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INCLUDING THE
AMERICAN ENGINEER

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The Tool Foremen's Convention

The Railway Tool Foremen's Association is proving to be more of a success than was generally anticipated when it was first organized. It is doubtful if there is a single member who attended the last convention that went home without feeling amply repaid for the time and expense of the trip. The discussion on every paper was lively, ideas were freely exchanged, and close attention was given directly to the subject at hand. While the field of interest of the tool foremen is comparatively limited when viewed from the standpoint of some other railway officers, still subjects of considerable importance that are entirely within their province can be found in sufficient numbers to furnish subjects for discussion for this association for a long time to come.

As an evidence of the intention of this association to occupy an influential position in its field, the action in adopting a definite recommendation for the form of thread and the taper for the boiler studs is an example. After thoroughly discussing the subject at two different conventions, the members at the last meeting unanimously recommended the adoption of the U. S. standard thread, 12 threads per inch, for all studs and plugs in a boiler with the exception of the staybolts. It further recommended a standard taper of ¾ in. in 12 in. for all studs.

The other subjects on which papers were presented, together with an outline of the discussion will be found in the report of this convention elsewhere in this issue.

A Competition on Grinding

Grinding processes have grown more and more important in railway shops in recent years, and in order that our readers may be fully informed as to the best practices and latest developments we have decided to announce a competition on that subject to close October 1. Those wishing to compete have a wide range of subjects to select from. What developments have been made in your shop in improving the efficiency of the various grinding machines and what new classes of work are being finished by grinding which were finished otherwise a few years ago? Have you been able to get better results by adding to the number of ordinary grinding wheels, or rearranging them so that they are placed more conveniently for the workmen who have use for them? What classes of work are done on your gap grinders and how does it compare with machine work? Do you use a grinding machine for smoothing off car wheels and with what results? Is it a paying proposition? How about grinding the journals on car and locomotive axles? Is it productive of better results and longer life to the axle? What measures have you taken to safeguard the grinding wheels? Do you use the best type of grinding wheel for each of the different classes of work, and what tests or experiments have you made to determine the best wheel for each job? Are you doing any special work in the way of surface grinding? These are only a few suggestions as to possible subjects upon which articles might be written. You may know of others that are possibly of even greater interest. A prize of $35 will be given for the best article and such others as are accepted for publication will be paid for at our regular rates.

Traveling Safety Exhibit

As part of the campaign it is pursuing with splendid results, the safety department of the New York Central & Hudson River has prepared a safety exhibit car which is modeled somewhat on the plan of the air brake instruction cars and will be used in a similar manner. The exhibit car consists of a standard baggage car which has been furnished in white enamel on the inside and fitted with improved lighting facilities. Running along each side, about 3 ft. from the floor, is a mahogany shelf on which are mounted a large number of models. Above these are a double row of photographs. On one side of the car there are over 100 photographs which show unsafe practices which commonly cause accidents that result in the injury of employees, and alongside of each picture is another showing the safe practice which, if followed, would have prevented the accident. This collection of photographs is based on those causes which statistics, covering the past two years, show to have been the most prolific sources of accident. Other photographs show how trespassers are killed and injured and it is the intention, as the car is taken over the road, to call the attention of the various magistrates, who will be invited to visit it, to these photographs in particular. The models show the construction of safeguards to shop machinery, locomotives, turntables, transfer tables, stairways, etc.

Accompanying this car will be another special car arranged with seats and a platform for lectures. These two cars will be taken over the entire New York Central System, visiting first the more important division and terminal points and later going to the smaller places. Every employee will be required to visit this car and lectures will be given at regular intervals. It is thought that the plan of giving the lectures in these cars is preferable to presenting them in a hall hired for the purpose, as in this case the men will feel free to attend in their working clothes and without special preparation.

During the first four months of 1913 on the New York Central & Hudson River and the Lake Shore & Michigan Southern there were 35 fewer employees killed on duty than during the same period of 1912. When it is understood that the locomotive mileage increased 2 per cent. on the New York Central and 8 per cent. on the Lake Shore in this period, the work of the safety department can be well appreciated. There are at present over 60 division safety committees on the New York Central Lines, with a membership of about 900 men. Each member serves six months.

Railway Storekeepers' Association

In the June issue of the Mechanical Edition of the *Railway Age Gazette* appeared an editorial concerning the recent convention of the Railway Storekeepers' Association. *The Railway Storekeeper*, the official journal of that association, reprinted this in its July issue, with the following comment:

"The article will no doubt prove interesting reading to any member of the association, many of whom unconsciously divert their remarks when on the floor of the convention from the regular topic under discussion, which means a considerable loss of time and in many instances, men who should speak on the subject and would confine themselves to the matter immediately under discussion are deprived of sufficient privilege.

"It is difficult for the presiding officer of a convention consisting of several hundred representatives, to call a speaker to order, and every member should make it a special feature, when arising to discuss any topic, to confine himself to the subject under discussion. Many times we go from the subject because we are too much wrapped up in our individual organization. We should learn that at the annual conventions, we are discussing the subjects at large and not as any individual road or individual methods.

"Many of our speakers arise to discuss a paper and begin with the practices on their railroads. This is entirely irrelevant on the floor of a convention, because after the paper is distributed and discussed, any members desiring to obtain the methods as to individual lines has the privilege, but it should not involve the association as a whole on the convention floor. Matter during that period embraces the territory represented, which means the entire country and not any individual line or system.

"We, as storekeepers, should appreciate this editorial and criticism, which it is intended to be, and is absolutely for the good of the association. We can well afford to profit by it. It is a severe lesson, but, were the association not worthy of such notice, it is entirely possible the editor of the mechanical edition of the *Gazette* would not take the trouble to so criticize.

"Every member should procure a copy of the June issue of this paper, as well as the *Railway Age Gazette* [May 23, 1913], and notice the amount of comment that these two prominent railroad papers have devoted to the storekeepers' work, as a result of the matter discussed at the last meeting."

The Railway Storekeeper is right in its statement that we do consider the Storekeepers' Association an organization of importance to the railways of this country, and that it is our aim to further its best interests in any way we can, as we do any other similar association that is working toward the solution of the problems confronting the railways today. The storekeepers', however, is not the only association to which this criticism can be justly applied, and nearly all of the so-called minor mechanical associations offer opportunities for a large improvement in many directions, if they are to accomplish the results that should be fairly expected of them.

The General Foremen's Convention

It is seldom that an association has better and more timely papers on subjects of especial interest and importance than was the case at the convention of the General Foremen's Association held last month in Chicago. In view of this, it was a distinct disappointment that the members did not make more of their opportunity for a thorough discussion of these papers. This was particularly true in connection with the two most important subjects that were presented, *viz.*, Shop Schedules and Apprenticeship. There are probably no two features of a general nature that should be of more interest to a progressive general foreman than these, and it would have been reasonable to expect that extra sessions would be required to give time for their discussion. They, however, were allowed to pass with but little comment, especially the former. Although the excellent lantern slides which accompanied the paper on apprenticeship, were repeated, they appeared to arouse but little interest and did not even bring out any questions. This unsatisfactory result can not in any way be blamed on the presiding officers, who did everything in their power to enliven and broaden the discussions, but seemed to be the result of a desire on the part of the majority of the members to listen rather than to talk. The subjects of a less general nature and of decidedly less importance to the railroad company were not subject to the same criticism, and the discussions on driving box work and repairs to superheater locomotives were lively and prolonged. The same would probably also have been true on the subject of engine house efficiency if an opportunity had been given for its discussion. All this would indicate that the most successful conventions of this association will occur when subjects of a specific rather than a general nature are presented. It is probable that the program for next year will take cognizance of this fact.

* * * *

Although the discussion on the subject of Shop Schedules may have been disappointing, the paper by Henry Gardner of the New York Central & Hudson River was most satisfactory and forms a valuable addition to the proceedings of the association. Mr. Gardner points out that the scheduling and routing of work in a railroad repair shop is not by any means a new idea; and also that his system does not differ from previous ones in its general principles, but that it is distinctly different in its design and application. The transportation department of a railroad depends on the exact adherence of a train to its schedule and it is strange that with this perfection of system in one department of a railroad, another department has been allowed to use inexact and guess work methods. A railroad shop cannot be operated to realize the maximum efficiency without some form of clearly defined scheduling and routing plans. In devising his system, Mr. Gardner has carefully arranged so that it will not displace any portion of the arrangement of the existing organization in the shop, and, further, that it will be maintained by the regular shop force.

This system, in general, provides first for the routing, or the determination of the path over which the material will travel in its natural course through the shop, and then scheduling it or listing the order of dates for each stop and start of any part from the time it leaves the erecting shop until it is again returned for completing the engine. The problem of scheduling and routing finally resolves itself into the very simple result or object of providing a proper predetermined date or day of the month when each part or group of parts will arrive at and leave the various departments comprising the path over which it is to travel and finally arrive at the erecting shop when wanted. In the same manner the principal operations necessary to assemble the engine in the erecting shop are also subdivided and given dates in the proper order for their completion. Naturally a very careful investigation must be made to allow sufficient, but not excessive, time for the work on each part, but the records already maintained in most shops will allow this to be done with sufficient accuracy to introduce the system. One of the advantages of the whole plan is its flexibility and it is a simple matter to correct mistakes and continue to perfect the time allowances as experience is gained.

Mr. Gardner states that after a trial of 15 months in the West Albany shops of the New York Central & Hudson River this system has helped to bring about many beneficial results. The shops are now more equalized; departments under or over supplied with men have been reorganized so that they are in harmony with the entire plant. A better feeling prevails in all departments; men are not unexpectedly called on to work at night and the friction between departments is reduced to a minimum. The system is as successful under piece work as with day work. In fact, the piece workers are strongly in favor of it, as their work is laid out ahead and they know exactly what they have to do and what their compensation will be for several days ahead. The foremen praise the system since it relieves them of unexpected censure and when the blame is placed, it hits the right man and he always knows it is coming. The general foreman's duties are now much less complex. Under the older methods he might go from one department to another trying to fix the responsibility for delay and receive all sorts of explanations, but under the present system the daily delay sheet gives him the exact information as to just what is holding up the engine and which department is to blame. The foreman's duties now become not so much a matter of seeing personally that each man is provided with work and that no work is delayed, as that of passing on the quality of the work and giving instructions as to the best and quickest way of doing it. In answer to the usual argument raised against systems of this kind, that the cost of clerical or non-productive labor is much greater than the benefits derived and the money saved, it is pointed out by Mr. Gardner that one competent man with shop experience and an assistant for office work and checking is all the force required with this system to route and schedule successfully all the principal operations and material for repairing 90 engines a month. In a small shop it would not require the full time of the special man, as most of the forms could be made out by the foremen or subforemen.

* * * *

The reason for the general interest throughout the country in the proper training of apprentices was well explained by F. W. Thomas when he stated, in an individual paper, that the modern shop offers little advantage for a boy without someone to guide and direct him. A boy floundering around in a big modern shop for four years with no kindly hand to help or direct is what caused the failure of the old apprenticeship system. The apprentice in a great majority of cases, was a failure, and at the end of four years he knew next to nothing of the trade. The modern methods have changed all of this, and on the Santa Fe it is found that a boy, with the assistance of his shop instructor, will become productive even at the beginning of his course. Quoting Mr. Basford the speaker said that, "the present shop needs more instructors and fewer inspectors." In spite of these well known facts, there are comparatively few railroads seriously undertaking the comprehensive training of their apprentices. Properly trained apprentices is one of the most valuable assets a general foreman can have, and it is to be hoped that, even if they did not care to say anything on the subject, sufficient thought was given it to start a broader movement toward real apprenticeship.

