controller serves to actuate the control and consists of a movable drum against which spring fingers press. When the drum is rotated to either side by the motorman the spring which holds the drum in its central position is compressed and tends to return the drum to that position. Two pipes lead the wires to each master controller, the one contains the wires of the train line, and the other contains the wires leading to the three small knife switches and to the emergency train brake magnet valve. All are located in the cab. These knife switches are the line switch cut-out switch, the overload trip reset switch, and the brake cut-out switch. When the line switch cut-out switch is open all the line switches on the train are open, and the operation of the switch group can be tested without starting the train because no current can come through the open line switches. When the train is in operation this switch must always be closed. The overload trip reset switch is a small knife switch held open by a spring. This switch should never be closed unless the controller handle is in the off position, and then if held closed for a couple of seconds it will reset any overload trip that may have opened due to an excessive current through a motor. This switch should never be kept closed. The third switch, the brake cut-out switch, must always be closed when the control is in use because it turns on the storage battery current for all the electro-magnet valves.

There are seven notches and two stops on the face of each master controller, three notches and a stop on each side of the central notch. The central notch is the brake position of the handle, the first notch is the off position in which the handle must be placed whenever it is necessary to reset an overload trip, the second notch is the slow speed position, the third notch is the half speed or series running position, and the stop or fourth notch is the full speed or multiple running position. The connections of the brake cut-out switch, which as stated, must always be closed in order to operate the control, and the emergency train brake magnet valve, inside the master controller are such that if the controller handle is permitted to come to the central or brake position while the train is in operation the emergency brake valve magnet will be energized and will open the train brake relay valve which exhausts air from the train line and produces an emergency application of the brakes, and at the same time opens the storage battery circuit, opening the unit switches and the line switch and cutting off the electric power. This action of the control corresponds to the dead man's handle of the New York subway and Manhattan elevated trains The controller handle must never be permitted to come to its central position unless the brake cut-out switch is first opened, and then the operation of the controller handle in either direction has no effect whatever on the unit switches, because the storage battery current is cut off. The train can be operated from any master controller, but only one must ever be used at a time.

General Foremen's Department

Ash Pans.

In the course of an extended tour the writer recently found the subject of ash pans occupying absorbing interest. There are now a great many ash pans in use designed to meet the requirements of the Federal law. As far as we could make out, the Talmage ash pan meets the legal enactments concerning ash pans as closely as any on the market. That pan received favorable mention at the General Foremen's Convention. Items of the report read:

Mr. Voges, C., C., C. & St. L. Ry.—We are using the Talmage ash pans on the Big Four, and we have experimented with them a great deal. In the first place, the valve of the cock we placed in horizontal position, but now it is vertical, and we placed a small hole where the pipe leads into the ash pan to get the mud out, and in case in the winter time it freezes up. A gentleman spoke about placing netting on the side of the ash pan; we have done that and found it a good thing. Our boiler-maker makes a little opening on the side and we place a little footboard. On the large power I should judge it is 3½ ins., or something like that. The man does not have to stand on the side of the firebox.

I believe there are all kinds of devices out for cleaning ash pans, but as far as I can see the Talmage has given very great satisfaction. Like anything else, it has to be watched closely. This little opening on the side of the ash pan is a very good thing. It gets the air through. With the small power and the narrow firebox we have an opening on the side, and just clean them out. At the Beech Grove shop they filled the ash pan with bricks and cleaned it out in 15 or 20 seconds.

Mr Beland, Frisco Ry.—On the road I came from we have the Talmage drop bottom slide. It is different from any I ever saw. The slides are independent to the ash pan proper. A frame is made that fastens on the side of the engine frame, independent of the ash pan. The ash pan is just over the slide apparatus that goes around a base 5½ ins. wide. The slides work underneath. We find it very successful, only in cold weather it will freeze up. The drop-bottom pan is the most successful. Fastened together with a turnbuckle, so adjusted that in case the pan warps the turnbuckle will close out.

President Ogden.—We have three kinds. We have an eight-inch pan and use a blow off pipe. We blow them out. That complies with the law, but it is not successful in all cases. If they get choked up you have to take them apart. With the slide ash pan the construction is all right if kept in order. Around the bottom the casing is hollow and it is quite a job to keep the pipes connected. I believe we have a good ash pan. They are tight on the bottom and we get our draft from the netting on the ash pan. There are wings perforated full of holes that we close. We have some little trouble from fire. Of course, in a dry country like Kansas it is pretty hard to get a pan that will answer all purposes and prevent fire. We have one we sometimes blow out the firebox door. We should get the idea of an ash pan that is practical for all purposes and one that will comply with the law. We have not done it yet in all cases. We have done it, but I do not think it is satisfactory to the heads of our departments. It is crude in a way, and I know our superior officers are anxious to get something more up-to-date and simple. The trouble with our passenger engines on long runs is that they get a clinker from the draft that comes in and they cannot stop to clean the ash pans. We have one that is used in the summer time; before they come in the station they turn the water on and try to kill the fire to dampen the dust. There is too much of it, and we ought to be able to get something different from what we now have in the ash pan.

Equity and Common Sense.

Among the many thoughful utterances at the last meeting of the International Railway General Foremen's Association some remarks of Mr W L. Kellogg are worth considering. Mr Kellogg is superintendent of motive power of the Cincinnati, Hamilton & Dayton. He spoke in part as follows, "Foremen ordinarily come from the ranks of their craft and are representative men. It is true that when elevated to the position of foreman their dignity should be added to, and their loyalty to their employer should be manifest in their actions. This need not, however, raise an insuperable barrier between the foreman so promoted and the craft. Nothing speaks so ill for the future success of a newly created foreman as to lose the good will and respect of his men. To do this he need not remain one of the boys, so to speak; in fact, the confidence which his superiors placed in him in elevating him to the position carries with it, to his associates, a certain amount of respect, which in their hearts they feel, although they may not make voluble expression of same. He need not hold himself aloof from the men, but on the other hand should join with them insofar as possible in expressions of thought on matters concerning their welfare and the welfare of their employers. It perhaps would have been better had I reversed the order, for such must always be the case; the employee can only prosper with his employer. No employer can long continue to benefit his employees, unless he himself is prospering. A foreman, as a rule, is better informed on matters pertaining to the welfare of the employer than are the men. Intelligent co-operation between foreman and men spells success by the shortest method possible.

"In this day of advancement and enlightenment it is difficult to get men to exert themselves in blind effort. Everyone works toward a goal, be that goal what it may, and I firmly believe that much of the unfortunate agitation which is presently sweeping wide over our country is due to the fact that our men are forced up to their tasks in blind effort, to produce so many pieces of this or that article, with little or no idea of what the results of their labor are, or what the component parts of material they work upon consist of, or to what future use they will be put. The workman's goal is one expressed in dollars and cents, with which he is compensated for their production. He has little of interest to turn his thoughts to, except the increase of his earning capacity. He has little or no love for his work or interest in his profession and no attachment for his shop or pride in his organization and falls an easy prey to the agitator who talks to him of the one goal he knows.

"I believe it is the duty of you gentlemen present in your staff meetings to impress this thought upon your subordinate foremen and advise them by every means possible to instill into their men a knowledge of their work, an interest in their output, a pride in their shop and the organization with which they are connected. Nothing is so difficult to combat as the lack of intelligence, and the most difficult man we have to handle is the man who, made valuable by his ability to do some one thing well, has grown lopsided in his intellect and believes that his ability as a workman or mechanic leaves himself equally able to legislate for himself and his fellow employees in matters economic and politic.

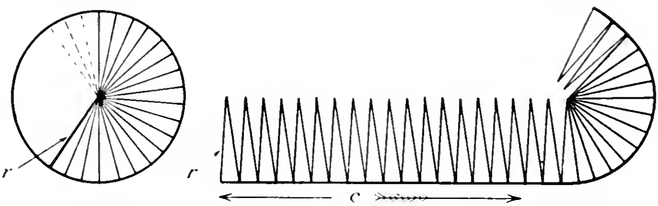
"You all have in your employ broad-minded workmen, developed both in their arts and craft and at the same time conversant with their other surroundings. With these men you have little to contend with. Their daily duties are performed systematically and regularly and matters pertaining to their business affairs can be handled amicably and equitably. Unfortunately these men are not ordinarily selected by their associates as their leaders and representatives when the question of shop rules or wage schedules are to be discussed. All too frequently you are called upon to receive committees who you well know are not made up of the best men qualified to handle such matters for their associates. Often the committee represents the radical element, who, after having enjoyed the benefits of their labors for a period and knowing of the whys or wherefores of their occupation, nothing of whether their employers are enjoying a profitable business or not, and having no other idea than personal advancement, regardless of equity, cannot be made to appreciate the unfortunate position in which you yourselves are placed when obliged to decline their requests or demands. I do not mean by this that the private affairs of your company should be scattered broadcast among your employees, but it is right that they should know something of the business in which their energies are expended. Your foreman has lost his most valuable asset if he is not able to keep in sufficiently close touch with his men to act as their counselor or adviser and exert his influence at all times toward peace and harmony, counseling the men to uniform activity and energy, pointing out to them the possibilities of their future success through the success of their employers, encouraging them in habits of temperance and morality, the establishment of savings accounts and the building of homes, counseling them when selecting representatives and leaders to pick conservative men, men qualified to appear for them when meeting their superior officers on matters of mutual interest. In this country, our mixture of races, with their varying habits and creeds, producing an enviable rivalry, harmonized and properly guided as necessity arose, has made us the great nation that we are. Our greatest law is equity, our greatest learning common sense. We are as a nation, an organization of organizations, extending down to the individual, and of which your shops are a well defined part. Let this simple law and learning ever be your guide."

Squaring the Circle.

By George S. Hodgins.

If you turn to the pages of any good engineering pocket book such as Kent's and look up the circle, you will find that the area of a circle is found by squaring the diameter, that is, multiplying the diameter by itself, and then multiplying the product by a constant. When put in the form of an equation, the area, $A = d^2 \times .7854$. This much is clear enough and simple enough, but the reason for it does not appear.

If you turn to the pages in your engineering pocket book dealing with the solution of triangles you will find that the area of any triangle whose base and perpendicular height is known, is found by multiplying the height and the base together and dividing the product by 2, or in other words, take the perpendicular height and multiply it by half the width of the base and the product will be the area of the triangle. Here are the two formulas, one for obtaining the area of a circle, and the other gives the area of a triangle where the base and perpendicular are known. By applying the rule for the triangle to that of the circle, the derivation of, or the reason for the formula for the circle will become apparent.



DEVELOPMENT OF THE CIRCLE INTO A SERIES OF SMALL TRIANGLES.

Suppose you cut a circle out of say, thin fine leather like that of a kid glove, you have material less stiff than paper, and capable of being bent without tearing. Now suppose you cut the fine leather circle into a series of small triangles with the apex of each triangle at the center of the circle and the circumference of the circle forming the bases of the triangles. This can be done by cutting the triangles to within a hair's breath of the outside of the circle and when all the triangles have been cut the leather can be laid on the table with what was the circumference in a long straight line and each triangle standing up from it like a series of very sharp saw teeth. This may be called a sort of development of the circle, or a transformation of the circle into a series of triangles.

The actual cutting up of the leather in this way into so many minute triangles would be a difficult and tedious process as a matter of fact, but it forms a picture in the mind and is a good illustration for our purpose. After you have cut the leather circle into a very minute series, suppose it to be a thousand times more accurate with very many more triangles and proceed to apply the triangle rule to the series of little triangles standing on the long straight edge that once was the circumference. You do not know the exact length of the base of each of the little triangles, but you know that the sum of them all is equal to the circumference of the circle, and that the height of each triangle is equal to the radius of the circle.

Now the area of each triangle if found and added together would practically be the area of the circle, but as each triangle has a base too minute to measure accurately, we are compelled to resort to a process of summing up which will apply to the case. The height of each triangle is the radius, and the sum of all the bases is the circumference of the circle, but when the circle is made into a series of the most minute triangles, the rule for finding the area of the series becomes, total area equals radius multiplied by half the circumference, or stated as a formula,

$$A = r \times \tfrac{1}{2}c.$$

In this formula we may substitute the idea of the diameter for the radius as it suits our purpose better, and of course the diameter being simply twice as long as the radius, it follows that the part of the diameter which equals the radius is represented as diameter divided by 2, or

$$r = \frac{d}{2}$$

We have then this new formula in which we use the diameter idea, instead of the radius, the statement

$$A = \frac{d}{2} \times \frac{c}{2} \text{ or } A = \frac{d \times c}{4}$$

but it so happens that the circumference is really made up of the diameter multiplied by the constant 3.1416 and if we substitute again in the formula so as again to introduce the diameter idea, for measurement in any circle; we have the formula

$$A = \frac{d}{4} \times \frac{d \times 3.1416}{1} \text{ or } A = \frac{d^2 \times 3.1416}{4}$$

It is easy to see that the next step in the process is to cancel out the figures as far as possible and we get the formula for the circle which we found in Kent's pocket book, and which is

$$A = d^2 \times .7854$$

Thus by the application of the general principle for the solution of triangles with base and height known, we have been able to trace one of the methods of reasoning by which the area of the circle has been worked out for practical every day purposes.

The First Canadian Railway.

What is said to have been the first railway in Canada was between Laprairie and St. Johns, Que., and it replaced a stage coach line. The charter was obtained in 1832, and it provided for a road 16 miles long. The authorized capital of this new enterprise, known as The Champlain and St. Lawrence Railroad, was £50,000. This was in fact a capitalization of a little over £3,000 a mile. Work was commenced in April, 1835, and the line was opened in July, 1836, horses at first being used to haul the cars. The rails were strips of wood covered with thin plates of metal, sometimes called strap rails, but later on replaced with iron rails of more modern pattern.

What the early passenger trains looked like is shown by our illustration, which is a reproduction of a picture now in the Grand Trunk board room at Montreal. We obtained the illustration and the data from the Railway and Marine World.

An advertisement in *The Montreal Transcript* of those old days announced that "The Champlain and St. Lawrence Rd. Co., in connection with the steamboat Princess Victoria, will continue to run as follows: Steamer from Montreal precisely: 9.30 a. m., 3 p. m. Cars from Laprairie, 10.30 a. m., 4 p. m., by locomotive." Then followed the time of the return trips and the times of the Sunday service. The fare for the return trip on the same day was 7s. 6d.; single fare, 5s.; children half price.

This advertisement appeared after the railway had been in operation only a few months. In the same issue of *The Transcript* appeared the following news paragraph, which shows how early the new line developed freight traffic: "A number of American speculators have been engaged in this city for the last two weeks buying wheat and salt for the American market. The steamer Princess Victoria has already brought 35,000 bushels of wheat and 20,000 bushels of salt to Laprairie to be taken to St. Johns via the said road."

The political troubles, sometimes called the rebellion of 1837-38, hampered railway expansion, and very little was done until 1845, when a charter was granted to the St. Lawrence and Atlantic Ry. Company, authorizing them to build a road from the St. Lawrence River, opposite Montreal, on the right bank, at St. Lambert, to the frontier of the United States, there to connect with a line running to Portland, Me. In 1847 the line from Montreal to Lachine was opened; in 1850 the line to Portland was opened as far as Richmond, Que., and a charter was granted to build a branch from Richmond to Point Levis, opposite Quebec. In 1852 the St. Johns-Laprairie line was built to St. Lambert, which became the general junction point, and eight years later it became the southern terminus of the Victoria tubular bridge, built by Robert Stephenson and A. M. Ross. These early railways are to-day parts of the Grand Trunk Railway system.

THE FIRST RAILWAY TRAIN IN CANADA, WHICH BEGAN RUNNING BETWEEN LAPRAIRIE AND ST. JOHNS, QUE., IN THE SUMMER OF 1836.

Colors of Mother of Pearl.

In our July paper, page 287, we had some observations on the colors of thin plates, the plate being a very thin film of oil or turpentine spreading out over water or over a wet surface. The plate or film eventually becomes so thin that the rainbow tints of colored light which go to make up what we call white light, actually interfere with one another and by destroying some of the ingredients of white light reveal the remaining constituents in the form of beautiful irridescent colors.

The colors of mother of pearl are produced in very much the same way and are the result of the interference of the colored rays of light, which are really waves of different lengths. The mother of pearl when viewed under the microscope is found to be made up of numberless little ridges like minute file marks, but running in more or less curved contour lines. These tiny ridges are less in height than the waves of light and the phenomenon of "interference" takes place with the result that some of the waves which make white light are destroyed and the others show clearly in the full glow of color. The fact that mother of pearl is structurally a series of ridges may be proved by making a sealing wax cast of the surface of the shell and the minute ridges being of course reproduced the wax shows all the glistening colors which gives to the mother of pearl its bright, lustrous appearance.

Track Premiums on the P. R. R.

The Pennsylvania Railroad distributes annually the sum of $5,400, in premiums to those whose divisions have been kept in the most perfect condition during the year. The premiums for 1910, six in number, were distributed at Harrisburg at the close of the first day of the general manager's thirty-eighth annual track inspection trip. A committee of maintenance of way officers goes over the line every few weeks during the year in a car attached to one of the regular high speed trains. Two glasses full of water are placed on the sills of two rear windows of the car, and every spill is counted against the man on whose section the spill occurs. An instrument is also used which has been designed to register every vibration of the car, either vertically or horizontally. The smaller the amount of vibration, the better the track.

The Special Main Line Track Inspection Committee for the year 1909-10 consisted of Messrs. J. T. Richards, Chief engineer maintenance of way, chairman; Messrs. L. R. Zollinger, engineer maintenance of way; H. A. Jaggard, superintendent of the Elmira division; J. B. Baker, superintendent Philadelphia terminal division; and E. B. John, superintendent Delaware division.

Nearly all young trainmen interest themselves in the construction and operation of the air brake. RAILWAY AND LOCOMOTIVE ENGINEERING encourages that tendency towards self-help, by maintaining an excellent air-brake department, but it cannot publish a treatise on brakes every month or two, and so recommendations are given to read the best permanent literature on the subject. In this connection we ought to mention the "Air-Brake Catechism," by C. B. Conger. Any person who studies that book thoroughly need fear no question or problem connected with air brakes.

We understand that several railway supply men are in the habit of annually making a present of a year's subscription to RAILWAY AND LOCOMOTIVE ENGINEERING. Several recipients of this courtesy whom we have met say the paper is the most welcome Christmas present they receive.

Items of Personal Interest

Mr. W. F. Lowe has been appointed road foreman of engines of the Alabama Great Southern.

Mr. A. H. Stebbins has been appointed superintendent of the Barre Railroad, with office at Barre, Vt.

Mr. F. W. Stanyan has been appointed general manager of the Barre Railroad, with office at Montpelier, Vt.

Mr. P. J. Hannifin has been appointed road foreman of engines on the Rochester division of the Erie Railroad.

Mr. J. J. Dewey, master mechanic of the Erie at Jersey City shops, has resigned to go into other business.

Mr. D. F. Farrell has been appointed purchasing agent of the Detroit & Charlevoix, with office at Detroit, Mich.

Mr. F. E. Marsh, assistant mechanic of the Pennsylvania at Trenton, has been transferred to the machine shops at Altoona.

Mr. A. R. Duncan, superintendent of car service for the Cincinnati, Hamilton & Dayton, has resigned to engage in other business.

Mr. John W. Storrs has been appointed consulting engineer of the Montpelier & Wells River Railroad, with offices at Concord, N. H.

Mr. W. W. Abbott has been appointed superintendent of the Auburn division of the Lehigh Valley Railroad, vice Mr. C. J. Shea, transferred.

Mr. J. A. Burke has been appointed road foreman of engines of the Atchison Topeka & Santa Fe Railroad, with headquarters at Amarillo, Tex.

Mr. F. H. Murray has been appointed master mechanic of the Erie Railroad, with office at Port Jervis, N. Y., vice Mr. C. James, transferred.

Mr. J. F. Schwaiger has been appointed road foreman of engines on the Eastern district of the Wyoming division of the Union Pacific Railroad.

Mr. M. C. Roach has been appointed superintendent of the New York division of the Lehigh Valley Railroad, vice Mr. W. W. Abbott, transferred.

Mr. C. James, master mechanic on the Erie at Port Jervis, N. Y., has been transferred to Jersey City, on the Erie, vice Mr. J. J. Dewey, resigned.

Mr. P. G. Leonard has been appointed road foreman of engines of the Hocking Valley, with office at Columbus, Ohio, vice Mr. L. C. Engler, deceased.

Mr. Geo. Whiteley has been promoted from road foreman of engines to district master mechanic, District 1, Saskatoon division, Canadian Pacific Railway.

Mr. C. J. Shea has been appointed superintendent of the Wyoming division of the Lehigh Valley Railroad, vice Mr. N. L. Moon, assigned to other duties.

Mr. J. J. Dewey, master mechanic of the New York division and branches of the Erie Railroad, at Jersey City, N. J., has resigned to go into other business.

Mr. L. L. Park, of Schenectady, has been appointed superintendent of apprentices of the American Locomotive Company, vice Mr. George L. Sprague, resigned.

Mr. A. M. Gracie has been appointed foreman of the car department of the Northern Central at the Elmira, N. Y., shops, vice Mr. J. W. Hawthorne, deceased.

Mr. E. L. Burdick, general foreman of the locomotive department of the Wabash at Forest, Ill., has resigned to become assistant engineer of tests of the Santa Fe at Topeka.

Mr. Fred H. Murray, general foreman of the Jersey City shops of the Erie, has been promoted to be master mechanic at Port Jervis, N. Y., vice Mr. C. James, transferred.

Mr. C. A. Kothe, assistant general foreman of the Southside Jersey City shops of the Erie, has been appointed general foreman of the Bergen shops, on the same road.

Mr. C. H. Norton, general foreman of the Bergen round house on the Erie, has been appointed general foreman of the Jersey City shops, vice Mr. F. H. Murray, promoted.

Mr. Garret Vliet has been appointed master mechanic of the western division of the Grand Trunk, at Battle Creek, Mich., to succeed W. Hamilton, who recently resigned.

Mr. W. A. Yanda has been appointed machine foreman on the Northern district of the Rock Island lines, with office at Cedar Rapids, Ia., vice Mr. P. F. Low, resigned.

Mr. Thomas Tait, Chairman of the Victorian Railway Commissioners, has, according to a Melbourne, Australia, cable, dated Sept. 21, resigned and will return to Canada.

Mr. J. Beaumont has been appointed signal engineer of the Chicago Great Western Railroad, with office at Chicago, vice Mr. W. H. Fenley, resigned to engage in other business.

Mr. F. A. Chase, formerly general mechanical inspector of the Chicago, Burlington & Quincy, has retired from active service after almost 61 years of railway and mechanical work.

Mr. J. P. McMurray, road foreman of engines of the Atchison Topeka & Santa Fe Railroad, has been transferred from the Colorado to the Western division, with headquarters at Newton, Kan.

Mr. M. A. Kinney, master mechanic of the Hocking Valley at Columbus, Ohio, has been appointed superintendent of motive power, with office at Columbus, vice Mr. G. J. De Vilbiss, deceased.

Mr. H. F. Wardwell has been appointed superintendent of power and equipment of the Chicago & Western Indiana and the Belt Railway Company of Chicago, with office at Chicago, Ill.

Mr. C. M. Stone has been appointed machine foreman on the Terminal and Illinois divisions of the Rock Island lines, with office at Chicago, vice Mr. W. Marks, assigned to other duties.

Mr. C. A. Blood, freight traffic manager of the Lehigh Valley, is receiving congratulations on having won the golf championship in a contest with some of the higher officials of the company.

Mr. E. Norton, road foreman of engines of the Atchison, Topeka & Santa Fe Railroad, has been transferred from the Western division to the Colorado division, with headquarters at La Junta, Col.

Mr. P. H. Wilhelm, lately associated with the American Steel & Wire Company, has become connected with the Boston Woven Hose & Rubber Company in the capacity of general railroad representative.

Mr. D. W. Mahoney, Saskatoon, Sask., Canada, has been appointed road foreman of engines, with jurisdiction over the fourth and fifth districts, Canadian Northern Railway, with headquarters at Saskatoon.

Mr. Garrett Vliet, assistant master mechanic of the Grand Trunk, Portland, Me., has been appointed master mechanic of the western division, with office at Battle Creek, Mich., vice Mr. W. Hamilton, resigned.

Mr. Frederick M. Weld, master mechanic of the Chicago, South Bend & Northern Indiana, has resigned to take the position of master mechanic of the Birmingham Railway, Light & Power Co., of Birmingham, Ala.

Mr. C. C. Hubbell, auditor of disbursements of the Delaware, Lackawanna & Western at New York, has been appointed purchasing agent, with office at New York, vice Mr. George F. Wilson, resigned on account of ill health.

Mr. F. A. Bushnell, purchasing agent of the Spokane, Portland & Seattle and the Astoria & Columbia River, at Portland, Ore., has been appointed purchasing agent of the Oregon Trunk, the Oregon Electric and the United Railways Co.

Mr. Paul L. Grove, assistant master mechanic at the Altoona shops of the Pennsylvania Railroad, has been appointed assistant engineer of motive power of the Buffalo division, with office at Buffalo, N. Y., vice Mr. C. L. McIlvaine, promoted.

Mr. C. L. McIlvaine, assistant engineer of motive power of the Buffalo division of the Pennsylvania Railroad, at Buffalo, N. Y., has been appointed assistant engineer of the Erie division of the Pennsylvania Railroad and the Northern Central, with office at Williamsport, Pa., vice Mr. J. L. Cunningham, promoted.

Mr. Geo. A. Holden, roundhouse foreman at Michigan City, Ind., for the Michigan Central, has recently been promoted to general foreman of the locomotive department on the same road and transferred to Grayling, Mich., vice Mr. E. A. Keeler, transferred. He will have charge of engines and engine crews at that point.

Mr. C. H. Peterson, hitherto connected with the Chicago office of the Baldwin Locomotive Works and the Standard Steel Works Company, has been appointed southwestern representative of these companies, with offices at 914 Security Building, St. Louis, Mo. Mr. Edward B. Halsey, who has been in charge of the St. Louis office, has been transferred to the sales department of the Philadelphia office.

Mr. E. Stutz, vice-president and general manager of the Goldschmidt Thermit Company, has retired from the direction of the company's affairs, which now comes under the management of Mr. William C. Cuntz. Mr. Cuntz brings to his position a thorough knowledge of the steel business and a wide acquaintance with the railway and street railway officials of the country, having been connected for eighteen years with the Pennsylvania Steel Company.

Mr. C. T. Allis, for years an engineer on the Memphis Route and one of the subscribers to the first number of THE LOCOMOTIVE ENGINEER, has given up railroading and is now secretary and general manager of the Roberts Lumber Company, of Pitkin, La. Mr. Allis is located a little away from crowded lines of travel, but the high fortune that has come to him has not made him proud and he will be glad to take any of his old friends out for a spin on his new automobile.

Mr. J. W. Wyatt has been appointed road foreman of engines on the first district of the Cincinnati, New Orleans & Texas Pacific Railway. Mr. Wyatt has been running an engine on this road for the past sixteen years, and has been chairman of the local committee of adjustment of Division 603, B. of L. E., and member of the G. C. of A. for the past five years. The members of his division regret very much to lose him as an active member, but congratulate the railroad officials on the appointment, and all join in wishing him success and advancement to higher positions.

Mr. James T. Brady, for many years superintendent of shops of the New York, New Haven & Hartford Railroad at New Haven, Conn., has been transferred to the extensive new shops of the company at Readville, Mass. Mr. Brady is one of the most thoroughly accomplished railway men in New England. He learned the machinist's trade with the Petty Machine Company over forty years ago, and was for many years in the employ of the New York & New England Railway Company. When the road became merged into the New Haven system Mr. Brady was placed in charge of the company's principal shops at New Haven. He is very popular among the younger mechanics, whom he encourages in many ways, especially in the personal superintendence of their theoretical as well as practical education. He is a great believer in railroad literature, and in spite of his growing duties he manages to keep thoroughly abreast of the times in all that pertains to the mechanical appliances used on railways.

Obituary.

It is with feelings of profound regret that we have to record the death of an old and valued friend, Henry S. Bryan. He died at the advanced age of 74. Mr. Bryan was born Sept. 7, 1836, at Cazenovia, N. Y. He received his education at the G. W. Seminary, at Lima, N. Y., and at the O. C. Seminary at Cazenovia, N. Y. In 1856, at the age of 23 years, he entered the railway work, his first position being that of machinist in the Chicago, Milwaukee & St. Paul Railway shops, at Milwaukee; from December, 1863, to September, 1865, he was foreman of the machine shops of the Galena division of the Chicago & Northwestern Railway, Chicago; from October, 1865, to February, 1866, he worked as machinist for the Chicago, Rock Island & Pacific Railway, at Chicago. He filled other positions in the mechanical department of several of our leading railways, and from April, 1880, to September, 1889, he was a member of the business firm of Bryan Elmer & Sloane, and from September, 1889, to April, 1890, in the firm Bryan & Elmer, dealing in railway material and supplies, with headquarters at St. Paul. In April, 1890, Mr. Bryan came to Two Harbors and from that time until 1904 served as master mechanic of the Duluth & Iron Range. In that latter year he was promoted to the office of superintendent of motive power, which position he held up to the time of his death. During the twenty years of his life in Two Harbors Mr. Bryan had ever been prominent in the affairs of the village and city. He served the public in many capacities, among them being president of the village for three years. He was president of the public library during the first five years of its existence. He served three years as president of the school board and three years as president of the old Commercial Club. His son, Mr. Luther H. Bryan, is general foreman of locomotive repairs on the Duluth & Iron Range Railroad, and he is also secretary of the International Railway General Foremen's Association.

Archibald C. Robson, formerly master car builder of the Lake Shore & Michigan Southern at Buffalo, N. Y., died at his home in Buffalo on Oct. 6 of heart disease. Mr. Robson was born on Feb. 19, 1830, at Langholm, Dumfrieshire, Scotland. He began railway work in December, 1854, as a carpenter on the Buffalo & State Line, remaining in that position until the road became a part of the Lake Shore & Michigan Southern. From May, 1868, to June, 1872, he was appointed division master car builder of the same road and was later promoted to master car builder.

C. D. Jameson, who recently resigned as master mechanic of the western division of the Grand Trunk at Battle Creek on account of ill health, died last week in Montreal.

We regret to announce the death on Saturday, October 22, in Buffalo, N. Y., of the railroad representative of Messrs. Manning, Maxwell & Moore; Charles E. Randall. Mr. Randall was sixty-nine years old. On account of the death of his father he was obliged to go to work at the age of fourteen, at which time he became an apprentice in the Taunton Locomotive Works. At the age of twenty-five he had become chief engineer on a steamboat. A few years later he was employed by the Hartford Steam Boiler Works in East Boston, where he was employed until 1870. On June 1, 1881, he entered the employ of The Hancock Inspirator Company as mechanical engineer and salesman and has been connected with them since that time. When Manning, Maxwell & Moore, Inc., purchased the Hancock Inspirator in 1900, Mr. Randall then became associated with this well known firm, and has represented its allied industries, The Ashcroft Manufacturing Company, The Consolidated Safety Valve Company, The Hayden & Derby Manufacturing Company and The Hancock Inspirator Company.

Robert Potts, who until his retirement from active service seven years ago was master car builder of the Michigan Central at St. Thomas, Ont., in which capacity he served for nearly 25 years, died recently, aged 71 years.

Shockless Jarring Molding Machine.

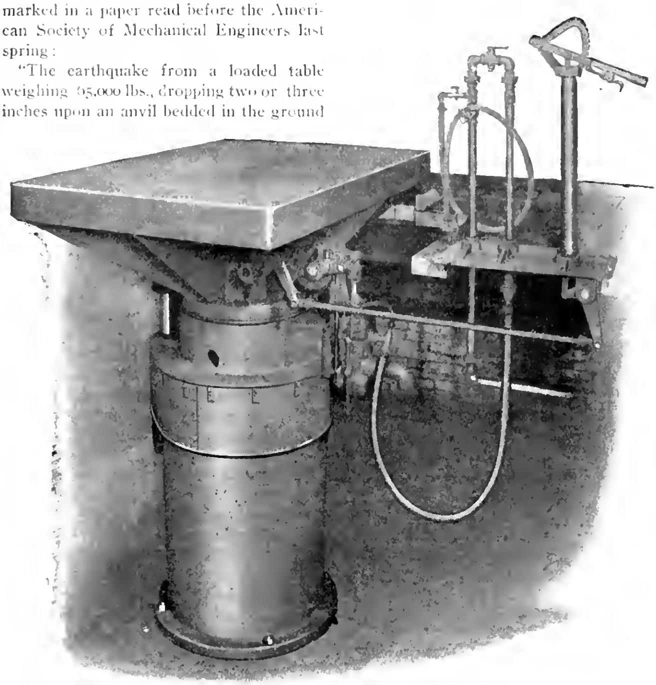
Our half-tone engraving illustrates a "shockless" jar ramming molding machine invented by Mr. Wilfred Lewis, president of the Tabor Manufacturing Company of Philadelphia. Jar ramming machines for molding have been largely used, and they have done very well for light work, but when applied to the immense castings now called for, the shocks imparted to the foundation had serious effects upon floors and buildings in the vicinity of the machine. On this subject Mr. Lewis remarked in a paper read before the American Society of Mechanical Engineers last spring:

"The earthquake from a loaded table weighing 95,000 lbs., dropping two or three inches upon an anvil bedded in the ground can well be imagined. Not only would it undo the work done by the machine, but a large area of the floor space in the vicinity would become useless and office buildings at a considerable distance might vibrate in sympathy. In this instance a comparatively small jarring machine of a well-known type, with anvil mounted on wooden cribbing, had caused more or less annoyance to the occupants of office buildings in the neighborhood, and the machine described was designed to avoid any further trouble of the same character."

Our illustration shows one of the 13 in. jarring machines with 4 ft. x 6 ft. table, set up ready for service in a suitable pit, the valve levers and operating mechanism being carried in a stand in a convenient position nearby. The connection from this stand to the machine is through the medium of a flexible hose. The machine is arranged to operate at any stroke from 1 in. to 4 ins. in length, and this can be adjusted while the machine is running.

What Mr. Lewis did was to invent a machine that relieved the foundation of the jarring action. The following description of the improved machine is condensed from an article that appeared in *The Foundry:*

"This machine consists of a jarring table cast integral with the cylinder, mounted upon a cylindrical anvil, which in turn is guided by a cylindrical base and rests upon supporting springs calculated to give the anvil a substantial velocity while the table is falling. The movement employed in this machine to overcome the shock is best defined as 'libratory,' which denotes 'countervailing forces opposing each other.' It will be noted that the supporting springs beneath the anvil carry the entire load of the anvil, table and mold, and they do this under static conditions, and also while the table is rising. However, when the table reaches the upward limit of its travel, and when the air is exhausted to let it drop, the anvil is suddenly relieved of the air pressure which supported the table, and the springs beneath the anvil expand and accelerate its upward movement while the table is falling. As a result, the momentum of the falling table and load is sub-



SHOCKLESS JARRING MOULDING MACHINE.

stantially equal to the momentum of the rising anvil at the instant of impact. These moments neutralize each other, and the table is brought to rest without shock or jar as completely as if it had dropped upon an anvil of infinite weight. To accomplish this, the springs beneath the anvil have a very long compression, so that their loss in supporting power, as the anvil arises, will not materially affect its velocity.

"Ordinarily, the springs are sufficient to give the desired momentum to the anvil, but in large machines, where the consumption of air is an important item, it is advantageous to utilize the air discharged from the jarring cylinder in augmenting the momentum of the anvil. This is accomplished by making an additional port in the operating valve, which connects the jarring cylinder and anvil cylinder while the table is falling. When the operating valve is again shifted to lift the table, the valve is opened to exhaust and the anvil is, therefore, free to drop.

"Ordinarily, supporting springs under about 8 ins. compression are used to carry the full load, and with a 4-inch stroke on the table, the anvil movement would probably not exceed 2 ins., while ordinarily it would be very much less. The maximum variation in floor load would, therefore, not exceed 25 per cent. of the total load resting upon the supporting springs, and this variation is so gradual that it does not partake of the nature of a shock. At the moment of impact the supporting springs simply cease to expand and therefore cease to reduce the load on the foundation. Following this they again compress and gradually increase the load on the foundation by a comparatively small percentage of the total load carried.

"This machine is built by the Tabor Mfg. Co., molding machine manufacturers, Philadelphia.

"Several of these machines are already in use and are giving the highest satisfaction. Any of our readers visiting the Baldwin Locomotive Works can see them in operation in the foundry."

Ditched.

As a philosophic passenger afterwards remarked, "It is the unexpected that always happens." The train had been speeding along hour after hour, through russet meadows and picturesque woodlands marked by reddening maples and fringed by glowing shumack, attractive scenes that kept the passengers gazing upon the beauties of the Indian summer. The train kept speeding on without jar or jolt over a track that seemed perfect, when without the least warning the wheel of the car I was riding on dropped upon the ties, and there ensued the never to be forgotten jolting, rolling and jerking that car wheels produce when plunging over ties and broken stone.