In its report, the committee presented eleven more or less well known principles of successful apprenticeship, and in addition it strongly urged the necessity of having adequate instructors for the shop and not confusing this part of the boy's education with the schoolroom work. This is undoubtedly one of the most important features of the whole course. It must be remembered that you are teaching a boy a trade, not giving him a liberal education. Thorough shop instruction without any schoolroom work is preferable to schoolroom work without any shop instruction, and it is only by the proper balancing of the two that the best results can be obtained.

* * * *

One of the most comprehensive discussions of the enginehouse problem that has ever appeared, was the paper presented by Walter Smith which, unfortunately, was not opened for discussion. The paper discusses the organization, operation, equipment and facilities of enginehouses in a most thorough manner, and includes many excellent suggestions and ideas. It deals with so important a subject and is so carefully prepared that it has not been found possible to bring it down to a length which will permit it to be included in the space limits of this issue, and therefore it will appear in almost its complete form, in the September issue of this journal.

* * * *

There were very few new ideas brought out in the comparatively lengthy discussion on repairs to driving boxes. There are evidently a number of different ways of doing this work which give successful results and are satisfactory to their users. In view of the many evident advantages where a solid brass is used, it is rather surprising to find how few roads are using a crown brass and hubplate cast in place in the box, a practice which has had a thorough trial with splendid results on the Lake Shore & Michigan Southern. But one speaker—and he a representative of the Lake Shore—mentioned using this practice. The decided reduction in the amount of machine work and the opportunity to use a better material for the bearing metal would seem to strongly recommend this method and design to a general foreman.

Success is reported by the few roads that have had experience with driving boxes with removable brasses. There are now several designs of this type of driving box available and it is quite probable that the future will see many more of them put in service. The opportunity to reduce the delay in the enginehouse is a very appealing feature of this design.

* * * *

It is quite evident that the ingenuity of the foreman and workmen in the railway shop is fully capable of coping with any difficulties that may arise in connection with the maintenance of superheater locomotives. On the whole it is rather surprising that so few difficult problems have arisen in this connection and while trouble has been found with some of the features of design, comparatively little difficulty was reported in solving the problems of maintenance. It has been found advisable to use greater care in the machining and fitting of both the valve and piston packing rings and in insuring the accuracy of the circle on the inside of the cylinder and valve chamber bushings and the insurance of the freedom of the flow in the oil pipes and passages. Beyond this, however, comparatively little change has been necessary in the method of repairs to the machinery. In the boiler the proper method of safe ending and applying the large superheater tubes is now pretty well understood and the problems arising with the superheater itself have been comparatively minor, although the damper has given some trouble.

NEW BOOKS

Entropy-Temperature and Transmission Diagrams for Air. By C. R. Richards. Bulletin No. 63, Engineering Experiment Station, University of Illinois. Illustrated. Bound in paper, 6 in. x 9 in. Published by the University of Illinois, Urbana, Ill. Price, 25 cents.

This bulletin presents the theory and use of an entropy-temperature and an entropy-log temperature diagram, by the aid of which all problems pertaining to the expansion and compression of air may be solved graphically; and an air transmission diagram for determining graphically the size of pipe required to transmit a given quantity of air through a given distance with any assumed loss of pressure. It further discusses the conditions affecting the maximum power which may be transmitted through pipe lines carrying compressed air, and the general efficiencies of power and pressure transmission.

Calculus, An Elementary Treatise on. By W. S. Franklin, Barry MacNutt and Rollin L. Charles of Lehigh University. Bound in cloth. 273 pages. 5½ in. x 8 in. Illustrated. Published by the authors at South Bethlehem, Pa. Price $2.00.

This book is intended as a text book for colleges and technical schools and the authors have endeavored to develop the subject as simply and as directly as possible in order to lead the students to a clear understanding of its principles. The importance of extensive practice in the handling of algebraic transformations has not been overlooked and an adequate collection of formal problems in differentiation and integration are included. These however are, in the most part, collected in the appendix in order not to break the thread of the discussion in the text by unnecessary algebraic developments. No claim is made for the completeness of this book, and throughout the text references to more complete treatises have been introduced, and an appendix is included which gives a carefully selected list of such works on mathematics and mathematical physics. The authors point out that they have used the idea of infinitesimals throughout the text because of their belief that this method contributes very greatly to directness and simplicity of speech in the discussion of physical problems and not because they are convinced of its accuracy.

Diesel Engines for Land and Marine Work. By A. P. Chalkley. Second edition. Bound in cloth, 226 pages. Illustrated. 5½ in. x 8½ in. Published by D. Van Nostrand Co., 25 Park Place, New York. Price, $3.00.

There are already some three hundred vessels in service propelled by Diesel engines, and the indications are that this number will soon be materially increased. On land, this type of prime mover has already attained a great popularity, particularly in Europe, and it is probable that its use in this country will be considerably extended within the next few years. This book, the first to deal exclusively with this subject, is therefore of especial interest at this time. In view of the commercial importance of the subject, the author has endeavored to prepare the book so as to render it suitable for all those who, for widely differing reasons, find it necessary to become acquainted with this type of gas engine. While this necessitated the including of a certain amount of elementary matter for the aid of the non-technical reader, technical discussion has by no means been eliminated and the engineer of experience will find that it will completely answer his requirements. In the first chapter the general theory of gas and oil engines, with special reference to Diesel engines, is fully discussed. The second chapter deals with the action and working of the Diesel engine, while the third considers its construction. In the fourth chapter the installing and running of these engines is given considerable space, and the fifth chapter deals with testing. A general discussion of the marine type of Diesel engine is given in chapter six, and chapter seven considers the construction of this special arrangement. The future of the Diesel engine is considered in the last chapter.

COMMUNICATIONS

UNDERPOWERED MACHINE TOOLS

New York, July 11, 1913.

To the Editor:

In our endeavor to secure the maximum possible output at a minimum cost, we are continually hampered with underpowered and poorly designed tools. To secure the maximum product from a machine tool, it is extremely important in selecting it to be sure that there is sufficient rigidity of construction and adequate provision for power. The advances in steels have been so rapid that the machine tool builders have had great difficulty keeping pace with the progress. This is particularly true of drilling machines, which are run at speeds and feeds unheard of a few years ago.

A mistake that for some reason is often repeated is that of failing to supply sufficient power to drive a machine tool to its utmost capacity. This mistake very often takes the form of a cone pulley entirely too small to transmit the required power. Frequently the driving pulley on the countershaft and the largest step on the cone are the same width and the same diameter. As the drive belts are never found to be too large this means a shortage of power on all steps of the cone except the largest. In some cases the pulleys are the same diameter and the face of the cone is narrower than the drive pulley, which means lack of power throughout.

It is seldom that as many mistakes are found in one machine as were recently noted on a radial drilling machine. As improvements are made by correcting mistakes, there may be some gain in calling attention to these. Although this machine was manufactured in 1912 by a well known firm it is entirely unsuited to modern machine shop practice. The speeds are as follows: 207, 129, 83, 53.8, 51.8, 32, 20.8, 13.4 r. p. m., while the feeds are: 0.0128, 0.0081, 0.0066 in. per revolution.

Just what purpose the maker expected this machine to serve is hard to tell. The speeds are about right for high-speed drills, ranging in size from 1 in. to 9 in., or for carbon drills from ½ in. to 6 in. Even then most of the drills would be running at improper speeds on account of the peculiar ratio and the fact that there are practically only seven speeds, the difference between 51.8 and 53.8 being too slight to be useful.

The largest possible drill that can be taken by the machine is 2 in. and it lacks power to drive that size up to full capacity. The driving pulley is 14 x 3½ in. and the largest step on the cone pulley is 14 x 2½ in., thus making the available power that which can be transmitted by a 2¼ in. belt. Trouble does not end here for the reason that the entire machine is of very light construction and the back gears are ordinary cast iron with 1¼ in. face.

A careful study of the situation has determined that the only way to make this machine serviceable is to practically re-construct it for high-speed light work.

C. J. Morrison,
Chief Engineer, Froggatt, Morrison & Company, Inc.

TRUCK EQUALIZER DESIGN

Berwick, Pa., July 22, 1913.

To the Editor:

Regarding the articles on truck equalizing bars by L. V. Curran and Sigurd Holm in the February and July issues, respectively. One who designs an equalizer and only considers the car weight has much to learn about equalizers.

Mr. Curran's discussion is very interesting as far as it goes, also Mr. Holm's, but in the latter's effort to cover all the forces, he failed to consider the direct tensile stress in the bent portion, which varies according to the angularity of the section; this stress should be added to the maximum tensile stress due to bending.

We will consider an equalizer supported at both ends and loaded symmetrically at two points between the supports as shown in Fig. 1, and it should be so considered in figuring the fiber stress for a given load, except as the calculations are modified by the curved shape. The maximum bending moment and

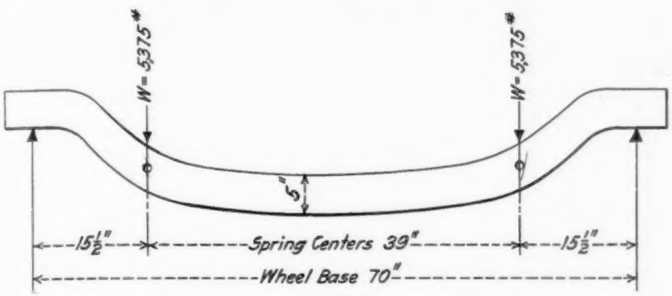


Fig. 1.

fiber stress will occur at the points where the springs are attached, and at all sections between these two points.

Fig. 2 shows the method of finding the bending moment at section X—Y through the point of spring suspension, or at any other point X_1—Y_1 between the spring and the support. The

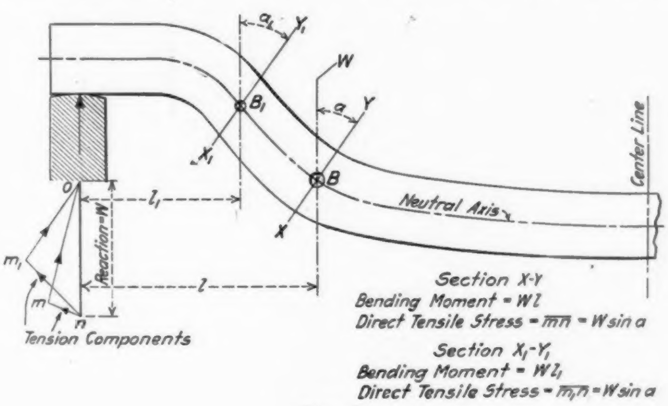


Fig. 2.

section must be taken at right angles to the neutral axis, and the distance l is measured from the neutral point of the section perpendicular to the line of reaction. The bending moment at all points between B and the corresponding point on the opposite side of the center line is the same as at B. Between B

Fig. 3.