When the tumult began a passenger stood up and shouted at the top of his voice: "What in hell's the matter?" repeating the unanswered query several times. I knew what was the matter, but had no leisure to explain, and just dropped upon the floor and grasped the frame of my seat and held on, taking the jolts as rigidly as possible. Hat racks, hand baggage, seat cushions, splintered head lining and miscellaneous articles began to fly about, and I found the seat frame afforded comfortable protection from the missiles that damaged some exposed limbs.

The tumult could not have lasted half a minute, but it seemed a long time till the end came by the car turning over with a terrific jolt. At that instant, the man who had shouted so vociferously "What's the matter?" was shot through the window like a huge torpedo. Most of the people who had been on the upper side came down in heaps when the car turned over. I was on the lower side, and settled sotfly upon the head lining when the car came to rest.

I had been in a similar accident once before and knew, not only what to do, but kept my attention upon what the other passengers were doing. Most of them stood up or sat without holding fast to the seats, so that they were thrown about by the plunging and jolting of the car. Then a mass of human beings seemed to drop from the higher to the lower level when the car went over. Many of them were badly bruised through being pitched about, pains that might have been avoided had they dropped upon the floor and clung to the seat frames.

It is difficult instructing persons how to do in case of the derailment of a train they are riding in, but sound advice is to drop upon the floor, preferably in the aisle or cling to the seat frame. The impulse to stand up and howl should be restrained. In a former derailment accident that I experienced a woman on the seat opposite to me stood up and proceeded to scream. I shouted to her to sit down on the floor, but she paid no attention, and when the car fell over on its side she was projected upon me like a pile-driver weight. She was nearly as big as a cow, and the impact of her body almost finished my career. A. S.

Explanation Necessary.

"The simplest proposition," said Senator Beveridge in a recent address, "must be sent out with the utmost care in the wording, or misunderstanding, dissent, even anger, may result.

While a train was leaving Cincinnati a man stuck his head far out of the window.

"'Keep your head in there,' a station attendant shouted in warning, 'or it will be knocked off.'

"'Knocked off?' shouted the passenger. 'Knocked off, eh? Well, it won't be knocked off by anybody the size of you.'"

Detroit Seamless Tubes.

Below is an item taken from a recent issue of the *Detroit Free Press*. The business success of the Detroit Seamless Tubes Co. is a matter for congratulation, not only among the officers of the company, but also among their many friends throughout the country:

"That more business is coming to Detroit industrial concerns than was expected is demonstrated by the remarkable record lately made by the Detroit Seamless Steel Tubes Company, one of the largest mills of the kind in the country.

"A few months ago a complete reorganization of the administrative force from the superintendent down took place. Since that time there has been an increasing output and every previous record has been broken in all departments. The rate of increase runs from 10 to 25 per cent., and the owners feel as though they are making a record that is extraordinarily great at a time when the automobile business is slack and has a natural tendency to decrease the demand for their products.

"The reorganization began with the appointing of Mr. W. H. Lantz, of Detroit, as superintendent. He was for many years one of the force of the American Car & Foundry Company plant, of this city, which he left to accept a position in the South, from which he has but lately returned.

"The other new appointees are Mr. William Imhoff, head of the cold drawing department, secured from Shelby, O., as was also his assistant, Mr. Robert Ihler; Mr. James Thompson, Detroit, superintendent of rolling mills; Mr. Charles Koelbel, Chicago, night foreman of the cold drawing department; Mr. Thomas W. Smythe, Detroit, general foreman; Mr. William Sythes, Detroit, night superintendent."

Presence of Mind.

"Hallo!" exclaimed a London costermonger on meeting an acquaintance. "Wot damages did you get for bein' in that motor 'bus accident?"

"'Eavy ones, my boy," was the reply, accompanied by a grin. I got £20 for myself and £20 for the missus."

"The missus! Was she hurt, too?"

"No, but I 'ad the presence of mind to fetch her one over th' 'ead 'fore we was rescued."

Among recent oil furnace contracts taken by Walter Macleon & Co., of Cincinnati, Ohio, are a large plate-heating furnace for the J. Baum Safe Company, of Cincinnati; complete furnace equipment for the Southern Motor Works, Nashville, Tenn., and a complete furnace equipment for the W. H. Clore Manufacturing Company, Washington, Ind.

Life of Steel Cars.

At a recent meeting of the New York Railroad Club, Mr. William Marshall, of Newark, N. J., president of the Anglo-American Varnish Co., said:

"The metal car is here to stay, and has been here long enough to demonstrate that it can be protected by suitable paint. With regard to its protection, he had found it wisest to obtain statements from the master painters of the leading railway systems. Replies received to a series of questions disclosed almost complete unanimity of opinion that all parts should be sand-blasted before receiving any application of material as a priming coat. Also the further necessity of giving careful and close attention to unseen parts, such as lapping joints where metal is placed against metal, or metal against wood, and which should be thoroughly painted with a red lead jute before riveting. Hidden parts which are not to be surfaced and varnished should be given not less than two or three coats of the best protective paint obtainable. The life of a car will depend entirely upon such protection. These priming coats should have less oil than for wood, owing to the smaller porosity of metal.

"As to the appearance and durability of steel cars in comparison with those of wood, four years' experience on one system with 200 such cars had not shown any material difference in general surface. Wherever there is the slightest opening of joints moisture is sure to creep in and corrosion follow.

"As the metal freight car has shown superiority over wood, the passenger car will undoubtedly do the same. Steel cars retain the luster of varnish longer than those of wood. Disintegration of metal cars dates from the time that the car leaves the sand-blast house, and continues until it becomes necessary to remove and repaint it in five and one-half or six years.

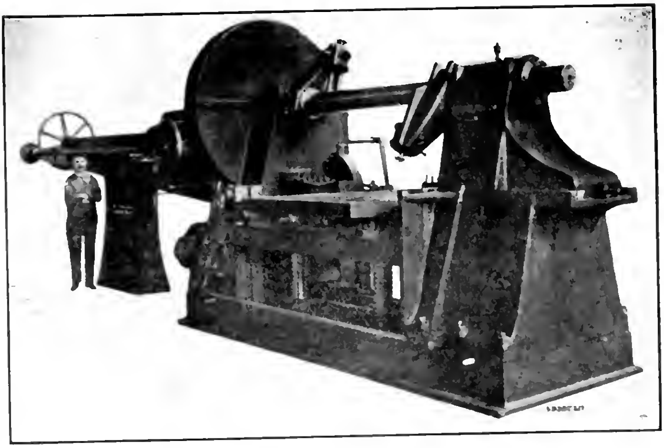
"Personal views greatly differ, in the light of present experience, as to the cost and making of repairs by reason of side-wiping, collisions and wrecks, but the consensus of opinion is that steel cars offering greater resistance in accidents, consequently the number of times they will have to be repaired will be reduced. An accident that would put a wooden car out of commission will hardly make an impression on one of steel.

"It is believed by a majority that ultimately it will be found that the life of the steel car will exceed that of the wooden car one-third, provided it has the proper care and attention. From an economical standpoint, the greater first cost of steel cars will be compensated for in economy of maintenance and the longer time such cars are out of the shop and more service per mile they give are factors in the case.

Cylinder and Valve Chamber Borer.

In the past it has been the practice to bore locomotive cylinders in machines having a fixed distance between the table and the boring bar, and this distance was so small that it was necessary to clamp the cylinder in a cradle or other special device designed for the purpose, the cylinder being held in extremely unstabled equilibrium. The setting of the machines have been requiring as much, if not more time than the actual boring of the cylinder and its piston valve ports.

To obviate these objections the Niles-Bement-Pond Company, of New York, designed and constructed a new line of locomotive cylinder and piston valve chamber boring machines, which we illustrate in this issue, the machines having sufficient height between the top of the table and the boring bar to enable the cylinder to be chucked with its flat side on the horizontal table. Only a few minutes is thus required to chuck the cylinder, thereby reducing by about one-half the cost of machining these awkward castings.



CYLINDER AND PISTON VALVE CHAMBER BORER.

The machine, which the makers refer to as the Bement locomotive cylinder and valve chamber boring machine, will bore and face both ends simultaneously of cylinders up to 60 ins. in length. The boring bar is a steel forging 7 ins. in diameter, it has a continuous traverse of 11 ft by hand, fast traverse in either direction, and six automatic reversible boring feeds. For boring the interrupted ports of piston valves the feeds are actuated by a screw instead of a rack, the feeds being engaged, changed or reversed by conveniently placed levers. The main table is supported on four large elevating screws, the nuts of which are revolved by hand or power. The cross table measures 54 by 72 ins., and has a longitudinal traverse of 18 ins. and a cross traverse of 30 ins. The minimum distance from center of boring bar to table is 30 ins. The maximum distance is 51 ins. Facing heads are provided with tool slides having compound motion and automatic star feed. They are clamped to end of the sleeve with the boring bar. The minimum distance between facing heads is 20 ins. The maximum distance is 60 ins. Boring heads of various sizes can be provided to meet any requirement.

The drive is by means of a powerful motor directly geared through reversing controller; the adjustment of table and fast traverse to the bar are obtained from the same motor. These machines have completely revolutionized all former methods of boring locomotive cylinders and piston valve chambers by chucking cylinders on the flat side, thus reducing to a minimum all possible chances of the setting slipping. These machines win favor as soon as seen and have been extensively adopted by the leading locomotive and railroad shops, such as the New York Central and the various shops of the American Locomotive Company.

Canadian Exaggeration Met.

"Where I come from," said the first, "we have a salmon river that rises in some boiling springs. As the salmon climb up the river they gradually get acclimated to the heat of the water and don't mind it. In fact, when we fish in the highest reaches of the stream we catch our salmon ready boiled."

"I don't doubt that," said the second Canadian, calmly. "Down my way there's a curious salmon river, too. It rises in some tin mines. As the fish work up they meet the suspended ore in gradually increasing quantities. They get quite mineralized if they keep on upstream, so that, if we fish at the head of the river, we catch our salmon ready tinned, and all we have to do is to pack and ship them to market."

New Drive for Flatwist Drills.

The questions connected with using and driving twist drills forged or twisted from flat bars of high-speed steel are probably receiving more attention from mechanics at the present time than any others connected with the use of tools. Although attempts to solve the problem of drive have been numerous, and complicated chucks have been designed to hold and drive the rough end of the flat bar of steel, the shank ends of the bars have been spirally twisted and machined to form taper shanks fitting regular taper sockets; more or less cumbersome taper shanks have been soldered or riveted to the shank ends of the flat twist drills but none of these methods have finally settled the matter.

The Cleveland Twist Drill Company, of Cleveland, Ohio, have recently applied for patents on a new device for driving flat taper shanks that are tapered both on the flat sides and round edges. These shanks are regularly furnished on that company's "Paragon" flat twist drills and are driven by sleeves or sockets internally equipped with flat taper holes accurately fitting the shanks and externally tapered to fit standard taper sockets or spindles. In the case of large diameter flat twist drills having No. 6 shanks this drive

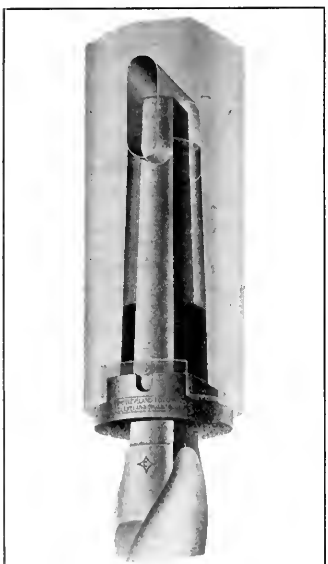


FIG. 2. SHANK COLLET AND SPINDLE.

was found to have certain disadvantages, as it made necessary the use of cumbersome extension reducing sockets to adapt the large shanks to the drill press spindles which seldom have a taper hole larger than No. 6. To overcome this difficulty as well as to provide additional driving strength is the two-fold object of the new device.

To this end both the No. 5 and No. 6 "Paragon" shanks have been redesigned the same length as regular taper shanks, the taper on the round edges being regular Morse taper as formerly. When, therefore, this modified shank is

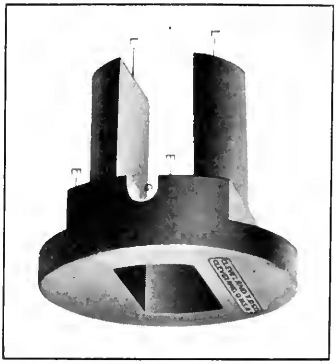


FIG. 1. THE "PARAGON" COLLET.

inserted directly in the spindle the upper end of the shank is received and driven by the flat slot in the spindle just as is the tang of an ordinary taper shank drill. This alone would constitute a strong and practical drive but for the lack of support the shank would have on its two flat sides at the lower end of the spindle. To provide against the possibilities of vibration and wear between the shank and spindle, and to furnish a powerful additional drive at the lower end of the shank where its cross sectional area is greatest, a new and original type of socket, called the "Paragon" Collet, has been evolved.

As shown in Fig. 1 the collet consists of two lugs L, L projecting upward from a flattened disk through which is cut a rectangular hole to receive the "Paragon" shank. The lugs have rounded outside surfaces ground to standard taper and flat inner surfaces tapered to fit the flat taper shank. The groove G is provided to receive the point of a drift key in case the collet should stick in the spindle. When the collet is on the shank the combination is practically an interchangeable taper shank with unusually long tang.

Fig. 2 shows the shank, collet, and spindle, in combination. The additional drive is provided by means of an extension E projecting upward, in the case of vertical drilling, from the circular base of the collet. This projection mortises into a slot cut across the end of the spindle conforming to the standard slots now being put in the spindles of heavy-duty drill presses by several well-known manufacturers. That this tongue-and-gro ve drive at the large end of the shank is very much stronger than any drive on the tang could possibly be is made evident by a single glance at the figure. The collets without this extension will fit any spindle or socket and the company informs us that these will be furnished to railways whose spindles are not fitted with slots, when this requirement is plainly specified, but they will, of course, not have the additional driving strength otherwise afforded. With the extension they make what would seem to be an almost ideally perfect drive for the largest sizes of flat twist drills.

High Destiny.

It used to be a matter of sentiment in nearly all Scottish households for the eldest son of a family to be destined for the ministry. The highest ambition of nearly every matron was to see her son "wag his head in a pulpit." Sentiment has sadly changed of late years. The writer was talking one day with Mrs. Kidd, wife of a Scotch railway inspector, about her growing sons. She was proud of their ability and remarked: "There's Jamie, the oldest, learning to be a mechanic in the railway shop; Tom, the second laddie, is learning to be a grocer, and Jack is working in the goods office." "What about Willie, the youngest, Mrs. Kidd?" "Weel, we're no verra sure about Willie. He's no verra bright, but we were thinking he might do for a minister."

P. R. R. for "Good Roads."

In an endeavor to stimulate interest in the "Good Roads" movement in the States through which the road runs, the Pennsylvania Railroad has issued a pamphlet entitled, "Good Roads at Low Cost." This booklet is being given a wide distribution in the country districts throughout Pennsylvania Railroad territory. "Good Roads at Low Cost" was written for the Pennsylvania Railroad by Mr. D Ward King, who is an acknowledged expert on road making. He is the author of a pamphlet distributed by the Department of Agriculture some time ago.

While the management of the Pennsylvania Railroad have for some time been keenly interested in the subject of good roads, in the past year they have redoubled their efforts in this direction. Meetings of agents have been held at different points, while the general manager's staff has also taken up the subject of improving the roads radiating from the company's stations.

The company has had Mr King, the inventor of the split log drag, deliver lectures at various stations in the State of Pennsylvania. The split log drag, which can be made by any one following the directions given in the pamphlet issued by the railroad, has been used with good effect in many parts of the country A number of these drags have been placed at various Pennsylvania railroad stations throughout the State of Pennsylvania in order that road supervisors and others might operate them.

Association of Interests.

Quite recently an association of interests in the manufacture and sale of machinery and machine tools has been announced by the Gisholt Machine Company and Joseph T. Ryerson & Son. This announcement is of particular interest as representing the establishment of a relationship which is understood to be intimate between one of the leading machine tool builders and one of the strongest general machinery organizations in the country. In furtherance of the plans formulated by the interests thus combined extensive additions will be immediately made to the Gisholt plant at Madison, Wis., which will greatly increase the output and scope of that company and permit of a development which the association of these two concerns would seem to prophesy.

The McKeen Motor Car.

The McKeen motor car appears to be attaining great popularity, especially in the West, and it appears that every new car acts as a convincing argument in favor of new orders. Within a month the following cars have been delivered:

One 70-foot, Southern Pacific Company, No. 45.

One 70-foot, Chicago Great Western Railroad Company, No. 1001.

One 70-foot, Rock Island Lines, No. 9023.

This makes a total of 88 "McKeen" cars in daily service in the United States and Mexico.

Gives Up Demurrage Bureau.

The Lehigh Valley Railroad have announced their withdrawal from the car demurrage bureaus in their territory. They will handle demurrage affairs through their own organization after November 1. By this new arrangement the company will be better able to prevent the delay incident to the holding of cars, and will expedite traffic in such a manner as to benefit the railroad, the shippers, and the public in general. The same action has been taken by other large roads.

The car demurrage bureau was formed some twenty years ago. The principal object was to minimize the detention of cars by shippers and consignees as well as to insure equal treatment of shippers by all the companies The bureau's function has been to keep track of the cars placed for loading and unloading and held beyond the allotted time, to hasten the release of these cars, and to determine upon the amount due to the railroads in the form of demurrage charges for unnecessary detention. A code sanc tioned by the Interstate Commerce Commission, has made the joint bureaus unnecessary.

The Humane Stock Car.

The Pennsylvania Railroad had an exhibit at the first international humane conference in America, which was recently held in Washington. The most important feature of the exhibit was a miniature model of the car, so made that the interior could be inspected. This model is 5 ft. long and a little over 1 ft. wide; it is 1 ft. 7 ins. high. The model and the other exhibits show in detail the method used for the protection of stock against injury in transit.

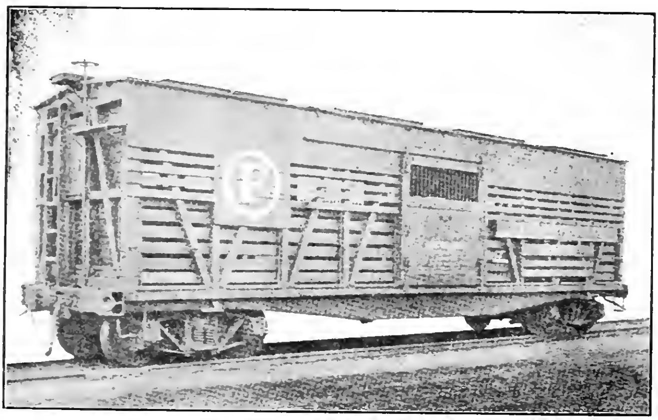
The Pennsylvania Railroad is also distributing pamphlets giving a history of the development of their standard steel underframe live-stock car. This pamphlet is being sent broadcast and contains illustrations of the interior of the car, showing how all sharp corners have been eliminated.

The experiments which the Pennsylvania Railroad have been making in the construction of this live-stock car have been going on for some thirty years, and the equipment which is now being exhibited at the humane conference has been examined by railroad men, veterinarians, live-stock shippers and societies for the prevention of cruelty to animals, and has been pronounced a most admirable car for the transportation of live stock.

The class "Kf" stock car is built of oak, on a steel underframe, giving a solid floor and a rigid body. There is no sagging in the floor to cause the stock to lose their equilibrium at every jerk of the train. The floor is rough, in order to afford a firm foothold for animals.

All bolt heads and nuts exposed on the inside of the standard stock car have been rounded or countersunk; all edges on side doors and interior walls with which the stock may come in contact have been rounded or chamfered. Hay racks within the car extend from end to end, thus permitting feeding in transit. The hay-rack bars at points of attachment are reinforced with a wooden facing strip to prevent horses, when tied to them, from pulling away from the racks.

The two bottom lining slats on the sides of the car are spaced 1 in. apart to keep the legs of hogs and sheep from sticking through while lying down. The side doors are equipped with guides or throws so that in the winter, when manure freezes against the door, the latter can be thrown out at the bottom from the side of the car and moved, thus eliminating the hammering to loosen, which frightens the stock. These "throws" also hold the doors tightly to the sides and bottom of the car, thereby preventing the legs of sheep or hogs from slipping through when leaning against the doors.



"HUMANE" LIVE STOCK CAR ON THE P. R. R.

The new car has end sliding doors and handholds on bottom of carlins in order that attendants may enter.

Allurements and Discouragements.

The humorist of *The Houghton Line* remarks: "If you want to get up a rousing reform meeting, just send each man a personal invitation and mention that he may be called upon to make a speech.

"If you want to have empty benches, tell him he may be called upon to make a contribution.

"We have tried both."

The chief of this clan has a hired girl whose name is Ingobar, a Norweigian appellation. There is a chronic strained relation between that girl and Mrs. Flynn, who visits the house every week to do washing. Mrs. Flynn, like many other Irishwomen, hates strange names and wildly makes a shout at some of them. Ingobar she invariably calls Incubator.

Difference in Brake Equipments.

In order that there may be no misunderstanding concerning the use and intent of late Westinghouse brake equipments for railroad service. We desire to state that the E.T. brake, the P.C. equipment and the "empty and load" brake are designed for use on three entirely different classes of motive power and rolling stock.

The E.T. (engine and tender) is a locomotive brake equipment.

The P.C. (passenger control) is an improved brake for passenger cars.

The "empty and load" brake is for freight cars.

Each brake is a separate and distinct type and a decided improvement upon the brake it supersedes.

The E.T. brake is actually the first efficient automatic brake for a locomotive, it being the first to guarantee the development of a positive amount of brake cylinder pressure as a result of predetermined brake-pipe reductions and to maintain this pressure against leakage, then in order to maintain the efficiency of the brake it is only necessary to keep the foundation brake gear in a condition to transmit the cylinder effect to the brake shoes.

At a meeting of the Air Brake Association a member stated that in a section of the country he passed through some of the engine crews understood the symbol E.T. to mean the "East Tennessee" brake, while others contended that E.T. stood either for "End of Trouble" or "Every Time."

The P.C. equipment is the practical solution of the problem of providing a heavy passenger car with an efficient brake.

In order to keep the total leverage within a prescribed limit which is necessary some modern passenger cars would require a brake cylinder of 20 ins. or more in diameter, and while it is for such weights of cars that the brake was designed, some railroad men were quick to see the advantage of one brake cylinder for service operations and two for emergencies and have adopted the brake for all weights of passenger cars.

There are no triple valves used with this brake and a control valve contains the brake cylinder pressure maintaining feature of the distributing valve of the E.T. brake.

The "empty and load" brake is intended to furnish an efficient brake for a heavily loaded freight car, one brake cylinder being in use when the car is empty, two if the car is loaded or in case the second one is desired during an emergency stop, and brake-pipe pressure remains the same regardless of the number of cylinders used.

By means of this arrangement the braking power is increased on the loaded car only, while the braking power on the empty car remains normal, and this cannot be accomplished with the Schedule U or high pressure control brake.

Missed the Cat, but—

The lodger's pet aversion was cats, and he cherished a special grudge against a feline which sometimes shared his meals without his consent.

Just as he was preparing for bed he caught sight of a suspicious hump under the counterpane.

"The brute!" he muttered, and his eyes glared murder as he reached for one of the ten-pound dumbbells with which he was wont to toy with each morning.

Stealthily he approached the bed. Then thud!

And one of the items on his next week's bill was: "To one hot water bottle, $1.25.

Water Line Indicator.

Among the rules concerning boilers issued by the International Master Boiler Makers' Association is the following, which ought to be strictly observed by every boiler owner:

"The highest point of crown sheet of locomotive type of boilers, also the highest point exposed to the flame of other types of boilers, should be indicated by a conspicuous mark on every boiler, as well as a high and low water mark. The water at all times must be kept between these two points. The proper working water level shall be designated by the words 'Water Level,' in letters not less than 3/4-inch long. They may be cast on a flexible plate, which should be permanently attached to the boiler proper, and all water-gauges should be set by this water-line indicator."

Using River Tunnels.

Michigan Central passenger trains are now running through the tunnels under the Detroit River between Detroit and Windsor. The first one through was the eastbound Wolverine Express. The value of the tunnel will come into evidence during the winter when the river is full of ice. At such times none of the delays known in ferrying trains across will occur. While there has been an impression in certain quarters that a reduction would be made in the time of fast trains nothing has been said about it officially

---

The best thing for anyone to say who has nothing to say is to say nothing, and stick to it.—*McLaughlin.*

Kind words are the brightest flowers of earth's existence; they make a very paradise of the humblest home that the world can show.—*Standard.*

Holding Down Dust.

For long we have had hard road, soft road, thorny road and rock road, now we are going to have sweet road. The road-makers of New Jersey, who have been trying many experiments with material to make roads dustless, have brought into service the sweet, sticky by-product of the great beet sugar refineries. This substance has been tried on the country roads in the West and the claim is made that a couple of applications a year, well rolled down, will keep the roads dustless and in fairly good condition and will be cheaper than oil. If there is not enough of the sugar—molasses—syrup by-product in this country large quantities can be brought here from Porto Rico. Such treatment might make a very sweet road for a time, but it is doubtful if it would stand the wear and tear of traffic in this State.

Her Turn.

A certain lady one Sunday induced her husband, who was not a regular church-goer, to accompany her to evening service. During the sermon he fell asleep, snoring at first softly, and at length so noisily that the good lady was constrained to give him a sharp nudge in the hope of rousing him. To her consternation, however, as he slowly awakened, he exclaimed in a loud voice, "Let me alone! Get up and light the fire yourself—it's your turn."

Safety Heating and Lighting News.

The first issue of this publication has reached our desk and it has filled us with envy. We have always been able to appreciate real art in illustrations and have fumed not a little that our illustrations were far short of our ideals; but we do not think that the publishers of *The Safety Heating and Lighting News* will have any reason for groaning in spirit over their engravings. We certainly believe that their illustrations are absolutely the finest we have ever seen in an engineering publication. This new addition to technical journals is published by the Safety Car Heating & Lighting Company, New York. People interested ought to apply for the new paper without delay before the issue is exhausted.

Bringing the Game Home Alive.

Sandy went to the wilds in Central Africa and found a job on a rubber plantation. Having heard of Col. Roosevelt's success as a hunter of big game, he borrowed a gun one day and started out to kill something. A little later his companion spied in the distance Sandy running at full speed for home, with a huge lion behind him, gaining at every step. "Quick! Quick! Jock!" he cried. "Open the door. I'm bringing him home alive."

Lehigh Orders 40 All-Steel Cars.

An order for forty all-steel vestibule passenger coaches has been placed with the Pullman Company by the Lehigh Valley. They are to be delivered in March and April of next year and will be put into service at once. The need of the new equipment has grown out of the increased traffic on the Lehigh, several new trains having been added in the last few months. In the future the company will follow the policy of having all its new passenger cars of fireproof construction.

New V. P. and G. M. for K. C. S.

Mr. J. E. Muhlfeld, formerly general superintendent of motive power of the Baltimore & Ohio, and since leaving that road engaged in special mechanical expert work for several roads, has been appointed vice-president and general manager of the Kansas City Southern, with headquarters in Kansas City. He succeeds Mr. William Coughlin, who had the title of general manager and recently resigned. Mr. Muhlfeld will be in charge of transportation, maintenance of way and equipment, and the engineering and purchasing departments.

The McConway Wheel.

The McConway Wheel is the title of a most interesting pamphlet recently got out by the McConway & Torley Company, of Pittsburgh, Pa. The McConway wheel is steel tired of the built-up type; the wheel center is a steel casting, the hub is cast iron, and the tire is of the usual rolled steel type. There is no machine work on the tire except such rough turning as may be necessary to make it round; and for the wheel centers, only a small amount of grinding and rough turning is required. There are no bolts, and the tire is neither fused nor shrunk on, it cannot come off by reason of expansion, and will not turn on the center. Separation of the two members, for the renewal of the tire, is effected by cutting the tire in two places, whereupon the structure falls apart, leaving the center ready for the immediate application of a new tire. The application of the new tire can be done by unskilled labor and requires no special machinery; all that is required is a foundry cupola and lifting appliances capable of handling units of the weight of a car wheel. This means that any ordinarily equipped foundry can give the required facilities for the work. The first wheels of this type were assembled with the use of a portable cupola, melting one ton per hour. The construction of wheel is most interesting and in a future issue we expect to describe and illustrate it in detail. In the meantime those interested should apply for a copy of the pamphlet.

In character, in manners, in style, in all things, the supreme excellence is simplicity.—*Longfellow.*

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances

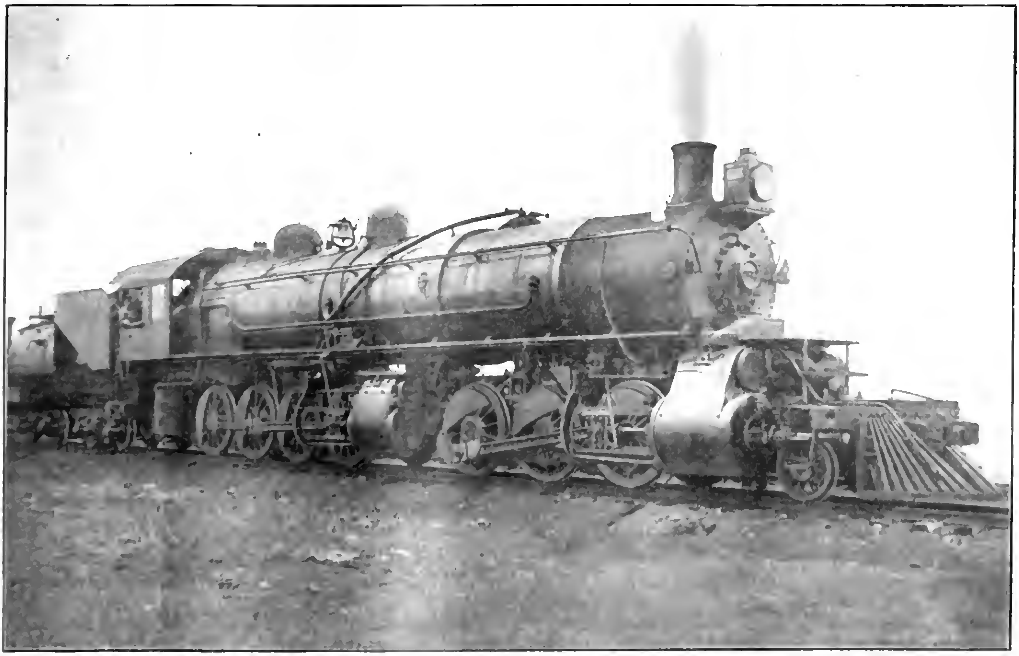
Vol. XXIII. | 114 Liberty Street, New York, December, 1910. | No. 12

Heavy 2-6-8-0 Mallet for the Erie.

Our frontispiece illustration this month shows a very interesting engine, which we may call a composite design made up of a regular Erie consolidation engine and a new unit designed by the Baldwin Locomotive Works. The arrangement is such that the consolidation part of the engine is in the rear and the new unit is in front. The resulting combination is not two consolidation engines, but has the 2-6-8-0 wheel arrangement. The added unit was built from entirely new material, the final work of uniting the two sections being completed by the railroad company. The engine altered was originally of the Erie's H-22 class, with principal dimensions as follows: Cylinders, 22 x 30 ins.; driving-wheels, 57 ins. diameter; boiler, straight type, 80 ins. diameter; steam pressure, 200 lbs.; heating surface, 3,403 sq. ft.; grate area, 49.5 sq. ft.; driving wheel base, 15 ft. 8 ins.; total wheel base, 24 ft. 4 ins.; weight on driving-wheels, 187,000 lbs.; weight, total engine, 208,000 lbs.

The new unit has three pairs of driving wheels, which carry approximately 135,000 lbs. The leading truck of the original engine has been placed ahead of the low pressure cylinders. A suitably designed steel casting, placed under the original cylinders and bolted to the lower frame rails, supports the hinge. This is embraced by a cast steel radius bar which is bolted to the rear end of the forward frames. The low pressure cylinders are supported on either side of a steel box-casting, which constitutes part of the forward framing and is arranged in accordance with the usual practice of the builders. The low pressure steam distribution is controlled by 15-inch piston valves, and the by-pass valves are of the Pennsylvania Railroad style, with flat plates over the relief ports. The low pressure cylinders are 35 x 30 ins.

The original locomotive was equipped with Stephenson valve motion, and the same style of gear is applied to the new unit. The high and low pressure motions are controlled simultaneously by the Baldwin power reversing mechanism. The smoke box of the original boiler is utilized as a combustion chamber in the new combination, and contains a reheater through which the high pressure exhaust steam passes. This reheater is arranged precisely like a Baldwin superheater. The main part of the new boiler section is used as a



MALLET COMPOUND ON THE [illegible] RAILROAD. R[illegible] UNIT ORIGINALLY 2-8-0 ENGINE.

feed-water heater, and is traversed by 422 tubes, 2 ins. in diameter and 7 ft. long. The pipe connection from the reheater to the smoke box passes through a flue 11 ins. in diameter which is placed in the center of the water heater. This arrangement keeps the steam, as far as possible, from any cooling influences.

The heating surface provided in the water heater amounts to 1,548 ft.

The weight of the boiler is transferred to the front frames through two waist bearers, both of which are normally under load. The equalization of the front group of wheels is continuous, as the three pairs of drivers are equalized with the leading truck. The total wheel-base of the rebuilt locomotive is 46 ft. 8 ins. The tender is of the Vanderbilt or cylindrical type. The engine is an excellent example of this method of combination by which a greatly enlarged power capacity can be had with a comparatively small outlay for new material.

Mallet for the Frisco System.

There were seven engines of this design built for the Frisco Lines, five of which will be put into service on the Kansas City, Fort Scott & Memphis Railway, and two on the St. Louis & San Francisco Railroad of the above system. The total order for equipment also included twelve consolidation locomotives for the New Orleans, Texas & Mexico Railroad. These latter engines which have a total weight in working order of 222,000 lbs., and the weight on drivers is 198,000 lbs. The cylinders are 26 x 30 ins., and the locomotives have a theoretical maximum tractive power of 45,150 lbs. These are a straightforward design of the consolidation type, except that they are equipped with superheaters of the sideheader type.

The Mallet locomotives, one of which we illustrate, are intended for pusher service. They are designed to handle 1,950 tons on a 1½ per cent. grade at a speed of five miles an hour and 1,600 tons on the same grade at ten miles an hour. The maximum grade on which they will operate is 2.3 per cent., and on this grade they are expected to haul 1,230 tons at a speed of five miles an hour, or to make a speed of ten miles an hour on the same grade, with 1,000 tons. They are designed to pass through curves of a minimum of ten degs.

Aside from the fact that they are the first locomotives of the 2-8-8-2 type, of wheel arrangement constructed by this company, the most interesting feature of the design lies in the new arrangement of steam pipes to the high pressure cylinders. These pipes are in two sections, one being inside the boiler and connecting to a T-head, which in turn is connected to the throttle pipe. The application of this arrangement was possible because of the use of a combustion chamber in the boiler, which allows space between tubes and the shell of the boiler for the introduction of pipes. The outside section of the high pressure steam pipe consists of a copper pipe fitted with an elbow at either end, and has a ball joint connection with the lower end of the inside pipe, and also with the cylinders. The construction is such that the outside section can be removed without in any way disturbing the inside pipe.

This arrangement has several important advantages. It simplifies construction by obviating the necessity for using the special design of cast steel dome employed in previous engines of the Mallet type where the high pressure steam pipes are on the outside of the boiler. Besides being located inside the boiler, the steam pipes do not, in any way, interfere with the engineer's view ahead. In cases where, because of the length and size of the boiler, the ordinary arrangement of outside steam pipes obstructs the outlook of the engineer, this arrangement, therefore, offers a satisfactory solution of the difficulty. One engine of this order is equipped with the Street locomotive stoker. Information concerning this design of stoker can probably be secured from Mr. Clement F. Street, P. O. Box 192, Schenectady, N. Y. Following the practice pursued in a number of recent engines of the Mallet type built by this company, the reach rod to the valve gear of the forward engines is located on the center line of the engines, and is connected by a universal joint to a downward-extending arm in the center of the main reverse shaft. Some of the principal dimensions are given below:

Wheel base—Driving, 15 ft. 6 ins.; total, 56 ft. 8 ins.; total, engine and tender, 85 ft. 6¼ ins.
Engine and tender, 567,600 lbs.
Heating surface—Tubes, 4817.1 sq. ft.; firebox, 315.7 sq. ft.; arch tubes, 29 sq. ft.; total, 5161.8 sq. ft.
Grate area, 75.4 sq. ft.
Boiler—Type, conical; O. D. first ring, 85⅝ ins.; working pressure, 200 lbs.; fuel, bitum. coal.
Firebox—Type, wide; length, 120⅜ ins.; width, 90¼ ins.; thickness of crown, ⅜ in.; tube, ½ in.; sides, ⅜ in.; back, ⅜ in.; water space, front, 5 ins.; sides, 5 ins.; back, 5 ins.
Crown staying, radial.
Tubes—Number, 342; diameter, 2¼ ins.; length, 24 ft. 0 in.; gauge, No. 11 B. W. G.
Air pump, No. 6 duplex.
Engine truck, 2 wh. radial center bearing.
Trailing truck, radial with inside journal.
Piston rod, diameter, 4 ins.
Smoke stack—Diameter, 18 ins.; top above rail, 15 ft. 9 5-16 ins.
Tender frame, 13 ins. steel channel.
Tank—Capacity, 8,000 gallons; capacity fuel, 10 tons.
Valves—Type, b. p. piston, 14 ins.; l. p., double portal slide; travel, b. p., 6 ins.; l. p., 6 ins.; steam lap, h. p., 1 in.; l. p., ⅞ in.; ex. lap, b. p., 5-16 in.; l. p., 5-16 in.
Setting, h. and l. p., 3-16 in.
Wheels—Driving diameter outside tire, 57 ins.; engine truck, diameter, 30 ins.; kind, spoke center; trailing truck, diameter, 30 ins.; kind, spoke center; tender truck, diameter, 33 ins.; kind, standard.