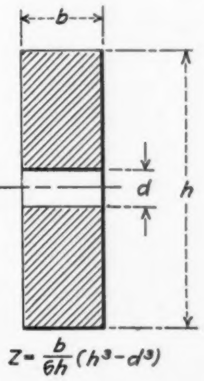


Fig. 4.

and the point of support when the sections are at different angles from the reaction, as in Fig. 2, there is a direct tensile stress to be added to the maximum tensile stress due to bending. The greater the angle, the greater the stress. In this calculation we will consider that the hole for the spring supporting pin is located on the neutral axis. The section will be the strongest if this is the case, and there seems to be no good reason why it should not be so located.

In the formulæ and calculations these reference letters will be used, in addition to those given in Figs. 2, 3 and 4:

A —Area of section.
W —Reaction.
M —Bending moment.
Z —Section modulus.
Sb—Fiber stress due to bending.
St—Stress due to direct tension.
S —Total tensile stress.

The maximum tensile stress at any section between B and the point of support is found by the following formulæ:

$$(1)\quad Sb = \frac{M}{Z}$$

$$(2)\quad St = \frac{W \sin. a}{A}$$

$$(3)\quad S = Sb + St$$

To find M, see Fig. 2; to find Z, see Figs. 3 and 4. The section at X—Y, which is the weakest, sustains the maximum fiber stress. Assuming that b equals 1½ inch and d equals 1⅛ inch (Fig. 4), the maximum stress is found by the following calculations:

$$M = 5{,}375 \times 15.5 = 83{,}312.5 \text{ inch pounds. (See Fig. 2.)}$$

$$Z = \frac{1.5}{6 \times 5}(5^3 - 1.125^3) = \frac{123.577}{20} = 6.1788. \text{ (See Fig. 4.)}$$

$$Sb = \frac{83{,}312.5}{6.1788} = 13{,}500 \text{ lbs. per sq. in. (about). (See Fig. 1.)}$$

This section seems to have an inclination of about 12 degrees, on which the sine is about 0.208.

$$St = \frac{5{,}375 \times 0.208}{3.875 \times 1.5} = 192 \text{ lbs. per sq. in. (about). (See Fig. 2.)}$$

$$S = 13{,}500 + 192 = 13{,}692 \text{ lbs. per sq. in. (See Fig. 4.)}$$

If we take any other section to the left of B, such as X_1—Y, we will find the maximum fiber stress considerably less than at X—Y. This section has an inclination of about 43 degrees.

$$M = 5{,}375 \times 7.5 = 40{,}312.5 \text{ inch pounds.}$$

$$Z = \frac{1.5 \times 5^2}{6} = \frac{25}{4} = 6.25. \text{ (See Fig. 3.)}$$

$$Sb = \frac{40{,}312.5}{6.25} = 6{,}450 \text{ lbs. per sq. in.}$$

$$St = \frac{5{,}375 \times 0.682}{5 \times 1.5} = 490 \text{ lbs. per sq. in.}$$

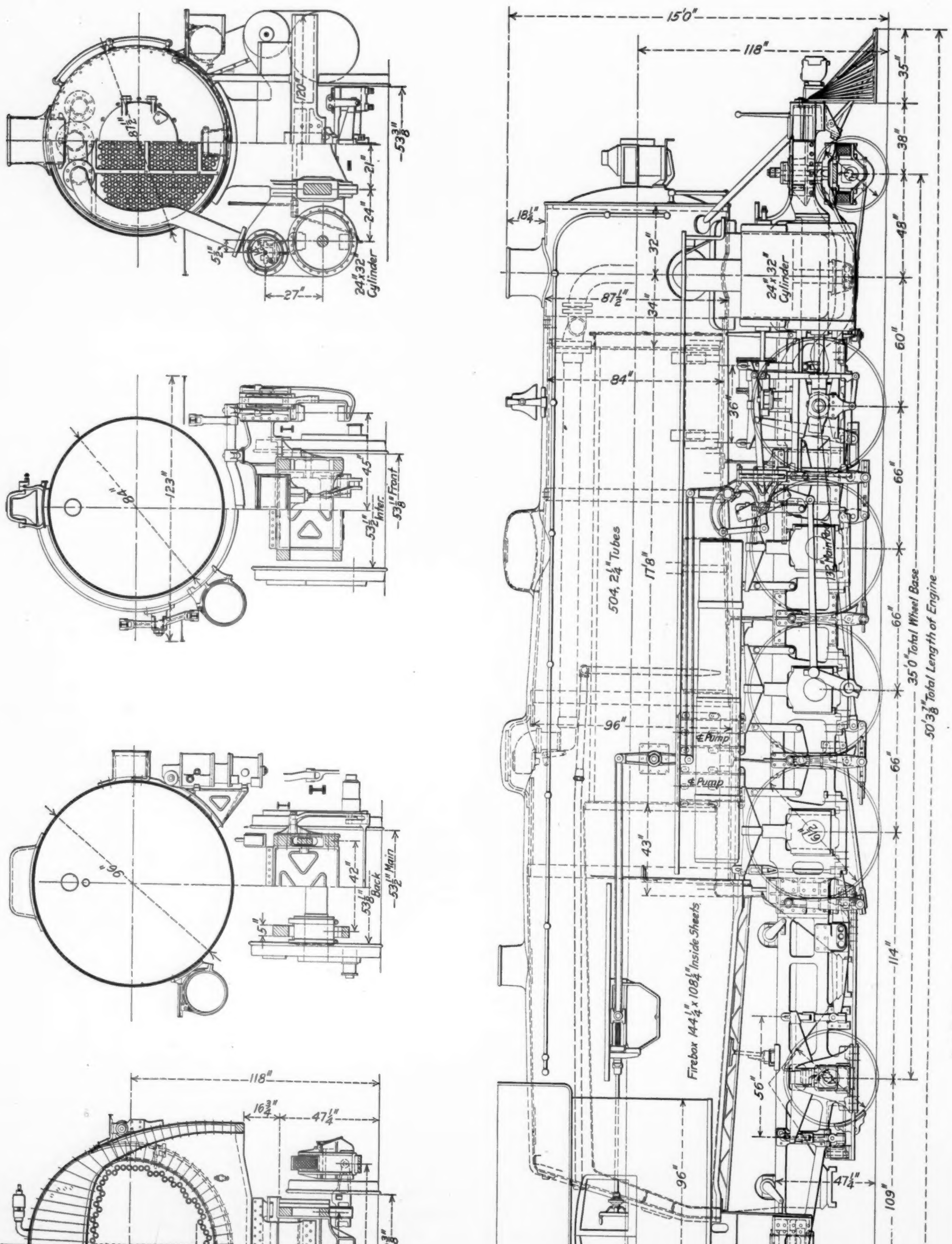
$$S = 6{,}450 + 490 = 6{,}940 \text{ lbs. per sq. in. (See Fig. 5.)}$$

In these calculations, I have assumed a thickness b of 1½ inch. This gives (see Fig. 4) a maximum fiber stress of 13,692 lbs. This is a reasonable value for wrought iron. The thickness is greater than usual, and it would be better, perhaps, to make the bar somewhat wider and so reduce its thickness.

H. E. PARSONS.

ORE SHIPMENT ON THE GREAT LAKES.—The shipments of ore on the Great Lakes during the month of June, 1913, amounted to 7,974,444 gross tons, an increase of 406,889 tons over June, 1912.

FIRST BALDWIN LOCOMOTIVE.—The extraordinary speed and power of the locomotive on the Germantown Railroad should excite more attention than it has obtained from the enlightened community in which it has been made. It is the more remarkable because it is in many points original and because it is the very first working engine of the locomotive kind made by Mr. Baldwin. In the trials recently made the road was muddy, so as to impair the grip and to lessen the smoothness, and she was used immediately after her return from her afternoon trip to Germantown. For the experiment a space of two miles and a quarter was selected, in which there are four curves and several very muddy crossways. In passing through this space the steam was cut off at each curve so as to visibly lessen the speed and yet the whole distance was passed over in 3 minutes and ⅜ths. It was therefore done at the rate of 40 miles per hour.—*From the American Railroad Journal, January* 19, 1833.

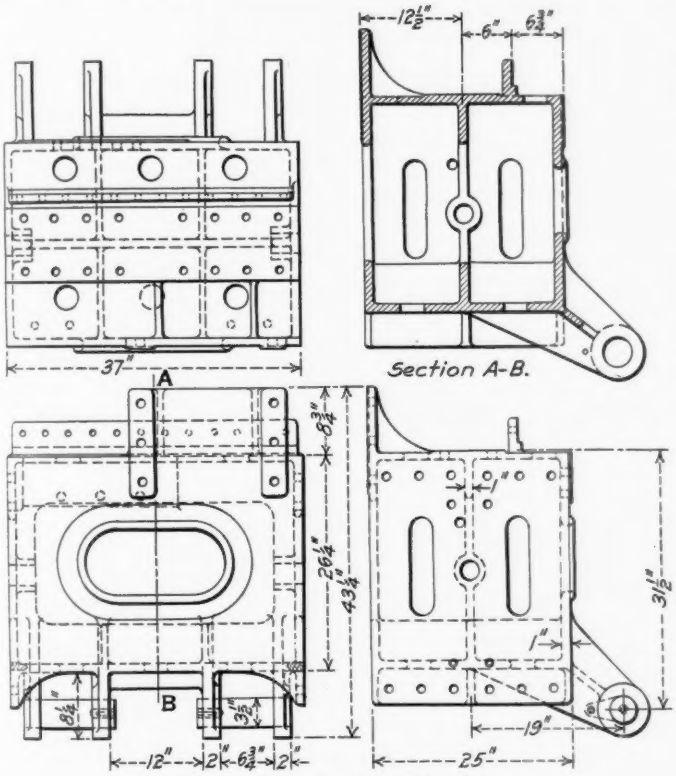


2-8-2 Type Locomotive Using Saturated Steam at 225 Lbs. Pressure; Philadelphia & Reading.

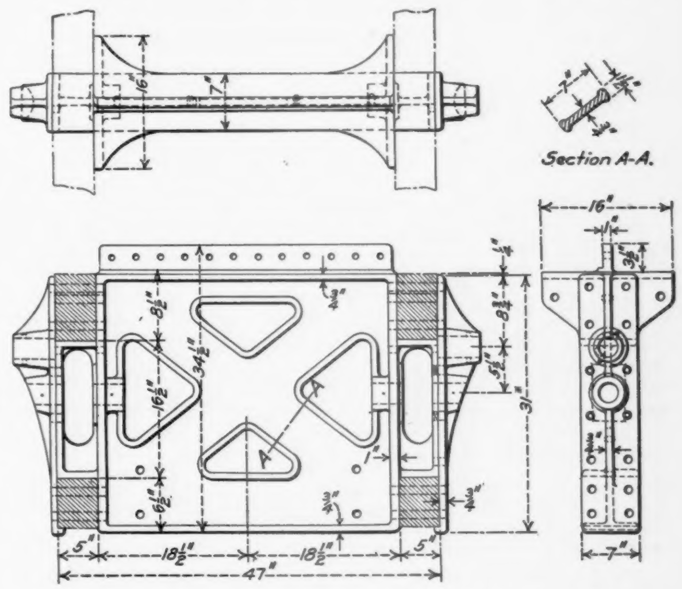
POWERFUL MIKADO ON THE READING

Largest of This Type. Exceptional Frame Bracing and Absence of Superheater Notable Features.