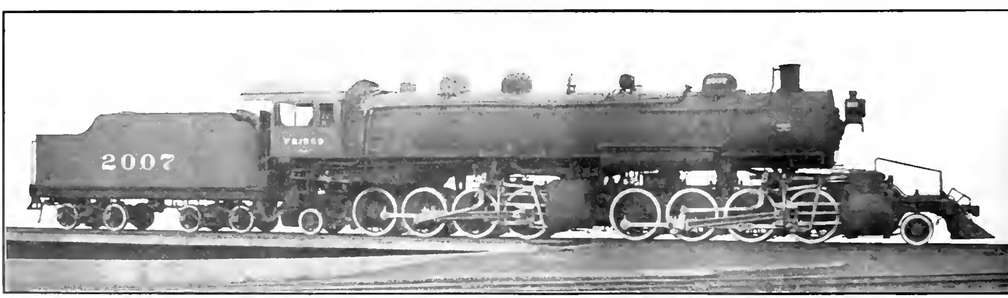
Notes on the Oroya Railroad.

By J. H. Maysilles.

(Abstracts taken from "Loco.")

It was my privilege several years ago to assemble some locomotives in South America. This paper is written from notes and photographs made during the trip. The locomotives required sixty-one days from New York to Callao via Cape Horn. My trip was so timed that I arrived one day ahead of them, having gone via Panama in fifteen days.

About 800 miles south of Panama is the northern coast of Peru, where the Peruvian desert begins, and which extends for nearly a thousand miles further along the coast. In parts of this desert it has not rained within the memory of



MALLET ARTICULATED COMPOUND FOR THE FRISCO SYSTEM.
G. A. Hancock, General Superintendent of Motive Power. American Locomotive Company, Builders.

man. At the south it terminates in the well-watered valley of the Rimae, at whose mouth is the city of Callao, the principal seaport of Peru, with a population of 30,000. At a distance of nine miles from Callao on the banks of the same river is the city of Lima, with a population of 140,000.

The Central Railroad of Peru, better known to the outside world as the Oroya Railroad, leaves the port of Callao at 9 ft. above sea level, and in 106 miles reaches an elevation of 15,665 ft., or nearly three miles, where it passes through a tunnel five-eighths of a mile long, under the summit of Monte Meiggs, 2,000 ft. higher. The road ends at La Oroya, 138 miles from Callao, and 12,200 ft. above the sea.

At San Bartolome, 48 miles from Callao, and at an elevation of 5,000 ft., begins an extensive system of switchbacks for the purpose of gaining elevation and avoiding steeper grades than 4½ per cent., which is the maximum allowed by law, and safety, too, for that matter. From here to Galera tunnel is a distance of 56½ miles; there are eighteen switchbacks and 58 tunnels, the latter having an aggregate of about five miles.

A few miles from San Bartolome is the famous Verrugas bridge, spanning a rocky ravine 580 ft. wide. The first bridge was made at Phoenixville, Pa., and built in 1873, and swept away by a flood in 1889. It rested on three piers of hollow wrought-iron columns. The base of the middle pier was 50 ft. square, and its height above the foundation was 252 ft. At the time of its construction it was, perhaps, the highest and one of the longest bridges in the world.

This bridge was replaced in 1891 by a much heavier one, of the cantilever type, built by the American Bridge Company. It is 585 ft. long and 300 ft. from top of rail to bottom of the ravine, and, having no pier in the middle of the ravine, precludes the possibility of being washed away by another flood.

This section of road presents more wonderful feats of engineering, perhaps, than any other of equal length in the world. Besides the Verrugas bridge, the Infernillo bridge is of interest on account of its being suspended between the high rock walls of a gorge, each end resting at the mouth of a tunnel. The bridge is probably 200 ft. long and 90 ft. above the stream below. In one instance three tunnels may be seen on the side of the mountain, one above the other. At Chicla the road makes a horseshoe, having a turntable at the switchback at each end; from one end of the lower to the corresponding end of the upper is a distance of 6 miles by rail, and an elevation of 1,400 ft. is gained with practically no advance whatever. Here one may shoot a rifle ball across five tracks. Finally, at an altitude of 15,665 ft., the Galera tunnel is reached, which passes under Monte Meiggs 17,575 ft. above the sea, and named after Henry Meiggs, the American who built the famous road. From this point there is a short branch road to Morococha, which reaches an altitude of 10,000 ft., and is said to be the highest railroad in the world.

Galera is the highest pass over the Andes mountains at any point, and is probably the highest inhabited point on the globe, where families actually live and pursue their daily toil year after year. At this high altitude there are no snakes, fish nor cats, although dogs are quite numerous. There are a few toads, which the natives fear worse than we do snakes. The air is rare and chilly, even in the bright sunshine, though it is only twelve degrees south of the equator. Mercury in a barometer stands at 16.5 ins. instead of 30 ins., as at the sea level, and records an atmospheric pressure of 8.1 lbs. per sq. in. instead of 14.7. Water boils at 193½ degs. F., and to cook beans it is necessary to have a steam-tight kettle with a safety valve. Eggs require seven minutes to boil instead of three, as at sea level.

THE PRESENT VERRUGAS BRIDGE—300 FEET HIGH.

At this high altitude the rare atmosphere causes rapid heart action, and most persons are attacked by an ailment called soroche. It begins with a severe headache and nausea at the stomach and lasts from a few days to a week. Another American and myself made the trip over the mountains together. As we went by a freight train, the evening of the first day brought us to Matucanna, at an altitude of 8,000 ft. Here we were delayed several days on account of a landslide. The evening before resuming our journey we met a German mining engineer, who kindly suggested that, as we were to cross the summit the following day, we should take a dose of arsenic, at the same time assuring us that it was perfectly safe to do so. We finally consented and went to a small mud hut, called a botica, or drug store, where a few bottles were kept on a shelf. I noted carefully that there was no surprise or hesitancy on the part of the druggist when asked for the arsenic, and I assumed that it was not an unusual request. He poured one drop of the liquid in each wine glass and then filled it with water. I contemplated the dose until Mr. German drank his, Mr. American his, and then I followed suit. The next day we crossed the summit, and, except for a feeling of weakness, I felt no ill effects; but before night my companion was tucked away in bed with a severe case of soroche.

At the eastern end of Galera tunnel may be seen drifts which mark the line of perpetual snow. The conductor was kind enough to hold the train two minutes to allow me to take a picture of this. The station building is so small as to be entirely hidden by the tender of the engine. The tracks in the tunnel are always wet from the melting snow. On good authority it is stated that engines sometimes enter the tunnel and, having used up the supply of sand, the drivers begin slipping and the engine is pulled backwards out of the tunnel by the weight of the train while the reverse lever is in the forward motion and the engineer unconscious of the backward motion until daylight appears over the tender instead of on the track ahead.

Sixty-ton engines are used on the road, and a freight train consists of four cars of fifteen tons capacity each. Steam brakes are used, with hand brakes on freight cars, while vacuum brakes are used on passenger engines and cars. One brakeman is required for each car and there are no cabooses. Passenger trains run twice a week in each direction, and eleven hours are required to cover the 138 miles. Freight trains require two days in ascent and one in the descent. Trains do not run at night, excepting when detained on the road. About 75 per cent. of the railroad trainmen are native Peruvians. Engineers and conductors receive salaries equivalent to about $70 to $90 per month; firemen and brakemen from $35 to $50 and common laborers 25 to 50 cents per day. Passengers pay a fare of 5½ cents per mile, first class, and 3½ cents second class on passenger trains; they may also ride on freight cars when there is room, by paying a first-class fare. Only small pieces of hand baggage are carried free. As a precautionary measure, in the interests of safety, a hand car precedes each passenger train by five minutes on the steepest and most dangerous down grades.

Some years ago engine No. 13 had been in several bad wrecks, and, on account of superstition, the regular engineer refused to run the engine. Finally another engineer consented to make a single trip to accommodate the master mechanic. On that trip he lost his life. The engine's number was promptly changed to 25, the next number in order, and there has since been no No. 13 on the road.

La Oroya is a town of about 1,000 native population, including a number of Chinese merchants, and is situated on the eastern slope of the Andes mountains at the junction of two rivers forming one of the headwaters of the Amazon and hemmed in on two sides by high hills. A bird's-eye view of a part of the town was taken from a cliff at the edge of a hill 1,800 ft. above. There is the roundhouse, car sheds, freight house, station of the Central Railway and the hotel and corral. To the right is the station of the Cerro de Pasco Railway, for which company the new engines were built. Two of the engines were assembled in the car shed of the Central Railway, near the roundhouse, and the remainder in a new shed of the Cerro de Pasco Railway, afterward built in the "Y" at the lower end of the yard.

In assembling the engines, the principal tools used were such as are usually supplied with them when leaving the works; but we were fortunate in having a supply of bridge timbers, crossties, several track jacks, a rivet forge and a few hand tools of German manufacture that were purchased in Lima.

The ten men employed in erecting the engines were mostly of that class called "hobo mechanics." There were two American engineers, previously employed in "The States," under contract to run the engines and to break in others that might be found in the country; one American tramp engineer, one German "car knocker," one German stoker, one Polish stoker, one Martinique machinist, one Peruvian marine boilermaker, one Peruvian machinist-helper and a Peruvian soldier who served as a watchman. There were also a number of native laborers to assist in handling the material. They were all full of the manana or "tomorrow" spirit.

In handling the boiler and cylinders of a locomotive the car containing the cylinders was placed in position, and by means of ties, bridge-timbers and jacks the cylinders were elevated to position and the car run out; the car containing the boiler was then run in and the boiler timbered up in like manner, and by means of jacks the cylinders were lowered, one side at a time, about 6 ins. The boiler was elevated in like manner by raising one end of a timber at a time that amount and following with blocks. The ties under the cylinders were then put on rollers and shoved under the boiler and the cylinders bolted fast. The frames were put on two ties, and by greasing the rails they were shoved beneath the boiler and cylinders and by means of the track jacks raised into position and bolted fast. The engine as assembled thus far was about high enough to roll the driving wheels under with boxes in position and then lowered by means of the jacks and by removing 6 ins. of blocking from one end, a timber at a time. The operation was slow and every move had to be examined to insure safety. On one occasion a runaway engine backed into the shop at a slow speed and hit a boiler on timbers, whose mud ring was 5 ft. from the rails, and precipitated it into the pit. Fortunately no one was hurt and the boiler suffered little damage.

AT THE SNOW LINE IN THE ANDES.

The heavy steel cab roof was one of the most difficult parts to get into position. The shed-roof truss, being light, and the rope and tackle not strong enough to lift it with safety, a crib of ties was built under it around the back of the boiler, a part of the weight being carried by jacks. The sides and ends being then bolted, the crib was removed. The smokestack was of heavy cast iron and raised into position by rolling it up an inclined plane. The tendency of the workmen was to want to build the engines from the top downward. Once having a boiler in position, and being absent for a short time, I returned finding the headlight and bell stand the first parts assembled. On numerous occasions a laborer was seen standing on the turntable trying to push it around. When the first engine was ready for trial it was found that the mud ring leaked. The firebox being between the frames, the boilermaker insisted that the boiler would have to be removed to get at it, and when my back was turned began taking out the cylinder bolts with that end in view. I had to caulk the ring myself to convince him that it could be done. Perhaps I should state that there were two types of engines in the lot; one class was consolidation, with narrow firebox, and the other mogul, with wide firebox.

The day the first engine was finished we had a little celebration, and one of the mistakes of my life was in placing "Old Glory" in front of the "White and Red Bars" of Peru. Peruvian blood is quickly warmed up at such apparent disrespect to the flag of the country. I learned also that it is an insult to place a foreign flag on the right side of a building as one stands facing it.

The building of a house in this section was an interesting operation. They are built without any foundation and composed of clay or mud mixed with excelsior, straw, burlap and any other material that could be found to act as a binder. The blocks composing the wall were made by tramping the mud into moulds, which could be removed after a few hours. The openings for the windows and doors were afterwards cut with an axe and the casings put in. The roof was of corrugated iron.

The railroad laws of Peru are regarded as severe when compared with those of our country. An act of carelessness by a trainman causing death is punished by a long term of years in the penitentiary.

Years ago revolutions were frequent in this part of the world. One was expected at every presidential election at least. On one occasion a party of revolutionists was about to capture a supply train. The engineer, a German, crossed the eccentric blades on one side of the engine and fled with the government troops. The revolutionist engineer was unable to run the engine or to find the cause of the trouble, and this caused a sufficient delay so that reinforcements arrived and captured his party.

There is a custom in Peru and other parts of South America of planting a cross marking the spot of every accidental death. One such cross was erected to the memory of Juan Marin, killed June 25, 1903. He tried to climb over the end of a runaway flat car to get at the brakes and accidentally fell across the rail.

When the Cerro de Pasco Railway was built it proved disastrous to the business of transporting silver ore by means of llamas, and the owners of these herds sought revenge by various means, such as piling obstructions on the tracks, tampering with switches, etc., but perhaps one of the most unique tricks was that of removing the packing from journal boxes, filling them with stones and replacing enough packing to avoid suspicion. The oily waste removed served as fuel in a country where there is no timber and coal costs 20 to $45 a ton.

General Correspondence

Very Large and Very Small.

Editor:

Enclosed you will find two photographs of locomotives on the Pennsylvania Lines which will likely be of interest to readers of Railway and Locomotive Engineering should you be able to publish them. Engine 7109, Fig. 1, is unique in several ways, as I believe it is the oldest, the smallest, and the only locomotive with a diamond stack in actual service at present on the Pennsylvania system. It is known as Class A-29, and was built at the Fort Wayne shops of the Pittsburgh, Fort Wayne & Chicago Railway in 1877. The engine has 48-in. driving wheels, cylinders 15 x 22 ins., and weighs 46,120 lbs. On account of its short wheelbase (7 feet) this little locomotive is very useful for handling dead engines and cars on turntables, and this is doubtless the only reason it is kept in service.

The locomotive shown in Fig. 2 represents the other extreme on the "Pennsy." It is one of the heaviest passenger locomotives ever built. It weighs 270,000 lbs., or about six times as much as the little fellow. The driving wheels are 80 ins. in diameter, and the cylinders are 24 x 26-in. stroke. The boiler is of the Belpaire pattern, so commonly used on the Pennsylvania, and has a wide firebox. The valves are of the piston type, and are actuated by Walschaerts valve gear. This engine, No. 7513, Class K-2, is at present handling heavy fast passenger trains on the Western division of the P., F. W. & C. between Fort Wayne and Chicago. She is one of several locomotives of the 4-6-2 type built at the Juniata shops, Altoona, Pa., this year. They are replacing engines of the 4-4-2 type (classes E-2, E-2a, and E-2b) on the heavier passenger trains, which are mainly composed of all steel coaches.

ROBERT C. SCHMID,
Draughtsman Penna. Lines.

Fort Wayne, Ind.

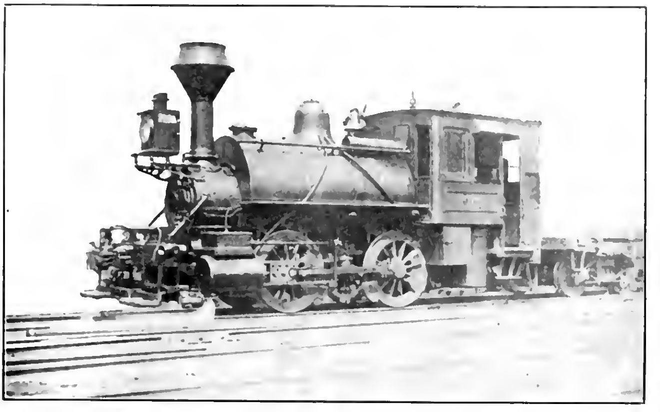


FIG. 1. YARD ENGINE P. F. W. & C. BUILT 1877.

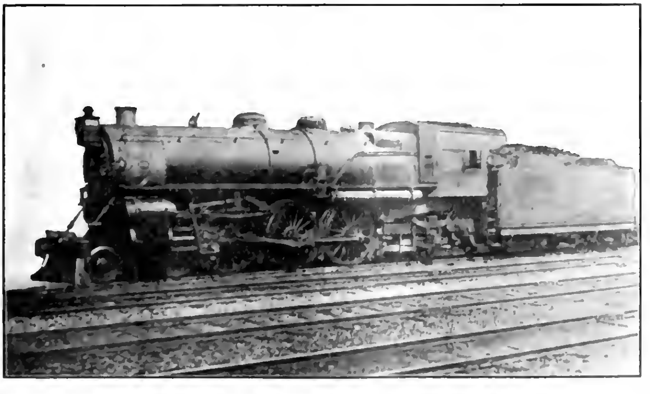


FIG. 2. MODERN 4-6-2 ON THE P. F. W. & C.

We Also Can Help.

Editor:

While we are considering the high cost of living, and making notes of every increase in our expenses, would it not be well for us to take a glance at the expense account of those who employ us, and see if we could in any way lessen their expenses, so as to make them better able to treat with us in our new wage scale each year. If our employers saw that we were each taking a personal interest in their business, and looking after that particular part assigned to us as if it were our own, would it not serve to bring us more closely together, and cause them to look more carefully after our personal interests.

We all know that the railroad companies are under a very heavy expense, and that the cost of material has increased during the last few years very largely. Each country and State has made laws restricting railroad rights, and adding to their expenses until it has almost stopped railroad improvements. A large portion of our popoulation will only see their bad points, and are always ready to advertise their faults to the world, but never mention any good thing that they may do.

We know that it is very essential to our welfare that our company make sufficient profit to declare dividends for those who have money invested in our road, or else they will withdraw their money and look for better investments.

Now, if we would give our engines a closer inspection at the beginning of each trip, and not depend so largely on the paid inspector, who has not had the time to even look at our machines, we might find a loose nut or bolt that would save a few cents. We might pick up that old air hose, the grease cup top, the lantern some one dropped, save a few shovels of coal each trip, take care of that lump of pin grease that was over, and not throw it in the box with the coal and dirt, where it is wasted; have that oil can, or torch, soldered instead of throwing it away and drawing a new one, and many little things too numerous to mention. All these things would save many dollars to the company, and if not openly noticed by them, would give us the proud satisfaction of knowing that we had done well our part by those who employed us. Let us start an agitation along these lines and see how far it will go; it surely can do no harm, and may result in much good to both parties. I would like to hear from others of your readers on this subject.

O. P. ANGELO,
Loco. Engineer, Div. 317.
Alexandria, Va.

Disconnecting Rods.

Editor:

Observations on disconnecting in your November issue, by Mr. F. P. Roech, are timely, and I think a discussion along that line from actual experience will be beneficial to many of us. From what I can gather from Mr. Roech's discussion, he has never tried the plan he suggests. However, I can see no reason why his way wouldn't work. I will give you a case of actual practice in the way of disconnecting.

Mr. Roech says fifteen years ago your time check would have been handed you even had you made a success of it. I was riding on an engine as a "passenger," a consolidation or 2-8-0 type, backing up light, descending a grade about 30 feet to the mile, running about 25 miles an hour. The reverse bar gave quite a jerk, and a terrible racket commenced underneath. We stopped as soon as we could without reversing. But after getting to a standstill we found the forward motion eccentric strap gone. Nothing left of that motion but the eccentric rod hanging to the top of the link. We took the eccentric rod off, disconnected the link lifter, let the link down to ride on the link block. We did not take down the back-up eccentric, did not disconnect the valve stem or the main-rod. We covered the ports on the disabled side, clamped the valve stem, opened the cylinder cocks and went to our destination 9 miles distant. Delay, 28 minutes.

There was nothing injured, more than the original break, but a "machinist," looking at the way the engine had been disconnected, remarked that he didn't see why she didn't tear herself to pieces. However, she didn't, and how could she? Now, we will say, suppose it had been the other or back-up eccentric strap. Take the broken parts down as before and disconnect the forward motion from the top of the link and connect it to the bottom of the link and let swing. In a case like this your main rod is up and valve stem connected on the disabled side. Should the engine stop on center, the valves can be moved enough on the disabled side to admit enough steam to get her off the center much quicker than by pinching.

FRED NIHOOF.
White Sulphur Springs, W. Va.

Delivery of Baldwin Engines.

Editor:

During the early part of February, of the present year, I left Philadelphia, Pa., as messenger and engineer, in charge of one, the first, of twelve Mallet articulated compounds, designed for road service, built by the Baldwin Locomotive Works for the Southern Pacific Company (G. H. & S. A. division) to be delivered to the purchasers at Houston, Tex.

These engines are of the same general design and construction as the road service Mallet articulated compounds built by the Baldwin Locomotive Works for the Great Northern Railway about four years ago, which was, as I recall it, the pioneer attempt at using this construction for a terminal-to-terminal service engine, and which has, probably, proved to be more successful than was ever even imagined by its earlier advocates.

About the only distinctive additional feature embodied in the design and construction of the Mallets delivered to the Southern Pacific Company, as compared with those furnished to the Great Northern, is the application of the Vauclain superheater, which, of course, greatly increases their efficiency, both in the matter of tractive effort and fuel economy. There is absolutely no doubt but that the salient features of this type of locomotive, particularly since the application of the Vauclain superheater, have passed far beyond the experimental stage, and will soon become mechanical standards, well known alike by designers and enginemen, wherever conditions will permit the weight necessitated by the design. It, therefore, behooves enginemen of the present day to "wise up" to Mallets and be ready for them "on call."

On the recommendation of the writer these engines, after making a preliminary light break-in trip, were immediately placed in the Southern Pacific fast coast freight service between Houston and El Paso, Tex., where, between Houston and Del Rio, a distance of 505 miles, they handled trains of 2,500 tons, on a practically level grade, at an average speed of twenty miles per hour. The fuel consumption on this performance was about twenty gallons of fuel oil, or equal to approximately 238 lbs. of run of mine coal, per mile. It will no doubt be of interest to mention that a great deal of switching was done with these engines, the work of which proved to be much easier, and more pleasant in every way, for the engine crew, than is the case with many of the larger engines of the present day. This is, of course, accounted for by the use of a special pneumatic reversing gear, with which all of these engines are equipped, the operation of which is very simple, and there is little or no chance for getting out of order.

Before my departure from the Southern Pacific Railroad the enginemen of that system, who are as fine and as true a lot of men as the sun ever shone on, were highly pleased with this new equipment, and had sensibly concluded that all of the mystery which, to the uninitiated, is supposed to surround the Mallet compound, had suddenly disappeared.

Our sojourn, of two and one-half months, in and near Houston during the time these engines were being delivered and tried, was most enjoyable for many reasons. Here is the scene of the famous battle of Santa Anna, where,

"On Fame's eternal camping ground
Their silent tents are spread,
While glory guards with solemn round
The bivouac of the dead."

It was my pleasure to attend the seventy-third anniversary of this battle, which was celebrated there on Sunday, May 1.

It was also a great pleasure to be associated both in a social and business way with such friends as Mr. J. J. Ryan, superintendent of machinery; Mr. Frank Galvin, master mechanic, and Mr. J. J. Powers, general foreman, the courtesies shown by all of whom contributed not a little to the enjoyment of the visit.

On returning to headquarters, at Philadelphia, we were instructed to accompany to Douglas, Ga., a delivery of six 18 x 24-in. 10-wheel (4-6-0) type passenger engines built for the Georgia & Florida Railway for medium passenger service on a comparatively level road.

During the first part of July we delivered to the Atlanta, Birmingham & Atlantic Railroad, at Fitzgerald, Ga., two locomotives of the Mikado (2-8-2) type. These are probably the largest simple locomotives that have ever, as yet, been used in the South, the principal dimensions of which are as follows: Tractive effort, 50,800 lbs.; total weight of engine, 260,000 lbs.; weight, on drivers, 200,000 lbs.; weight, engine and tender, 400,000 lbs.; diameter of cylinders, 25 ins.; piston stroke, 32 ins.; steam pressure, 170 lbs.; tank capacity, water, 7,000 gals.; tank capacity, coal, 14 tons. The steam distribution is controlled by specially designed balance valves operated by Baker-Pilloid valve gear. The performance of these engines, from the very start, was little short of phenomenal.

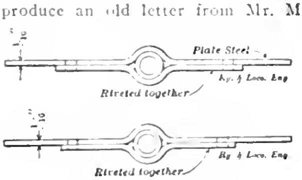
The month of August was spent on the Grand Trunk Railway, at Detroit, Mich., delivering five Pacific (4-6-2) type locomotives built for that company's fast passenger service between Chicago, Ill., and Battle Creek, Mich.

At this writing we are most pleasantly occupied in the delivery of twenty-five consolidation (2-8-0) engines to the Louisville & Nashville Railroad, at Louisville, Ky. Louisville is the gateway to and the metropolis of the South, and must be visited leisurely to be appreciated. The Louisville & Nashville Railroad is, without a doubt, the most valuable railroad property in the South, and bids fair to rival the most valuable in the country. Mr. Theo. H. Curtis, who is also president of the M. C. B. Association, is superintendent of machinery, in charge of all matters pertaining to motive power and mechanical equipment. Mr. H. C. May is master mechanic of their main shop, which is located at Louisville, Ky., and which, in equipment and efficiency of management, is second to none in the country.

Geo. H. Jackson,
Traveling Engineer,
Baldwin Locomotive Works.
South Louisville, Ky.

A Clever Design of Gauge.

At the urgent request of a correspondent of ours from Crewe, Va., we reproduce an old letter from Mr. M.

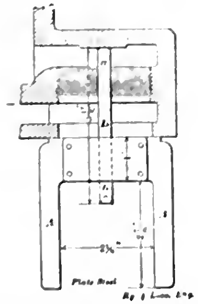


TOP VIEW OF GAUGES.

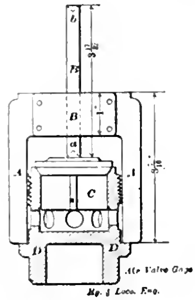
H. Shepard, of the New York Central Lines. The original letter and engravings appeared in Railway and Locomotive Engineering for November, 1903, and are to be found on page 509 of that issue. The method given below is for getting the proper lift of air valves of the 9½-in. Westinghouse air pump. The letter was as follows:

Editor:

These gauges, which I claim to have originated, and are illustrated herewith, are two in number, and are used

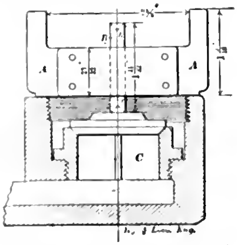

ADJUSTING GAUGE IN CASE CAVITY.

in correcting the air valve lift in 9½-in. and 11 in. Westinghouse air pumps. In the 11-in. pump it may be necessary to change the dimensions of the gauge somewhat, but so long as the staff B of the gauge is the required lift of the air valve longer than the width of the gauge A this does not matter. The gauge can be made in a variety of


GAUGE REVERSED GETTING LIFT OF VALVE.

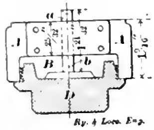
ways. I have illustrated the form which seems to be the most simple to make. As indicated by the drawings, the gauge is made of two plates of steel, A, riveted together so as to bring a pressure on the staff B, and prevent it from being moved by accident.

The larger of the two gauges is used in regulating the lift of lower receiving or discharge valve, and is described as follows: The air valve cage D is removed from the cylinder of the pump. The gauge is inserted in the cavity from which the cage was removed, as shown in the drawing, and the staff of the gauge pressed firmly against the valve stop, bringing the body of the gauge at the same time against


ADJUSTING LIFT OF VALVE.

the bottom face of the cylinder. The gauge is then removed and placed on the air valve cage with the valve in position. The valve is filed off until the points of the gauge resting on the flange of cage will permit the head of the valve to just touch the staff of the gauge, as shown in the drawing. It will be found that the valve has the required lift, 3/32 of an inch. Thus it will be seen that the use of this gauge does away with all measuring in adjusting the lift of the air valves.

The smaller gauge is used in regulating the lift of the upper receiving or discharge valves and the same principle is involved in this gauge as in the other, and it is used in a similar manner. The chamber cap is removed, the gauge placed on the cap, as shown in the drawing, pressing the staff firmly down on the valve stop. The gauge is then removed, placed on the cylinder, as shown in the drawing, filing away until the head just touches the staff of the gauge, while the gauge is held firmly against the face of the cyl-


ADJUSTING THE GAUGE.

inder. Care should be taken that the gauge is not shifted after adjusting to chamber cap.

The small projection which is usually found worn out on the valve stop should be removed. The interference of this projection is overcome in adjusting the gauge, however, by having the end of the staff hollowed out as shown. This gauge does away with rule or scale measuring and the possible errors of such method. We have used the gauge for some time past, and have had excellent results.

M. H. Shepard,
Foreman Air Pump Repairs,
N. Y. C. & H. R. R. R.
West Albany, N. Y., Nov. 3, 1903.

The Equity of the Derail.

Editor:

In your November issue you ask for the opinion of enginemen on the subject of derails, whether necessary or not. Although not an engineman, I have had a few years' experience in another department, and beg to address a few remarks on the subject. Are derails necessary? They are.

It is evident from the article that the idea from which the derail evolved has been overlooked in favor of the basic principle. The original idea was to stop runaway cars, and the intention never was to derail a train with locomotive attached and having train under control. I have yet to find a derail that was placed with this intention. My experience has all been West of Chicago. East of that point, with interlocking plants and towers, some may have been placed with a different intention.

The statement that a sound, reliable and efficient stop signal may replace the derail, sounds rather broad. A stop signal will never stop a runaway car, and this I maintain is their use and the idea which brought them into being. The knowledge that a derail is in the track may act as a deterrent to a chancetaker who would overrun a signal, but it was never placed there with that purpose in view. Were this so, the cure would be as acute as the result of the disease. The derail is essentially a safeguard to the engineer as well as to the traveling public and trainmen. Let us take the places at which they may be found and analyze them, seeing if this is not so.

Firstly, At a swing bridge, as stated in the article. I am acquainted with several hundred miles of Middle West and Western tracks in this country, and have yet to find one in this position; in fact, could quote where there are patent rerailers to rerail cars and avoid danger to the bridge, rather than the reverse.

Secondly, At a grade crossing of two railroads. Here it may be used to derail trains, and probably would be where one train is already using the crossing. But the first principle which caused its use was to prevent a runaway car from striking a train on the crossing. Acting in conjunction with the signal, it must necessarily derail an engine overrunning the signal, but was not placed with that intention.

Thirdly, At the end of a side track or yard. I have never known one placed in this position to derail trains, but they are placed because there is a grade, and as a prevention of runaway cars getting on to the main line..

Fourthly, At a coal chute. This is probably the best instance we have of why a derail is placed in the track. The track is not in constant use, and the only object is to prevent cars that have got away on decline to run through switches and get out on main line.

Fifthly, Mine spurs. These are generally constructed at a grade, and are sometimes miles in length, owing to mines being located in mountains and hills. With these runaway tracks are coming into use and replacing the derail, but where there are derails it is to prevent cars from getting away to the main line.

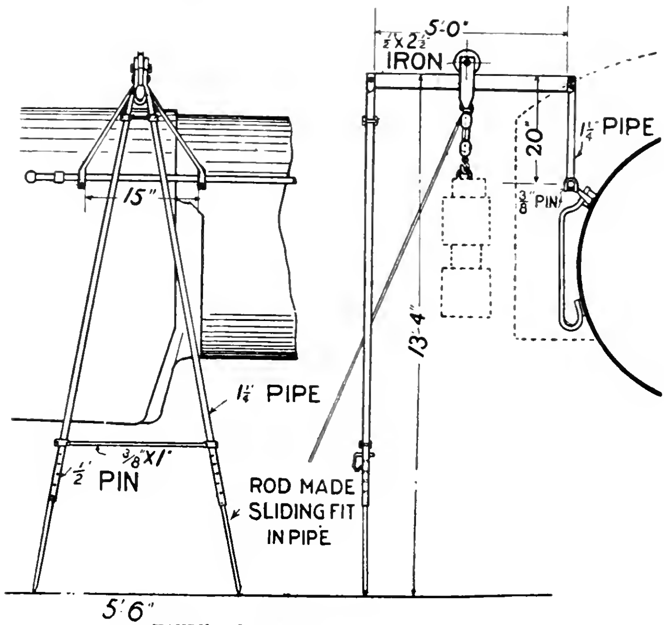
I believe that this will make my point clear that the derail is a safeguard and not a deterrent against careless running; also that it is necessary. Truly, it should have a signal to show its position, where it is not piped to switch stand, as I have known cases with a lifting derail where the switch was thrown and the derail not, with the usual result. Yours truly,

C. Clay,
Roadmaster's Office, A., T. & S. F.
East das Vegas, N. M.

Air Pump Crane.

Editor:

Attached drawing shows air pump crane made from pipe and other material which can be handled and put in place by two men, and makes a very safe and reliable crane, and will be found very useful in any roundhouse when taking down or applying the heaviest air pump. This crane, you will see, is supported by two feet overlapping the hand rail on the boiler, and held in place by two pins. On top of this is bolted a rail ½ x 2½ ins. x 5 ft., on which runs the yoke and wheel. To support this rail from floor there are two pieces of 1¼-in. pipe into which is inserted two pieces of round iron, which have a series of holes to allow for adjustment up and down for different heights of engines. This crane was suggested by Pipe Fitter Com. Haun, and it is a very useful one.



HANDY AIR PUMP CRANE FOR SHOP USE.

Chas. Markel,
Shop Foreman, C. & N.-W. Ry.
Clinton, Ia.

Superheated Steam.

Editor:

We note in your answer to "R. L. B." of Chicago, in your November issue, the statement that those having reliable experience with locomotives using superheated steam say that a temperature lower that 150 degs. of superheat will not be felt in fuel saving. This is directly contrary to the result of using superheat in the marine service, as you note, and is also contrary to our experience in the stationary work on land, where we have made several thousand installations. All of our experience goes to show that the drying out of the moisture in the steam effects a considerable saving in itself, and that the first 50 degs. of superheat are usually worth more than the next 50 degs., although, of course, 100 degs. superheat will result in better economy than 50 degs.; it does not mean that 100 degs. of superheat will save twice the fuel that 50 degs. will.

In discussing the various designs of locomotive superheaters with builders and operators, we have arrived at the conclusion that it is the type of superheater usually used which necessitates the high degree of superheat before any fuel saving results. In most types of locomotive superheaters the arrangement of the heating surface of the boiler is altered to make room for the superheater, the result being that the efficiency of the boiler is interfered with to a certain extent, and it is necessary that the superheat offset this difference in efficiency by increasing the economy of the engine before any net saving is accomplished.

It is our firm belief that a waste heat superheater in a locomotive, so arranged that the heating surface of the boiler is not interfered with, and therefore its efficiency remaining the same, would show exactly as good results as superheaters in marine practice; for instance, with 50 degs. superheat. Several railway men, with whom we have discussed this proposition, and who have had extended experience with locomotive superheaters of the flue fire type, are strongly inclined to agree with us.

Power Specialty Company.
John T. Munro.
New York, N. Y.

Lubricator Trouble.

Editor:

A very particular incident came under my notice a few weeks ago, and I should like to know what you and the readers of RAILWAY AND LOCOMOTIVE ENGINEERING think about it. An engine came in off a long run, 165 miles; she was fitted up with a 20A Detroit lubricator; the driver shut off the throttle valve, opened the cylinder cocks, shut off the valve for the Westinghouse pump and opened the cylinder cock for pump. The fireman shut off the feed valves first, then water valve, then the top steam valve, and last the valve on turret. The steam for injectors, Westinghouse pump, and lubricator, likewise the blower, are taken from the turret.

After about fifteen minutes the driver came back to examine the drain plug on the lubricator, as it had been leaking a bit on the journey. After slacking it off and letting the water out of the lubricator, he loosened the filling plug. After all the water was out he took out the drain plug to examine it, went to the side of engine to clean it, and finding nothing wrong went back to replace it with the intention of opening the steam valves to blow it out, but before he got the plug in, it blew out oil, water and some steam, he getting badly scalded.

Now what made this lubricator explode, as it were, after the drain plug had been out over a minute or more and the filling plug quite slack? I was a witness to the above and can vouch for every word being correct. I hope some of your readers can throw some light on the subject. The lubricator was clean, as it had been blown out only about seven days before.

F. A. MONCKLAND.

Maryborough, Queensland, Australia.

[Any of our readers who can help Mr. Monckland by offering an explanation of this occurrence is welcome to do so through our columns. We would like to have the experience of our readers.—Editor.]

Bright Side Obscured.

Editor:

In looking over conditions of motive power—that is, general conditions—all through the country, one cannot help but see that instead of conditions getting better for the men who operate them they are getting worse. When engines go to the shop for a general overhauling it seems to be the policy of some to get them out again regardless of how the work is done, instead of seeing how good a job could be done. If it did show up a little higher repair bill, it would be the cheaper in the long run.

Is it any wonder then that the enginemen are losing all interest in their work, which one hears so much about nowadays? If engines had been maintained this way a few years back a howl would have gone up that could have been heard from one end of the road to the other, and men would have refused to run them, but now anything goes as long as all the wheels are there.

Can you expect an engine crew to be interested in an engine which looks as if it had come out of I don't know what? It is almost impossible for a man to wear any kind of decent clothes—that is, if he takes any pride in his personal appearance off duty, going and coming from work. Nobody will be as careful in oiling a dirty engine as he would a clean one, and here is one way some oil can be saved. But don't try to make too big a valve oil record, as you are saving cents and throwing dollars away in coal.

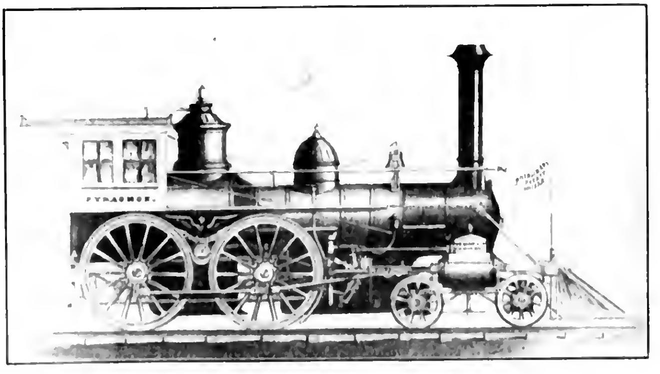
Does it pay in dollars and cents to have the men lose all interest in their work, except the money they can get out of it? Men who were A1 a few years ago have got into the same rut as the rest, and don't care for anything just so long as the engine hangs together till they get in. Who is to blame for all this? If a little more care was exercised in making working conditions better and a little more comfortable for the men who ride the head end of the train it would pay big returns to the companies.

Sioux City, Ia. F. C. SANDBAG.

Old Mason Engine.

Editor:

It is possible that quite a few persons never heard of the locomotive built by the late Mr. William Mason of Taunton, known as the Boardman engine, with Mr Boardman's patent attached to the locomotive boiler.



EARLY MASON ENGINE TAKEN FROM OLD LETTERHEAD.

The enclosed picture, copied from an old letter head, gives some idea of it. The engines were not a success. Two blew up and the other was altered, and is now in regular service on the Boston & Maine Railroad. Mr. Mason did not think much of the idea, if I am correctly informed.

CONSTANT READER.

Taunton, Mass.

Slide Valve Trouble.

Editor:

In reading a letter by Subscriber, "C. & O. Shops—the Slide Valve Troubles," in your September number, I would advise him to examine his piston rings, that is, the packing rings of his pistons. I once ran an engine fitted with the American Company balance rings. She was in the pooling swim, but I always got her; in fact, she was my regular engine. The boys who used to get her used to say "cuss words" not fit for print, about old A—— and his scrap heap, and his valves blowing. They would book them to get the "old fellow" (of course that was myself) in trouble, because I was afraid that had been done. Valves were tight; nothing wrong, but some alterations had to be made, and the top rubbing plate would be raised or lowered on the balance rings, but she was the same. One of the other boys had a sister engine, and she caught the same disease, or complaint. The doctors, after careful operations, etc., gave her up, too.

One night he came in, and as he had some trouble with knocking in one of his cylinders, booked his rings to be examined. The rings, or the pieces, were taken out and new ones put in, and the engine was all right. Then they tried my engine piston rings; they were not broken, but were worn very thin. New ones were put in, and no more trouble was experienced. Since then I got hold of an engine in freight service that was taken off the passenger service, ran her for some time, but as her valves had been overhauled just previous to my getting her, she started to blow through; but it was after you had pulled the lever back near the center when running with light steam. One of the boys had her out one day that I happened to be off, but I was at the shop or running shed when he came in at night, and he wanted to find out which side was in fault. We set her in full front gear. There was a blow up the funnel, but no steam out of the opposite cylinder cock. I put the lever in full back gear. Another roar up the funnel; no steam out of the front cock. Whichever cock or port was closed with the valve was tight; only the roar up the funnel; and with the cocks shut there were four different roars, showing her piston rings were at fault. Perhaps if "Subscriber" will get his piston rings examined it might fix him up. Hope none of my readers will laugh, but piston rings and balance valve blows are sometimes very puzzling.

QUEENSLANDER.

Australia.

C. & O. Valve Trouble.

Editor:

Reading over the September number of RAILWAY AND LOCOMOTIVE ENGINEERING, I see our C. & O. friend is having some valve trouble, which we had ourselves, just the same as they are having. He will find that he has his valve overbalanced. If he drills about three 1½-in. holes in the top of the valve, he will get along until he can make two new valves and reduce his balance strips from 19 to 18¾ ins. and from 7¼ to 7 ins. This valve will not then give him any trouble by lifting off the valve seat and blowing. He will not have to instruct the engineer to carry that block of wood to pound his valve down when he starts his train. The 14¼ ins. should read 11¾ ins.

P. J. CONNORS.

Bessemer Shop, Greenville, Pa.

Engine Tows a Boat.

Editor:

The many uses to which a locomotive is put is exemplified in the following: On Sunday, Nov. 6, 1910, I was running engine 605, a B. & O. eight-wheel engine, for the American Bridge Company, who are reconstructing the Schuylkill river drawbridge. About 4.30 p. m. the tug *Madiera* came down the river towing the steamer *Aaragan* of New York. In order to get through the draw it was necessary for the tug to make a "fly" of the steamer, as the space between draw and bridge proper was too narrow.

In making the "fly" the tug made for the west shore of the river opposite the plant of the Pennsylvania Reduction Company to clear for the steamer. In doing this the tug grounded on the bank. After several unsuccessful attempts it was found useless to make any further efforts, as the tide was going out. Mr. Reynolds, the superintendent of the American Bridge Company, had the draw closed, and the 605 was put to use by running a long line from the stern of the tug to the rear of the tender. When all was ready he gave the proceed signal, and a short, steady pull of the old 605 again placed "Mr. Tug" in the proper channel. In the meantime the steamer was drifting down the river. If space will permit, kindly have this record placed on pages of RAILWAY AND LOCOMOTIVE ENGINEERING. WM. F. EBERWEIN.

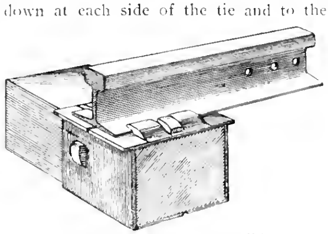
Philadelphia.

The Tie-Plate.

Editor:

I write to say I am a resident of Sedalia, Mo., and I have invented a new and improved tie-plate, of which the following is a brief descripton, which may be of interest to your readers.

The invention relates to metallic tie-plates, and has in view such an appliance as forms a seat for the rail and engages over the base flanges, the plate extending down at each side of the tie and to the



NEW FORM OF TIE PLATE.

under side thereof, and incasing the tie for a portion of its length under the rail, the plate being preferably constructed of two sections, the sections divided from each other longitudinally of the rail at the top and transversely of the rail at the bottom. The illustration makes this clear, I think. My invention is now patented. LOUIS LEBOVITZ.

Sedalia, Mo. Machinist.

Washing Out Main Reservoir.

Editor:

All railroad companies wash their boilers at a regular period, to get good results, prevent foaming, etc. Very good practice indeed. Now tell me why in these advanced times they do not place a plug on the top and bottom of the main air drum and wash the drum out at regular intervals and drain off the water that may accumulate in it.

Here is one case out of a score I wish to draw your attention to. I had a certain 8-wheel passenger engine on a work train lying in the siding for orders. I thought I would drain the main drum, as every time I used the brake valve the exhaust air was damp. I got under this engine, and opened the drain cock. It was stopped up. I took a monkey wrench and took a brass bushing out; still no air or water would run. I got a long slender stick 8 ins. long and ran it up into the drum, still no signs, so I got a longer stick, 12 ins. or a trifle over, and for 9 minutes it was constantly passed through the main drum to help the stream flowing out. I was unable to clean out this paste on the road.

This drum was robbed of over half its storage capacity, and the air in the train line contained more or less moisture and dirt. To my mind, this kind of thing causes break-in-two's, due to bad working triple valves. I think if main drums were washed and drained in the shops, we would have more space in main drums to store air for braking trains. This causes a big percentage of the trouble in many cases. Let us hear from you or others who have had an experience like mine.

LOCO. ENGINEER.

West Philadelphia, Pa.

Round House Chat.

Editor:

I want to tell you how we are getting along on the Chicago, Milwaukee & St. Paul Railway at my station, Portage, Wis. Considerable trouble was experienced with the grease cellars two years ago with the advent of the new heavy power, also some this spring. These are now all wearing good to bearing. While many of the grease cellars are not running as long as is claimed they should, they are doing much better than formerly. A few back end of main rods run hot occasionally, but it seemed that a close inspection of the back driving box wedges and keeping them set up prevent much of the heating, aside from saving much crosshead and knucklepin work.

Rods and straps are examined every three months. Apparent flaws are inspected with the magnifying glass, and the flaw covered with a thin coating of moist whiting, which, if a real flaw, soon shows by the oil working out. Concerning cylinder-packing some of the late engines had cut the ends of the cylinder packing rings down to less than ⅛ in. thick in a few trips, owing possibly to a different grade of cylinder metal, these after one or two renewals are coming down fairly well. An extra half-pint of valve oil for a week relieved the trouble very much. The dowel to keep the rings from moving does not seem to give as good results as the free ring. An easier and cheaper way to make the rings is to leave them eccentric in and out circles, leaving one side about ¼ in. thicker and cutting the ring at the thin part, giving the best results. Piston packing is giving much better service than a year of two ago, by keeping the swab on the rod, and a little oil does much to stop the excessive wear.

Sunday work is kept to the lowest minimum possible, but in a roundhouse it cannot always be as little as we would like it to be. One machinist, one handyman, and one wiper or laborer change off Sundays when they can be spared. However, when it is cleaning-up day on the road, Saturday and Sunday, the roundhouse gets the most work on Sunday, making this day often the busiest day of the week. The Y. M. C. A. Railway department fills a necessary place among the employes, as the testimony of the higher railway officials at the St. Louis convention in May, 1909, showed. Money for this movement is money well spent, that does bring in returns after the manner of "casting thy bread upon the waters." The reading room and baths, etc., are practically a necessary adjunct. There is no branch here, but a branch of the State work is being started downtown.

H. W. Griggs,
Roundhouse Foreman.

Portage, Wis.

P. R. R. "Class A-Anthracite."

Editor:

The accompanying photograph shows a type of passenger locomotive once very common on the Pennsylvania Lines, but of late years many have been retired from service, so that only a few remain. The engine was built at the Altoona shops of the road in 1888 for passenger service, and under the old classification was known as "Class A-anthracite," later changed to Class

CLASS A-ANTHRACITE.

D-7-a. The engine had drivers 62 ins. in diameter and 17 x 24-in. cylinders, while the firebox was long and shallow for burning hard coal. Like all the passenger engines built for the road at that time, the engine had wheel-covers over the drivers, but these were removed a number of years ago. Many features peculiar to Pennsylvania engines will at once be noticed, among them the standard 18-in. stack with cap, the beautifully rounded dome casing and sand box, rounded edge to smokebox, and the headlight.

This particular engine was sold a number of years ago to a small road near this city and her original number removed, but she probably ran on the old Philadelphia, Wilmington & Baltimore Railroad. The cabs were novel in arrangement; many small features, such as good steps and hand-holds, were provided, and last, but not least, good oil cups on the link motion, instead of small oil holes. These engines with their mates reflect great credit on their designer, Mr. T. N. Ely, chief of motive power of the Pennsylvania.

H. G. Boutell.

Washington, D. C.

Mallet Engines and Other Power.

Editor:

I am taking the liberty of sending you a clipping which appeared in the New York *Evening Post* for Nov. 10, in which it is stated:

"An inspection of the Union and Southern Pacific lines certainly makes the Eastern roads begin to look out of date. That applies to the way business is handled, as well as to the equipment. For example, the Pennsylvania does not own a single Mallet locomotive, and the Baltimore & Ohio has one, bought in 1904. On the Harriman roads powerful locomotives of that type are not only used to haul all freight over heavy grades, but they are used about the yards as pushers."

It seems to me somewhat strange. If the Pennsylvania needed Mallet compounds they certainly would have bought them before this late day. I understand that the B. & O. loaned theirs for testing purposes, but do not know any of the results. On the other hand, the P. R. R. have some smart consolidation engines, one of which hauled 120 loaded steel freight cars from Altoona to Harrisburg without assistance, on Aug. 25, 1910. The number of the engine was 1221, type H-8-B; weight of train, 14,132 tons, and 4,440 ft. long.

Another thing, they have very few Pacific type engines. Most of their trains are handled by Atlantic type engines, and who can say that they do not do their work, and do it well? Mr. Gibbs, general superintendent of motive power, is a smart man, and I have no doubt that he knows what he is about. As for Mallets in New England, the question arises. Are the grades heavy enough to demand them? I doubt it, for New England is a flat country. If Mr. Loree had stated the motive power was in poor condition I should have heartily agreed with him, but New England is not alone in this trouble. Roads west of Chicago are in the same mess. As near as I can see, the sooner the railroads begin to pay more attention to their motive power and equipment and a little less to stocks and legislatures, then we will have some railroading and dividends.

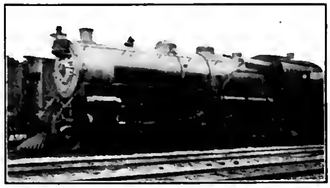
Chas. E. Fisher.

Ann Arbor, Mich.

Heavy P. R. R. Engine.

Editor:

Under separate cover I am sending you a photograph of locomotive No. 7515 of the "K-2" class, recently built for passenger service by the Pennsylvania lines. This photograph was taken at Sewickley, Pa., and so far as I know believe these



HEAVY P. R. R. ENGINE.

engines are the heaviest ever built for passenger service on any line, excepting the Mallet compounds.

D. W. Kettering.

Pittsburgh, Pa.

Injector Troubles.

Editor:

I would be thankful if you, or any of your readers, would answer the following questions: First, concerning a Monitor lifting injector. If the line check casing does not seat on the delivery nozzle, allowing a leak by delivery nozzle, how will it affect the operation of injector? If the intermediate and condensing nozzle does not fit closely in the body (front and back part), how will it affect the working of the injector? What is the best way to determine whether a steam valve, jet valve or boiler check is leaking?

Second, What is the best way to determine a leaky steam valve, priming valve or boiler check with a Nathan non-lifting ejector?

Third, old type Nathan triple sight-feed lubricator. This lubricator is in engine room with just one feed in use (the air pump feed) connected to a large water pump. After the lubricator is well blown out and refilled with stationary engine cylinder oil, the feed may work awhile, but very slowly; sometimes it will stop feeding before the oil is half gone and at other times it may work till reservoir is empty. Water collects in the sight glass soon enough, but when the lubricator stops working no oil will come out of the feed nozzle. The reducing plug seems to be the right size, also the steam pipe to lubricator. When this lubricator was installed two feeds were used, i. e., air pump feed and left cylinder feed.

Fourth, Nathan triple sight-feed lubricator, class "1899." What is wrong with lubricator acting as follows: With reservoir full of oil, with steam and water valves open, shut water valve, open waste cock until some water runs out, then close water cock and open water valve, after which the lubricator will feed a few drops on opening the regulating valve. Finally no oil will issue from feed nozzle (this defect was just in one of the cylinder feeds, whether the engine was working steam or not, the other two feeds worked O. K.). If the steam chest oil plug has too large or too small a hole, how will it affect the working of the lubricator? E. W. ECKERT.

Belle Plaine, Ia.

How It Is in Buenos Aires.

Editor:

Yours of Aug. 17, with RAILWAY AND LOCOMOTIVE ENGINEERING, also books, arrived O. K. Down here they are celebrating the centenary of their existence as a republic by holding a miniature World's Fair. Most of the countries are represented by locomotives, etc. With exception of Baldwins, whose engines are shown as supplied to customers, they are a gaudy bunch; paint, varnish, emery, etc., has been dealt out without stint, and they look to a man from Mexico like a pulque shop on feast days. Slab frames and underhung springs predominate. Valves are usually located inside, so as to keep them warm and incidentally the Mechanico who has to face them.

Boxes are brass, wedges wrought iron, case hardened, and if shoes are used they are of the same material. Detroit lubricator seems to be winning, and Sellers injectors have also patrons. Vacuum brakes are used on the majority of roads. Enginemen are mostly made here, but there are a few imported under contract. The majority would not grade very high in Mexico, as that country, owing to heavy grades and curves, has developed possibly a higher percentage of really high-class men than most. Thanking you for sending books so promptly. WM. REED,

Ferro Carril Sud.

Salleres, Buenos Aires.

No World's Fair for New York.

No city on this continent could manage a world's fair so well as New York, but New York has no ambition to draw crowds to witness such an extra attraction. International exhibitions are nearly always got up by parties who expect much gain from the shows, but New York as a city has no ambition in that direction.

Some parties started an agitation lately in favor of holding a world's fair in New York in 1913 to commemorate its 300th anniversary, but they were promptly informed that New York would promote nothing of the kind. Coney Island freaks are sad, but they must grin and bear the decision.

The management of the Boston & Maine Railroad have applied to the Railroad Commission for permission to issue 106,637 additional shares of common stock. President Mellen explains that $11,720,700 is needed to carry out authorized improvements on the system.

Engines at the Brussels Exhibition

From the fine collection of various types of Belgian, French, German and Italian locomotives at the Brussels Exhibition, we illustrate in this issue four interesting examples.

A powerful 2-10-0, four cylinder simple locomotive built by the Societe Anonyme des Forges Usines et Fonderies, Haine Saint Pierre, for the Belgian State Railways. This engine is shown in Fig. 1, and has the following leading dimensions: Four cylinders, each 19⅝ by 26 ins., operated by piston valves actuated by a modified Walschaerts gear; diameter of ten coupled wheels 4 ft. 9 ins.; total wheelbase, 33 ft. 2¼ ins. The boiler is fitted with a superheater, and has a total heating surface of 2,563.65 sq. ft., with a grate area of 53.82 sq. ft.; the working pressure is 199 lbs. per sq. in. The engine has a total weight in working order of 98 tons, 8 cwt., 3 qrs., and a tractive effort of about 45,635 lbs.

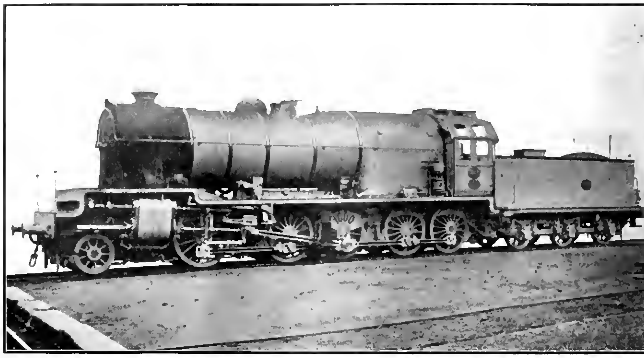
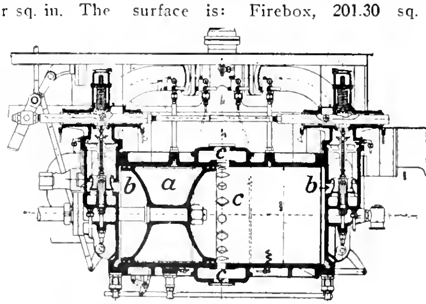


FIG. 1. 2-10-0 FOR THE BELGIAN STATE RAILWAYS.

Another remarkable machine built for the Belgian State Railways is the pacific type express locomotive designed by M. J. B. Flamme, the chief mechanical engineer. There has been a need for more powerful engines to work the express service on the line from Brussels (north) to Verviers and Herbesthal, and M. Flamme accordingly designed this pacific type shown in Fig. 2, with four high-pressure cylinders and a Schmidt superheater. The leading particulars are as follows: The four cylinders are each 19 ins. in diameter, with a stroke of 26 ins., piston valves actuated by Walschaerts motion, there being only one valve motion on each side, acting direct on the valves of the outside cylinders, which have tail rods extending to the front and connected by means of rocking arms to the inside cylinder valve rods. The reversing gear is of the Flamme-Kongy type, steam actuated. The coupled driving wheels are of 6 ft. 6 ins. diameter. The boiler is of almost similar dimensions to that of the Decapod, previously mentioned. It has a maximum interior diameter of 5 ft. 11⅞ ins. and has a working pressure of 199 lbs. per sq. in., there being four safety valves of the Wilson type arranged in pairs. The boiler contains 230 tubes 16 ft. 5 ins. long by 2 ins. in diameter, in addition to 31 superheater tubes of 5 ins. diameter. The heating surface is: Firebox, 201.30 sq. ft.; tubes, 2,368.12 sq. ft.; total, 2,569.42 sq. ft., with a grate area of 53.82 sq. ft. The superheater surface is 692.14 sq. ft. The weight of the engine alone, is, light, about 90½ tons, and in working order about 100¼ tons, of which 56¼ tons rest on the coupled wheels. The tender has a capacity for 5,280 gallons of water and 7 tons of coal. The tractive power exerted by these huge ma-



CYLINDER MADE ON PROF. STUMPF'S PRINCIPLE.

chines is 33,550 lbs., and they develop about 2,000 i. h. p. as a maximum.

A new type of four cylinder compound express locomotive for the Northern Railway of France is noteworthy (see Fig. 3). It has a rather unusual wheel arrangement, 4-4-4, the large wide firebox requiring for its efficient support a four-wheel bogie under the foot-plate. The firebox is quite exceptional apart from its external dimensions, for it contains a number of water tubes and is extended into a combustion chamber, this chamber giving a heating surface of more than 1,000 sq. ft., irrespective of the Serve tubes in the boiler, of which there are 136, and each is 14 ft. 3½ ins. long and 2¾ ins. diameter. Another feature is the high boiler pressure, 256 lbs. per sq. in. Below are given the leading dimensions: High-pressure cylinders, 13⅜ by 25⅜ ins. stroke; low pressure cylinders, 22 by 25 ins. stroke; diameter of bogie wheels, leading and trailing, 2 ft. 11 ins., and of coupled driving wheels, 6 ft. 8¼ ins. Total wheelbase of engine, 32 ft. 8 ins.; boiler, diameter, 5 ft. 1 . ins.; height of center above rails, 9 ft. 2½ ins. Heating surface, firebox, water tubes and combustion chamber, 1,033.35 sq. ft.; tubes 2,373.60 sq. ft., grate area, 38.1 sq. ft. weight of engine in working order 75 tons 19 cwt. 3 qrs. of which 34 tons 2 cwt. 3 qrs. rest on the coupled wheels; weight of tender with 4,230 gallons of water, 41 tons 16 cwt. 3 qrs.

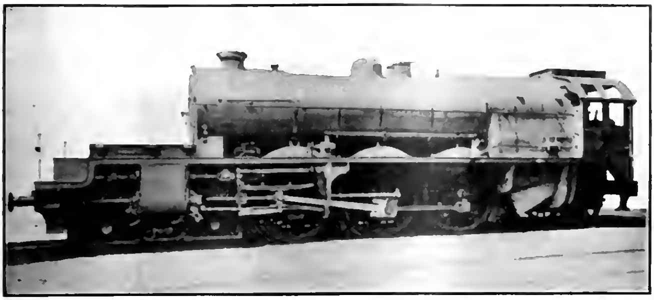


FIG. 2. 4-6-0 FOR THE BELGIAN STATE RAILWAYS.

Among the German examples is a large 0-8-0 goods locomotive (Fig. 4), built by the Vulcan Locomotive Works of Stettin, for the Prussian State Railways. Though similar in general design, the engine, No. 4841, differs from others of the same type in respect to several details, and notably as regards the cylinders, which are constructed on the principle introduced by Professor Stumpf, of Charlottenburg. One of the cylinders is shown in section in our diagram (Fig. 5). A brief description will serve to explain its leading features. The object of departing from the ordinary type of steam cylinder, with its steam and exhaust ports controlled by a D-slide or piston valve, is to do away with the condensation of steam within the cylinder, which results from the alternate admission of live or hot steam, and the exhaust of comparatively cold steam through the same set of ports in rapid succession. In Professor Stumpf's system the cylinder is made with its length of bore practically 50 per cent. longer than is usual, and the piston *a* is of unusual shape, its bearing surface against the cylinder wall being within a fraction of one-half of the total length of the cylinder barrel. This is clearly shown at one end of its stroke. Two sets of piston rings are fitted to this trunk piston, and the intermediate portion of the piston is provided with an annular ring which bears lightly against the cylinder wall. Admission of steam is provided for through ports *bb* in the end covers of the cylinder. In the engine illustrated this is controlled by lift valves of the Lentz type. There is no valve controlling the exhaust. As the piston travels under the pressure of the steam admission, it passes from one end of the cylinder to the other in the ordinary course, and shortly before reaching the other end of its stroke it uncovers a series of openings made around the center line of the cylinder's length, shown at *cc*, these openings leading to the exhaust and blast pipes. Thus the steam passes in one direction only throughout its course of effective work, entering the cylinder at one end and emerging at the center; and it is found that this system of operation prevents those abrupt changes of temperature in the cylinder walls which are so fruitful in condensation.

FIG. 3. FOUR-CYLINDER COMPOUND FOR THE NORTHERN OF FRANCE.

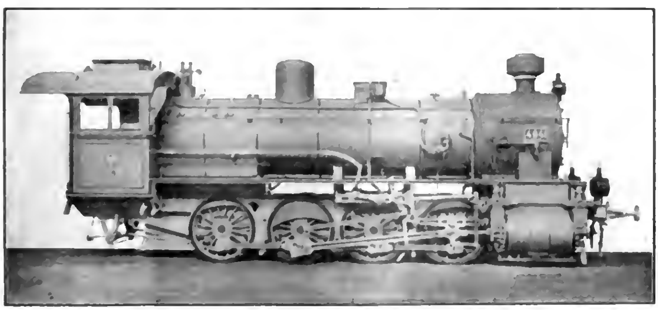


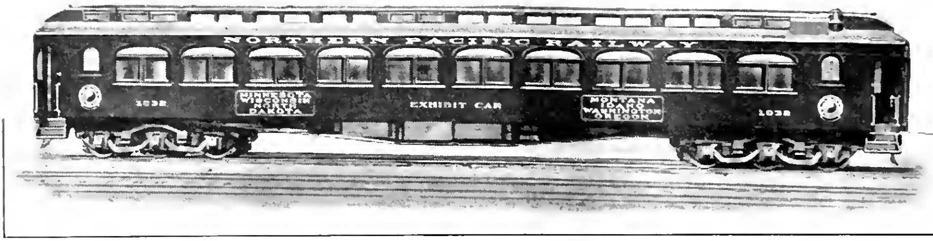
FIG. 4. 0-8-0 FOR THE PRUSSIAN STATE RAILWAYS.

The engine is equipped with the Schmidt superheater and an efficient spark arrester within the smokebox, and has the following leading dimensions: Cylinders, 23⅝ by 26 ins.; diameter of coupled wheels, 4 ft. 5⅛ ins.

Exhibition on Wheels.

The Northern Pacific has recently got up what may very reasonably be called an exhibition on wheels. It is in fact a fine passenger car mounted on six wheel trucks. It is laden with evidence of the productivity and varied resources of the States through which the road runs. It is not a new plan for this railway to send out such a car, for several years ago the Northern Pacific equipped a similar car which was on exhibition at the World's Fair in Chicago. This car afterwards made numerous tours advertising the Northwest.

However, the new car which starts out at this time is of latest model, seventy-five feet long, lighted by electricity and acetylene gas, equipped with extra wide windows, and all other details of an up-to-date passenger coach.



SPECIAL CAR TO SHOW NORTHWESTERN PRODUCTS; RUN BY THE NORTHERN PACIFIC RAILWAY.

The arrival of this car is an event long to be remembered in the smaller towns. The exhibit car is pushed in on the siding and thrown open to the inspection of those who would in no other way see the products of the soil from such a wide range of territory as that lying between the Great Lakes and the Pacific Ocean The fertile wheat and corn fields of Minnesota and North Dakota, the farms, orchards and gardens of Montana, Idaho, Washington and Oregon, have all contributed their share to the grand display.

A great many of the exhibits in the car were secured from the Minnesota, North Dakota and Montana State Fairs, from the Dry Farming Congress recently held at Spokane, and from numerous county fairs in Washington and other States.

The itinerary of the car is being carefully worked out with a view to exhibiting it in these sections of the Eastern and Southern States from which thousands annually migrate to the Great Northwest.

The exhibit shows how productive are the fields lying along the "Scenic Highway Through the Land of Fortune."

The car is accompanied by representatives of the passenger and immigration departments of the road, and by a lecturer who gives illustrated addresses. Literature is also liberally distributed.

While chief interest in the car is among the farming class, yet the car stops in the smaller towns to show those who labor at trades and in factories the advantages of outdoor life on the farms along the Northern Pacific.

Protecting the Steel Car.

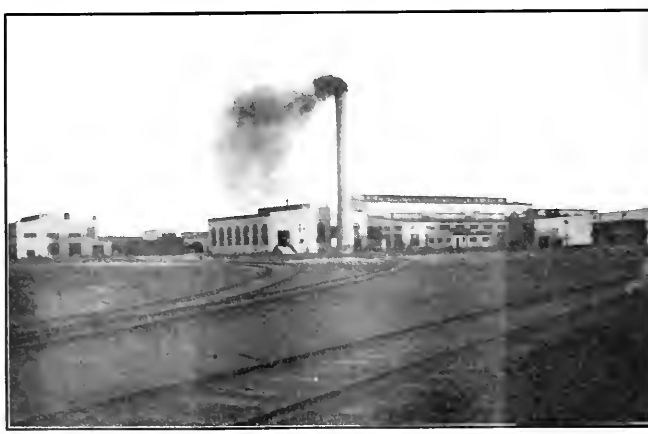
The steel freight and passenger cars have come to stay, and one of the most serious problems in the maintenance of these cars is the protection from rust by some kind of paint. The Joseph Dixon Crucible Company of Jersey City, N. J., seem to have solved this problem in a very satisfactory way—the Dixon silica-graphite paint, as made by them in four shades.

The best vehicle for pigments is boiled linseed oil. Probably nine out of ten protective paints are linseed oil paints. This vehicle is strongly adhesive and dries in a tough, elastic film. Linseed oil might be used without the addition of a pigment but for the fact that, by itself, it is not wholly impervious to moisture. A pigment also lends "body," assists the paint film in withstanding beating rain and hail storms, and helps to protect the oil against the destructive influences that affect it.

The shades placed on the market by this well-known company are olive green, dark red, black, and what they call Dixon's natural color, which is something like a dark slate, but any and all of these are made with the silica-graphite mixture. This paint lends itself most readily to stenciling. The mixture of graphite and silica is analagous to an alloy of gold; the silica increases the wearing quality of the graphite, which is in itself almost an ideal coating. Probably the best way to get a good idea of the whole subject is to write to the company for a small pamphlet which they have just issued, in which the matter of protective paints for steel cars, bridges, etc., is very clearly set forth. Samples of the colors are shown on four strips pasted in the pamphlet, and the manufacturers say that test samples will be supplied to those who wish to give the Dixon protective car paint a trial. The pamphlet is well illustrated, and is well worthy of careful perusal.

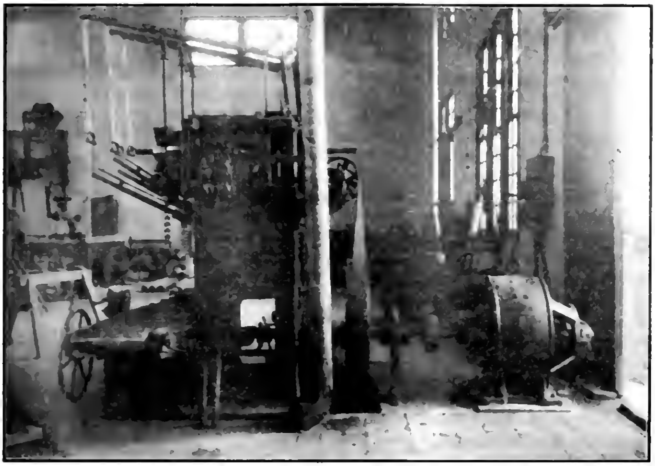
Southern Pacific Shops at Empalme.

The new general shops of the Sud-Pacifico de Mexico are located at Empalme, Sonora, at the junction of this railroad and the Sonora Railway. About five years ago, at the time construction of the Cananea, Yaqui Railroad was started at a junction with the Sonora Railway, five miles east of Guaymas, the present site of Empalme (Spanish for



SOUTHERN PACIFIC SHOPS AT EMPALME.

junction), it was a waste covered with cactus, with not a single improvement except the bare lines of an old railroad. To-day there is a shop plant that is as up-to-date as any other west of the Rocky Mountains, and a modern American town site with first-class quarters to take care of the company's employees. This rapid growth was due to the aggressiveness of Mr. Epes Randolph, who has been instrumental in the laying out and construction of the Southern Pacific road through Western Mexico, and who deserves practically all the credit for the road and the fine shops at Empalme.



INTERIOR OF SOUTHERN PACIFIC SHOPS AT EMPALME.

Plans for the shop and construction were started about three years ago. The first building erected was the twenty-eight stall roundhouse, which was constructed of stone obtained from the company's quarry 2½ kilometers from Empalme. This construction proved that the rest of the buildings could be erected more economically from concrete, and plans were made accordingly. A test of the soil showed that it would either be necessary to put in large spread concrete footing under the piers supporting the large buildings with traveling crane loads or to drive concrete piles. The latter plan was adopted.

The shops are complete in every respect, being built to take care of locomotives, passenger and freight cars, repairing and rebuilding, and are also equipped as a manufacturing plant, making them, to a large extent, self supporting. Among the features of this complete plant are machine and erecting shops, boiler and blacksmith shop, material shed, belt shop, flue shop, foundry, pattern shop, car and paint shops and mill. Work is about to begin on the erection of the dry lumber storage building and a dry kiln. Special attention has been paid to light. All buildings are exceptionally well lighted, and, to eliminate the disagreeable feature of the strong sunlight, factory ribbed glass is used throughout.

Particular attention has been given to labor and time saving devices. Cranes, push-car tracks, turntables, floor air jacks, air hoists, etc., have been provided wherever considered practicable, and a telephone system, connecting all shops, offices, stores, etc., is installed. A general fire alarm system, with fire-alarm boxes located at suitable places about the shops and connecting with the power house, is provided for. An independent fire line with hydrant has been installed, and is used only in case of fire or fire drill by the shop fire department, thus insuring piping in good condition that will stand high pressure in case of fire, and eliminating the dangerous practice of allowing general service and other taps to be connected to the fire line, which is always bursting when a good pressure is called for. The coal storage has a capacity of ten thousand tons, the coal being dumped from an elevated trestle twenty-two feet high.

The shops are electrically driven throughout, power being furnished from a central power station, which is a handsome [illegible] concrete building 88 ft. [illegible] building. This building is [illegible] by a wall extending [illegible] separating the engine [illegible]. The engine-room [illegible] 5 ft. above the boiler-room [illegible] provides for a basement to [illegible] condenser, air pumps, hot [illegible] washing, general service, hydraulic and fire pumps, steam and exhaust headers and all piping. In the power house there are two Westinghouse 200 kw., three-wire, 250-volt D.C. engine type generators, direct connected to reciprocating engines.

There are about 200 Westinghouse type "S" motors, from 1 to 50 h.p., operating the various wood and iron-working machinery in the different departments. Our illustration clearly indicates the suitability of electric motors for railroad shop use. The machines are all direct driven and the necessity of overhead belts and line shafting is precluded. By means of the adjustable speed motors that are used the speed control of the different machines is extremely flexible, and hence a considerable gain in the productive capacity of the machines is made.

INTERIOR OF EMPALME SHOPS OF SOUTHERN PACIFIC.