It has been the practice of the Philadelphia & Reading to design most of its own locomotives and also to build as many as possible in its own shops. The latest result of this policy is a series of locomotives of the Mikado type which have a total weight, in working order, of 331,000 lbs., of which 249,000 lbs. is on the drivers. This makes them the heaviest of their type on our records, both as regards total weight and weight on drivers.



Frame Brace at the Guide Yoke.



Frame Brace Between the Third and Fourth Pairs of Drivers.

They have an unusually large firebox of the Wooten type and are arranged for burning a mixture of anthracite and bituminous coal. Eight months' service has shown that the combination of 24 in. x 32 in. cylinders, 225 lbs. steam pressure and 61½ in. diameter of drivers has produced a locomotive which is very well adapted for fast, heavy road service, as well as for slow, heavy grade work.

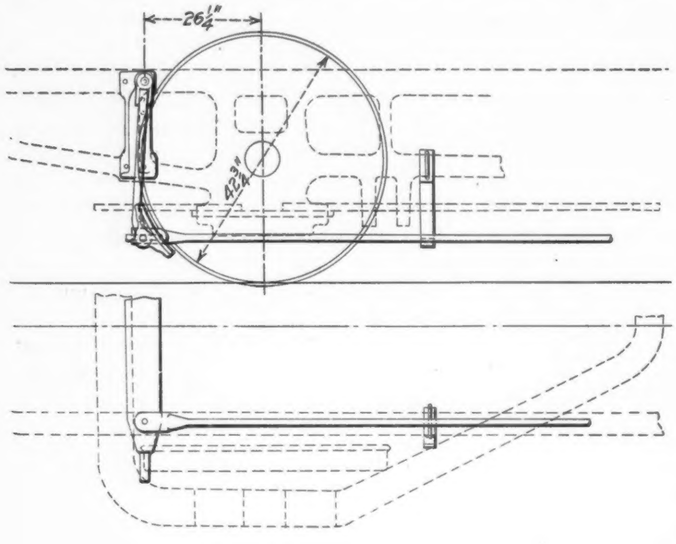
One of the most interesting features of the design is the fact that a superheater is not used. To make up for its absence, however, an extra large amount of evaporative heating surface has been provided. It is stated by the designer that a proportion of 30 to 1 between heating surface and grate area is considered good practice for burning low grades of fine anthracite coal. The grate area is 108 sq. ft., and with this proportion the boiler should have 3240 sq. ft. of heating surface. As a matter of fact 2268 sq. ft. of heating surface has been added to this, making the total 5508 sq. ft., It is necessary to burn buckwheat coal at comparatively low furnace temperatures which requires a very large grate surface to get the best results. On this account the extra heating surface is added in order to approximate the same fuel economy as might be obtained by the superheater without the extra complications incident to its use. Thus far in the operation, the smokebox temperatures seem to be comparatively low and the amount of coal burned for the work done is relatively smaller than is required in other types of locomotives on this road.

Since a combustion chamber 43 in. in length has been installed ahead of the firebox, the tubes are but 17 ft. 8 in. long. In order to get this very large amount of evaporative heating surface with the 2¼ in. diameter tubes used, it is necessary to have a very large diameter boiler. The barrel is made up of three sections, the forward one being 84 in. in diameter and the third one 96 in. in diameter, the intermediate course being made conical to connect the two. The thickness of the sheets of the first

Largest Mikado; Designed and Built by the Philadelphia & Reading.

course is ⅞ in., and it is 15/16 in. in the second and third courses. The dome is flanged from a single piece of 1⅛ in. steel plate and is but 10½ in. in height.

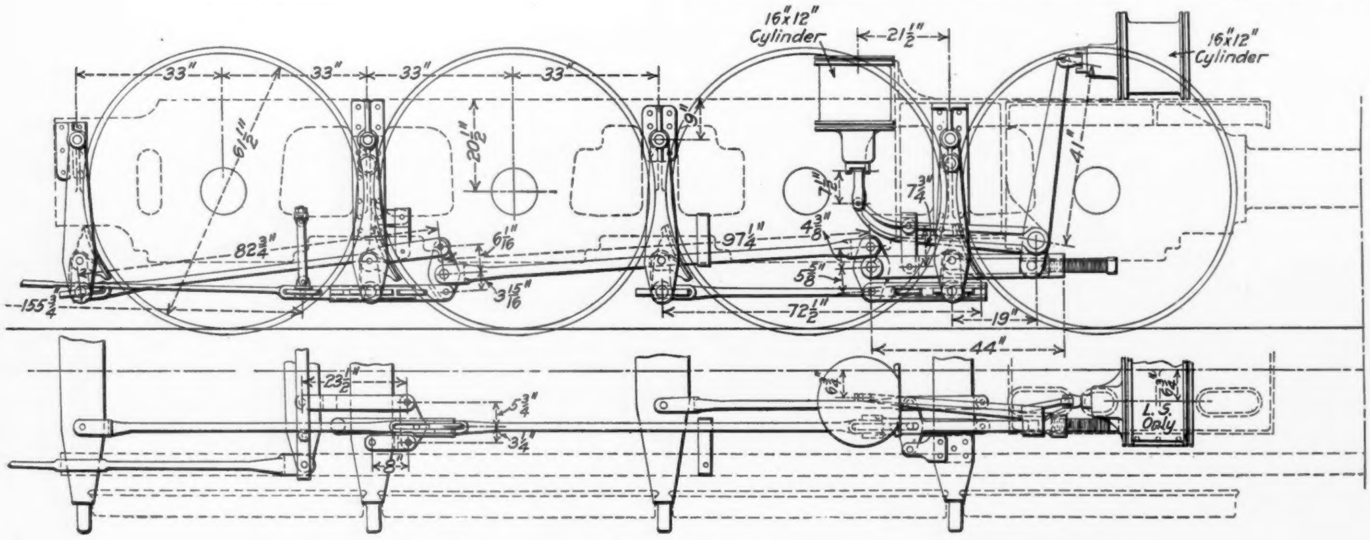
This is probably the largest grate that was ever applied to a



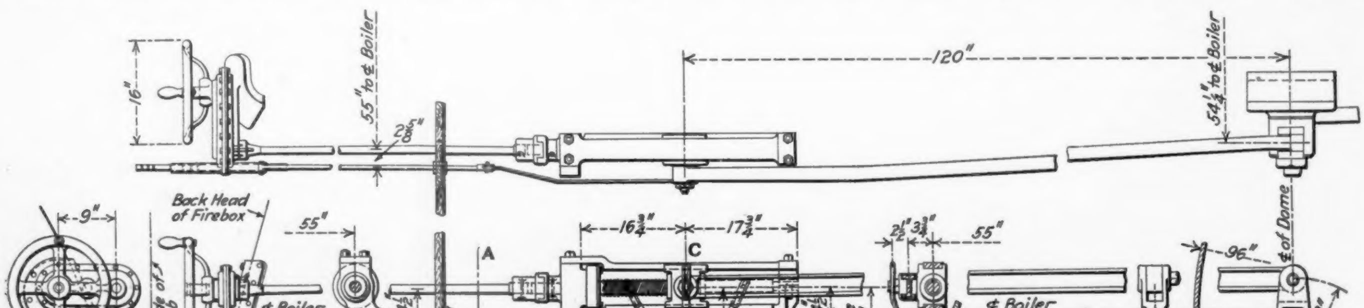
locomotive and measures 9 ft. in width by 12 ft. in length. The grates are of the rocking type with short fingers and narrow openings in the center, suitable for the fine grade fuel to be burned. They are installed in three sets across the firebox and each is in two sections for shaking. There is a wide dump plate at the front and rear of the center row of grates. There are two fire doors, elliptical in shape and measuring about 12 in. x 18 in. The grates have a slope toward the front in a straight line in order to make it possible to fire this length of firebox. The usual brick wall used in the Wooten type of firebox is found in this design and flexible staybolts are used in the corners of the sides and in the roof sheets. The combustion chamber is supported by sling stays.

In order to reduce trouble with frame breakage as much as possible, the matter of substantial bracing has been given particular attention. The frames are in two parts, the main section being 5 in. in width and 7½ in. in depth over the pedestal. The trailer frame is spliced to it and is 4 in. in width. In addition to the cylinders and the firebox supports, these frames are braced by a heavy casting at the guide yoke and but slightly less heavy braces between the other pairs of drivers. An inspection of the illustrations of two of these braces will give a good idea of the care this feature has been given.

The cylinders are cast separate from the saddle, and the front frame extension, which measures 5 in. x 13 in. at this point, is completely housed between the castings for a length of about 52 in. Fifty-nine 1⅛ in. bolts are used to form the connection between the cylinders and saddle, and ten of these pass through the frame. Exceptionally large exhaust ports are provided through the cylinder castings, and large outside steam pipes connecting at the top center of the valve chest are used. It is stated that these large steam passages have made a very free moving



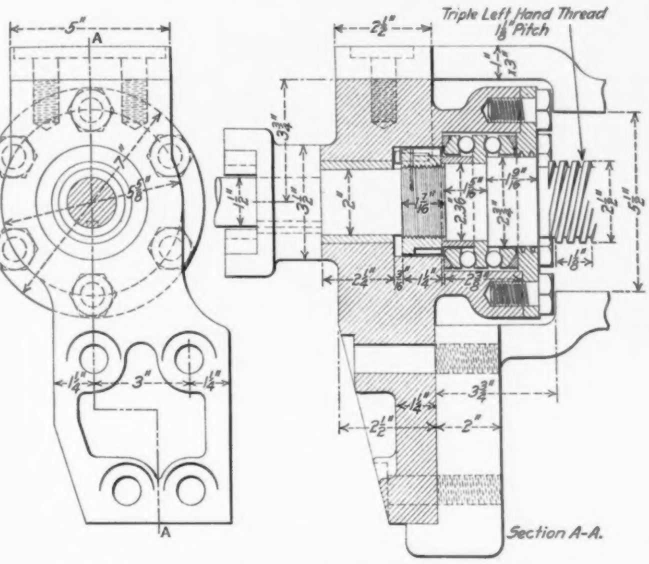
Arrangement of Brake Rigging Which Includes a Connection to the Trailing Truck.



General Arrangement of the Screw Reverse Gear; Philadelphia & Reading Mikado.

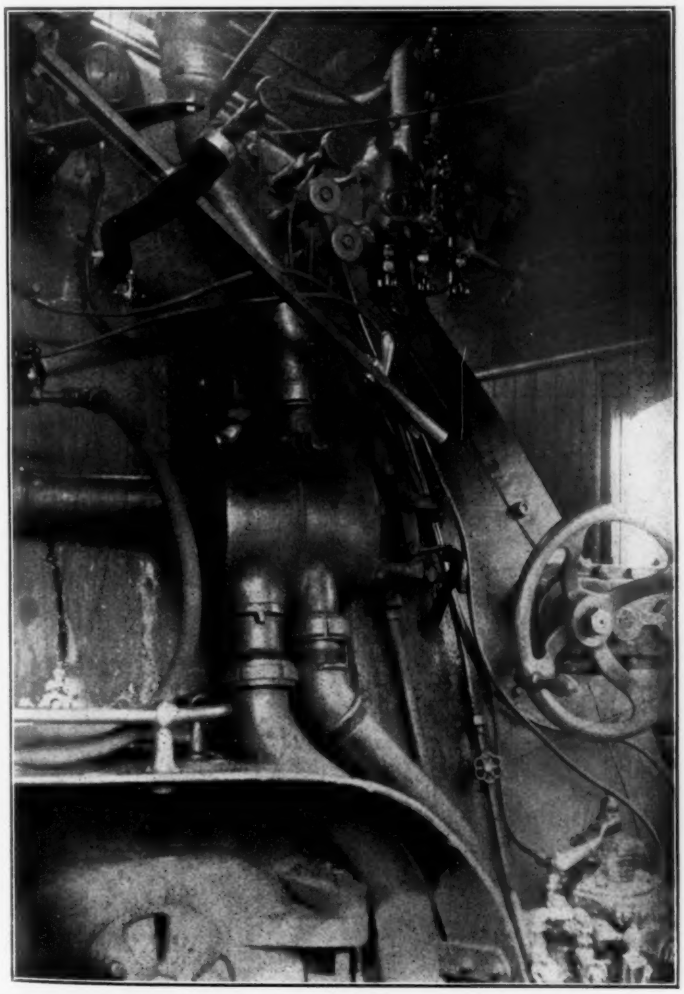
locomotive with little back pressure. The engine will move itself with 30 lbs. steam pressure.

The 14 in. piston valves are arranged for inside admission and the valve gear gives a maximum travel of 6 in. An original



Ball Thrust Bearing in the Screw Reverse Gear.

arrangement of screw reverse gear has been used and is shown in detail in one of the illustrations. The limited clearance between the sides of the cab and the firebox made it necessary to place the screw and the crosshead outside of the cab, and it was also necessary to offset the center of the hand wheel from the center of the shaft, bringing it on the back of the boiler head. This was done by introducing a train of gears contained within a case secured to the boiler head. A cut-off indicator is arranged just below the reverse wheel by means of a pointer connected to an inverted pendulum working with the crosshead of the reverse gear. To obtain the desired offset in the center line of the screw reverse shaft and the connection to the arm of the lift shaft, a central rocker has been introduced in the reach rod. This is pivoted at the center and reverses the movement of the reach rod. One of the detail illustrations shows the arrangement of the ball bearings on the main screw. It will be seen that these are arranged to take the thrust in either direction.



Interior of Cab Showing Position of Reverse Wheel.

Two 16 in. x 12 in. air brake cylinders are used on either side of the locomotive and operate the brake shoes on all four of the drivers, as well as the shoes on the trailer truck. The arrangement of this rigging and location of the cylinders is clearly shown in one of the illustrations. The locomotive is provided with two 11 in. air pumps and the main reservoirs are located in a vertical position underneath the cab.

The general dimensions, weights and ratios are shown in the following table:

General Data.

Gage	4 ft. 8½ in.
Service	Freight
Fuel	Mixture
Tractive effort	57,319 lbs.
Weight in working order	331,000 lbs.
Weight on drivers	249,000 lbs.
Weight on leading truck	25,100 lbs.
Weight on trailing truck	56,900 lbs.
Weight of engine and tender in working order	491,000 lbs.
Wheel base, driving	16 ft. 6 in.
Wheel base, engine and tender	68 ft. 4¼ in.

Ratios.

Weight on drivers ÷ tractive effort	4.34
Total weight ÷ tractive effort	5.77
Tractive effort × diam. drivers ÷ heating surface	640.00
Total heating surface ÷ grate area	48.24
Firebox heating surface ÷ total heating surface, per cent	5.41
Weight on drivers ÷ total heating surface	45.20
Total weight ÷ total heating surface	60.10
Volume both cylinders, cu. ft	16.75
Total heating surface ÷ vol. cylinders	3.29
Grate area ÷ vol. cylinders	6.45

Cylinders.

Kind	Simple
Diameter and stroke	24 in. x 32 in.

Valves.

Kind	Piston
Diameter	14 in.
Greatest travel	6 in.
Outside lap	1 in.
Inside clearance	1/16 in.
Lead	¼ in.

Wheels.

Driving, diameter over tires	61½ in.
Driving journals, diameter and length	11 in. x 13 in.
Engine truck wheels, diameter	33 in.
Engine truck journals	7 in. x 11 in.
Trailing truck wheels, diameter	42¾ in.
Trailing truck journals	8 in. x 14 in.

Boiler.

Style	Wooten
Working pressure	225 lbs.
Outside diameter of first ring	84 in.
Firebox, length and width	144 in. x 108 in.
Firebox plates, thickness	⅜ in.
Firebox, water space	F, 5 in.; S. & B., 4 in.
Tubes, number and outside diameter	504—2¼ in.
Tubes, length	17 ft. 8 in.
Heating surface, tubes	5,210 sq. ft.
Heating surface, firebox	298 sq. ft.
Heating surface, total	5,508 sq. ft.
Grate area	108 sq. ft.
Smokestack, height above rail	180 in.

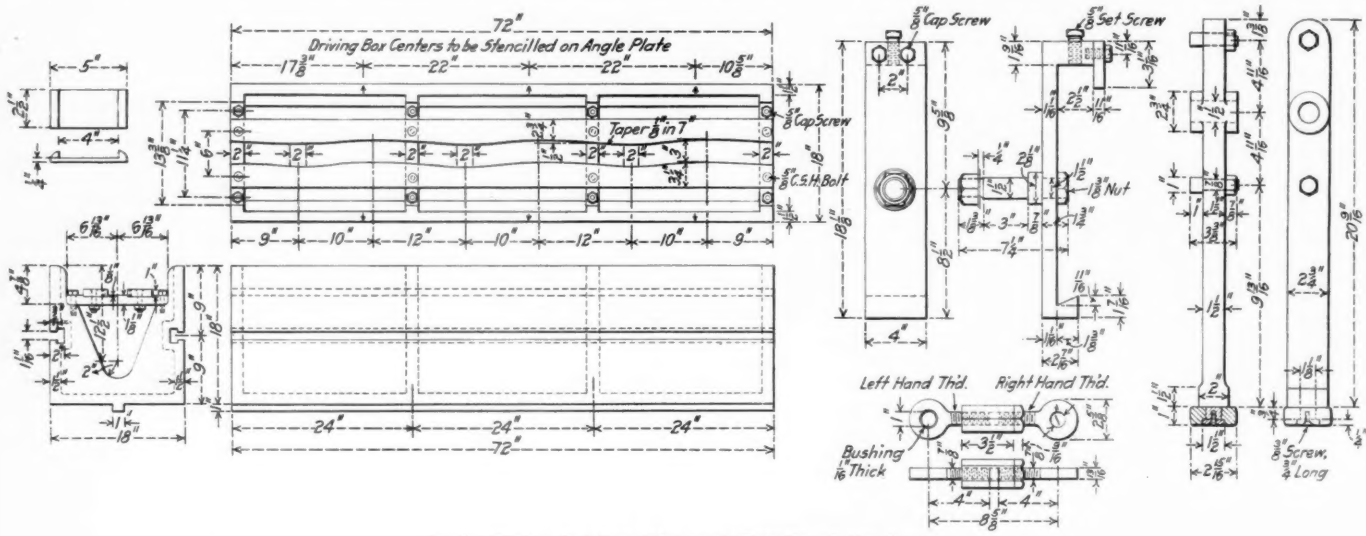
Tender.

Frame	12 in. channel
Wheels, diameter	36 in.
Journals, diameter and length	5¾ in. x 10½ in.
Water capacity	8,000 gals.
Coal capacity	12.85 tons

PLANING TAPER FLANGES ON DRIVING BOXES

BY C. L. DICKERT,
Assistant Master Mechanic, Central of Georgia, Macon, Ga.

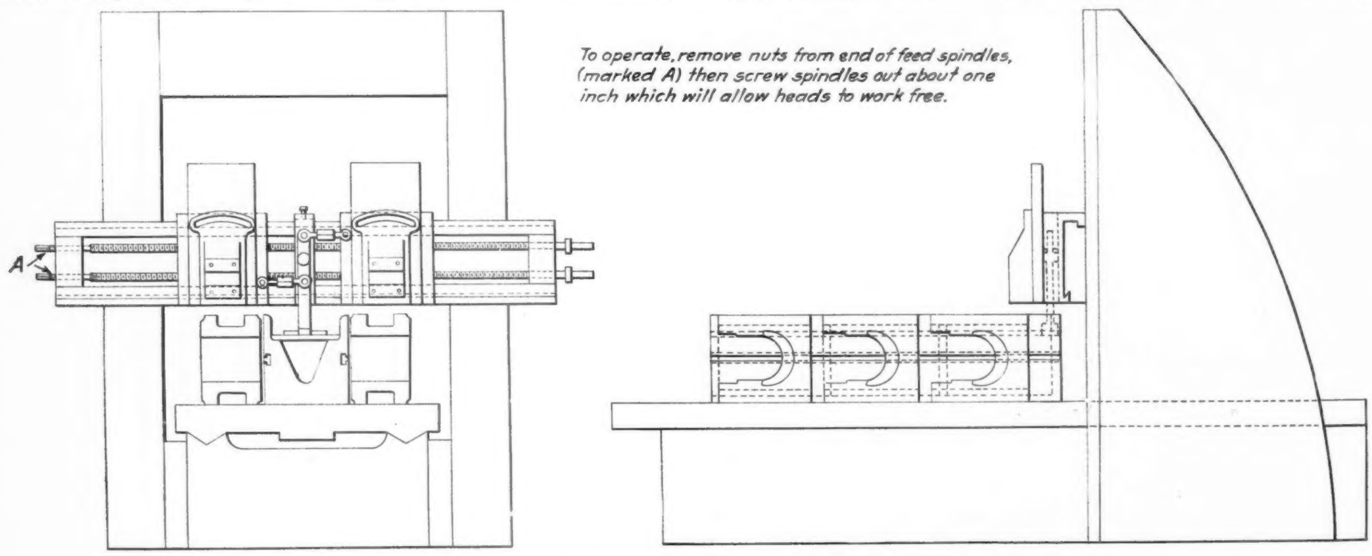
It is the general practice on most roads to taper the inside of the flanges of driving boxes from the center in both directions. In this way the rocking of the engine will not tend to break the flanges of the box or the shoes or wedges, nor will the box bind in the pedestal as the locomotive sways. In order to properly plane these taper flanges it is generally necessary to have six separate chuckings of the box while on the planer. The general practice in this respect, is, first to plane the boxes straight in the shoe and wedge face, then line out one end of the box for the required taper and plane one side. The tool is then swung over and planes the opposite side of the channel, and the same operation is performed for planing the other two tapers on this side of the box. The boxes are then turned over and the other side is planed in the same manner, requiring six separate chuckings.



Angle Plate, Guiding Slot and Details of the Lever.