Railway and Locomotive Engineering

A Practical Journal of Motive Power, Rolling Stock and Appliances.

Published Monthly by

ANGUS SINCLAIR CO.

114 Liberty Street, New York.

Telephone, 984 Cortlandt.

Cable Address, "Loceng," N. Y.
Glasgow, "Locoauto."

Business Department:
ANGUS SINCLAIR, D.E., Prest. and Treas.
JAMES KENNEDY, Vice-Prest. and Gen. Mgr.
HARRY A. KENNEY, Secretary.

Editorial Department:
ANGUS SINCLAIR, D.E., Editor.
GEORGE S. HODGINS, Managing Editor.
JAMES KENNEDY, Associate Editor.

Boston Representative:
S. I. CARPENTER, 643 Old South Building, Boston, Mass.

London Representative:
THE LOCOMOTIVE PUBLISHING CO., Ltd., 3 Amen Corner, Paternoster Row, London, E. C.

Glasgow Representative:
A. F. SINCLAIR, 15 Manor Road, Bellahouston, Glasgow.

SUBSCRIPTION PRICE.

$2.00 per year, $1.00 for six months, postage paid in the United States, Canada and Mexico. For other parts of the world, $2.50, or ten shillings. Single copies, 20 cents. Remit by Express Money Order, Draft, Post Office Order or Registered Letter.

Mailing address can be changed as often as necessary—always give old and new address, and if you subscribe in a club, state the name of the agent.

Please give prompt notice when your paper fails to reach you regularly.

Entered at the Post Office, New York, as Second-class Mail Matter.

Aid to the Ambitious.

Since the beginning of the publication of Railway and Locomotive Engineering it has been the constant aim of the publishers to keep abreast of the most advanced thought as manifested in the constant improvement in the mechanical appliances used on railways. It would be idle to imagine that an educational magazine could be reduced to the mechanical status of a barrel organ, and go on repeating the same measured monotone year after year and yet retain its hold on popular favor. New mechanical devices and new methods of applying mechanical forces require new illustrations and descriptions. The popular favor which has never failed us is the best proof that our work has been appreciated. As was to be expected, we have had imitators and followers in the same field, and we esteem it a high compliment to observe that the promoters of these publications have invariably striven to adopt one or other of our departmental features as some reason for their existence. Our leading articles are frequently copied in their entirety. We have no fault to find with this. The truth cannot be too widely known, as long as it concerns the welfare of any important section of the community.

It is not our purpose, however, to boast of our accomplishments. If any mechanical journal in the world today could rest on accomplishment alone, we could. The world's work, however, is not accomplished by those who look backward, but by those who look forward. We believe that the true part of our work in the field of mechanical educational journalism lies in taking up the new problems that arise, and from the vantage ground of our experience in doing what we can to solve these problems and record the solution so that others, younger perhaps, may reap some advantage from our pages in the work which they have chosen.

In the furtherance of this object we have been favored by many friends who have furnished us with copies of the various books and pamphlets issued by the leading railway companies containing the questions which will be submitted to the railway men who are necessarily expected to answer these questions, and so show a proper familiarity with the occupations in which they are engaged, besides exhibiting some good reason why they should consider themselves available in the case of an opportunity for promotion. In furnishing the answers to these questions we consider ourselves engaged in a laudable work. Previous publications of this kind have met the approval of the highest authorities, and have been warmly received by the ambitious railway men.

Some there are who may imagine that persons of this kind should become learned only by experience. Therein they err. Experience is of slow and often of bitter growth. Railway men will not be trusted in charge of intricate mechanical devices in operation unless they are already familiar with the details of the construction and operation of such devices, and the question naturally arises, by what means are railway men to obtain this knowledge? We recall many instances of young railway men endeavoring to gather information from their elders, and the results were not gratifying. The kindlier spirit grows among workingmen as the years roll on, but their own exacting duties preclude the possibility of telling all they know to the uninitiated.

"Reading maketh a full man, and study an exact man," and a careful perusal and study of the questions and answers, the first instalment of which will appear in our January, 1911, issue, will qualify any intelligent railway man to pass the examinations to which we have referred. It is almost needless to state that we have particularly in mind the younger railway men, but there will be much in the new department that will be of particular interest and value to the most experienced engineer or mechanic, or, indeed, any man of the widest experience in the railway mechanical service.

Our facilities for procuring information on the latest devices are of the best. We are in close touch with the most accomplished inventors and manufacturers. Our mental horizon is not clouded by ignorance nor warped by prejudice. Whatever we have been able to do in the past strengthens us for the tasks of the future. We know that we will be pardoned in confessing that we have some confidence in ourselves, of feeling and knowing that while we are not perfect we press toward the mark. In this spirit we enter upon our new task with the beginning of the new year, in the hope and assurance that the railway men, particularly those engaged in the mechanical departments, will appreciate our efforts to present something worthy of their attention and to prove our claim that we can furnish not only the first but the best aid to the ambitious railway man.

The Law of the Inverse Square.

If an ordinary railroad man was asked why the reflector of a locomotive headlight was made like a deep cavern of silver which completely envelops the source of light, he would probably say that the shape of the reflector was to concentrate the light and throw it ahead so that none of it should be lost. This is quite true, but there are one or two very interesting facts connected with the diffusion of light and the properties of the curve which forms the contour of the reflector, which it is worth while to consider.

In the first place it is a matter of common knowledge that as you go farther away from an object it becomes less distinct and ultimately fades from view. The object also appears to become smaller as one recedes from it. A very familiar example is this: If you can read a newspaper comfortably one foot away from a candle, you will find the paper more indistinct at two feet distance. At three feet it will be much more indistinct and at four feet it will require close scrutiny to read the small type on the paper. Here is evidence that the intensity of light diminishes the farther it travels from its source.

A lighted candle on a table pours forth luminous rays in all directions and the walls of the room, if equally distant from the candle, will all receive the same amount of light. The object of using the headlight reflector is practically to cause the light which uselessly falls on three of the walls to be reflected upon the one which it is desired to illuminate. The diminishing power of the candle light as one moves away from it is controlled by a natural law.

For example, if a board 1 ft. square, and therefore having 1 sq. ft. of surface, be placed at a distance of 1 foot from the candle, it will be capable of obscuring a board 2 ft. square, or containing 4 sq. ft. area, at a distance of 2 ft. from the candle. At 3 ft. distance the first board would obscure a square having a length of 3 ft. on a side, or containing 9 sq. ft. of surface. At 4 ft. distance, 16 sq. ft. would be in shadow, and at 5 ft., an area of 25 sq. ft. would be darkened. It is evident from these facts that the intensity of light diminishes four times at twice the distance, or the light on the 4-ft. board is only one-quarter as bright on the 1 sq. ft. board, and on the 9 sq. ft. board it is only 1/9 as bright as on the first. Thus the intensity of light is said to vary inversely as the square of the distance—inversely meaning that, as the distance increases, the light diminishes, and vice versa.

Looked at in another way one may say that if a pot of white paint will color a certain area so as to make it snow white, that same pot of paint when spread over four times the area will be only one-quarter as white; in fact, it may look a trifle gray. If spread over nine times the area it will be a very thin poor white, and on an area sixteen times as large it will hardly show up as good white at all. Here then in rough and ready way is the law of the inverse square.

This is the way the direct light from a locomotive headlamp is thrown, and the idea in using the particular form of reflector is to collect the light which radiates in all other directions and throw it ahead on the track where it is needed. The direct light from a headlamp may be disregarded for all practical purposes, as it is the light which comes out of the headlamp without having touched the reflector at all. It is a feeble light to begin with, and obeying the law of the inverse square it is practically lost a short distance ahead. The reflected light, however, comes out in a much more concentrated beam of light. It is, of course, a cone of light, but its divergence is very small. Theoretically it would be a solid cylinder of light if the flame was no bigger than a pin's head and placed exactly in the focus of the parabolic reflector. As a matter of fact it is not possible to get a source of light of sufficient intensity and small enough to be placed so as to be all at the focus. The oil flame is arranged around the focus, not in it; the electric arc and the gas flame are partly in and partly out of the focus and so throw a more concentrated beam ahead, but the slight divergence of the issuing beam cannot be wholly eliminated.

The beam of light concentrated into practically a cylindrical form does not lose its intensity as it proceeds outward, and barring the slight absorption by the atmosphere, it penetrates to a great distance, with but little dimming of its power. In other words, the reflector enables the light to depart from the natural law of diffusion, which is that of the inverse square, and projects it forward as a very slightly divergent pencil of rays, which illuminates the track ahead with steady brilliancy. Under these circumstances objects are more clearly and quickly seen, bathed in the concentrated light from the reflector than they would be if viewed in the scattering and feeble rays of direct light.

The law of the inverse square is a very common one in nature; radiant heat obeys this law, the force of gravitation is under its sway, the expansion of steam conforms to it, and the propagation of sound in air is governed by it. The burning of a quantity of gunpowder in free air gives a flash and a puff of smoke, and may be likened to the direct light from the headlight of which we have been speaking. The reflected light ignoring the law of inverse square is like the same powder-charge, exploded in a coast defence gun, which being concentrated, drives its projectile a long way out to sea.

Real Observing Habits.

We are acquainted with no class who can profit more from habits of exact observation than railway trainmen. The man who mentally absorbs the meaning of things that come before his eyes is likely to be much more successful than persons who retain no exact impression of what they see. Here are some very sagacious notes on the subject by Ruth Cameron, a correspondent of the New York *Globe*.

The person who takes in and understands all that he looks at is going to get a heap more out of life than the person who lets almost everything "go in one eye and out the other."

Know your own business first, of course, but if you are any good at all you ought to have enough energy left over to take some interest in what the other fellow is doing and how he does it. Some people can see a thing done forty times and not have any idea how it is done. Other people can see the same thing done once and know exactly how it's done and be able to do it themselves. Of course that's due partly to an inborn ability that New Englanders call "knack," but also partly to a cultivated habit of observation and wide-awakeness.

This is what happened in a big newspaper office. The telephone girl who presided at the office switchboard was taken suddenly ill. The switchboard was in a prominent part of the office. Some dozens of reporters and a half dozen office boys had daily hung over her desk and watched and listened as she pressed the magic keys and answered the call of the little red and white lights.

Of all these only one office boy had learned, from watching her, to operate that switchboard. He had had no more opportunity to see how the thing was done than the rest, but he had improved his opportunity. He was at once installed, and succeeded so well that when the telephone girl decided not to come back he was permanently promoted.

I found one of my girl friends the other day deftly fashioning a marvelous bow for her hat, as if to the manner born. "Gracious!" I said. "I didn't know you ever studied millinery." "I didn't," she answered. "I just watched the girls when I had a bow made up at the store." She had "watched," you see, what I had merely looked at.

I was sitting on the front seat of a suburban car the other day—the kind that whizzes along so recklessly that you can feel your heart coming up into your throat most of the time.

"What wo-would ha-happen if the m-motorman should faint?" I gasped to my companion as we struck a curve at something that felt very much like sixty miles an hour. "Wouldn't we all be killed?" "I'd stop the car," she responded calmly. I've watched just what they do to start it and stop it, and I'm sure I could." I couldn't. Could you?

And yet we've probably sat on the front seat of the car as many times as she has, and had as much chance to see how it was done.

Thinking of more important things, you say disdainfully: Tell me truly, are most of the dreamings that keep you from seeing and taking in what happened around you really as valuable as a habit of observation would be?

Women Blacksmiths.

Five hundred women blacksmiths are idle in Cradley Heath, England, because they will not agree to work for the next six months for four or five shillings a week, says the Youth's Companion. The women, who operate forges in their own homes, are engaged in making chains. Their wages have been so low that a commission, after an investigation extending over seven months, decided that they should be increased, although the old rate might continue for six months if the women would consent. About half the women agreed to work for the old pay. The rest have been locked out.

Bad Steaming.

A gratifying sign of the times among roundhouse men is the fact that we do not hear so much of bad steaming in locomotives as formerly. The amount of ignorance which existed in regard to the causes that led to the defect would be difficult to overestimate. Instead of making a systematic search for the trouble and, if possible, rectifying it, the locomotive became stamped with a character similar to that of certain individuals who are known to possess sundry moral and intellectual defects, but nobody takes time to make a sustained effort to set them right. In the case of the bad steaming locomotive, the experiments that have been so sucessfully carried on in regard to the appliances used in the smoke-box or front end of the locomotive have brought about the improved condition in regard to steaming. As a general rule, defects in steaming are now discovered and remedied with a degree of promptitude that leaves little to be desired. The careful experiments on the part of locomotive designers have brought the parts to a degree of symmetry and proportion so nearly perfect that a readjustment of any particular part is comparatively easy.

Defects in steaming may now be promptly looked for in the smoke-box attachments. It should be seen that the exhaust pipe and nozzle are securely held in place, and that the exhaust nozzle is set exactly in line with the center of the smokestack. The diameter of the nozzle should be such as to allow the exhausted steam to fill the smokestack as completely as possible. An exhaust jet failing to fill the stack fails to produce the vacuum necessary for furnishing a strong and equable draught on the fire. A jet expanding beyond he limits of the smokestack, although less pernicious, has a disturbing effect on the fire, with a corresponding shortcoming in the generation of steam.

The same remarks apply with equal force to the adjustment of the petticoat pipe, if such forms part of the smoke-box equipment, and it should be borne in mind that it does not follow that even with the most exact degree of careful designing in the original construction these appliances will continue to retain their just alignment for any considerable length of time. The variations in temperature and the incessant though intermittent blasts on the heated fastenings tend to distortion of the parts, and the divergence from their correct positions cannot be discovered by a mere casual glance. It does not take much time to level the engine and drop a plumb line in the smokestack, when any variation from the true adjustment will be readily revealed.

The diaphragm or deflector plate, although not so readily moved as the petticoat pipe, is also of particular importance in its adjustment. If set too low the draught will be stronger in the lower flues, and if high set the draught will be more marked in the upper flues. It is desirable that the draught should be as equable as possible, and if the equalization of the draught is maintained and the parts in the smoke-box kept in their proper position, little remains to be done other than that the netting should be kept free from obstructions, which accumulate rapidly.

It may be added that leaks either from the steam pipes, or from the outer air, by reason of a defective joint in the front casting, or smoke-box door, or smokestack base, all contribute in causing a marked defect in the steaming qualities of the locomotive, and when any of these are discovered they should not be set down as organic defects in construction, but should be looked upon sensibly as the natural results of the strenuous service which these parts of the complex mechanism are constantly called upon to bear, and the defects should be promptly and intelligently remedied.

Employers' Liability and Relief Departments.

At the last regular meeting of the New York Railroad Club Mr. Joseph N. Redfern, superintendent of the relief department of the Chicago, Burlington & Quincy, presented a paper on the subject of "Employers' Liability and Railroad Relief Departments." The paper contained much information concerning the admirable work of the department with which Mr. Redfern is identified, and some information not only concerning the activity of his road, but referred to similar work on others. Speaking of these departments, he said:

"There are six railroad systems in the United States operating relief departments, the general features of which are similar. The roads in the order of their establishment are: Baltimore & Ohio, 1880; Pennsylvania lines east of Pittsburgh, 1886; Philadelphia & Reading, 1888; Chicago, Burlington & Quincy, 1889; Pennsylvania lines west of Pittsburgh, 1889; Atlantic Coast Line, 1899. These roads employ about 400,000 men—nearly one-quarter of the railroad employees in the United States. About 275,000 of them, or 70 per cent., are members of these relief departments. The members are contributing to the funds annually about $4,000,000, and the companies are contributing a like amount in cash and facilities. There is being paid to the members and their families about $4,000,000 a year, and to date about $50,000,000 has been paid in benefits, over one-half of which is on account of sickness."

Mr. Redfern pointed out the necessary distinction between what is called "Employers' Liability" and "Workmen's Compensation," the broad distinction being that in the case of the workmen's compensation the payment for injury or death is compulsory on the employer, and must be accepted by the workman or his heirs-at-law. The employers' liability insists upon payment in all cases of injury, but instead of the automatic compensation, it proposes that the right to sue for damages shall be retained, and that the employer shall be denied the defense of the fellow-servant assumption of risk and contributory negligence.

This brings us face to face with that piece of English common law, imported into this country before the Revolution, and at a time when industries were small, and each workman had personal knowledge of the disposition and characteristics of all the other workmen in the factory in which he was employed. The fellow-servant idea has long ago been outgrown; modern conditions have rendered it not only useless as an equitable rule of law, but it has worked much hardship in the majority of cases where it has been applied. We must remember that for quite a number of years it has been a dead letter in Great Britain, while it has been retained here.

Mr. Redfern continued by saying: "There does not seem to be any sound reason for compelling an employer to pay damages to an employee who breaks a leg because he accidentally stubs his toe on the stairs of his employer, which were not defective, or because of a defective sole in his shoe; if an employer can by law be compelled to pay damages in such cases, could the employer be compelled to pay damages for similar injuries inflicted while the employee was on his way to his work, but not on the premises of his employer? There would be as much reason for the latter as the former. If the employer may legally be compelled to pay damages for all injuries sustained by his employees, may we not expect the next step to be legislation compelling the employer to pay when his employees are disabled from what are called occupational diseases? And it would then naturally follow that after a while all diseases would be construed to come within the term occupational diseases, so that the employer would probably be compelled to pay whenever an employee was physically incapacitated for work. And then another step might be expected—that is, the employer to be compelled to pay pensions and something for the maintenance of the dependents of his employees, irrespective of the cause of death. But why should the employer do all this? The fact that Germany and France and England, and other foreign countries carry on paternalistic work is no reason why we should follow in their steps in this respect any more than we should follow in their steps as regards wages paid employees."

We do not agree with Mr. Redfern in his question as to why we should not do as Great Britain and other nations do. The law works well there and in other countries. Our concern ought not to be whether we lead or whether we follow. Our duty is to find out what is the fair, equitable and humane policy for us to pursue.

There is one thing that stands out clearly in all discussions of this kind, and that is, the fellow-servant rule is a block to progress in the way of equitable adjustment of the question of liability or compensation. If there is one subject upon which RAILWAY AND LOCOMOTIVE ENGINEERING has pursued a steady and consistent policy, it is in its unwavering advocacy of the complete retirement of the fellow-servant rule, and it has done this as a matter of justice to the thousands of workingmen throughout the country who are now affected by this harsh rule.

Relief departments on railways are good, the work done by them is excellent, and no one who studies the question can fail to appreciate the mutual good will and the team play between corporation and employees which the existence of such a department indicates. But the relief department is a voluntary arrangement, and though it works smoothly and in the interests of both parties, it is not the law of the land. There can ultimately be no substitute for rights guaranteed by law, and whether we in this country adopt an employers' liability law or a workmen's compensation act, we must finally secure a constitutional enactment from which the fellow-servant rule shall have as entirely disappeared as if it had never been.

The Velocity of Steam.

The velocity of steam escaping under pressure is known to be very great, though few are aware that even under a moderate pressure of, say, 20 or 30 lbs. to the square inch, it is, generally speaking, equal to that of a projectile fired from a cannon. A notable example of the high velocity of escaping steam is that of a steam whistle in which a jet of steam little thicker than ordinary writing paper produces a sound that can be heard further than the loudest thunder. The writer has often heard a railroad whistle 18 to 20 miles away, while thunder is seldom heard over 10 or 12 miles. Every engineer knows how little his safety valve lifts, while the whole current of steam required to run his engine escapes therefrom, and how small a leak in a valve will cause his engine to "creep," provided his piston packing is tight.

To understand the reason of the very high velocity of steam or other gaseous bodies on escaping from under pressure, we have to consider that such velocity is as their pressure and the square root of their density inversely. Thus at a given pressure, if we double the density of the mass, we reduce by one-half the height of a column that would produce such given pressure, and the velocity due to any head or height of fall being as the square root of such head or height, it follows that increasing the density with a given pressure, reduces the velocity and contrariwise reducing the density with a given pressure increases the velocity.

It is understood that it is the height of column that determines the velocity in all cases, the density, with a given height, not affecting such velocity.

Now, the velocity of steam under a given pressure is in a like ratio as that of any dense body, and for a like reason, and to calculate such velocity it is most convenient, first, to ascertain the ratio of the density of steam at the given pressure above atmospheric pressure as compared with water. Tables giving such relative density will be found in almost any work on steam engineering. This data once obtained, next calculate therefrom the height of a column of steam, considering it to be homogenous or of equal density throughout, that would give (by its weight) such given pressure. To ascertain such height of column we must calculate the height of a column of water, calling the weight of such (2.304 ft. in height) equal to 1 lb., that would give the required pressure, and the height of this water column multiplied by the ratio of the density of steam at the given pressure to that of water, gives the homogenous steam that would give (by its weight) the required pressure, and eight times the square root, if such height in feet is the required velocity in feet per second.

Practically the results do not agree exactly with the above rule. There is some waste of power from friction at the point of discharge. If the discharge pipe is short, its length being no more than its diameter and properly enlarged inside, there will be but little loss of power, whereas, if the steam escapes through a pipe of considerable length, the steam will expand very considerably in passing its length, and while thus expanding exerts a back pressure on that back of it, thus retarding the velocity of that just entering the pipe and rendering the flow of steam correspondingly less.

Anyone who will calculate by the above rule the size of a circular orifice that will give vent to 30 horse power of steam at a pressure of 90 lbs. to the square inch, will find its diameter to be less than three-eighths of an inch, and to vent 120 horse power, such orifice would be less than three-quarters of an inch, and to vent 480 horse power it would be less than one and a half inches.

Book Notice.

MARK ENDERBY, ENGINEER. By Robert F. Hoffman. Published by A. C. McClurg & Co., Chicago. Cloth. With four illustrations in oil. Price, $1.50.

The author of this book is a railway man of very considerable practical and literary ability and experience. The literary quality is given to very few railroad men. Their strenuous physical life gives little or no leisure for perfecting the art of expression, which does not come even to the most gifted without much care and continued effort. The book before us is a remarkable proof of this fact. The author has seen railroading in all its phases from the luxurious elegance of managerial meetings to the maddening misery of midnight disasters. The scenes and incidents are those of the early days of railroading in the West and Southwest, and the author must be credited with the collection of a number and variety of stirring stories of rough adventures among a class of men where the primal instincts were unchecked by law or unchastened by kindness. As a contribution to the railroad literature of our time, it is interesting as the work of one who has been part of that of which he writes. The shortcomings of the work, from a literary standpoint, are not far to seek. As a connected tale or novel it is utterly deficient in the essential requisites of unity of action and logical sequence. The character drawing lacks individuality. The men have a family resemblance to each other utterly at variance with the men of real life. The women are merely hinted at, or if seen at all, are, like Niobe, all tears, which is not a characteristic of Western women. The work would have shown to better advantage in the form of a number of separate short stories something akin to Kipling's "Plain Tales of the Hills." In a word, while the author has collected material for an excellent book, he has failed in construction, as a builder who has the materials on hand, but whose plans are still in embryo. This defect in mental vision is also seen in the descriptions of natural phenomena. What glimpses the reader gets of the panoramic splendors of the West are like winks here and there. There is promise of better things in the book, however, and with the skill which comes from experience and perhaps with that leisure which is essential to literary perfection, we may hear again from this author to better purpose and more pronounced effect.

A Practical Low Water Test on Overheated Crownsheet

A short time ago the Atchison, Topeka & Santa Fé, of which Mr. W. F. Buck is superintendent of motive power, made a very practical test of the effect of low water on the crown sheet of a Jacobs-Shupert firebox. This form of box was very fully illustrated and described in the columns of RAILWAY AND LOCOMOTIVE

INTERSTATE COMMERCE COMMISSION INSPECTOR LOOKING AT GAUGES.

ENGINEERING for August, 1909, page 357, and the effort to explode this firebox is as interesting as it is instructive.

A boiler with the Jacobs-Shupert sectional firebox was placed in a large field and an oil tank nearby supplied the fuel. On the back head of the boiler a line was painted corresponding to the crown sheet. The usual water glass was in place, but for the test a second one was applied, so placed that, with a scale behind it, the inspector could tell exactly how far below the crown sheet the water had fallen. A telescope placed behind a tree and protected with ties enabled the Interstate Commerce Commission representative to read the steam gauges and observe the exact height of the water in the lower water gauge glass.

One of our illustrations shows the engineer of tests in what a military man might call his "bomb-proof casemate." The necessary protection was afforded by a radially stayed firebox placed on one side, carried on a flat car and shored up with two stout timbers, one to each corner. In this protecting box were telescopes for taking steam gauge and water readings. Pyrometers for indicating the heat of the bare crown sheet plates were placed in the protecting shield. The apparatus and the assistant are not shown in the illustration.

The boiler was fired up in the usual manner, the pops being set for a pressure of 225 lbs. When the pops and steam gauges had shown that the limiting pressure had been reached, the blow-off cock on the boiler was opened by one of the operators in the shield, the oil fire being kept up steadily. The water level was lowered at the rate of 1210 lbs. per minute until a point 4 ins. below the highest part of the crown sheet was reached, and the blow-off cock was then closed. In this condition the boiler remained for 10 minutes with fire unabated. Under these conditions the pops were blowing off and the water level went down 6 ins. below the highest point on the crown sheet by the end of the test. The average steam pressure during the test was 230 lbs.

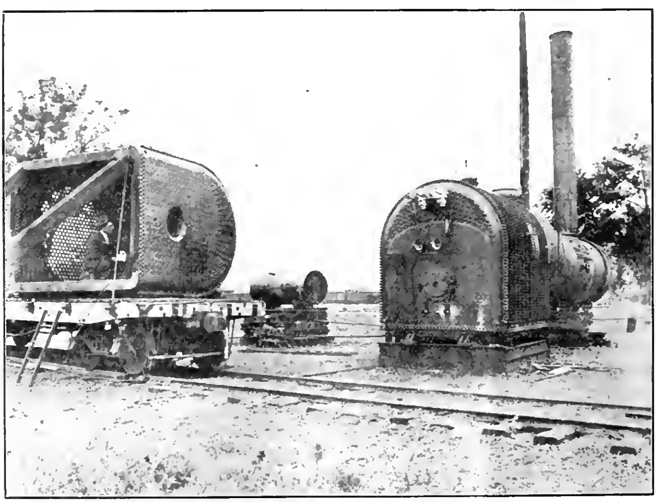
When the 10 minutes during which the crown sheet was bare had elapsed the fire was extinguished and water at a temperature of 60 degs. Fahr. was pumped in, until the water level had risen to two-thirds of the regular water glass, or practically to normal water level again.

Just before the cold water was pumped in a reading of pyrometers showed the front part of the crown sheet to have sustained a temperature of 1125 degs. Fahr., and the rear portion 1065 degs., Fahr. The crown sheet had heated up gradually at an average rate of 67 degs. Fahr. per minute. The steam from the pops, after the crown sheet was bare, indicated that the crown sheet was getting hot. Toward the end of the test, when practically the whole of the crown sheet was bare and a large amount of hot metal exposed, the steam from the pop valves was considerably superheated.

Two minutes after the crown sheet was bare the firebox showed the effects of expansion due to the heating of the crown sheet. Some very slight openings appeared in the stay sheets near the middle of the box. The leaks from these openings were so very small that they would not be considered of any consequence in ordinary service. The opening of these sheets was due to the form of construction of the stay sheets.

At the moment the cold water was introduced into the boiler the pressure fell a few pounds. Eight and a half minutes after the pumps were started the water was level with the top of the crown sheet and the steam pressure showed 215 lbs. When the test had been concluded the box was examined by a number of experts, but no evidence of deformation of the plates was found.

The most important lesson of this test, of course, is the proof that the prevailing belief is a fallacy, that cold water pumped upon hot sheets would cause a boiler explosion. The same thing has been demonstrated several times. About 1870, upon the advice of Mr. Francis Stevens, of Hoboken, N. J., the United States Government conducted a series of tests of boilers in which high pressure and intense temperature was employed until the boilers exploded. No bad effects resulted from pumping cold water upon hot sheets. The Pennsylvania Railroad Company also carried out exhausive experiments to show the effect of intense pressure on boilers and the damage done by pumping water upon red-hot sheets. When excessive pressure was employed on boilers full of water they exploded; when cold water was pumped upon red-hot sheets, the sheets contracted and leaked, but no explosion resulted.



ARRANGEMENT OF BOILER AND SHIELD FOR OPERATORS.

Vice-President Stuart on Government Attitude to Railroads.

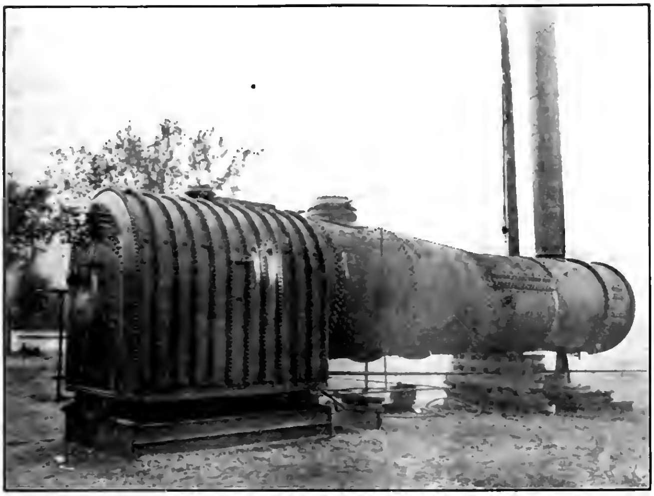
At the hearing of railroad officials before the Interstate Commerce Commission concerning railroad rates, Mr. John C. Stuart, vice-president of the Erie, expressed some wholesome truths regarding railroad rates, wages and regulation. He made the important point that Government has control of five features of operation, but shirks responsibility for establishing credit.

In the course of an interview with a representative of the *Wall Street News* Mr. Stuart gave the following summary of conditions as they exist: Either directly or indirectly through the medium of the State or Federal Government, the following features of the railroad business are controlled in whole or in part: first, financing; second, number of men to be employed; third, operation; fourth, maintenance, and fifth, making of rates. The only features of the railroad business that are not controlled are the establishment of credit and the power to make or induce people to invest in railroad securities. Any experienced business man will admit that no private business can be carried on successfully under such conditions. The sale of securities and maintaining of credit cannot be accomplished through this same medium of legislation, or at least it has not as yet.

Based on the control and requirements mentioned above railroads are obliged to extend their lines, make improvements and furnish better facilities and better serrvice, all of which requires money. When that money is needed it is necessary for a railroad to go into the money market and submit collateral to justify the loan, as any other business concern is obliged to do.

Assuming that the present Commerce Commission should grant the increased rates desired by the railroads, it may restore to some extent confidence which the people have formerly had in railroad securities, but there is no guaranty that a changed personnel in the commission would take the same view of a later request. Furthermore, the railroads as suppliants do not stand before the commission in the same light as any other citizen or corporation. To some extent, based on the language of the law, the commission stands more in the position of counsel for the prosecution than as an impartial body without prejudice.

The fact that the burden of proof rests upon the railroad eliminates the impartial attitude which should prevail. The railroad employes presented certain demands for increased wages before the Meditation Board, but it was not necessary for them to submit the burden of proof, while the railroads, on the other hand, in their efforts to reimburse their treasury for the higher costs of labor, supplies and materials are obliged to furnish burden of proof as to necessity. Inasmuch as the Government has control of the five features of railroad operation, it is illogical to expect that the railroads can raise money for improvements and maintain their credit unless the Government assists in this also by permitting the increase in rates. I believe in proper control, but the scheme is imperfect and unfinished. The principles of successful business as applied to railroads at present clearly indicate that the latter are today operating under conditions which might be called a business paradox.



JACOBS-SCHUPERT BOILER READY FOR LOW WATER TEST.

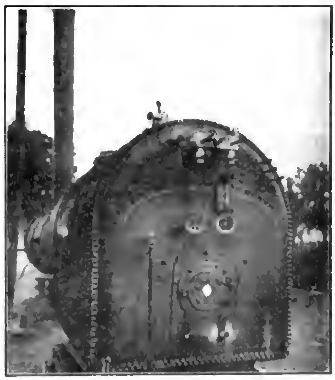
Unsuspected Heat Losses.

Moisture should not be paid for as coal, remarks a writer in the *Erie Employes' Magazine*. If 50,000 tons of coal contained only one per cent. of moisture above normal, it would mean 500 tons of water to be evaporated before the coal would be effective, and at the low price of $1 to $2 per ton it would mean $500 to $1,000 per week, or $26,000 to $52,000 per year.

Don't block the way. The ash is the material that blocks the way of the air. If the percentage of ash is high it will rapidly fill up the firebox and the larger the quantity of ash the more difficult for the air to come through evenly and in sufficient quantities. In 50,000 tons of bituminous coal the ash will probably average 10%, which would equal 5,000 tons. If 10% was normal and each per cent. above considered as a loss and purchased on that basis, and if the percentage of ash was only equaling 12 per cent., 2 per cent. above normal would in 50,000 tons amount to 1,000 tons, which at the low price of from $1 to $2 per ton would amount to from $1,000 to $2,000 per week, or $52,000 to $104,000 per year.

If the ash contains iron and lime and sulphur in sufficient quantities they will fuse in the firebox and run down through the fire, blocking the air and enclosing some of the carbon of the coal, which is thrown away with the ashes. Also a great deal of carbon is being lost in the cleaning of the fires.

In a test recently made at eighteen points on the Erie Railroad on ninety-five samples of ashes taken from the ash pits, an average of 33 per cent. of carbon was contained in the ashes. This loss figured out equals a loss of over $3,000 per week. If only the percentage of this could be burned it would make a considerable saving. The matter of coal saving is very carefully looked after on the Erie Railroad and good results are making their appearance.



BOILER SHOWING CONTOUR OF CROWN SHEET AND LOW WATER GAGE

Locomotive Running Repairs

X—Setting and Repairing Flues.

In the running repairs of all locomotives the original setting of the flues cannot be gone about with too much care, especially with a view to note that all scale and sediment are thoroughly removed, both from the inside of the flue sheet as well as from the flue holes. It should also be observed that all flue holes are perfectly round and free from angular indentations, and all ragged edges should be removed, both from the inside and outside of the flue holes. The tendency to slightly injure the flue holes while removing the worn flues is very great, more especially where the older method, still in vogue in many shops, of cutting out the flues with chisels is still practised. The abrasions or indentations made by chisels, carelessly handled, are a sure means of paving the way for future leaks that are almost impossible of remedy. A chisel mark scarcely visible to the eye or touch increases in dimensions by the action of the impurities in the water, and the trouble grows with a provokingly mysterious persistence.

A fillet, which need not be large, but which should be as nearly symmetrically perfect as possible, should be made on the inside as well as on the outside of the flue holes. Where copper ferrules are used they should be annealed. Hammering hardens copper and greatly reduces its expansibility. The ends of the flues should not only be carefully swedged, but they should be thoroughly cleaned, as in rolling and expanding the flues, if the scale is left on the outer side of the flue, the process of expanding the flue has the effect of cracking the thin scale and the cracked or separated broken particles of scale, after indenting the flue sheet, gradually crumble into crystilline particles and open the way for the leaks that are sure to follow. The flues and ferrules should be a neat fit, and the copper should be of a substantial kind, that known as 40 lbs. being preferable to the lighter materials. It is good practice also to have the ferrules so constructed in point of length that they will project into the boiler not less than a quarter of an inch and not more than half an inch inside the inner edge of the flue sheet, the longer distance being preferable for the reason that scale or sediment will not adhere to copper, the projecting copper thus acting as a partial safeguard both to the flue and flue sheet.

The copper ferrule should be set in flush with the outer edge of the flue sheet, and the flue should project from three-sixteenths to a quarter of an inch outside of the flue sheet. The common rule is that the amount projecting should be at least one-and-a-half times the thickness of the flue. This will leave sufficient metal to form the bead. When the flues are clinched and held in position. a mandrel may be used to set them out firmly to the copper. The expander may then be driven into each flue and further tightened into place. The standard belling tool should then be used to turn the bead. This will leave the end of the tube turned back towards the flue sheet at an angle of about 30 degs., and the projection should be beaded from this particular position and not driven backwards in a promiscuous manner with a hammer. It will be noted that hammering the ends of the flues, unless skilfully done, has the effect of producing small cracks in the projections, which readily catch and retain small particles of burning coal and gradually extend the fracture and open the way for the eventual leak.

The rolling out of the flues should then be begun at the two upper corners. The centre flues should then be rolled, and then the remaining bottom flues. In this way the pressure is equally distributed, and is preferable to beginning at the right or left side, which may create unequal strains on the flue sheet and adjoining stay bolts. The beading should then be accomplished by the standard beading tool. It should be borne in mind that in expanding flues the sole purpose is to tighten the tube in the hole in the flue sheet. Expanding if persisted in will stretch the opening and weaken the limited space between the flues. The experienced mechanic will readily know when the blows on the tapering pin of the expander are sounding against solid metal. The hammering and rolling should then cease. The same remarks apply to the use of an expander.