With the device shown in the illustration, which is used at the Macon shops of the Central of Georgia, the operation can be finished complete with but two chuckings. It consists of a large angle plate, which is clamped to the planer bed in the usual manner. The driving boxes are placed on either side of this plate, the center of the box being set to a center line marked on the plate, which provides for running out the taper at the proper place. In the center of the plate is a guide or slot which gives a movement, varying up to ½ in. either side of the center line, to the bottom of a lever supported from the cross rail of the planer. This lever is fulcrumed around a pin secured at the center of the cross-rail and carries a roller at its lower end which fits in the slot. On this lever or rocker arm are two connecting links spaced a suitable distance from the center of the fulcrum to give the required travel to the tool heads. These links are connected by pins to the rocker arm and to the tool head, and are provided with turnbuckles so that the tool head can be adjusted.

When planing a set of boxes, the first operation is to plane out the shoe and wedge face. When this is done on one side, the links are connected as shown in the illustration, and the feed screw nuts are removed, allowing the heads to move freely on the cross-rail. The side tools are placed in heads and adjusted by means of the turnbuckle on the connecting links. When one side of the flange has been planed, the links are reversed, changing the motion for planing the opposite flange.



Arrangement of the Apparatus on the Planer for Planing Taper Flanges.

After finishing the first side of the boxes, the cross feed is again required, and all that it is necessary to do is to remove the connecting links and place the nuts on the feed screws. It is not necessary to remove the rigging. All the boxes are planed alike, and the attachment can be made to plane any taper, leaving as much straight at the center as desired.

General Foremen's Convention

Apprenticeship, Scheduling and Routing Work in the Shop, Repairs to Superheaters, Driving Boxes.

The ninth annual convention of the International Railway General Foremen's Association was opened at the Hotel Sherman, Chicago, on July 15, 1913, by President F. C. Pickard. After a prayer by Rev. Bishop Fallows, the association was welcomed to the city by Leon Hornstein, assistant city attorney.

President Pickard's Address.

F. C. Pickard in his presidential address spoke, in part, as follows:

The work of the General Foremen's Association has been far-reaching, well defined and its benefits have been appreciated by all. By a mutual discussion of the many subjects that come before the convention and the benefits gained by convention work, your attendance is profitable to yourself and to your company. The man who tries to keep all his own trade knowledge to himself should remember that he has no right to the ideas of others.

As general foremen we should be able to make an analysis of our local conditions and surround ourselves with the proper organization to meet the requirements of shop management. Organization is recognized as an economical necessity to effective control and co-operation in human effort. Organization deals with men, and industrial organization includes the elements of production and transportation.

We should consider carefully the recommendations that are placed before us and let us not lend the prestige of the association to anything that may increase the cost of maintenance in shop operation. The conclusions we may arrive at as recorded in the minutes of our convention are the harvest we reap. The improvement so derived in shop practice means necessarily an increase in output which is always appreciated by our superiors. Be sure you are right and then command the courage to carry out your convictions and you will win.

I have been particularly impressed during my connection with this organization with the probabilities of promotion from the ranks of the general foreman to one carrying higher responsibilities in the mechanical field. Many men who have so risen have been active in the work of this body and owe their promotion to their activity in promoting the welfare of their companies by close attention to the subjects brought before them. You will find that the men doing the big things today are those who were yesterday doing the little things the best they knew how.

I wish to recommend that the subjects to be presented for discussion continue to be on shop operation, methods, etc., and that standing committees be appointed on machine work, erecting work and roundhouse practices.

Mr. Quayle's Address.

Robert Quayle, superintendent of motive power and machinery of the Chicago & North Western, addressed the meeting and spoke on the value of the meetings of mechanical men having the same interests, of which there are now a large number each year. He pointed out that it is not only the intelligence of one man that counts, but much greater is the combined intelligence of all men. If each man will take back a single idea or kink from each of the others, his value to his company would be increased enormously.

It is not so much the idea that somebody will notice you and put you in some other position that makes you put forth your best efforts, but because you think it was right to do it, and because you love to do it, and because your self-pride and your ambition compels you to do it; and when you do that without any thought of anybody else, somebody comes along without even touching your shoulder, and you are moved to a higher position, and then you see what did it. There were other eyes that were looking around for men to fill the position, and they found you right there and took you. Keep going on this line and it will be your turn next.

How about the progress of the man? We talk about the progress of machinery. We are building ponderous locomotives; we are putting on superheaters and other devices. But we are not considering very much about the man. There are certain lines along which men can develop and become better men; they can be more useful in the community in which they live, more useful in their own homes. They can be more useful in the field of labor in which they are exerting their efforts.

General foremen hold an important position. You are the leader. Your influence means a good deal. Your intelligence ought to mean a good deal. Sometimes we think that as one man we cannot do much, but one man can do a whole lot and we ought to determine that we will do the best we can and have things coming our way.

Are you a good instructor?

You have had some teachers in your time that could say something to you, or ask you a question in a cynical manner that would stir up all the ire in you and you would resent it. They made an impression, but it was not a good one. They did not know your disposition. If you have foremen under you, you ought to know their dispositions. You ought to be able to teach them without touching under the lower rib, and you are not a good instructor if you cannot do it. You may have some men that you cannot treat that way, and if you have the best thing is to relegate them to the rear, because you must have harmony, and you must be the leader to work with them and get them to work with you. If you do that you will have a very good knowledge of the men who are associated with you in each department. By and by somebody higher up will look for a man to take some important job. You may be the fellow he has his mind's eye on, but you are filling such an important position that the fellow next to you in the shop—he is not as good a man as you, not nearly—cannot succeed you. He says: "I can't take a chance on that. I am not going to take a man out of that position and lift him up a notch higher until we have somebody in the ranks that will take his place." Some of us sometimes feel that it is not a good thing to have that kind of a man right next to us. We get jealous and afraid that he will get our job. Jealousy has no place in a workshop, nor anywhere else. I want to tell you that the man who succeeds in getting men who are in every particular better men than he is, will succeed, and if I cannot get a man for my associate who is a better man than I am, I won't have him. He must be a better man than I am in every way. At least I must think so, and when I have got him there, what does he do with me. I get a force around me then and support that is as staunch as the very heavens above. Let us get men about us that we know are our superiors. That is not reflecting on you either when I say it. If I have a man who has good men about him I know he has the fellows that are doing the work.

Have you got your eye on good material all the time to fill the positions that are becoming vacant by men who are being moved up or leaving the service? You ought to have, and I have no doubt you do have. Don't you know it is the hardest thing in the world for men to pick out men to fill the positions higher up. A good deal of training is necessary and you men ought to have these men down at the beginning that have the intelligence, that have the moral fitness, that have the mechanical fitness. I said, moral fitness, and I want to tell you that you do not want to put any man into a position of trust who is over a lot of other men, unless he is a clean man.

If a young man were to come to me and ask me how to succeed, do you know what I would tell him was the first essential to success? You might say a good technical education. I would not. That is a splendid thing. You might say a fine physique and good health. That would be a good thing, and I might name a good many other things, but the greatest thing for us to cultivate is character, and I want you to spell it with capital letters. Character goes out from you in every word that you speak and indicates the kind of man you are. It will be reflected today in the work that you do. It is reflected in your conversation; it is reflected in your home; it is reflected in the community in which you live—the kind of character you have, the kind of man you are—and don't we all like to be the best kind of man we can be.

Secretary-Treasurer Report.—The total membership at the opening of the convention was 214, and the balance in the treasury was $620.

SUPERHEATER LOCOMOTIVES

BY P. C. LINCK, C. & E. I.

One of the most important items in maintaining superheater locomotives for successful operation, is to keep the flues and superheater units clean. To obtain the best results a special man should be appointed to clean the flues, remove the clinkers or honey-comb that may form on the return bends at the firebox end, the crown sheet and the brick arch. He should be held responsible if the engine is allowed to go out without being thoroughly cleaned. For cleaning the flues a 3/8-in. gas pipe long enough to extend entirely through the flue should be used. This pipe to be inserted at the firebox end and gradually worked forward to the front end of the flue under the superheater unit, blowing the dirt off the front end of flue.

The flues should be given close attention, if leaking or in need of re-working. The prosser expander only should be used. If some of the beads are away from the sheet, a standard beading tool should be used to tighten them to sheet. Rolling has a tendency to stretch flue sheet holes and put a strain on the bridges between flue holes.

At stated intervals, the superheaters should be given a test with warm water at a pressure of about 100 lbs. The boiler, seams and flues in front flue sheet, all joints in the superheater steam pipes, rings, exhaust pipe, all joints to the steam header should be carefully examined for leaks; also for cracks or break in header, and the unit pipes just below the ball joint. I understand on some roads this is where the most trouble is experienced. The return bends at firebox end should be thoroughly inspected and the slightest leak repaired before the engine goes into service.

On one type of superheater we have had trouble with the steam pipes leaking. Considerable of the trouble was due to the rings being made of brass. They seemed to deteriorate very fast, and we have changed these to a good grade of cast iron. We also found the joints were not made perfectly. By seeing that joints are perfect and by using cast iron rings we have overcome most of this trouble.

We have experienced some trouble with both types of superheater unit pipes and return U's leaking where fitted together, generally at the back end, but a few at the front end. To make temporary repairs on one type we plug the front end, but if left plugged too long, the back end will burn off on account of having no circulation through the pipes. As soon as practicable we remove the pipes that are leaking, repair, and test before replacing.

We had considerable trouble with the valve bushings, valve packing and cylinder packing on the first superheater engines. They were Pacific type passenger engines equipped with Emerson superheaters. Part of this trouble was on account of the men not being familiar with the best way of handling the lubrication, and a great part was due to the metal used in these castings. The best quality of cast iron should be used for these parts. We have very little trouble with valve packing since, we make the valve packing 1/8 in. large, cut out the proper amount, then have a jig for compressing together and turning off to the exact diameter of the valve chamber. The later superheater engines were equipped with a semi-plug piston valve.

The piston heads seem to wear very fast, partly due to the weight of the head riding on the cylinder. We have none equipped with the extension piston and it is a question if it would be economical to apply the extension piston and maintain it or to renew the heads every eight or nine months. We experimented by trying a composition of copper, lead, tin, zinc and antimony, applied to the bottom of piston head. It has been running on some of the engines for five or six months and is giving good service. On one engine that had worn the cylinder and piston head 5/16 in. we applied this composition to the piston head. Three months afterward it showed 1/16 in. wear of the metal applied.

The question of lubrication of superheater engines is one of the most important items. There is considerable discussion on using a high grade of valve oil, that would withstand the heat before burning, or carbonizing. It has been recommended that a special grade of oil be used for superheater engines. We have made a few experiments and tested out different theories. One test was to attach a long copper pipe to the lubricator on a test rack, coil the pipe, and put the coil in a forge, heating to a red hot heat, letting the lubricator feed regular valve oil through the hot pipe. The oil came through the heat in as good condition as it did when the pipe was not hot, the oil being kept from burning by the steam as they both flowed through the pipe.

The oil should enter the steam as far away as possible in order that it may atomize and be thoroughly mixed with the steam before reaching the parts to be lubricated. On this theory we removed the oil pipes leading to the cylinders, and only used the feed to each valve. All the new engines purchased since have been ordered with only a three feed lubricator, with booster valve attached. We have had but comparatively little trouble with these engines.