Some of the leading boiler makers approve of testing the boiler before the beading of the flues is proceeded with. The boiler is filled with warm water in the usual way, and a pressure of at least twenty-five per cent. above the working pressure is applied. This affords an opportunity of a general test of the boiler, as well as a special test of the flues. It is good practice to roll the flues tightly again after the beading process is completed, as the beading of the flues has a tendency to loosen the inner bearings of some of the flues.

The general practice in the front flue sheet is to bell out only a scattering portion of the flues, more for the purpose of partially bracing the boiler longitudinally than preventing the tendency to burn off. The heat in the front end is comparatively low, but while there is no danger in burning off the ends of the flues, it should be remembered that in some cases of boiler explosions the flues have been entirely pulled out of the front flue sheet, whereas if the flues had been properly belled out and beaded the rupture might have been averted.

In smaller running repairs, except in cases of emergency, all work on flues should be done when the boiler has had time to cool, and after being washed out. All loose and leaking tubes should be tightened by the use of the expander, and the beads properly reset. The caulking of flues is a mere temporary makeshift. It can be readily understood that a leak cannot occur in the bead of the flue. The weakness is deeper and can only be thoroughly tightened by the use of the expander. At the same time the expander must be used with much care on flues that are old and have been frequently expanded. The frequent use of the beading tool has also its dangers, as the hardened metal becomes more brittle by repeated pressures and portions of the bead will break off, exposing the end of the flue, and so hastening the decay of the joint. It is also important that the flues should be kept tight. A few leaky flues have a most pernicious effect on the flues over which the water may pass. Not only does it hasten the coming of other leaks, but it also hastens the crystallizing process to which all metals are subjected by the action of fire and water on the same surface. Wood fires are occasionally resorted to as a means for drying up small leaks. This make-believe practice should be abandoned altogether.

It need hardly be said that the careful use of tools is always necessary. The improper use of the beading tool will readily destroy a flue sheet by cutting into the metal, and the excessive use of the expander will rend the flue longitudinally and also induce the beginning of cracks in the flue sheet, especially in the limited spaces between the flues. Care should also be taken in opening any flues that may be closed. In examining the flues the hanging of a torch in the smokestack is a simple scheme for inducing a draught through the flues. A light in the firebox will readily show the flues that are closed. In the open flues the flame of the torch will readily turn into the flue, the closed flues will not draw in the flame. Roundhouses that are furnished with compressed air have a ready method of cleaning flues with air hose connections to which a suitable nozzle is attached. It is often found, however, that the air pressure alone is not sufficient to clean out a flue in which case an auger should be used and the air hose afterward.

In the case of a flue bursting while the locomotive is in operation, metal plugs are usually provided for such emergencies, but in their absence a wooden plug will serve in place of one of iron. The steam pressure should be lowered and if the flue can be reached from the firebox door the metal or wooden plug can be driven tightly into the end of the bursted flue, almost every locomotive being furnished with appliances for reaching the flue and driving home the plug. The wooden plug will not burn inside of the flue, but it should not be depended upon longer than is necessary for the locomotive to reach the nearest repair shop. The same may be said of an iron plug, as their tendency to loosen after cooling is very great.

In closing it might be remarked that the size of the exhaust nozzle is an important factor in the matter of leaky flues. The smaller the exhaust nozzle the stronger the blast of air will be that passes through the fire, and hence the portion of the flues that project through the flue sheet towards the firebox becomes heated to a greater degree than the flue sheet itself. The result is that when the engine is entirely cooled it will be found that the flues in the lower part of the boiler—that is, those nearest to the fire—have a tendency to loosen from the overheating referred to. In locomotive construction there are exact dimensions in regard to the size of exhaust nozzles based upon very careful experiments, but as locomotive service is apt to be of a variable kind, there is a tendency to experiment with the size of the opening or exhaust nozzle, and these experiments are rarely or ever of a beneficial kind. It is generally found that a slight gain in one direction is apt to incur larger losses in some other, so that it is often wise to let well enough alone.

Questions Answered

PUMP GOVERNOR TROUBLE

89. W. F. B., Rocky Mount, writes: On an engine equipped with the No. 5 E. T. brake, if the automatic brake valve handle is placed in lap or service position, the pump will not go to work and pump main reservoir pressure above 90 lbs., but if the brake valve handle is placed in emergency position the pump will start and compress air in the main reservoir to 130 lbs. Would you kindly tell me what could cause this?—A.: As the excess pressure head of the governor is controlling the pump when the valve handle is on lap position, it is evident that for some reason the pressure under the diaphragms and in the operating pipe is being maintained, but is cut off as soon as the valve handle is moved to emergency position. This could be due to a cut or scratches on the face of the rotary valve of the automatic brake valve at the end of the small groove at the lower end of port *s*. These cuts or scratches have the effect of lengthening the groove, and are usually caused by the use of grinding material in the hands of an inexperienced workman. Under these conditions, moving the valve handle to emergency position would move the lengthened groove entirely out of range of the port *p*, which would allow the pump to start and compress air until stopped by the maximum pressure head. It is also possible for this trouble to occur, due to a combination of disorders, such as a partly closed relief port in the governor, slight leakage through or past the diaphragm valve, leakage due to the valve being a trifle too short from reseating or grinding. Under such conditions the governor piston would hold the steam valve closed while the handle is on lap or in service position, as pressures on both sides of the diaphragms are nearly equal, but as soon as the brake valve handle is moved to emergency position, main reservoir pressure rushing into the feed valve pipe would increase the pressure above the diaphragms, seat the diaphragm valve, and allow the governor to start the pump.

SLOPING OF BACKHEAD AND THROAT SHEET.

90. J. L. G., Manitoba, writes: I would feel very much obliged if you would enlighten me as to the advantage of the sloping face plate and throat sheet in nearly all locomotives in this country?—A. The sloping of the face plate of a locomotive boiler is generally done for the purpose of gaining room in the cab, and the enginemen can more easily see and speak to one another where the back head is sloped than they can where the boiler comes out straight and flush with the back of the cab. The sloping of the throat sheet is usually done for the purpose of obtaining some advantage in the matter of supporting the front part of the mud ring. It is not the universal practice, but sometimes it is more convenient, to slope the throat sheet than to keep it vertical. Where it is sloped, it usually gives opportunity for widening the water space from the bottom up and so facilitates the free circulation of water.

HIGH BOILER CENTER

91. J. L. G., Winnipeg, asks why is a high boiler center better than a low one. All the railroads seem to believe in a high boiler center.—A. The high boiler center is largely a matter of convenience, and often results from setting a wide firebox on top of the frames. A high center of gravity gives an easier riding engine and it not so hard on track. Look over the chapter in Dr. Sinclair's "Development of the Locomotive Engine," and in chapter xxvii you will see some very curious attempts to keep the center line low in the early days of locomotive building. In some cases the axle of large wheels was carried through the boiler, involving costly construction for the sake of gaining what the builders then believed to be important. Now-a-days convenience and facility of construction are aimed at and the high boiler center is not only convenient, but it is very satisfactory.

CAPACITY OF TANK.

92. C. M. J., Central City, Ky., writes: A tank 5 ft. 5 ins. in diameter and 6 ft. high. How much oil will it hold? How much oil per inch will it hold?—A.: It will hold 1,034 gallons. It holds 14.36 gallons to one inch of depth. Where can I purchase a book that would give me this information?—A.: You can buy Kent's Mechanical Engineers' Pocket Book from us. This is an excellent book, and has all the rules and formulas and information a mechanical engineer, foreman, etc., would ever want. See the notice of this book in Railway and Locomotive Engineering for October, page 416.

LAPPING HOLES.

93. J. W. P., Kansas City, Kan., writes: In lapping holes we have several plans here, but the results are not as good as we would wish. What is the best method of lapping out a hole so that it will be straight and true?—A.: The methods of lapping are generally correct, but the conditions are not always so. The first requisite is that the lap should fill the hole. If the lap is loose, it is almost impossible to prevent what is known as bellmouthing. The snug fitting will naturally bear on the high spots, and with the application of emery and oil rub off, or, at least reduce, the spots. Lead laps that fit well produce the best results. The laps should be long enough to reach through the hole, and the lathe should not be in motion while the work is being placed in position on the lap. The emery and oil should be placed near the center of the hole, as the motion of the lathe and a slight backward and forward motion of the work will have the effect of working the emery towards the outer edges of the hole.

HEATING MACHINE SHOP.

94. J. S. S., Worcester, Mass., writes: In heating a machine shop is it advisable to use steam at the same pressure as in the stationary boiler, which is between 60 and 70 lbs., or is it more eco-

nomical to use the steam at a lower pressure?—A.: It is much more economical to use steam at a low pressure, and for this reason the exhaust steam from a stationary engine is sufficient to heat a small machine shop. The pressure need not exceed 5 or 6 lbs. Higher pressures are not only more expensive, but in extensive piping the safety diminishes as the pressure increases.

DEFECTIVE BRAKE VALVE.

95. E. W. E., Belle Plaine, Ia., asks: If the equalizing discharge piston in the engineers' brake valve does not make a tight joint on the lower body gasket when making a brake pipe reduction, what effect will it have?—A.: The effect depends upon the condition of the equalizing piston packing ring. If the ring leaks, the defective gasket will permit brake pipe pressure to enter the equalizing reservoir during a service reduction, and with a long train the amount of brake pipe reduction would vary because equalizing reservoir pressure would not remain constant. If a 10-lb. reduction were made in the equalization reservoir pressure, this leak would increase equalizing reservoir pressure while brake pipe pressure was being discharged, and when the brake pipe exhaust port closes the brake pipe reduction may be but 7 or 8 lbs., as a result of the 10-lb. reduction in equalizing reservoir pressure. The extent to which the reduction would be affected depends upon the amount of leakage past the gasket and the brake pipe volume.

FEED VALVE REPAIRS.

96. E. W. E., Belle Plaine, Ia., asks: How could you repair a leaky supply valve in the slide valve feed valve? Would you use a face plate for truing up the valve? How would you true up the seat? Should the valve be ground or scraped to a bearing? Should oil be used or should they be rubbed together dry?—A.: About the quickest and most accurate way to make the repairs is to use a small fine flat file the width of the valve seat and having two safe edges, to file the seat, then hold the finger on the file inside of the bushing to keep the file flat on the seat. When this is done make the center punch mark in the center of the back of the supply valve, insert a sharp-pointed hook in the mark and rub the valve over a fine file until it shows a full bearing surface; then rub the valve over the seat in the same manner and scrape off the high spots until a perfect bearing is obtained. By this time the valve and seat will be highly polished and have a "hard" finish; the hook keeps the side valve from tilting on the seat. Almost every repair man uses a different method, and it is seldom that two valves will be trued up in the same identical manner; the method depends upon the condition of the valve and seat after filing, and with a little practice you can almost file them to an air tight bearing. Whether the valve should be rubbed on the seat with oil or dry is a matter of choice, and the valve can be ground or scraped; scraping is more accurate and quicker, but grinding material can be used advantageously at the same time; for instance, should the valve bear a trifle hard on one side, the use of the scraper might remove too much metal and transfer the bearing to the other side, while the least bit of grinding material on the high side would bring an even bearing all around. Touching the dry face of the supply valve in flour of emery and rubbing it over the seat will show the parts of the surface in contact. The entire operation requires but a few minutes' time; therefore, the use of the surface strip or face plate is a waste of time and energy.

PRESSURE IN FEED VALVE PIPE.

97. K. N., Wheeling, W. Va., asks: Referring to the H 6 brake valve, if the brake pipe pressure is 70 lbs., what is the pressure in the feed valve pipe when the brake valve handle is in release position? What is the pressure in the feed valve pipe when the valve handle is on lap position? —A.: When the handle is in release position the pressure in the feed valve pipe will be 70 lbs., provided that there is no leakage past the supply valve or the regulating valve of the feed valve in excess of the volume of air escaping from the warning port. On lap position the feed valve pipe, if free from leakage, will contain main reservoir pressure because of a connection through port j in the brake valve rotary; however, this supply is not in any considerable volume, and if the handle is crowded back pretty well against the shoulder between lap and holding positions, or if there is considerable lost motion between the valve handle and rotary key, or between the key and the rotary valve, or if the handle latch and notch are worn somewhat the flow into the feed valve pipe, from the main reservoir is likely to be cut off entirely.

CUTTING OUT BRAKE.

98. K. N., Wheeling, W. Va., asks: To support certain remarks made during a controversy, would you kindly state what you consider the proper method of cutting out the engine and tender brake on an engine equipped with the Westinghouse No. 6 E. T. brake?—A.: Close the stop cock in the distributing valve supply pipe if the plain cylinder cap is used, but if the distributing valve has a quick action cylinder cap, close the stop cocks in the brake cylinder pipes also.

A Good Locomotive Engineer.

Gilbert Newbold is road foreman of engines on a trunk line, and has many locomotive engineers under his supervision. He has made a special study of the characteristics necessary to make a good locomotive engineer and has sent us the following notes:

In hiring firemen who will make your locomotive engineers, know that they are strong, healthy young men, not liable to plead sick in bad weather or when business is rushing.

He ought to have a good common school education and be able to read and write readily, with sufficient acquaintance with handwriting to read orders quickly without making mistakes.

Natural quick perception is necessary to enable him to understand the mechanism of the engine, and to decide on the best way to work the engine to produce the best results with the least possible expense for fuel, oil and repairs.

A good engineer is courageous without being reckless. Courage is needed to face dangerous situations without nervousness, to move him to do the right thing coolly when emergencies arise.

The faculty of concentrating the mind on the work is of the greatest importance to a locomotive engineer. The tendency to what is called, "mental wool gathering" has led many a locomotive engineer to grief.

Good eyesight is essential to enable an engineer to read signals and to detect any signs of danger.

Good judgment is a quality that contributes more than anything else to the making of a successful engineer. If it was possible to test a man for possession of good judgment, it would be the most valuable test he could be subjected to, but that is beyond the sphere of the examination class. Noting his performance on the engine is the only way to prove the judgment of an engineer.

A good engineer always co-operates with the fireman, feeds the boiler according to the demand for steam, but favors the fireman as much as possible during difficult parts of the trip. He knows exactly what to do when any emergency arises and does the right thing without fuss or excitement. That capability is brought about by the man keeping possibilities in mind so that he is never overtaken by the unexpected. We once knew an engineer who shut off, applied the brakes, reversed the engine and jumped off, all in five seconds, before he realized that he had mistaken the shot of a hunter for a detonating signal. That was a case of being too ready to deal with an emergency.

Air Brake Department

Conducted by G. W. Kiehm

Calculating Air Pressures.

(*Continued from page* 466.)

The capacity of the auxiliary reservoir is found in the same manner that the capacity of the brake cylinder is, squaring the diameter and multiplying by the decimal .7854 and multiplying the product by the length of the reservoir in inches.

This, of course, refers to outside measurements and an allowance must be made for the flange and the thickness of the metal.

The reservoirs used in freight service are somewhat irregular, but the capacity of one can be found by filling one with water and weighing it, and weighing it when empty and subtracting to find the difference in weight, which will be the weight of the water. At an ordinary temperature a pound of water will occupy about 27½ cu. ins. of space.

The simple methods of calculation given to determine the brake cylinder pressure resulting from light reductions, or from a reduction not heavy enough to result in an equalization of pressure, hold good whether the brake pipe pressure is 70, 90 or 110 lbs., as a reduction of 20 lbs. from a 110-lb. brake pipe pressure results in practically the same cylinder pressure as a 20-lb. reduction from a 70-lb. brake pipe pressure.

When the brake is used in quick action or emergency position, brake pipe pressure also enters the brake cylinder and a 60-lb. pressure is developed from a 70-lb. brake pipe pressure, and often a question arises as to what per cent. of the pressure in the brake cylinder entered from the brake pipe.

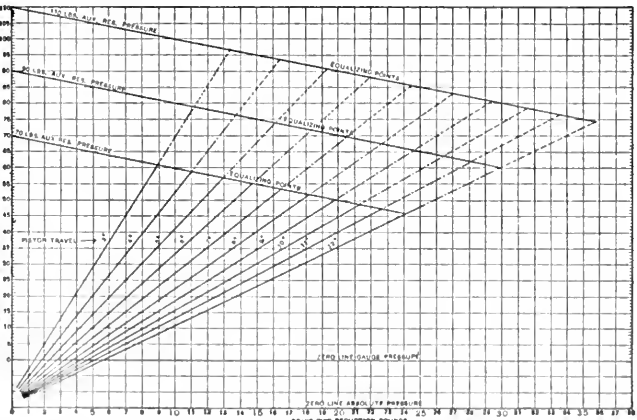
Using the same brake cylinder and auxiliary reservoir capacities we find that as both chambers have equalized at 60-lb pressure, the auxiliary reservoir has lost from 70 to 60 lbs., or 10 lbs. of its original pressure, or 10 lbs. from each inch of its capacity, and that the brake cylinder contains 728 cu. ins. × 75 = 54,600 cu.-in. lbs., the figure 75 being absolute pressure 60 + 15 atmospheric. Of the 54,600 cu.-in. lbs. 3,030 × 10 or 30,300 cu.-in. lbs. came from the auxiliary reservoir, 54,600 — 30,300 = 24,300 coming from the brake, pipe 24,300 ÷ 728 = 33 lbs. absolute or 33 — 15 = 18 lbs. gauge pressure, that entered from the brake pipe.

This calculation applied to an 8-in. freight equipment shows a somewhat different result, as the auxiliary reservoir contains but about 1,620 cu. ins. space, and the entire brake cylinder space at 8 ins. piston travel is 450 cu. ins.

In this case the amount of air that left the auxiliary reservoir is 1,620 × 10 = 16,200 cu.-in. lbs., 33,750 — 16,200 = 17,550 lbs. coming from the brake pipe.; 17,550 ÷ 450 = 39 lbs. absolute or 24 lbs. gauge pressure coming from the brake pipe into the brake cylinder during the quick action application.

The calculations are all upon the same principle and any difference in results is due to the relation the volumes bear to each other, the larger brake cylinder having a tendency to absorb more brake pipe air during emergency applications, and the greater its expansion is the lower the resultant pressure will be.

In connection with this subject we take pleasure in printing a diagram prepared by Mr. W. V. Turner. The diagram is self-explanatory to the advanced student, but for the benefit of the beginner in the study of air brakes it may be well to supplement the diagram with a brief explanation.



VARIATION IN BRAKE CYLINDER PRESSURE FOR VARIOUS REDUCTIONS.

This diagram or chart is intended to show the number of pounds brake cylinder pressure that will result from any service reduction of brake pipe pressure for different lengths of piston travel.

It shows the number of pounds brake cylinder pressure that will result from an equalization of pressures for the different lengths of piston travel from the three standard auxiliary reservoir pressures used in railroad service.

As indicated on the chart, the vertical lines show brake pipe reduction in pounds, the horizontal lines brake cylinder and auxiliary reservoir pressure in pounds, and it will be observed that those figures "run together" as those pressures do as a result of equalization.

Where the diagonal lines cross or where the auxiliary reservoir lines cross the piston travel lines are the point of equalization of auxiliary reservoir and the brake cylinder pressure. On a direct line to the left in the margin will be found the number of pounds pressure that will result, and on a direct line from this point to the bottom of the chart will be found the number of pounds brake pipe reduction necessary to accomplish the equalization. Thus by following the 70-lb. auxiliary line to the 3-in. piston travel line we find that an equalization of auxiliary and brake cylinder pressure results in 61 lbs. pressure, and by following the vertical line from this point to the bottom of the chart we find it has required but a 9-lb. brake pipe reduction to result in equalization.

To find the number of pounds pressure that result from equalization at proper piston travel we follow the 70-lb. line to the 8-in. piston travel line. The horizontal lines show that the point of equalization is at 52 lbs. and the vertical lines show that the brake pipe reduction required is 18 lbs. However, it will be noticed that the note reads:

"Results obtained in practice will be from 2 to 3 lbs. lower than indicated by the chart on account of leakage, etc."

To find the pressure resulting from equalization of auxiliary and brake cylinder pressures where the former is 110 lbs. and the latter 8 ins. we follow the 110-lb. line to the 8-in. line and find the result is 83 lbs. cylinder and auxiliary pressure and the reduction necessary to accomplish this 27 pounds.

Now, to find the brake cylinder pressure resulting from light reductions; as an example, to find the pressure in a cylinder with 8 ins. piston travel after a 10-lb. reduction in brake pipe pressure, following up the 10-lb. "brake reduction line" to where it crosses the 8-in. line shows the cylinder pressure to be about 22½ lbs. as indicated by "cylinder pressures" in the margin.

This we know is regardless of whether the original auxiliary pressure was 70, 90 or 110 lbs.

In order that the beginner will not be confused let us follow the 10-lb. reduction line to the point at which it crosses the 3-in. piston travel line. This is at about 70-lb. pressure line and may for a moment look inconsistent, but a second glance shows that a 9-lb. reduction results in equalization; therefore a 10-lb. reduction would be wasting 1 lb. of air, or rather after passing the point of equalization the brake pipe reduction lines are disregarded; therefore as we see by the chart that the 70-lb. auxiliary pressure equalizes with cylinder with 9 ins. piston travel at 50 lbs. and requires a 20-lb. reduction of brake pipe pressure to accomplish this, we do not look on this chart in an effort to find the result of a 22 or 25-lb. reduction on this brake.

The chart is by no means a novelty alone, but it contains some valuable information; as an example, in following the 5-lb. brake pipe reduction line and glancing first between the absolute and gauge pressure lines it will be seen that the 5-lb. brake pipe reduction develops less than gauge pressure in the cylinders having 11 and 12-piston travels, but results in a 29-lb. cylinder pressure if the piston travel is but 3 ins. and gives 15 lbs. cylinder pressure if the travel is 7 ins.

It may be well again to remind the beginner that these results obtained are practically the same whether the initial auxiliary reservoir pressure is 70, 90 or 110 lbs.

Blow At Distributing Valve Exhaust Port.

A leak of air issuing from the exhaust port of any of the valves of a brake equipment is usually referred to as a "blow," and by the expression it is meant that compressed air is leaking from the point mentioned in sufficient volume to attract attention at a time there should be no escape of air.

The blow of air coming from the exhaust port of a valve at a time the brake is not applying or releasing, is taken to mean that the part at fault contains a valve having an imperfect wearing surface, a defective gasket, a flaw or break in a casting, or possibly an improperly fitted bushing.

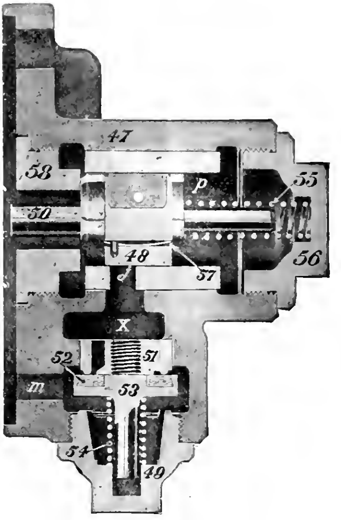
When a blow occurs at the exhaust port of the No. 6 distributing valve having the quick action cap, it may be coming from either the application or exhaust valve, from the cylinder cap gasket, from the slide valve in the quick action cap, from the distributing valve gasket or from a defective casting.

A defect in a casting is very unusual, and is generally found before the valve gets into service, and a leak into the brake cylinder port through a defective distributing valve gasket will nearly always show a leak to the atmosphere also, and when the leak to the atmosphere is tightened the leak into the cylinder port will also cease, except in the event of the gasket being broken between the brake pipe and brake cylinder ports, which is so unusual that it can be disregarded for practical purposes. The ordinary causes of the blow at the exhaust port are, a leaky application valve, a leaky exhaust valve, a leaky emergency valve or a leaky cylinder cap gasket, and in order to determine where the leak is from a test should be made before the valve is removed or taken apart.

If the application valve is leaking it would show at the distributing valve exhaust port while the brake is not applied, that is while the application piston is in release position, then after the brake is applied the volume of leakage will continue to escape at the exhaust port, due to increasing brake cylinder pressure above application cylinder pressure unless brake cylinder leakage was equal to or in excess of the leakage past the application valve. If the exhaust valve is leaking there will be no blow at the exhaust port while the brake is not applied, but a blow would start immediately upon the application and continue until the pressure was released from the brake cylinders.

If the quick action slide valve or emergency valve or the cylinder cap gasket was leaking air into the brake cylinder port it would in either case be a brake pipe leak, and would show at the exhaust port, while the brake was released, and in the case of a leaky application valve, it would increase brake cylinder pressure above application cylinder pressure when the brake is applied and cause a blow at the exhaust port while brake pipe pressure remained at a higher figure than application cylinder and brake cylinder pressures, provided that brake cylinder leakage is not equal to or in excess of the volume of leakage through the defective part.

In dealing with the effect of a leak into the brake cylinders it will be noted that an increase of application cylinder pressure forces the application portion of the distributing valve into a position to admit air pressure to the brake cylinders, and during the operation a spring is compressed and as soon as the pressures are equal the spring forces the valve to lap position. At this time a fall in application cylinder pressure causes a blow or escape of air at the exhaust port, provided brake cylinder pressure does not escape elsewhere, and naturally an increase of brake cylinder pressure from



No. 6 DISTRIBUTING VALVE QUICK ACTION CYLINDER CAP.

some other source, application cylinder pressure remaining constant, would have the same effect of forcing the application piston, to which the exhaust valve is attached, toward release position until the exhaust port opens sufficiently to permit air pressure to escape from the brake cylinders as fast as it is leaking into them and, application cylinder pressure remaining constant, the leak at the exhaust port represents the volume of leakage into the brake cylinders in excess of that leaking from the cylinders to the atmosphere through other sources.

Referring to this blow of air means either a constant or intermittent escape of air while the brake is either applied or released, but a light blow occurring at the distributing valve exhaust port just before the brake applies and ceases immediately as the brake does apply and shows no leakage whatever at any other time indicates that application cylinder pressure is escaping past the packing leather and ring on the application piston.

This escape of application cylinder pressure is similar to the escape of brake cylinder pressure past a leaky packing leather that seases as soon as the leather has set out firmly against the wall of the cylinder, but the leaky leather and ring on the application piston results in an intermingling of application cylinder and brake cylinder pressures as the valves move to application position. This leak at the exhaust port usually shows when the independent valve is placed in slow application position and its effect on the automatic application is a lower brake cylinder pressure developed during service applications.

Another blow that occurs at the distributing valve exhaust port that is not due to any ordinary leakage is the effect of a stuck open emergency valve or a broken graduating spring. This blow, of course, comes after a quick action application of the brake, and a few seconds after the release of the head brakes on the train the blow issues or rather continues from the exhaust port in sufficient volume to reapply the brakes. The effect encountered is identical with the broken or stuck open emergency valve or the stuck emergency piston in a triple valve, and the two last mentioned leaks from the exhaust port should not be confused with the ordinary leakage caused by worn valves or defective gaskets. Assuming, then, that we have what is termed a blow at the exhaust port of the distributing valve, and wish to make a test to locate the source of it, it will first be observed as to whether the blow exists during the time the brake is applied or while it is released or whether it exists at all times.

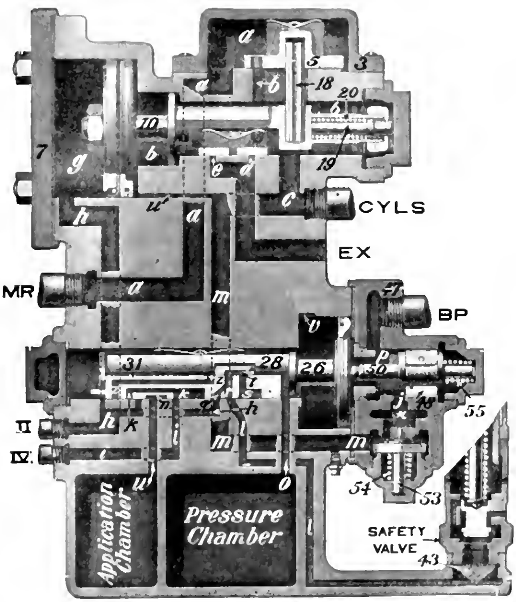
If the blow exists only while the brake is applied, it indicates that the exhaust valve is leaking. If there is a blow after the brake has released, it indicates a leak from the application valve or from the emergency valve or from the cylinder cap gasket.

To determine whether the leak is past the application valve from the main reservoir or from the brake pipe past the emergency valve or cylinder cap gasket, the stop cock in the distributing valve supply pipe should be closed, and if the leak stops after a few seconds' time has elapsed, it indicates that the application valve is at fault.

If the blow continues after the stop cock has been closed, it indicates that either the emergency valve or cylinder cap gasket are leaking, and in order to make any repairs the quick action cap must be removed in either case save in the event of a piece of dirt lodging on the valve seat, which could be loosened and blown off by tapping the cap lightly.

This test applies where one of the parts mentioned is at fault, but not exactly to a case where a combination of disorders exist.

In this test, to locate the source of a blow that exists while the distributing valve is in release position, it is evident that both the stop cock and the application valve may be leaking, and following the test given, would make it appear that the leak was from the brake pipe, and again the application valve might be worn in a manner that it would leak when on lap position and show no leakage when in release position, and if either defect were encountered it would naturally complicate matters somewhat; therefore, in order to be positive as to where the blow originates, more than one test should be made before any parts are removed. If there is a blow at the exhaust port only at a time the brake is applied, which would indicate a leaky exhaust valve, a leak should be started in the brake cylinder pipes before the distributing valve is removed for repairs, and in case the blow at the exhaust port ceases as soon as a cylinder leak occurs and begins again as soon as the leak is tightened, it shows that instead of a leaky exhaust valve the application valve is worn in the manner previously described, that is, leaking when on lap position and showing no leak when in release position, which would build brake cylinder pressure up higher than application cylinder pressure and force the piston and exhaust valve far enough toward release position to exhaust the amount of application valve leakage that is entering the brake cylinders.



NO. 6 DISTRIBUTING VALVE. EMERGENCY POSITION.

In the other test to distinguish the source of a leak at the exhaust port while the brake is released, if after closing the stop cock in the supply pipe, should the blow at the exhaust port continue, indicating that the blow was from the brake pipe, before removing any parts the distributing valve should again be cut in and all the brake pipe pressure withdrawn with the brake valve in service position, then the engine brake should be released with the independent brake valve and if the blow at the distributing valve exhaust port were to continue under those conditions, it could not be from the brake pipe pressure which has been withdrawn, but rather the entire action would be due to both a leaky application valve and a leaky stop cock in the distributing valve supply pipe.

To the student the foregoing might appear a trifle complicated, but it is merely a matter of observing the results of the tests as prescribed, and if a leaky exhaust valve is indicated, make a further test by creating brake cylinder leakage, and in the other test, if a leak from the brake pipe is indicated, test for a leaky application valve and leaky stop cock also, it being understood that the pressure is pumped up and pump working during all tests, and that the application cylinder and pipe connections are free from leakage so that application cylinder pressure will remain constant during the tests.

It might, of course, be possible to allow a blow at the exhaust port to go unnoticed until such time as both the exhaust and application valves started to leak; in fact, it might be neglected until the emergency valve should start to leaking with them, and at such a time a test would not be very misleading, as there would be no part of the distributing valve that did not require attention, but the test given will suffice for all practical purposes.

The blow at the exhaust port should be given attention as soon as it occurs, and the cause should be removed, so there will be no effect, for if a leak were to start from the brake pipe into the brake cylinders, and it were given no attention, the effect might under certain conditions become somewhat undesirable.

A leak through the quick-action parts would allow brake pipe pressure to escape at the exhaust port until the brake was applied; then if the reduction was continued until the point of equalization between brake pipe and brake cylinder pressures has been passed, the flow of air would be reversed, main reservoir pressure passing through the brake cylinders past a defective gasket, or past a defective cylinder check valve if the equalizing valve was at full stroke, would enter the brake pipe.

Leakage past the check valve under ordinary conditions can get no further than the seat of the emergency valve until brake pipe pressure has been reduced to a figure lower than pressure chamber air, plus the tension of the graduating spring and the friction of the slide valves, at which time the quick-action port would be opened and the leakage would enter the brake pipe.

The leakage through the cylinder cap gasket, however, would permit a constantly maintained brake cylinder pressure to enter the brake pipe as soon as brake pipe presssure fell lower than brake cylinder pressure.

With a neatly fitted brake valve packing ring, this leak into the brake pipe would unseat the equalizing discharge valve and cause a blow at the brake pipe exhaust port, and if the ring leaked slightly so that the equalizing reservoir could be charged as fast as the brake pipe was being supplied, there would be no blow at the brake valve exhaust, but instead an increase of brake pipe pressure, that might release some of the brakes in the train, and whether this would do so would depend upon the engine brake cylinder pressure developed, the volume of leakage into the brake pipe, the volume of leakage from the brake pipe, the volume contained in the brake pipe, the amount of brake pipe reduction, the length of time the brakes are applied, and the condition of the car brakes themselves.

For instance, if a locomotive brake cylinder pressure of 68 or 75 lbs. was being maintained after an emergency application that had developed but 58 or 60 lbs. car brake cylinder pressure, the leak from the brake cylinders would immediately start building up brake pipe pressure, releasing brakes at a time they were most needed, provided the equalizing piston packing ring in the brake valve was not a perfectly airtight fit, as mentioned before.

If a locomotive brake cylinder pressure of 50 lbs. was developed during a full service reduction and brake pipe pressure should be drawn down to, say, 45 lbs., during this time, there is no doubt but that, owing to car brake cylinder leakage, many of the auxiliary reservoirs would contain but about 45 lbs. shortly after the reduction, or be equal with brake pipe pressure, and a leak from the locomotive brake cylinder pressure of 50 lbs. into the brake pipe would immediately build up brake pipe pressure, releasing the brakes on which auxiliary reservoir pressure had reduced, but, as in the former case, it is assumed that brake pipe pressure is increased instead of the brake valve equalizing piston being unseated, and it is needless to say that if brake pipe leakage was equal to or in excess of the amount of leakage into the brake pipe. the pressure could not be increased, regardless of any other conditions.

While calling attention to this effect, it may be well to repeat that if the cause is first removed there can be no effect; therefore the importance of paying attention to the small matters in due season.

In this particular instance it will be noted that the leak into the brake cylinders will escape at the distributing valve exhaust port when from the brake pipe, but when the check valve leaks into the brake pipe it cannot be detected by the action of the brake until after the effect; therefore it is evident that a test for a leaky check valve should be conducted occasionally, and one that will answer for the purpose is, with the pressure pumped up and all other parts of the equipment in good condition withdraw brake pipe pressure with the automatic brake valve in service position; if all the pressure cannot be withdrawn, the handle should be placed on lap position and an angle cock opened, and the brake valve, being known to be free from leakage, the amount of air escaping from the hose attached to the open angle cock represents back leakage from the check valve.

Should there be no leakage from the open hose coupling, or if the brake pipe pressure can be entirely withdrawn with the brake valve, the check valve can be considered tight.

If while reducing brake pipe pressure from 50 lbs. to zero it is observed that brake cylinder pressure is falling, which would be shown by the cylinder gauge, it would indicate that pressure chamber and consequently application cylinder air is leaking past the equalizing valve packing ring and cylinder cap gasket into the brake pipe, it being understood that the application cylinder cover gasket and application cylinder pipes are tight.

Shown Up by the Test Rack.

An occurrence that will emphasize the necessity of using the triple valve test rack has recently come to our notice. A triple valve has been removed from a freight car in order to be cleaned and tested, as a year had elapsed since the triple valve had been cleaned, and when being tested it was found that the valve would not pass the service port capacity test. In an effort to open the service port the slide valve bushing was forced out of the body, and it was found that there was no service port in the casting. In fact, there never had been one in that body. Dates stamped on the flange of the body showed it to have been in service in the year of 1907.

No doubt this triple valve frequently worked in the service applications with other triple valves under favorable conditions by expanding auxiliary reservoir pressure through the emergency port and past the loosely fitted emergency piston, but it is safe to say that it did not do this under all conditions, and there is no doubt that this valve was responsible for many a case of "dynamiting" or train parting.

There are many defects of triple valves that cannot be detected unless by the use of the test rack, and this instance should not fail to convince the most skeptical repairman of the old school of the absolute necessity for the use of triple valve test racks.

Impossibilities that George Westinghouse Has Overcome.

George Westinghouse is the greatest inventor of this age. He is always inventing something that would make any other man famous, but he keeps on in a modest way without boasting of what was coming, and everything he produces is a success. Commenting on some Westinghouse inventions, the New York *Tribune* says:

"George Westinghouse has been overcoming obstacles all his life. During the last three years there have been more obstacles than usual. But, as Andrew Carnegie is reported to have said: "George Westinghouse is a genius; you can't keep him down."

"Forty-two years ago they said it was 'impossible' to stop a railroad train with air. But he did it.

"Force natural gas through hundreds of miles of pipe, regulate its flow, safely supply the homes and aid the industries of Pittsburgh, with cheap and invisible fuel? 'Impossible!' But he did it.

"Build great gas engines that would work as smoothly as watches and could be connected direct to the dynamo shafts? 'Impossible!' But he did it.

"Use the alternating current for transmitting electricity over long distances, supplying light and power to homes, halls, stores, factories, railroad trains? 'Impossible!' But he did it.

"Build dynamos that would harness Niagara? 'Impossible!' But he did it. And several other 'impossible' things. Probably that is why he never seems to be disturbed when anybody tells him that this or that is 'impossible' to accomplish by engineering.

"There at the works the men know that he can do what he starts out to do. Even years ago they had this saying: 'When the boss is on the job all we have to do is to hand him the tools.'"

Electrical Department

Operating a Long Island Railroad Motor Train.

By W. B. Kouwenhoven.

On the Long Island Railroad, as well as on all other railroads, there are certain places where slow speed is necessary. This is especially true in leaving terminals and in passing over switches. When slow speed is required on a Long Island Railroad motor train the engineer may retain the controller handle in the switching position. However, it should not be permitted to remain in this position any longer than is absolutely necessary, because of the amount of electric power lost in the resistance grids, all of which are in circuit at this notch. There is also present the danger that one or more of the grids will become overheated and burn out.

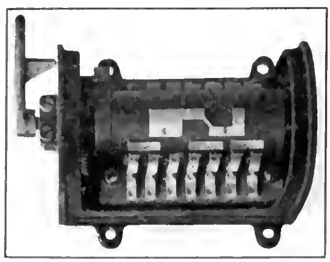
LONG ISLAND MOTOR TRAIN.

The rate of acceleration of a Long Island motor train is determined by the limit switch, as explained in last month's issue of Railway and Locomotive Engineering. But if the motorman desires to, he can retard the rate of acceleration, and use a rate that is much slower than that provided by the limit switch. Under no conditions, however, can the motorman increase the rate of acceleration to one higher than that permitted by the switch. To produce a slow rate of acceleration the motorman first advances the controller handle to the switching position and retains it there until the train is moving steadily ahead. Then he advances it to the half speed position, and instead of retaining it there, as in normal operation, he holds it there only long enough to allow the next unit switch to close. When this has happened he immediately returns it to the off switching position. The unit switches that are closed remain closed, and no more can close until the handle is again advanced to the half speed position. The motorman by repeating this performance can notch the control up one unit switch at a time until the half-speed position is reached, if necessary. The increase in speed which immediately follows the closing of each switch tells the motorman that the switch has closed and that he must at once return the controller handle to the switching position if he wishes to continue the slow rate of acceleration.

The train can be run backward simply by moving the controller handle to the left of the central or brake position, but the motorman should never do this when the train is in motion except in cases of extreme danger, or when the brakes have failed. The best braking effort is obtained with the handle in the reverse switching position. If the motorman advances the controller handle further than this position the result is that there is usually a rush of current, sufficient to blow the fuses, cut off the electric power and bring the braking effort to an end. If, however, circumstances should ever arise where both the air brakes and the electric current in the third rail fail simultaneously, the train can be brought to an emergency stop by bucking the motors, as it is called.

To bring an electric motor train when in motion to a stop by bucking the motors all that is necessary is to throw the controller handle to the full multiple running position for travel in the opposite direction. This will cause the motors to act as generators and will produce a very powerful retarding action. This action depends upon the fact that, broadly speaking, any direct current generator can be changed into a direct current motor by simply supplying it with current at the proper voltage and, vice versa, any direct current motor if driven will act as a direct current generator. Now all railway motors are almost without exception of the direct current series motor type. [By the term series it is to be understood that the current which passes through the motor passes first through the armature and then through the field windings, or vice versa. In other words, the same current flows through both in turn.] In order to make a direct current series motor act as a generator two things are necessary: one, that it be turned by some outside force, and the other that its field connections be reversed. When the motors on a train are supplied with current from the third rail they turn and drive the train ahead, and a certain amount of energy is stored in the train, due to its weight and speed. When the current is cut off the train is still in motion, and part of the energy that is stored up in it now goes to turn the motors. Under ordinary conditions when the motorman has returned the controller handle to the off position the motors simply turn. The turning force is there, but their connections are not reversed; therefore, they turn idly around.

But when under abnormal conditions the motorman has thrown the controller handle to the full speed parallel-running position for motion in the opposite direction, not only is the driving force there, but the field connections are now reversed and both motors act as generators. The motors are in parallel, and each is generating power in the form of electric current. There is no place for the power of one motor to go except into the other motor. So each motor is generating power and driving it into its fellow, and as the connections are reversed the power generated tends to drive each motor in the opposite direction. The result is that both motors stop and stop rather suddenly. It can best be compared to two steers locking horns with each other, because for all practical purposes the two motors are simply locked together, one fighting against the other. Any electric car, whether trolley, elevated or subway, that has for its equipment two direct current series motors can be brought to a stop by this method when the brakes and the power fail. The motorman on the Long Island Railroad should remember that this method of bringing a train to a stop and that of reversing with the current on should never be used except in cases of emergency.



CONTROL CUT-OFF SWITCH.

The motorman should not use the overload reset switch unless one or more of the overload trips belonging to the switch groups on the train have opened, and then he should not use the switch repeatedly. If one of the trips on a car continually opens it is probably a sign that there is trouble in the motor to which the switch belongs. In this case the motorman should go to the car on which the trip is located and by lifting up the proper seat cushion gain access to the control cut-out switch. He should set the control cut-out switch first so as to cut out motor number one. If, however, the overload trip still continues to operate, he should cut motor number one back into circuit and cut out motor number two. If the trip still continues to open he must throw the cut-out switch to the "both motors out position." With a motor on any car in the train out of service the motorman must never advance the master controller handle beyond the half-speed position.

If after the motorman has completed his inspection of the train and received the conductor's signal to go ahead, or if when leaving a station along the road the train fails to start when the motorman advances the controller handle to the switching or one of the running positions, the failure to start may be traced to one or more of the following causes: The first thing that the motorman must find out is if there is power in the third rail. This test is made by closing one of the switches on the switchboard which controls the lights in the car; if these light it indicates that the electric power is on. Another way is to observe any train that may be within sight and ascertain, if possible, whether they are moved by power or not. If there is no current in the third rail the motorman must return the controller handle to the off position and wait until the lights light, indicating that the power is on again, before trying to proceed. If other trains in the vicinity have power, and there is no power on the train in question, then the motorman should inspect the main fuses and the shoe fuses and replace any that may have blown.

If there is no current in the operating car it may be caused by either a blown main fuse or a blown line relay fuse. If the other cars in the train have current, and the train is standing so that the third rail shoes of the operating car are not touching the rail, and there is no current in the operating car, the trouble may be traced to a blown bus line fuse or a defective jumper between the first and second cars of the train. The motorman should first look at the fuses and if they are all right he should see if pushing the jumper connection any further into its sockets will do any good, because the jumper may have worked loose. If pushing will not help, then he should replace the jumper with a jumper from between two other cars on the train. It is preferable to use the jumper connecting the last two cars for this purpose. The defective jumper should be replaced at the earliest opportunity. If both the jumper and the fuse are all right and still there is no current in the operating car, the motorman must investigate the main fuse and the line relay fuse. To find out if either one of these have blown, the motorman must call the conductor to his assistance, and ask him to watch the line relay on the switchboard while he (the motorman) moves the controller handle back and forth between the switching position and the off position; meanwhile the conductor watches the relay to see if it raises its armature or not. Failure of the relay to act indicates that either the relay fuse or the main fuse has blown and the motorman must replace the blown fuse before the power can enter the control equipment on the operating car.

If the control of the first car operates while that of the others in the train do not, the trouble can usually be traced to the train line jumper connecting the first and second cars together. The motorman should bring the train to a stop and replace the jumper with a spare jumper or with a jumper taken from between the rear cars of the train. If the auxillary control on any car in the train fails to work, while the operation of the others is satisfactory, the trouble is very likely caused by low battery voltage, or else poor contact at the battery switches of the car in question. The first act of the motorman, after bringing the train to a stop, should be to reverse the battery switches—that is, to cut out the battery in use and cut in the other one. At the same time he should examine the parts of the switches to see if they are clean and make good contact, and if necessary he may spring the switch clips a little closer together with a pair of pliers in order to improve the contact.

If the train operates in a jerky fashion, and if the action of the auxiliary control does not always follow the position of the controller handle—that is, if there is no response of the auxiliary control when the motorman holds the controller handle at certain positions—the trouble is probably caused by poor contact inside the master controller drum itself. Before starting to investigate this trouble the motorman must open the line switch, cut-out switch and the brake cut-out switch located in his cab. The first opens all the line switches throughout the train, and the second cuts off the battery current and the dead man's handle feature of the control. After opening the two switches he must remove the controller handle from the controller and then the front of the master controller case. Now he has access to the drum and the fingers which press upon it. He must replace the handle in position and move it backward and forward, at the same time watching the fingers to see if they bear properly on the drum, and testing the contact pressure between the two by lifting the fingers. In this way a poor contact can be easily located and the motorman can increase the tension to the proper amount by tightening up the screws. When he has completed this adjustment he should replace the cover, close the switches again and proceed. If after removing the controller drum cover he cannot find the trouble, or if it proves too serious for him to attempt to fix, then he should operate the train from the master controller of one of the other cars.

If fire occurs in the motor equipment of any car in the train while in motion the motorman must be immediately signaled to bring the train to a stop and notified of the extent of the trouble. Upon ascertaining that fire has broken out in the equipment, the motorman must open the brake cut-out switch and bring the controller handle to the central or brake position. The opening of the brake cut-out switch cuts off the storage battery current throughout the train and this should at the same time open all the unit switches. If this fails to stop the electric spark or arc which is causing the fire, then the main switch of the car where the fire is must be opened. If this does not stop the arc, then the arc is caused by a short circuit in the wiring somewhere between the shoes and the switch, and the train crew must immediately pull the jumpers from both ends of the car and insert the wooden paddles that are to be found on each motor car platform between the shoes and the third rail. This cuts off the electric power completely, and the fire can then be easily extinguished by the use of the fire extinguisher provided for this purpose. After the fire is out the motorman must cut the car out of service by throwing the motor control cut-out switch of the car to the out position before proceeding, and if thought necessary the shoe fuses may be removed in order to prevent a recurrence of the short circuit. If fire or smoke is noticed issuing from any of the light or heater circuits on a car the train hand must immediately open the switches on the switchboard that control that circuit and cut off the current before turning the extinguisher on the fire. It must always be remembered that if water is thrown on a fire when the electric current is on that the water is very likely to form new short circuits between the wires that will only increase the fire, and instead of the water putting it out, only makes it worse. Throwing water on an electric circuit while the current is on and which is on fire is very similar to throwing water on blazing oil.

If a third-rail shoe strikes an obstruction or breaks in such a manner as to interfere with the further movement of the train, the motorman must either remove the broken shoe or tie it up before proceeding with the train.

Consolidation Type for the Western Maryland Railway

The Baldwin Locomotive Works have recently completed six heavy consolidation type locomotives for the Western Maryland Railway. This road is an important coal carrier, and it traverses a mountainous country where grades and curves are frequent. Heavy freight traffic is handled principally by consolidation locomotives, and the following table presents the leading dimensions of the new engines, compared with two previous examples of the same type, furnished by the same builders:

Date	Cylinders	Drivers	Steam Pressure	Grate Area	Heating Surface	Weight on Drivers	Total Weight	Tractive Force lbs.
1905......	22 ins. x 28 ins.	51 ins.	200	37.2	2,614	164,000	179,500	45,000
1907......	22 ins. x 30 ins.	57 ins.	200	52.5	3,013	182,000	200,000	43,300
1910......	24 ins. x 30 ins.	60 ins.	200	54	3,466	199,550	223,950	48,700

These figures illustrate the present tendency to increase the diameter of the driving wheels, and augment the steaming capacity in proportion to the theoretical tractive force. The design of 1905 develops a higher tractive force than that of 1907, and is but little inferior, in this respect, to the latest engines. The more recent locomotives, however, have a larger relative boiler capacity and higher ratio of adhesion than the first design, and should therefore be able to handle their tonnage at higher speed, and with more certainty under adverse rail and weather conditions.

The new engines have straight topped boilers, the diameter at the front being 82 ins. An interesting feature of this boiler is the dome, which is 29¼ ins. in diameter, and is formed of a single piece of flanged steel. This construction is entirely satisfactory for the shallow domes necessary on large, high pitched boilers. One of the new Western Maryland locomotives, the boiler center line is placed 9 ft. 9 ins. above the rail, and the clearance limits are such that but little room is allowed for the boiler mountings.

The front end is fitted, in accordance with the railway company's practice, with a high single nozzle and cinder pocket. The stack has an internal extension, and is 20 ins. in diameter at the choke. The grate has drop plates at the front and back, and the ash pan is self dumping, with double hoppers and sliding bottoms. The mud ring is supported in front, by a cast steel frame brace, and at the back by a vertical expansion plate.

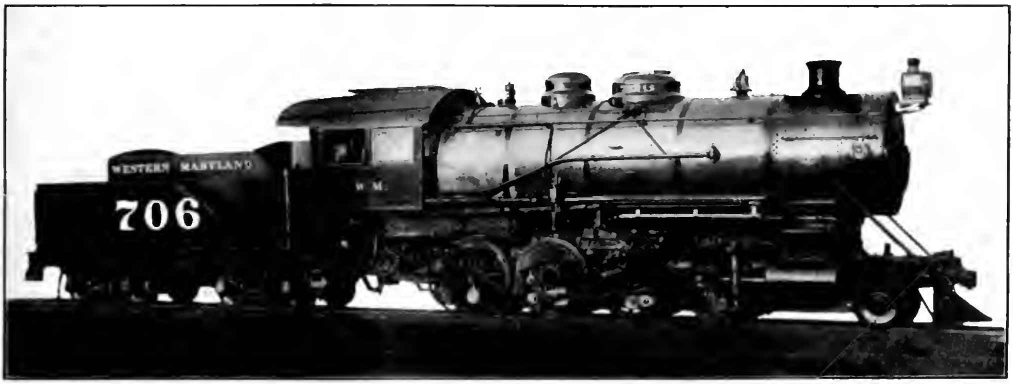
The steam distribution is controlled by balanced slide valves, driven by Walschaerts motion. The valves are set with a lead of 5/16 in., they have an outside lap of 7/8 in., and are line and line on their exhaust edges. There is ample room, in this engine, for a satisfactory arrangement of valve gear, with long eccentric and radius rods. The links are placed outside the second pair of drivers, and are supported on cast steel bearers. These carry the reverse shaft bearings also, and are bolted in front to the guide yoke, and at the back to a cast steel frame brace. The radius rods are suspended back of the links, and are down when in forward gear. The valves are driven from long crossheads, which are supported on brackets bolted to the upper guide bars. By means of offset lugs, these crossheads transfer the motion from the plane of the link to that of the valve center, without the use of rockers.

The guides are of the Laird type, and are of forged steel, as is also the guide yoke. The latter is made in one piece, and is secured to the engine frames by cast steel knees. Additional cast steel details include steam chest bodies, cylinder heads, driving wheel centers and driving boxes. The wheel centers have bronze hub liners. The tires are all flanged, except those on the main drivers. The engine truck wheels are of forged and rolled steel.

The main frames are of cast steel, 5 ins. wide, and they have double front rails of forged iron, 4½ ins. wide. The pedestal binders are lugged and bolted to the lower ends of the pedestals. The equalization system is broken between the second and third pairs of drivers. The frames are supported, at the rear, on inverted leaf springs, and these are suspended from yokes placed over the back driving boxes.

For an engine of this size, the cab is roomy, with two large windows on each side and fittings conveniently arranged. The injectors are placed crosswise on the back-head, while the checks are in the usual position near the front end of the barrel. Two air-pumps are provided, and are placed right and left ahead of the firebox. Air is stored in three main reservoirs, two being hung under the running boards, while the third is placed inside the frames and between the second and third driving wheels.

The tender frame is composed of 12 in. steel channels. The trucks are of the arch bar type, with cast steel bolsters and chilled cast iron wheels. The tank has a water bottom, and carries 7,000 gallons of water and 12 tons of coal.



CONSOLIDATION ENGINE FOR THE WESTERN MARYLAND.

C. M. Trisch, Superintendent of Motive Power and Car Department. Baldwin Locomotive Works, Builders.

Additional particulars are given in the accompanying table, and our illustration gives a good idea of the general appearance of the engines.

Cylinders, 24 x 30 ins.
Valve, balanced slide.
Boiler.—Type, straight; material, steel; diameter, 82 ins.; thickness of sheets 13/16 in.; working pressure, 200 lbs.; fuel, soft coal; staying, radial.
Firebox.—Material, steel; length, 111 ins.; width, 70 ins.; depth, front, 75¾ ins.; back, 66¼ ins.; thickness of sheets, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube, ½ in.
Water Space—Front, 4½ ins.; sides and back, 4 ins.
Tubes.—Material, steel; wire gauge, No. 11; number, 338; diameter, 2¼ ins.; length, 16 ft. 0 ins.
Heating Surface.—Firebox, 187 sq. ft.; tubes, 3,279 sq. ft.; total, 3,466 sq. ft; grate area, 54 sq. ft.
Driving Wheels.—Diameter, outside, 60 ins.
Engine Truck Wheels.—Diameter, front 33 ins.; journals, 6 x 10 ins.
Wheel Base.—Driving, 16 x 0 ins.; total engine, 25 x 0 ins.; total engine and tender, 58 x 11¼ ins.
Weight.—On driving wheels, 199,550 lbs.; on truck, front, 24,400 lbs.; total engine, 223,950 lbs.; total engine and tender, about 355,000 lbs.

Westinghouse Invention Will Dispense with Steel Springs.

Some time ago we mentioned that George Westinghouse had invented a system of air springs for automobiles which were likely to do away with the necessity of pneumatic tires. These springs have been in use on several automobiles for eight months and the experience gained seems to indicate that air springs may in course of time come to be used on all vehicles, including railway cars.

In describing his latest invention, as applied to one of his automobiles, to a correspondent of the New York *Tribune*, Mr. Westinghouse said: "You see this automobile is, with two exceptions, of the conventional style. The exceptions are, first, that it has no springs in the sense that the word 'springs' is usually understood, the springs having been removed and these four brass cylinders, two in front and two behind, having taken their places. The second exception is that the car has solid rubber tires instead of pneumatic tubes.

"Now, if you get closer you will see that what appears to you to be a single cylinder are really two cylinders, or concentric tubes, an upper one attached at the top to the chassis frame, and a lower one attached at the bottom to the axle. The inner cylinder or tube telescopes into the outer; the outer telescopes over the inner. These outer tubes are mud guards. Inside of each are three other tubes arranged for similar telescopic action, and with annular spaces between them. These spaces are connected by a series of openings, with a central chamber.

"Inside this central chamber is a standpipe. The annular spaces are always filled with oil. These chambers and spaces are charged with air and oil. The standpipe fixes the lowest permissible oil level. Rings at the ends of the telescoping tubes act as pistons and cause a portion of the oil to flow in and out of the central chamber through ports at the lower end. There is also a self-adjusting packing, which prevents the escape of oil. But this packing is not absolutely air-tight, because it must be properly lubricated. A minute quantity of oil is allowed to escape past the piston for purposes of lubrication, and it finds its way to the bottom of the annular chamber.

"In the bottom of the central chamber is the heart of the invention, a little pump which, while the car is running, takes the oil which has collected in the way I have just told you and restores it to the spaces and chambers where the main body of oil seals the air and prevents its escape.

"When the car is running the pistons are constantly working up and down in their respective annular chambers, keeping the oil in circulation. Besides this, the air pressure is always maintained because the packing is thoroughly sealed with oil.

"Now, what we have here is a spring suspension that can be accurately adjusted to suit the load. Mind you, this is a shockless spring, not an auxiliary to an ordinary steel spring. You see, if we partly fill the cylinders with oil the volume of air is, of course, reduced. For every inch of telescopic action the air is compressed by a greater percentage of its original volume; consequently the resistance increases more rapidly than would be the case were the oil absent. With a given initial pressure of air the spring will support a corresponding load before it begins to compress. The air pressure, you see, determines the initial tension on the spring."

"Is the application of the air spring to be limited to automobiles?"

"No, indeed. It can be made of any desired size and power. The discovery, if you choose to call it so, is fundamental in its nature and application. I believe the influence of the air spring on current practice, not only in the automobile industry, but in every branch of engineering, involving the use of powerful, reliable elastic springs, will be so far-reaching that the conception and working out of this vital detail will be ultimately regarded as one of the most important inventions with which my name is associated."

Accident Bulletin No. 36.

According to accident bulletin No. 36, issued by the Interstate Commerce Commission, it appears that the number of persons killed in train accidents during April, May and June of this year was 137, and 2,641 were injured. This is an increase of 38 killed and 525 injured. Accidents of other kinds increase the total number of casualties to 2,650. This figure is made up of 766 killed and 19,884 injured, being an increase of 178 in the number killed and 2,547 in the number injured.

The bulletin, which completes the publication of accident records for nine years, shows the casualties for the year to be 3,804 killed, and 82,374 injured. For the same period of a year ago there were 2,791 killed and 63,920 injured, which shows an increase of 1,013 killed, and 18,454 injured.

There were 5,861 collisions during the year ending June 30, 1910, causing the death of 433 persons and injuring 7,765 persons, with a damage to the property of the railroad companies of $4,629,279, being an increase of 1,450 in the number of collisions, with an increase of 91 in the number of persons killed and an increase of 2,370 in the number of persons injured. There were 5,910 derailments during the year ending June 30, 1910, an increase of 659, and there were 34 persons killed in derailments and 4,814 injured, an increase of 79 in the number killed and 676 in the number injured.

Encouraging Apprentices.

British educational authorities were extremely slow in recognizing the rights of the industrial classes in higher education, but a very great change has been made in the last decade, particularly in Scotland. It used to be that all education above the three R's was arranged for the exclusive benefit of what was called the learned professions. Nowadays college authorities are striving to give industrial apprenticeship the benefit of technical and scientific education.

A practice is growing up about Glasgow to give working apprentices the benefit of a college education. Nearly one hundred of the leading firms in and near Glasgow have expressed their willingness to allow to a selected number of their apprentices facilities for carrying out a scheme of college study conjoined with practical work. Many of these firms are willing to recognize, wholly or partially, the time spent in college as part of the apprenticeship period, but such recognition in each case is of course contingent upon satisfactory reports being received from the college.

The Cock Sure Scientist.

A veteran editor has remarked that a young scientific writer could always be detected by his repeated use of the positive adverbs, while the veteran, schooled by experience to acknowledge the universality of error, made frequent use of the modifying clause, and frequently introduced the element of uncertainty in his statements. The young scientific investigator frequently undertakes experiments with foregone conclusions concerning the results, and the work done is generally worthless.

Items of Personal Interest

Mr. Kenneth Seaver has been appointed chief engineer of the Harbison-Walker Refractories Company.

Mr. J. D. Muis has been appointed acting locomotive foreman on the Canadian Pacific at Red Deer, Alta, vice Mr. J. G. Norquay, on leave of absence.

Mr. G. E. Geer has been appointed trainmaster of the Western division of the Chicago Great Western, with headquarters at Clarion, Iowa.

Mr. B. M. Angwin has been appointed master car builder of the Birmingham Southern, with office at Pratt City, Ala., vice Mr. J. N. Collins, deceased.

Mr. S. T. Harris has been appointed foreman of car shops on the Birmingham Southern, with office at Pratt City, Ala., vice Mr. N. W. Howell, resigned.

Mr. G. M. Gray has been appointed superintendent of motive power of the Bessemer & Lake Erie Railroad, vice Mr. Gilbert assigned to other duties.

Mr. C. T. Ripley and Mr. B. Hoffman have been appointed assistant engineers of tests of the Atchison, Topeka & Santa Fe, both with offices at Topeka, Kans.

Mr. J. L. Butler, master mechanic on the White River division of the St. Louis, Iron Mountain & Southern at Cotter, Ark., has been transferred to Crane, Mo.

Mr. G. W. Cundiff has been appointed road foreman of engines on the Mobile & Ohio, with headquarters at Jackson, Tenn., vice Mr. F. E. Patton, promoted.

Mr G Motta has been appointed locomotive foreman at Moose Jaw, Sask., on the Canadian Pacific Railway, vice Mr. R. Ives, resigned on account of ill health.

Mr. J. Baumont has been appointed signal engineer of the Chicago Great Western at Chicago, vice Mr. W. H. Fenley, resigned to engage in other business.

Mr. J. W. Wyatt has been appointed road foreman of engines on the first district of the Cincinnati, New Orleans & Texas Pacific, with headquarters at Ludlow, Ky.

Mr C L Shattuck has been appointed general foreman of the Danville, Ky., shops of the Cincinnati, New Orleans & Texas Pacific, vice Mr H. B. Hayes, transferred.

Mr. R. G Smock, secretary of the St. Paul & Des Moines, will hereafter have charge of the purchase of all material and supplies for that road, vice Mr. W J Souder, resigned.

Mr E. J Murphy, heretofore assistant locomotive foreman at Toronto, Ont., on the Canadian Pacific Railway, has been appointed locomotive forman at that point, vice Mr. W. J. Brown, transferred.

Mr. F. E Patton, formerly road foreman of engines on the Mobile & Ohio, has been appointed master mechanic on the Southern Railroad in Mississippi, with headquarters at Columbus, Miss.

Mr. J. R. Magarvey, heretofore manager of the Brooks works of the American Locomotive Company, has been appointed manager of the Schenectady plant, vice Mr. W. L. Reid, promoted As a token of the esteem in which he is held by the members of the Masonic association at Dunkirk, he was presented with a handsomely engrossed book by the members, the presentation being made in the club house of the Masonic building.

Mr. D. S. Taylor, heretofore locomotive foreman at Havelock, Ont., has been appointed night locomotive foreman at London, Ont., on the Canadian Pacific Railway, vice Mr. C. Wheeler, transferred.

Mr. James Gibson, heretofore locomotive foreman at Belleville, Ont., has been appointed assistant master mechanic on the Grand Trunk Railway at Deering, Portland, Me., vice Mr. G. Vilet, promoted.

Mr. C. Wheeler, heretofore night locomotive foreman at London, Ont., on the Canadian Pacific Railway, has been appointed assistant locomotive foreman at Toronto, Ont., vice Mr. E. J. Murphy, promoted.

Mr. H. B Hayes, general foreman of the Danville, Ky., shops of the Cincinnati, New Orleans & Texas Pacific, has been transferred to the Chattanooga shops of the same company, vice Mr. J. Quigley, promoted.

Mr D. E. Sullivan, master mechanic of the Union Pacific at Evanston, Wyo., and Mr. P. A. Beck, supervisor of bridges and buildings, at Ogden, Utah, have had their offices removed to Green River, Wyo.

Mr. Edwin Schenck, Jr., assistant master mechanic of the Pennsylvania Railroad at Meadows, N. J., has been appointed assistant master mechanic at the Trenton shops, vice Mr. F. E. Marsh, promoted.

Mr. E. B. Gilbert, having resigned the office of superintendent of motive power of the Bessemer & Lake Erie Railroad, has been appointed special agent of the motive power department of the same road.

Mr Frederick A Delano, president of the Wabash Railroad Company, recently addressed the students and faculty of the college of engineering of the University of Illinois on the subject of "The Railway as a Profession."

Mr. W. L. Reid, manager of the Schenectady plant of the American Locomotive Company, has been appointed general works manager. His jurisdiction has been extended over all the plants operated by this company.

Mr. W. J. Brown, heretofore locomotive foreman at Toronto, Ont., on the Canadian Pacific Railway, has been appointed locomotive foreman at Havelock, Ont., vice Mr. D. S. Taylor, transferred to London, Ont.

Mr. C. J. Stewart, formerly master mechanic on the Central New England Railway, has accepted the position of master mechanic on the New York Central & Hudson River Railroad, with headquarters at Waterbury, Conn.

Mr. Joseph Quigley, formerly general foreman of the Chattanooga shops of the Cincinnati, New Orleans & Texas Pacific, has been appointed master mechanic of the same road at Birmingham, Ala., vice Mr. W. H. Dooley, promoted.

Mr. A. W. Wheatley, heretofore manager of the Montreal, Can., shops of the American Locomotive Company, has been transferred to Dunkirk, N. Y., as manager of the Brooks works, vice Mr. J. R. Margarvey, transferred.

Mr. J. B. Randall, who has been for many years a most successful locomotive engineer on the Louisville, Henderson & St. Louis Railroad, has been appointed assistant master mechanic on that road, with headquarters at Louisville, Ky.

Mr. Wm. Garstang, superintendent of motive power of the Cleveland, Cincinnati, Chicago & St. Louis, at Indianapolis, Ind., has been appointed also superintendent of motive power of the Cincinnati Northern, with office at Indianapolis, Ind.

Mr W. H. Wallace, traveling engineer on the Indianapolis division of Cincinnati, Hamilton & Dayton, has been appointed assistant trainmaster.

Mr. W. H. Dooley, master mechanic of the Alabama Great Southern at Birmingham, Ala., has been appointed superintendent of motive power of that road and of the Cincinnati, New Orleans & Texas Pacific, with office at Ludlow, Ky., vice Mr. J. P. McCuen, retired on account of ill health

Mr. G. Vilet, heretofore assistant master mechanic on the Grand Trunk Railway at Deering, Portland, Me., has been appointed master mechanic of the Western division of the same road, with headquarters at Battle Creek, Mich., vice Mr. W. Hamilton, resigned.

Mr. Oscar Townsend, assistant general freight agent of the Chicago Great Western, Pittsburgh, Pa., has been transferred to St. Paul and Minneapolis, Minn., succeeding Mr. G. F. Thomas, resigned to engage in other business. Mr. Townsend has offices at 368 Robert street, St. Paul, and room 217, Metropolitan Life Building, Minneapolis, Minn.

Mr. J. L. Brummel, formerly road foreman of engines on the Iowa Central, has been appointed road foreman of engines on the Minneapolis & St. Louis Railway, with headquarters at Minneapolis, Minn., with jurisdiction over trainmen, engineers and roundhouse foremen on an Eastern division.

Mr. Linvin L. Woods, master car builder of the Evansville & Terre Haute, the Evansville & Indianapolis, and the Evansville Belt Line, has been promoted to be superintendent of motive power, vice Mr. E. H. Bussing, who recently resigned to enter the service of the Buffalo & Susquehanna.

Mr. L. L. Wood, formerly general foreman of shops of the Evansville & Terre Haute and of the Evansville & Indianapolis, and since August, acting superintendent of motive power, has been appointed superintendent of motive power of these roads, with office at Evansville, Ind., vice Mr. G. H. Bussing resigned.

Mr. E. Stütz, formerly vice-president and general manager of the Goldschmidt Thermit Company of New York, has retired, and the affairs of the company will henceforth be conducted by Mr. William C. Cuntz as general manager and treasurer. Dr. F. H. Hirschland has been elected vice-president of the company.

Mr. J. H. Cummings, traveling freight agent on the Chicago Great Western, Lincoln, Neb., has had his office transferred to 1512 Farnam street, Omaha, Neb., and the office of Mr. George F. Daniels, commercial agent of the same road at St. Louis, Mo., has been moved from Room 243, Frisco Building, to Room 326, Pierce Building, St. Louis, Mo.

Mr. F. H. Clark, general superintendent of motive power of the Chicago, Burlington & Quincy Railroad, recently delivered an address before the students and faculty of the College of Engineering of the University of Illinois. His subject was "Problems of the Motive Power Department." Mr. Clark is a graduate of the University of Illinois, with the class of 1890.

Mr. Walter Brinton, Superintendent of the manganese steel department of the Taylor Iron & Steel company's plant at High Bridge, N. J., since 1895, has resigned, and has accepted a position as consulting engineer for the Edgar Allen American Manganese Steel Company, who are manufacturing manganese steel at Chicago Heights, Ill., and at New Castle, Del. Mr. Brinton's headquarters will be at the New Castle plant.

At a recent meeting of the directors of the Galena Signal Co., of Franklin, Pa., the resignation of Mr. J. C. Sibley as chairman of the board, was accepted, General Miller being elected to the vacancy, and Mr. Samuel A. Megeath, president, in place of General Miller. The office of first vice-president and general manager previously held by Mr. Megeath is now filled by Mr. L. J. Drake and Mr. C. C. Steinbrenner was elected second vice-president to succeed Mr. Drake.

Mr. Frank R. Goehler has been appointed railroad representative of the Falls Hollow Staybolt Co., with office at 1143 Marquette Building, Chicago, Ill. Mr. Goehler was formerly connected for some four years with the purchasing department of the A., T. & S. F. at Chicago, resigning to accept a position as factory business manager with the Buda Company, at their works at Harvey, Ill. He is a young man of wide business acquaintance, among whom he enjoys a most excellent reputation, which, with his genial disposition, should make him exceedingly popular and successful in his new line of work.

Mr. John I. Rogers has opened a New York office in the City Investing building at 165 Broadway, and now uses it as his main office. He is making a specialty of forging by the steam hammer, the drop hammer and the hydraulic press; of special rolling, such as railway tires and rolled wheels; of the use and manufacture of alloy steels, of machine shops and power plants and of general iron and steel works engineering. Mr. Rogers resigned from the Midvale Steel Company of Philadelphia about a year ago to take up professional practice, and since that time has been engaged in consultation work and design along the above lines.

Obituary.

George F. Hall, a locomotive engineer, for forty years in the service of the New York Central, and to whose credit some of the fastest runs with the Wolverine and Empire State expresses were recorded, died recently at his home in Rochester.

Wm. C. Ennis, recently died at his home in New York City. He was sixty-six years of age. In his youth he was apprenticed to the machinist trade in the old Danforth Locomotive Works, afterward working for various railways until the building of the New Jersey Midland, when he became its master mechanic, serving it and its successor, the Susquehanna, for twenty-five years, until the management of the latter road passed into the hands of the Erie. He was subsequently master mechanic of the Central New England and the Delaware & Hudson. He served the American Locomotive Company in various capacities almost from its organization; and up to the time of his last illness was active in the works of the New Jersey Board of Railroad Commissioners. He was a past master of Falls City Lodge, No. 82, F. and A. M., a member of the New York Railroad Club, and an honorary member of the American Railway Master Mechanics' Association. Besides his widow and an unmarried daughter, Mr. Ennis leaves five sons, all of whom, like himself, have adopted the profession of engineering.

Erie Experiments with New Car.

A test of the new Edison-Beach storage battery car, and the Klaxon warning signal as a substitute for compressed air signals on electric lines, took place Saturday afternoon, Nov. 19, in the presence of a party of Erie Railroad officials and others interested in the experiment. The trip was from the West Orange station of the Erie to Forest Hills, about four and one-half miles, the highest grade point being one and seven-tenth per cent. to the mile. The car ran with great smoothness, although the road bed was only in fair condition. The Klaxon horn, which is a mechanically actuated diaphragm run by a small electric motor, proved an ideal warning signal, and was considered as a marked improvement in warning signals by those on board the car.

The party included the president of the Erie, Mr. F. D. Underwood, First Vice-President Mr. John C. Stuart of the Erie; Mr. A. F. DuPont, Wilmington, Del.; former Congressman Charles E. Littlefield, New York; Mr. G. W. Govin, of H. B. Hollins & Co., New York; Mr. W. C. Brown, Washington, D. C.; Mr. Robert H. Davis, general manager of the Munsey publications; Dr. Angus Sinclair, editor of RAILWAY AND LOCOMOTIVE ENGINEERING; representatives of the Beach and Lovell-McConnell companies, the latter being the manufacturers of the Klaxon, and Mr. M. R. Hutchinson, the inventor of the Klaxon. No effort at speed was made, the purpose of the trip being the demonstration of the practicability of the equipment.

Telephone Train Dispatching.

Two more telephone circuits for train dispatching, Toronto to London, 115 miles, and an additional 114 miles, London to St. Thomas, Port Burwell and St. Marys, are to be installed on the Canadian Pacific. When this work is completed this road will have 2,130 miles operated entirely in this manner.

General Foremen's Department

Storm Door Annex on Wheels.

By Charles Markel.

The enclosed photograph, I believe, will interest readers of Railway and Locomotive Engineering, as the idea can be used to advantage at a number of shops where the conditions are the same as they are at the Clinton shops on the C. & N.-W., or any old time shop that will not allow the flues to be taken from the boiler on modern engines without large doors being open in front of engine in cold and stormy weather.

FIG. [illegible] STORM DOOR ON WHEELS WITH CAVITY FOR TUBES.

This idea originated with the foreman boilermaker, Mr. Fuller, and is as follows: Fig. 1 shows car built to fit in shop door frame when shop doors are open, and is of sufficient length to take the longest flues. This photograph shows car with set of flues ready to be placed in front of engine. Fig. 2 shows the large doors open and car of flues in place, allowing the men to work with comfort and plenty of room without shop becoming cold. Fig. 3 shows interior view of car in place, and Fig. 4 shows set of flues removed from car by teamster to be taken to rattler and there to be welded.

Since the photographs were taken we have put [illegible] large wind[ow] in top of car, which let[s] in plenty of light when car is in place. Before this car was built the large shop doors had to be wide open in all kinds of weather when flues were being removed or applied, and you can imagine the complaints of the shop employee in winter weather.