On receiving general repairs, flues or steam pipe work on one type of superheater we remove the steam pipes and superheater unit pipes together; a boiler plate bracket is used to hold the pipes in proper position. They are handled with the electric crane, and after being repaired and joints made on the steam pipes they are given a hydrostatic test of 250 lbs. They are then handled with the crane and replaced in the engine. After all joints are tightened we apply a water test to see that joints and connections are tight. The other type we handle one unit at a time; each unit is tested separately; we have a tool that we connect to the unit pipes and apply a water and air pressure of 200 lbs. Where one or two unit pipes are broken below the ball joint, it is the practice at some places to splice the pipe with a steel coupling, making the ball on the short piece of the unit pipe in the smith shop, on a die similar to a bolt header die; it is afterwards finished to proper size. We have applied the ball end to new unit pipes in this way, finishing on a turret lathe to a standard former for ball joint. We are also trying welding a set of return bends on the firebox end with acetylene.

The units should be provided with supports and bands to replace any that have been lost or damaged; units 18 ft. long or over should have two supports, the first 6 in. from the back end and the second midway between the first and the end of the straight portion of the unit. Unit bolts should be examined and replaced if not in good condition. Whenever units are removed from the boiler, the tube supports and bands should be inspected and replaced by new ones if not in good condition.

We have made quite a number of small special tools. The formers for grinding the superheater header and unit pipe ball joints give the best service when made of copper. We have reamers for these, so when they are worn or not standard, all that is necessary is to use a reamer to keep the formers standard. We made a cutter for cutting large holes in flue sheet, a ball reamer for removing the sharp edge after cutting the holes, a roller for copper ferrules in the back flue sheet, rolls for applying unit pipes on the Emerson superheater, rolls and Prosser expanders, for working the large flues, a machine for cutting all size of flues, jig to hold the steam pipe rings to be ground with an air motor, one for drilling and reaming the holes on the superheater header, standard gages to keep all beading tools, Prosser expanders and ball joints to a standard. These should be carefully checked as an odd size beading tool or Prosser may do considerable damage to the flue or flue sheet.

DISCUSSION.

Difficulty in making a tight joint between the units and the header has been overcome in a number of instances by heating the bolt holding the clamp to the header when putting it in place. It is only given a black heat, or approximately the same temperature it attains in service. Copper gaskets under the ball joints are successful for temporary repairs, but should not be used for permanent work.

Piston heads and rings wear much more rapidly on superheater engines and the extension piston rods were generally favored on this account. Graphite lubrication has been very successful on several roads, although if too much graphite is fed to the cylinder it will cake around the rings with disastrous results.

The expander should always be used in tightening the superheater tubes. A tight fitting ball on the end of a rod has been successfully used for removing dents in these tubes when they are being repaired.

The practice of plugging superheater units that leak was generally condemned. Repairs should be made immediately. Broken unit pipes have been repaired by joining on a new piece by means of a connection made of seamless steel tubing and threaded or welded.

The importance of greater care and accuracy in the general repairs to the motion work was mentioned by one member. Packing on piston and valves should be fitted with great care. Cylinder and valve bushings should always be bored after they are in place. The valves should be very carefully lined in the chamber. Lubricating connections should always be free and clean.

While the damper has been taken out of some engines it is not considered good practice. On European roads where the idea had been given a careful trial the dampers were all restored. It appears that no particular trouble has been found in keeping the dampers in good condition with the exception of the steam cylinder and its attachment to the rod. The vertical cylinder and heavier attachments now being used will probably overcome this.

One case of the cutting of the tube by the feet on the bottom of the return bends was mentioned. This is probably due to an ingredient in the fuel which forms a cutting compound and when combined with a loose unit permits these small projections to wear through the tube. The remedy is to keep the units tight in the tube and use sufficient supports properly spaced.

Difficulties with rod packing have been overcome by the use of better material.

APPRENTICESHIP

The committee prepared a list of questions regarding apprenticeship and sent them to forty-five representative concerns in the United States, asking for replies to the several questions. Twenty-five of these letters were addressed to railroad companies, and twenty to other corporations, such as engine builders, electrical manufacturers, etc., etc. The following is a condensed abstract of the information received in reply to the questions:

Number apprentices employed? Railroads, 4,925; other corporations, 3,004.

Age limit? Railroads from 15 to 22 years; other corporations, from 16 to 21.

Educational qualifications of applicants? Common school education.

Number shops employing apprentices? Railroads, 168; other corporations, 38.

Are apprentices given any educational advantages? Yes.

Number apprentice school instructors? Railroads, 96; other corporations, 51.

Number apprentice shop instructors? Railroads, 61, other corporations, 48.

Hours apprentices attend school per week? Railroads, average 3.61—vary from 1 to 6; other corporations, vary from 2½ to 8, average 5 hours.

Are apprentices paid while attending school? Railroads: Out of 18 replies, 16 pay while attending school; other corporations, 17 out of 20 pay regular rate while attending school.

Subjects taught in school? Railroads: Spelling, letter writing, arithmetic, elementary mechanics, materials, drawing, trigonometry, physics. Other corporations, subjects vary according to needs of different corporations, much attention being given to character building, courtesy, civility, etc., the practical subjects relating directly to needs of each company.

Is instruction during daylight working hours? Railroads, out of 18 replies, 16 give instructions during daylight working hours. Other corporations, 17 out of 20 give instruction during daylight working hours.

Length of apprenticeship? Railroads, 2 from 3 to 4 years; 3 from 4 to 5 years; 13, 4 years. Other corporations; 12 require an apprenticeship of 4 years, the other 8 vary from 2 to 7 years.

Per cent. of boys entering who complete apprenticeship? Railroads, 71 per cent.; other corporations, 65 per cent.

Per cent. of graduates remaining in the service? Railroads, 77 per cent.; other corporations, 56 per cent.

Do you encourage graduates to remain? Railroads, yes; other corporations, yes.

Is any bonus or prize offered boys to complete apprenticeship? Railroads, yes, 3; no, 15; other corporations, yes, 13; no, 7.

Have results obtained justified your trouble, expense, etc., of educating and training your apprentices? Railroads, yes; other corporations, yes.

From the information received it is evident that the subject of apprenticeship is attracting considerable attention, and that there has been a substantial development in the work. In additions to the larger and more prosperous railroads in the country, nearly all of the large industrial concerns have instituted educational courses; some of these have regular apprentices schools, others co-operate with the public schools in the continuation schools or part-time system and still others have made arrangements whereby the men whom they are training may receive instruction through the correspondence schools or Y. M. C. A. schools. These courses are offered to their employees not only by the large corporations making railway supplies, but by the large department stores, etc.; even large banking concerns organizing schools to train men to handle their auxiliary organizations such as gas and electric power companies, street railways, etc. Many of the men trained by the large supply companies go out and work for the companies purchasing their supplies. In addition to teaching these men subjects relating directly to the needs of their respective organizations, they also teach character building, politeness, and the ability to "get along." Probably some 200 corporations are now offering their employees educational advantages, paying them for the time spent in school. They would not be doing this if it did not pay them in dollars and cents.

The committee unhesitatingly recommend to the association that the question of apprenticeship is worthy of consideration by the officers of railroads, and manufacturing concerns, and submit the following reasons:

First: Apprentices have proven satisfactory from a commercial standpoint.

Second: Graduate apprentices have been advanced to positions of authority in many shops. The apprenticeship system is harmonious in a shop employing either the day work or piece work system. The committee, recognizing the fact that there is a wide difference in organization and local conditions as to available material and facilities for instruction, considers that a hard-and-fast general apprenticeship code is impracticable, and, therefore, suggests the substitution of basic principles rather than a formal code.

To assure the success of the apprenticeship system, the following principles seem to be vital, whether the organization is large or small:—

First: To develop from the ranks in the shortest possible time, carefully selected young men for the purpose of supplying leading workmen for future needs, with the expectation that those capable of advancement will reveal their ability and take the places in the organization for which they are qualified.

Second: A competent person must be given the responsibility of the apprenticeship scheme. He must be given adequate authority, and he must have sufficient attention from the head of the department. He should conduct thorough shop training of the apprentices, and in close connection therewith, should develop a scheme of mental training, having necessary assistance in both. The mental training should be compulsory and conducted during working hours, at the expense of the company.

Third: Apprentices should be accepted after careful examination by the apprentice instructor.

Fourth: There should be a probationary period before apprentices are finally accepted; this period to apply to the apprentice term if the candidate is accepted. The scheme should provide for those candidates for apprenticeship who may be better prepared as to education and experience than is expected of the usual candidate.

Fifth: Suitable records should be kept of the work and standing of apprentices.

Sixth: Certificates or diplomas should be awarded to those successfully completing the apprentice course. The entire scheme should be planned and administered to give these diplomas the highest possible value.

Seventh: Rewards in the form of additional education, both manual and mental, should be given apprentices of the highest standing.

Eighth: It is of the greatest importance that those in charge of apprentices should be most carefully selected. They have the responsibility of preparing the men on whom the roads are to rely in the future. They must be men possessing the necessary ability, coupled with appreciation of their responsibilities.

Ninth: Interest in the scheme must begin at the top, and it must be enthusiastically supported by the management.

Tenth: Apprenticeship should be considered as a recruiting system and greatest care should be taken to retain graduate apprentices in the service of the company.

Eleventh: Organization should be such as graduate apprentices can afford to enter the service for their life work.

In addition to the principles set forth above the committee urges the necessity of having adequate instructions for the shop and not confusing this part of the boy's education with the school room work. While we recognize the great value of the school room instruction, we believe the one should supplement the other. The principal objection offered by foremen to apprentices in the shops is the time which must be spent with beginners. With adequate shop instruction the foreman is relieved of this. The boy is given assistance as soon as he enters the shop and is made productive at once. It has been demonstrated that where you have twenty apprentices in one trade in a shop the increased output of the boys brought about by a practical instructor, will amply justify the employment of a shop instructor.

Committee: F. W. Thomas (A. T. & S. F.), chairman; C. W. Cross (N. Y. C. Lines); E. V. Lea.

DISCUSSION.

After presenting the report, Mr. Thomas spoke on the general subject stating in part:

While all of the railroads included in the report, and also the manufacturing or commercial concerns, show a determined spirit to give the boys in their employ the best opportunity possible to learn the trade, it is a further evidence of a necessity which the times have demanded. The modern shop offers little chance for a boy without some one to guide and direct him. The foreman, and the gang foreman are too busy and have too many other duties to perform to be bothered with green boys. A boy floundering around a big modern shop for four years with no kindly hand to help or direct him is what gave the old apprentice system a black eye from 1890 to 1905. He was a failure, and at the end of four years he knew next to nothing of the trade. The old mechanic passed away, and there were no trained men to take his place. That is why you suffered such a dearth of first class mechanics. That is what drove you to the specialist, the handy man, the man who could successfully run one machine, but no other.

The Santa Fe Railway said to the general foreman and foremen: "We know you haven't the time to pay much attention to these boys; you look out for the output of the shop and your other duties, and we will put a man there whose sole duty will be to look out for the apprentices, and be responsible to you for the boys' progress and work. He will move them from machine to machine, job to job, showing them step by step, and then we will have a school room; the boy will be taught by another instructor on such subjects as he needs in his trade, receiving the mental training along with the practical." With the present system we have found that the boy, with the assistance of his shop instructor, becomes productive at once. No time lost experimenting and finding his place or getting over his stage fright. In the absence of a regular man on any machine, our foremen simply ask the shop instructor to put one of the boys on the machine while the regular man is off. He does it and stays with him enough to insure a reasonable day's output. The success we have attained with our apprentices has been due to the full, ample shop instruction. We appoint the best men we have and enough of them to insure the boys' complete instruction. I believe, with Mr. Basford, that the present shops need more instructors and fewer inspectors.