Kind Words Pay.

Some foremen and others in charge of men act on the belief that the best way to increase output of work is to keep their tongue lash constantly in use, which is a very great mistake of the kind that promotes eye service. Faultfinding ought to be indulged in as little as possible, while words of praise should not be stinted [illegible] when [illegible] deserved, will do more to [illegible] than all else.

[illegible] STORM DOOR [illegible] ROUND HOUSE.

Wide Fireboxes.

Mr. Kelley read the following paper at the last meeting of the General Foremen's Association. It was written by H. O. Olson, Foreman Machine Shop, D. & I. R. R R. Co., Two Harbors, Minn., at the last meeting of the General Foremen's Association:

In writing a paper on this subject, there are many things to be considered, such as saving of fuel, cost of repairs, the conditions under which the engines are to be worked and size of engine.

When comparing the two types of fireboxes it is of the utmost importance that the locomotives shall be used under the same conditions and be the same size; but as a general rule, the engines with the wide firebox are much heavier and are expected to handle a greater tonnage.

Long before locomotives had reached their present enormous size and power it was found that the old style of narrow firebox would not give sufficient grate area for what was supposed to be the economical combustion of fuel. The idea was formerly held that the higher rates of evaporation were obtained with slower rates of combustion and with larger ratios of heating surface compared to grate area. It was not considered economical to burn coal at a higher rate [of] combustion than 75 lbs. per hour per square foot of grate surface. That this [illegible] is no longer universal is shown from the fact that narrow fireboxes burning 180 lbs. of coal per square foot of grate area are considered economical by some. This is made possible on account of being able to maintain a deep fire in the deep narrow fireboxes, so that there is little chance for excess of air to get through the bed of fuel and decrease the efficiency of combustion. But there is no doubt in my mind that a wide firebox gives better results in fuel economy than the narrow on account of the greater grate area compared with the heating surface that can be had with the narrow, providing the wide firebox is deep enough so that a good body of fire can be maintained at all times. A wide firebox of the same depth in front as the toboggan firebox, or not less than 36 ins. under the flues is not an impossibility and would probably give better results from a firing standpoint and also cost less to keep in repair; but if the wide firebox is too shallow it may not be economical in fuel on account of holes being torn in the fire and too much cold air admitted, reducing the temperature of the gases and interfering with proper combustion. And in this case there is no question but that the cost of repairs is greater, caused by the thin fire allowing the cold air to come in contact with the flues and side sheets, causing leaks and cracks, due to the variation in expansion and contraction.

As a general rule, engines with wide fireboxes are much heavier and handle a larger tonnage, which apparently increases the cost of repairs. This should be considered in comparing the wide with the narrow fireboxes, and therefore the repairs and also the fuel should be figured on the tonnage basis.

On the Duluth & Iron Range road we have engines with the narrow and engines with the wide firebox, and the engines with the wide firebox have required more repairs than those with the narrow, although they have shown better fuel economy. This saving of fuel will more than pay for the extra expense of repairs, especially if the cost is figured on the ton-mile basis.

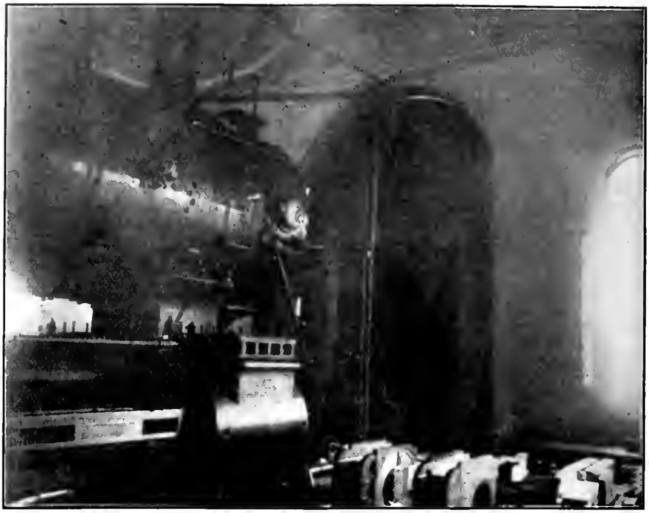


FIG. 3. INTERIOR VIEW SHOWING CAVITY IN DOOR FOR FLUES.

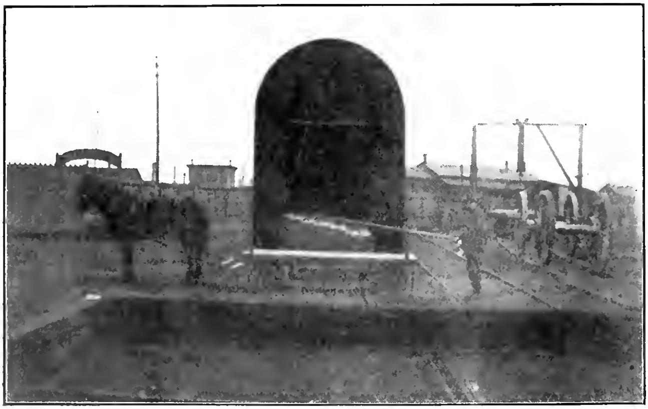


FIG. 4. STORM DOOR WITH OLD FLUES BEING REMOVED TO RATTLER.

Important Circulars.

Two very important circulars have been sent out recently by the committees of the Master Mechanics' Association. One of the subjects is the contour of tires of which Mr. W. C. A. Henry, superintendent of motive power on the Pennsylvania Lines at Columbus, Ohio, is chairman. Seven questions are asked and it is to be hoped prompt and comprehensive replies will be sent in. The object is to report on the advisability of adopting for engine trucks, driving and trailing wheels, the same contour of tires as was recently adopted by the M. C. B. Association.

The other subject is the best construction of locomotive frames. Mr. H. T. Bentley, assistant superintendent of motive power and machinery of the Chicago & North Western Railway at Chicago, Ill., is chairman. There are twenty-seven questions asked, and there are twelve illustrations of frame splices. Shop practice is asked for and also suggestions are in order. It is likely that the work of these two committees will elicit a great deal of valuable and usefull information on the subjects dealt with by them.

Duralumin.

An aluminum alloy has been produced containing over 90 per cent. of aluminum, which may prove a useful metal to employ in various railway appliances. It has a specific gravity of about 2.8 as compared with 8.9 in copper. The melting point is about 1202 degs. F., while copper melts at 1930 degs. F. This material, which has been given the name of "duralumin," can be rolled, forged, and drawn when hot or cold. For motor-car work, for flying machines, and for high-speed marine craft it is expected to be found very useful.

The Potter's Wheel.

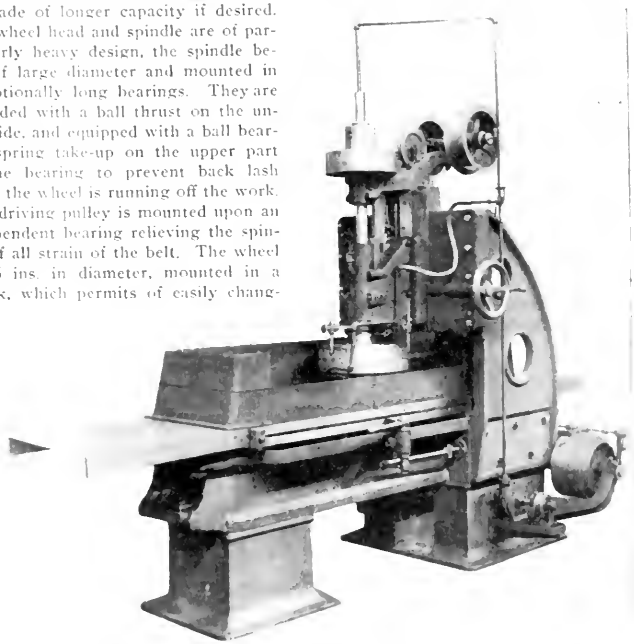
The potter's wheel was the forerunner of the hand lathe, and was one of the first revolving contrivances invented. The Egyptians classed it among the inventions of the gods, and claimed that Num the creator fashioned man upon it.

Vertical Grinding Planer.

This machine has recently been improved in design by the makers, and has been called by them the Springfield Brandes Vertical Grinding Planer. It has also been improved in its general construction, as well as in its details, being a very much heavier and more substantial tool than has ever been made by this company for this class of grinding, the weight of the machine being 8,000 lbs.

The machine shown in our illustration has a capacity to grind 12 ins. wide, 12 ins. high by 4 ft. long, and can be made of longer capacity if desired. The wheel head and spindle are of particularly heavy design, the spindle being of large diameter and mounted in exceptionally long bearings. They are provided with a ball thrust on the under side, and equipped with a ball bearing spring take-up on the upper part of the bearing to prevent back lash when the wheel is running off the work. The driving pulley is mounted upon an independent bearing relieving the spindle of all strain of the belt. The wheel is 16 ins. in diameter, mounted in a chuck, which permits of easily changing the wheels, and is also well protected by guards to insure against accidents in case of damage to the wheel. Further than this, this machine possesses all the advantages, so far as stiffness and rigidity are concerned, that are possessed in the modern planer, and, as may be seen in our illustration, the guard around the table is made in sections on the front side, so as to permit of being easily removed. The table drive of this machine is of the general planer construction, except that in this case the power is transmitted through a worm and worm-gear on the rear of the machine, direct to a large and substantial screw which runs in a long nut to insure long life and giving an absolutely smooth action to the table.

The machine is arranged with a hand feed for moving the wheel to the work, and it is equipped with a micrometer dial, back of the hand-wheel to facilitate the setting, getting sizes, etc. This tool, here illustrated, is arranged for hand feed only, but can be made with a power feed if desired. This vertical planer is equipped with a pump to supply lubricant to the wheel, which can be applied either through the spindle or from the outside, and when applied through the spindle, the water is forced against a deflector on the under side of the spindle, so as to force it to the periphery of the wheel, which is a very essential feature in grinding narrow or interrupted surfaces. The photograph of the machine shows two rear legs, but it is the maker's intention in the future to make this one solid leg.



SPRINGFIELD BRANDES VERTICAL GRINDING PLANER.

New One On Him.

A youth from Calhoun County, Ill., which has nothing but steamboat transportation, came over to Elsberry, Mo., the other day to catch a Burlington train to St. Louis. He had never seen a train, and when the Hannibal local came rolling in he stood there gaping, watched it hiss and steam, and finally pull out.

"I thought you were goin' to St. Louis on that train?" shouted the station agent, thrusting his head through the window.

"I was," answered the youth, "but they didn't put down no gangplank."—St. Louis *Post-Dispatch*.

Using Railway Motor Cars.

The McKeen Motor Car Company of Omaha have been giving good evidence that the style of car turned out by them is gaining in popularity. Mr. W. R. McKeen, Jr., the president and general manager of the company, recently informed us that a 70-ft. motor car for the Rock Island lines had not long ago been delivered, and was en route to Waurika, Okla. Two of these cars have recently been ordered by the Denver, Laramie & Northwestern, and the Woodstock & Sycamore Traction Co. ask for another gasoline car. When all are in service this will make the 93d McKeen car now in service in the United States and Mexico. An illustrated account of these useful boat-shaped motor cars appeared in Railway and Locomotive Engineering for October, 1910, page 436.

Universal Remedies.

People who have charge of boilers in districts where hard feed water causes trouble from scale, should they happen to be in Chicago, will be interested in making a visit to the chemical department of the Dearborn Drug & Chemical Works, located in the McCormick building. The gentlemen connected with these works have formed ideas concerning the proper method of treating impurities in feed water. The story is told of a visitor to one part of Scotland who, learning that the nearest doctor resided fifteen miles away, asked his host, "What do you do when a person gets sick and the doctor so far away?" "We give him a drink of whiskey." "And if a drink of whiskey does not help him?" "We give him another drink." "But if all the drinks you can give fail to help him?" "Then we decide he is not worth helping and let him die."

That universal remedy is of the character that has generally been used in treating bad feed water, and it is not surprising that railway companies have come to discredit treatment asserted to be effectual in neutralizing all kinds of impurities. The Dearborn Drug & Chemical Works treat each case of water impurity according to the scale forming or corrosive material present. The result is that they are meeting with great success, as leaky flues, cracked firebox sheets and general boiler repairs are materially reduced on the roads where their system is in operation. If care is taken in having boilers properly washed out in connection with the Dearborn Drug & Chemical Company's treatment, the railway people are safe to use any water found on their lines.

Manual of the Mallet.

The American Locomotive Company have just issued their bulletin No. 1006. It is the manual of the American Articulated Compound Locomotive. This publication is most valuable to all those who have to do with this class of locomotives, and it affords information for the student in locomotive engineering.

Following a general description and definition of what a Mallet articulated engine is and how it is constructed, the intercepting valve used on this form of compound is taken up and fully illustrated and described. The operation of this valve is given in detail, and is illustrated in a series of what have been called "ghost" pictures, which are most effective.

The power reversing gear made by this company is explained and illustrated, also the by-pass valves, the vacuum and relief valves, the flexible points and the adjustment of the alignment of the front engine frames. The subject of break-downs is briefly touched on, and a summary of rules for operating are on the concluding pages. Altogether, Bulletin 1006 is a very comprehensive and valuable treatise on the subject, and ought to be in the hands of those who have to take care or run the American Locomotive Company's Mallet compounds.

Worse Than Bigotry.

"What is the charge?" demanded the magistrate, as a verdant-looking culprit was brought in.

"Bigotry," your honor. "He married three wives."

"Officer," remarked the magistrate sternly, "what's the use of all this education, all these evening schools, all the technical classes an' what not? Please remember in any future like case, that a man who has married three wives has not committed bigotry, but trigonometry. Proceed."

Business Very Good.

The Barrett Machine Tool Company, of Meadville, Pa., have no complaint to make about business being dull. Their erecting shop floor is covered with boring mills of various sizes, the specialty for which this establishment is noted. Some of the horizontal cylinder boring mills ready for delivery display as fine mechanical construction work as we have ever examined. One huge machine, weighing 36 tons, has lately been made for the Fairbanks-Morse Company. It contains a variety of manipulation features that must materially increase the work-finishing capacity of the tool.

From what we have seen of college graduates in railway service, we think they give off little wave from the volume of sound, but we are far from endorsing the assertion of Superintendent of Public Works Schaeffer of Pennsylvania, who said that "education today consists of football, baseball, evening balls and highballs."

Welding Rails by Thermit.

The Goldschmidt Thermit Company has issued an elegant sixteen-page pamphlet describing and illustrating the welding of rails by the Thermit process. The progress made in the remarkable discovery of the fusing of aluminum and iron oxide is further enhanced by its adaptability to the characteristics of the metal upon which it is used. In the case of steel rails, it is now an easy matter to weld the rails together so that the metal at the joint will be of the same hardness as the metal of the rail, thus insuring an equality of wear. A marked advance has also been made in the rapidity with which the superfluous metal surrounding the weld may be removed. A blow pipe is used in roughly cutting off the metal, and a specially designed rail grinder speedily perfects the surface. It is interesting to note the degree of elegance in finish with which rails of different sizes may be welded together. Apply for copies of the pamphlet to the main office of the company at 90 West street, New York.

Asking a Great Favor.

It was after a railway supply men's banquet that some congenial spirits resolved to make a night of it and made good. About 3 a. m. four friends emerged on Seventy-third street from a taxicab and rang the bell of a brownstone front house. A window was raised and a lady demanded, "What do you want?"

"Are you Mrs. Brown?" was asked.

"Yes, I am Mrs. Brown; what can I do for you?"

"We would be ever so much obliged, Mrs. Brown, if you would come down and pick out Mr. Brown."

Twentieth Century Outfit.

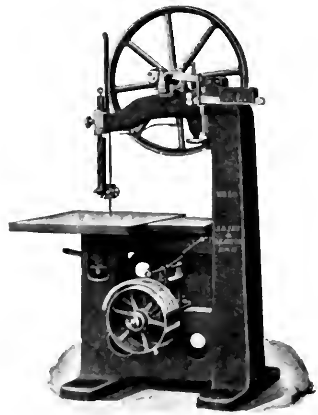
This is an equipment which is well worth finding out about. It is explained and illustrated in a folder recently got out by the Buker & Car Manufacturing Company of Rochester, N. Y. If you write the company they will be happy to send you the folder on the subject. In the first place, this machine will mount air brake, signal or steam hose. It cuts clamp bolts on old hose, and separates metal fixtures, both nipple and coupling. It performs four operations, and all the work is done on the same bedplate. In mounting new hose there is a close fitting clamp that supports the entire length of the hose, thus preventing buckling, or any injury, to the fiber of the hose—both coupling and nipple being forced to their places at the same time, and quicker than we can tell it.

This tool is, in fact, practically a requisite of the air brake department, and is almost as necessary as the engine that runs the shop. It saves time, labor and money. Write for the folder if you want to get an idea what the handy little tool is like.

Pattern Shop Band Saw.

The pattern shop tool shown in our illustration is made by J. A. Fay & Egan Company, of Cincinnati, Ohio. The fact that the manufacturers designed this No. 50 band saw for use in shops having a considerable amount of plain or intricate scroll sawing to do makes it especially adapted to the pattern shop, where this kind of work is turned out daily.

For pattern shop work the machine is arranged so that the table has a tilting device having micrometer adjustment, which enables the operator to quickly place the table at any angle up to 45 degs. to the right and 10 degs. to the left. This device is said to combine



BAND SAW FOR PATTERN SHOP.

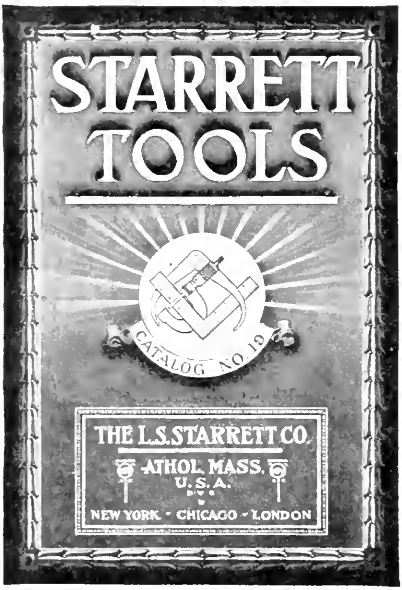
quick and accurate angling of the table, which will be found of great importance to the pattern maker.

The most important feature in the construction of this machine is the straining device, which is known as the Fay & Egan patent knife-edge balance. The upper wheel is hung solely on a knife-edge, and the tension on the blade is given by a compound lever arrangement. This is a perfect device for straining the blade. Its action under all conditions is instantaneous; it enables the machine to run at a high rate, with no danger of breaking the blade, no matter how fine it is.

Many other features which have contributed to the favor accorded to this machine by pattern shop men are fully described in a large illustrated circular issued by the company, for which you are invited to write.

Starrett Tools.

Catalogue No. 19 issued by the L. S. Starrett Company, of Athol, Mass., is just off the press. It is of convenient size and contains 274 pages, and within that compass there are 350 illustrations showing an almost bewildering variety of small tools. As the book contains 42 pages more than the previous catalogue it stands to reason that the number of tools made by this well-known concern has been considerably increased. Among the handy appliances for shop work which may be mentioned by way of showing the increase referred to there are shrink rules, key seat rules, metric; combination builders' tool, double square, vernier calipers, micrometers in several sizes, micrometer attachment, protractor, fillet or radius gage, metric; micrometer depth gage, metric; depth gages, hack saw frame,



screw slotting saws, scriber, new size B extension plyers, ratchet wrench, scraper. The catalogue also gives prices, and in ordering the simple catalogue number is all that is required. There is, however, a condensed description of each tool, so that the possession of this catalogue puts the reader in touch with the latest and most modern small tools for fitters, machinists and others. Write direct to the company if you would like to have a copy, as the distribution of the catalogue is gratis.

Extension Work at Purdue.

Last month a very interesting ceremony took place at Purdue University at Lafayette, Ind. It was the dedication of the new buildings for the department of practical mechanics. They provide facilities for instruction in mechanical drawing, descriptive geometry and shop work. Ground was broken July 22, 1909, and the completed structure turned over to the University June 15, 1910. The main building contains 25,000 sq. ft. of floor space. It can accommodate at one time 400 students in drawing, and has locker accommodations for 1200 students. The lecture room seats 300 and there are two class rooms, each having a capacity of 60 students. The shops cover 43,000 sq. ft. of ground and are capable of accommodating a group of 350 students at one time. The machines, tools, benches, lockers, in fact, all the details of the equipment, are modern, while many of the special features are unique. The buildings as a whole constitute what is probably the largest and most completely equipped plant for the instruction of students in shop practice and drawing in this country and represent the accumulated experience of twenty-five years at this university. Angus Sinclair received the honorary degree of Doctor of Engineering at this university some years ago.

His Distinguishing Mark.

One day a big city bank received the following message from one of its country correspondents: "Pay twenty-five dollars to John Smith, who will call to-day," says *Success*. The cashier's curiosity became suspicious when a cabman assisted into the bank a drunken "fare," who shouted that he was John Smith, and wanted some money. Two clerks pushed, pulled and piloted the boisterous individual into a private room away from the sight and hearing of the regular depositors. The cashier wired the country bank:

"Man claiming to be John Smith is here. Highly intoxicated. Shall we await identification?"

The answer read: "Identification complete. Pay the money."

Working Hot Metal.

The Ajax Manufacturing Company of Cleveland, Ohio, have recently issued a reference book and catalogue of the Ajax hot metal working machines. The book, which contains 96 pages, is profusely illustrated, and shows rivet and bolt headers, axle upsetting machines, bolt heading, upsetting and forging machines, bulldozers, standard and new high-speed hot sawing and burring machines, universal forging machines, hot pressed nut machines, taper forging rolls and reclaiming tools. With each of the illustrations is a short descriptive paragraph, and adjoining the view of each machine is a marvelous display of the work which each of the machines can do. The variety of product is seemingly without limit. These hot metal working machines are very substantially built, they are compact, and are designed to stand up to the heavy work which is expected of them. Write to the company for a copy of the catalogue and reference book if you are interested in knowing what can be done with this class of machinery.

Opening American Museum of Safety

The formal exercises in connection with the permanent exhibition of safety devices of the American Museum of Safety, were held last month at the Auditorium of the Engineering Societies' Building. Mr. Philip T. Dodge, presiding. The Museum of Safety is the fourteenth similar organization of which there are twelve in Europe, and one in Canada. The object of the Museum is the conservation of human life, by means of a permanent exhibit of the best, and most practicable safety devices for making safe the dangerous parts of machines and processes. It is a clearing house for the prevention of accidents, of which the Museum asserts 50 per cent. are unnecessary. In commendation of this new conservation movement, the President of the United States, sent this greeting:

"The White House,
"Washington, Nov. 9, 1910.

"My Dear Sir: I write to express my interest in the work which the American Museum of Safety proposes to do in fostering the development and adoption of appliances to conserve human life. The whole civilized world is stirred with anxiety and hope for the adoption of those safety devices which will prevent the loss of life and limb in industrial pursuits, and I do not know any method of bringing about the use of such safety devices more effectively than in exhibitions of them in many varieties in such a museum as yours.

"Very sincerely yours,
"(Signed) Wm. H. Taft."

New York Passenger Terminal, P. R. R.

The Westinghouse, Church, Kerr & Company of New York have issued a neat little book on the New York passenger terminal and improvements of the Pennsylvania and Long Island railroads. This book contains an account of the general scheme, but is more particularly concerned with the work performed by this company in the great terminal. The book is well illustrated, 62 pages, and not a single detail is omitted. The project of connecting New York with the New Jersey shore by a subaqueous tunnel was adopted in 1902, and now the finished work is before us. Write to the Westinghouse, Church, Kerr & Co. of New York if you would like to obtain a copy of the book they have issued on the subject.

Railway Business Association.

The Railway Business Association held their second annual meeting just before Thanksgiving Day. It was a most successful affair, about 800 railroad men, bankers, publicists, etc., were present. The following officers were elected for the ensuing year: President, Mr. George A. Post, of the Standard Coupler Co.; vice-presidents, Mr. H. H. Westinghouse, of the Westinghouse Air Brake Co.; Mr. O. H. Cutler, of the American Brake Shoe and Foundry Co.; Mr. W. H. Marshall, president of the American Locomotive Co.; Mr. E. S. S. Keith, of the Keith Car & Manufacturing Co.; Mr. A. H. Mulliken, of Pettibone, Mulliken & Co.; Mr. O. P. Letchworth, of the Pratt & Letchworth Co.; Mr. A. M. Kittredge, of the Barney & Smith Car Co.; treasurer, Mr. Charles A. Moore, of Manning, Maxwell & Moore.

New Steel Suburban Cars.

The first lot of all steel suburban coaches built for the Pennsylvania Railroad Company have just been received. These cars have been sent to New York, where they will be used in the suburban service out of the new Pennsylvania station. These suburban coaches are 54 ft. long, seating eighty-two people. By means of special designs which have been used the weight of the car has been materially lessened, as compared with the wooden coaches, the latter carrying 1,510 lbs. of dead weight for each passenger, while the new steel suburban coach carries only 1,078 lbs. of dead weight per passenger. The suburban coaches have vestibule ends and are made entirely fireproof. Heavy steel girders running from end to end are calculated to resist shock in collision. The cars are lighted by electricity, and are fitted with green plush cushion seats.

The Pennsylvania Railroad system will shortly have available for use on its lines east and west of Pittsburgh and Erie 1,988 solid steel passenger cars. This includes some 600 Pullman parlor and sleeping cars, as well as a large number of suburban coaches, such as the company's shops are just beginning to turn out.

Trust Busting.

"A Constant Reader" of Railway and Locomotive Engineering, one who claims to have been one of the first subscribers, has written to the editor complaining that we must be on the wrong side of the fence, for he had never seen in the paper a single article "calculated to vanquish the trusts that are fattening on the vitals of the American people." We admit that "trust-busting" has not been considered in our time, for so much of our time has been fully occupied cogitating on things of an engineering, mechanical and purely railway operating character, for the instruction or amusement of our readers, that we have left the abuse of accumulated capital to the literary and story-telling magazines. Many of these publications have great difficulty in finding subjects for sensational articles, and we dislike to embarrass them by taking away any part of their thunder.

As trust-busters have always devoted a large part of their abuse to railroad property, we feel that they have been making indiscriminate assaults on the interests from which most of our readers make their living. The lies and exaggerations of the trust-busters are making it hard for railroad companies to obtain sufficient income to pay their employes and to carry out needed improvements; a result that puts these would-be reformers among the worst enemies—enemies that are bringing disaster and depression upon all business enterprises.

Record of Recent Construction.

Record No. 67 has just been issued by the Baldwin Locomotive Company, and contains fourteen fine illustrations of locomotives for passenger service, with accompanying letterpress descriptions. The designs include several wheel arrangements, and cover a wide range in weight and capacity. The rapid introduction of superheating apparatus in locomotives is shown by the fact that seven of the fourteen locomotives shown are equipped with superheaters. It is another proof, if proof were necessary, that superheated steam increases the capacity of a locomotive. The fact that eleven of these representative types of locomotives are equipped with the Walschaerts valve gear also shows that this type of gearing is rapidly gaining favor. This feature is a marked one in the smaller as well as in the larger class of locomotives, the advantage in the latter type being generally conceded. In the matter of valves, nine are of the balanced piston type, while five are of the older type.

Fertile Facts.

We recently read some very severe strictures made by a college professor upon people who learned facts without acquiring knowledge of how to use them for practical purposes. We have the greatest respect for the processes that make knowledge power, but we consider it is carrying the utilitarian spirit too far to discourage people from learning facts entirely for the satisfaction that the possession of knowledge gives.

The tendency of the day is to specialize all lines of investigation, but we do not think there is any harm in people learning something of fields that cannot be thoroughly explored except by savants who devote most of their time to a particular region of research. Thus, the geologist digs into the realms of rocks; the biologist into conditions relating to the phenomena of life; the astronomer into stellar masses and motions; the mathematician into the relations of space and number; the chemist pursues his atoms and elements of nature with their combinations, while the physical investigator and engineer pursue facts in the fields of thermal, optical, electrical and other phenomena. That being the case, there is no reason why intelligent and ambitious persons should not acquire conservative knowledge of all the sciences that have been cultivated and developed by the human intellect.

The system of things which we call nature is too vast and varied to be studied first-hand by any single mind. As knowledge extends there is always a tendency to subdivide the field of investigation, its various parts being taken up by different individuals, and thus receiving a greater amount of attention than could possibly be bestowed on them if each investigator aimed at the mastery of the whole.

Peat Fuel.

There is on the surface of the earth a tremendous quantity of peat fuel which is largely used for domestic purposes in various districts, but has failed when tried for furnace use. Many attempts have been made to burn peat under boilers, to put it into a form resembling coal by mixing it with adhesive substances, pressing the mixture into briquettes. The difficulty with these briquettes has been that the peat having an affinity for moisture absorbed water until a large proportion of the heat in the fuel was wasted evaporating its water.

A German engineer named Franke has lately invented a method for preventing the peat from absorbing moisture which promises to render peat fuel a success. Having squeezed peat mixed with ten per cent. of coke into the form of briquettes in a hydraulic press they are dipped into a glazing waterproof compound that prevents them from absorbing water.

The inventor is at present engaged in setting up a large experimental plant for the production of "Franketts" in Berlin. The importance of this fuel, both for furnace work and for domestic fires, will be the more readily realized when one remembers that peat fuel is comparatively smokeless, and that what smoke it produces is free from injurious gases.

Value of Carefulness.

We have frequently heard the statement made that a first-class locomotive engineer is worth more than double the wages of an inferior and careless man handling an engine. Nearly every roundhouse foreman can testify to the correctness of the above allegation, but it is frequently troublesome to make out a bill of particulars. Knowledge of his business is essential in making a first-class engineer, but a spirit of carelessness or recklessness combined with laziness may render knowledge of little value. One of the worst accidents to an engine that the writer ever saw was due to an engineer thinking he might manage to run eight or ten miles with one side rod. He was perfectly familiar with the rule requiring the rods on both sides to be taken down when one side rod was disabled, but he was a natural chance taker, the result being that crank pins were torn off, one driving wheel fractured, and the cylinder smashed beyond repair. When remonstrated with about causing the damage, the engineer excused himself on the plea of bad luck.

In a series of dynamometer car tests made by one of our leading railways to ascertain the magnitude of shocks imparted to draft gear in the handling of heavy freight trains it was found that with a careful and skillful engineer the strongest tensile strains seldom exceeded 50,000 lbs., while the buffing shocks seldom exceeded 80,000 lbs. With a less skillful or more careless engineer the shocks were increased to about 70,000 and 150,000 lbs., respectively. The difference represents what might be material increase in the cost of repairs to draft gear.

Jack and Jacks.

The announcement is made that the Duff Manufacturing Company, of Pittsburgh, the well-known makers of jacks, great and small; track jacks, lowering jacks, differential screw jacks, oil-well jacks and other varieties of jacks, have added another jack to their list. They have secured control of the business of William Fongie, Washington, Pa., and will make the Fongie jack, the only one needed to make the Duff people's pyramid of jacks complete.

The Blacksmith at Work.

All observant railway men are familiar with the blacksmith at work, but few of them understand the meaning of the various taps of his hammer when assisted by a helper. With his left hand he moves and turns the hot iron, tapping all the time with the hammer held in his right hand, while the helper is striking heavy blows with a sledge. The character and position of the strokes imparted by the blacksmith's hammer mean as much to his assistant as the signal given by switchmen means to the engineer.

When the blacksmith gives the anvil quick, light blows, it is a signal for the helper to strike quicker. When the blacksmith, on the other hand, strikes slow, heavy blows, it indicates to his helper to use his sledge in a similar fashion.

The blacksmith's helper is supposed to strike the work in the middle of the width of the anvil. When this requires to be varied, the blacksmith indicates with his hammer where the sledge blows are to fall. If the sledge is required to have a lateral motion while descending, the blacksmith indicates the required action by blows with the hand hammer delivered in the proper direction.

When the blacksmith delivers a heavy blow upon the work and an intermediate light blow upon the anvil, it means that heavy sledge blows are required. If there are two helpers, the blacksmith strikes a blow between each helper's sledge hammer blow, the object being to denote where the sledge blows are to fall. An emphatic blow struck by the blacksmith on the anvil means stop.

Train Did Not Stop.

They were on their wedding tour and imagined that every civility given them related to their new condition of servitude.

Having stopped off at a way station, the bridegroom was approached by the station master, who asked: "Are you going to take the next train?"

"It's none of your business," retorted the bridegroom, indignantly, as he guided the bride up the platform, where they condoled with each other over the impertinence of some of the natives.

Onward came the train, its vapor curling from afar. It was the last to their destination that day—an express. Nearer and nearer it came at full speed, then in a moment it whizzed past and was gone.

"Why in thunder didn't that train stop?" yelled the bridegroom.

"Cos you said 'twarn't none of my bizness. I has to signal if that train's to stop."

Railway Business Association Second Annual Dinner.

Within the short two years of its existence the Railway Business Association has leaped into international importance and is exercising extraordinarily beneficent influence as a medium of conciliation between railway interests and public sentiment. To say that Mr. George A. Post is president of the association and exerts the strongest influence in its management is to assure our readers that success of the most pronounced character would attend all its operations.

The second annual dinner of the association was held in the Waldorf-Astoria Hotel, New York, on November 22, at which the most distinguished body of general business and railway men took part that has ever came together under one roof. They met under a banner inscribed: "From apprehension to security, via mediation, tact, reciprocity, co-operation, conservatism." An address was made by President Post, who acted as toastmaster in his usual masterly manner. Daniel Willard, president of the Baltimore & Ohio Railroad; Chairman Knapp, of the Interstate Commerce Commission; John Claflin, the famous wholesale merchant, and Thomas A. Daly delivered excellent addresses. The spirit of the speeches were the sentiments expressed in the mottoes on the banner.

President Willard's address was strongly inspired by sentiments of harmony between railroad companies and their patrons. He was not opposed to the policy of government supervision of railroads. On the contrary, he felt convinced that under all circumstances it is for the best interests of all the railroads as well as the public that there should be effective government regulation.

Arguing that if costs of railroad operation continue to go up, an increase of rates becomes imperative as the only means wherewith to meet the situation. Mr. Willard said that as such increase must have the approval of the commission it operated to place the credit of the railroads in the hands of the commission; for credit will depend upon net earnings, and net earnings will be dependent upon the rates received, which, in turn, rests with the commission.

Mr. Willard urged that the railroads should treat all alike while giving full and proper consideration to the rights of the security holders, to give fair consideration also to the rights and feelings of the shipper, and keep out of politics. He also suggested that they consider each new proposal for legislative restriction with studied freedom from any spirit of retaliation, holding their official representatives strictly accountable for adopting no new restriction which is not urgently needed

Chairman Knapp began: President and gentlemen of the association for the prevention of cruelty to railroads, and went on with an interesting address that lasted one hour and seven minutes.

"The freedom of a person to move about," he said, "is at the very root of the problem of individual liberty. The roads must be kept open on equal terms to all, and the street was the foundation of the State. Now, in the midst of rapid changes the railroad has taken the place of the street."

He said that if the country was to grow and prosper the necessity existed for returns on three things—on railway investments "of such amount and so well assured as to attract the necessary capital to improve existing roads and construct thousands of miles of new lines in fruitful districts now destitute of any means of transportation, the payment of liberal wages to an adequate number of competent men not only to insure increasing skill and reliability, but also because of the great influence of railway wages upon compensation of labor in private employment," and "the betterment of existing lines without unnecessary increase in capitalization."

Mr. John Claflin, President of the H. B. Claflin Company and of the United Dry Goods Companies, said:

"The railroads now have reached a point where it seems difficult for them to continue to increase their gross revenue materially without very great expenditures for betterments and for extensions. Under ordinary conditions the money to pay for such extensions and sale of bonds bearing a moderate rate of interest. At the present time, however, investors are asking larger returns on their capital than in the near past, and certain investors, especially those who handle only the choicest of American securities, are inclined to be indifferent to the offerings of American railroads, because they are doubtful, in view of the recent advances in wages, whether or not the railroads now have a safe margin of profit which will enable them to pay interest on all their fixed obligations and to continue reasonable disbursements to their shareholders."

Value of Enthusiasm.

Enthusiasm has always been the ruling passion of men and women who have attained greatness. No one has ever moved the heart of the world who has not been touched by this divine fire. It makes all the difference between a half heart and a whole heart, between signal defeat and splendid victory. The young man who hopes to succeed today must be smitten with this master passion or his life will be a comparative failure. The one-talented who has fallen in love with his work, who is enthusiastic over his vocation, will accomplish infinitely more in life than the ten-talented who has not been touched by this heavenly spark.

Did Not Have to Wait.

"If I am not home from the smoker by eleven o'clock," said Jim Blank, a well-known railway supply man, to his wife, "don't wait for me, dear."

"I shan't wait," she replied. "If you are not home by that hour I'll come for you." Jim was home in good time.