We are not trying to make mechanical engineers; the colleges furnish these. We are not trying to make draftsmen; the schools furnish these. We want to make first class skilled mechanics to operate our machines, men who are trained and educated in our ways, our methods, our standards; whose home and family ties are within our midst. We are making them the equal of any on earth, good mechanics, good citizens, proud of their work, and their road, and the apprentice system which has made their present condition possible.

C. W. Cross, supervisor of apprentices, New York Central Lines West of Buffalo, stated that the purpose of the apprentice system is to provide the motive power department of railroads with an adequate recruiting system which will eventually produce from the ranks a large number of skilled workmen, a number of foremen, a sufficient number of good draftsmen, a few master mechanics and an occasional superintendent of motive power. The general plan is twofold, and provides for shop instruction of the apprentice in the trades and also for his instruction in mechanical drawing, practical mathematics and shop problems during working hours while under pay.

It seems to me at the present time there is no more serious problem confronting the railroads and manufacturing concerns, especially the mechanical department, than the future relationship between the employees in the mechanical department and the companies. We find that probably as much of the time of motive power officers is taken up in considering the difficulties of the labor problem as is devoted to the strictly technical subjects of the department. The growing tendency to specialization seems to have led to a lack of general all-around mechanics in the shops, and it has been noticed in probably every shop in the country that there is a great dearth of suitable men. When a good man is desired for a foreman, the man in charge of the shops, or of the department, looks about to find a man of the right caliber and a man who has enough general information about his department work to be put in charge of men. That problem has to be faced, and it seems to me that the step that has been taken by the several roads which have established apprentice schools on a comprehensive and broad scale, is one of the most important moves that has been made by the railroads and manufacturing concerns in this country for a long time.

There has been a tendency lately, in connection with various organizations, to seemingly lower the standard of efficiency of the men. I believe that an apprenticeship system will offset that tendency and raise the standard permanently for the future, as it should be raised, so that instead of going through our shops and comparing the present class of men with those of fifteen or twenty years ago, and commenting as we do now that they are not up to the old standard, that we may in a few years from now look through the shops and find the standard constantly improving, and so that others may look to the railroads as an example of the best methods of raising the caliber and the general standard of mechanics. There is a common tendency in shops for foremen to feel that they, in taking young men into the shops as apprentices to become mechanics must get all they can out of them—to get all the value possible at the first from their services, forgetting that one of the desirable features in training apprentices is to make them first-class workmen. The value cannot always come in the first year of their apprenticeship, but just as surely as they are properly trained, the value will come to the company and to the community at large from their services after they have been properly trained, and I think we should not forget to make the proper training of the young men the first consideration, and the getting of the value of their services in the first year of their apprenticeship secondary. Surely the best results will come in the end by carrying out this principle.

The apprentice school of the Central of Georgia at Macon, Ga., was described by C. L. Dickert. This school was organized August 1, 1912, under the direction of D. C. Buell. It, as well as several others similarly designed and operated under the same management on the Illinois Central, developed from the fact that there was a shortage in available mechanics competent to take responsible and well paying positions, and a principal object was to train men in accordance with shop ideals and standards so that when vacancies did occur competent men could be taken from the ranks to fill them.

The total enrollment is 75. Several of these included in the total enrollment are messengers used in the shops and several others are rivet heaters in the boiler shop. One-half hour each day is devoted to class room work, the apprentice being paid for that time and his attendance made compulsory. The subjects, mathematics and reading working drawings, are taught on alternate days. The enrollment is divided into nine classes, each class reporting every thirty minutes, from 7 to 9, and from 9:30 to 12.

This half hour period every day is contrary to the practice of most apprentice schools, most of them having two hour periods two or three times a week. It was not adopted, however, for convenience. Consider the fact that nearly all grammar schools have only thirty minute periods, and the class periods of the universities are not over one hour. Thirty minutes is about as long as a boy can be kept well interested on one subject. Other advantages of the half hour period are that the instructor can see the boy every day, keeping fresh in his mind the thought of improving every opportunity, and the classes can be made small, allowing the instructor to give each boy almost individual attention.

As to the subjects taught, the first thing necessary for the boy to know, after he learns the use of his machine and tools, is to learn to read a drawing; therefore, we give him the subject of "reading working drawings." Mechanical drawing is nothing he can use in the shop, and while it teaches him after a while to read a drawing, it is rather a roundabout way to get at it. In teaching "reading working drawings," the instructor makes use of a straight-edge, triangle and compasses on the blackboard, showing some of the principles of geometrical construction, also requiring the boys to use these instruments frequently. It is also necessary in teaching "reading working drawings," to have the student make many sketches on the boards and on paper. After completing this course a thorough study on shop sketching is taken up. When completing these two subjects, without the boy knowing it, he has really learned the biggest part of mechanical drawing, except the use of the instruments and lettering. It has been planned that in the last six months of a boy's apprenticeship, he can, if he wishes, take mechanical drawing and learn the use of the instruments, lettering, etc., so when he finishes his apprenticeship, he will not only have a knowledge of reading drawings, but he will know enough of actual drafting, so that if at any time he should want to start in drafting, he will have the knowledge to enable him to get started and make some progress with it.

It takes a year, or a little more, to complete the drawing and sketching; after that on the drawing day, work is given that might be classed as specific shop instruction; that is, instruction relating directly to the work in the shop. At that time, the various crafts which have been mixed in classes, are divided and the boys are given specific instructions relating to their particular trades.

On mathematics day the beginner in the shop is started at the very beginning of arithmetic with addition, and is so instructed that at the time he has finished the drawing and sketching he will have gone through addition, subtraction, multiplication, division, fractions and decimals, which are so essential to a man in the shop.

Applications for employment are rejected unless the boy has gone practically through the grammar school, but even then he is not as thorough as he should be in this part of mathematics, and a review is necessary. Shop arithmetic is carried practically through the four years as far as trigonometry.

In addition to the work already mentioned, from time to time lessons in spelling, composition and penmanship are given. Also matters of general information, so that when the boy finishes his apprenticeship he has gotten something which he can use whether he becomes a mechanic, business man, or anything else. On the other hand, he will have something that will be a definite dividend-bearing asset to the shop. Half the time the generous thing is done by him, and the other half of the time he is specialized for railroad work.

With this apprentice school the instructor has nothing to do with the boy in the shop; therefore, not interfering with that organization at all. In some cases where the apprentice instructor is responsible for the boy in the shop, the men in the shop seem prone to shift the responsibility of the boy and of course lost interest in him. It is the desire of the apprentice school to have the whole shop organization work in sympathy with it, and to take a more active interest in the welfare of the apprentice, and to feel that they are responsible for him.

The cost of this apprentice school is made very low on account of the educational bureau having charge. The educational bureau can do all the text book writing and work of that kind without putting on any extra force and without much other additional expense. The cost for each apprentice per year is $20.

A large number of lantern slides showing apprentice schools, methods and apparatus used both in industrial plants as well as railroads were thrown on the screen and described by Mr. Cross.

Henry Gardner, supervisor of apprentices, New York Central & Hudson River, drew attention to the probable accidental elimination of the subject of shop practice under railroad schools. He pointed out that this was one of the most important subjects to be considered. The value of studying the personal character and habits of each apprentice was also mentioned. It is the practice on the New York Central to require a report on the qualifications and character of each graduate two weeks before his time is up. A copy is furnished each shop that may require his service. The general foremen are urged to visit the apprentice schools at their shops at least once a week and thereby indicate their support.

DRIVING BOXES

Three papers were presented on this subject, abstracts of which follow.

MR. LOGAN'S PAPER.

George H. Logan, general foreman, Chicago & North Western, Missouri Valley, Iowa, said in part:

The driving box and its component parts, viz., binders or pedestal braces, shoes and wedges, form one of the most essential parts of a locomotive and when properly machined, assembled and taken care of, give the engine crew and roundhouse foreman but little trouble and prolong the period in which engine may be kept in service between shoppings to a considerable extent.

The combination mentioned is valueless, however, if any of the three stipulated conditions—proper machining, proper assembling, and proper care—are not carried out. If wedges are not properly set up and if the engine is allowed to make a few trips with loose main wedges, due to carelessness or indifference, the setting up of these wedges will not eliminate the pound, and particularly is this true of a left main box on a right lead engine, or vice versa. The pound is still there—the box does not pound in the jaws but the journal pounds in the brass and unless the wheels are dropped and the brass rebored or renewed, any or all of the following troubles are invited: The breaking of frames, rods, rod straps, crank pins, crosshead keys, pedestal, binder, frame, deck and cylinder bolts; excessive wear on the rod bushings and brasses, the loosening of the wrist pin bearing in the crosshead, the crosshead and spider fit on the piston rod, and, if a Stephenson valve motion is used, distortion of valve gear. In fact, we do not believe any one can estimate the resultant damage of a main driving box pound, with any degree of accuracy, as many of the breakages and defects mentioned above do not occur or become evident until after the pound has been eliminated, but were nevertheless due to straining of the metal or the starting of indiscernible cracks while under the stress of a pound.

The importance of keeping binders tight in frame, jaws and wedges set up so as to preclude possibility of any other than the intended vertical movement cannot be too greatly emphasized.

Special attention should be given left main driving boxes on right lead road engines, as this box is subjected to a harsher shock from the piston thrust than the right. To make this point clear, let us assume the wedge to be at the back of the jaw and the shoe to the front on a right lead engine working in forward motion, and we find that these conditions exist at the time of steam admission to the front of left cylinder, and the left main driving box is against the shoe. At the time of steam admission to front of right cylinder the right main driving box is against the wedge. At time of steam admission to back of the left cylinder, the left main box is against the wedge. At the time of steam admission to the back of the right cylinder, the right main box is against the shoe. It is now apparent that the right box is in position to receive the shock of the piston thrust while the left must be forced from the shoe to the wedge and the wedge to the shoe for each revolution while engine is working steam.

This accounts largely for the excessive worn flat spot on the left main tires due to a slight slip of the wheel necessary to change the position of the box from the shoe to the wedge, or vice versa. Slip will also be perceptible if the brass is slightly larger than the journal. While the Chicago & North Western have no left lead engines we will guarantee that where they are in use, the right main box pound is as much a source of trouble as the left on other systems.

Driving box troubles are more frequent on engines having underhung springs than those with springs on top of frames, not because the difference in suspension causes excess wear or strain, but because the wedges and wedge bolts of an underhung spring engine are neglected in service. Where one of two wedge bolts is broken a block is substituted.

The correct adjustment of wedges is an important factor; on the road the average engineer takes advantage of the time at a meeting point or a stop of a few minutes for any reason and spotting his engine with the right crank pin slightly in advance of the top quarter, he loosens the nuts on the wedge to be adjusted, gives the engine enough steam to pull the drivers against the front jaws, or if the brakes are back of drivers, sets his drivers, and pries up wedge with small bar, then tightens the wedge nuts and if the parts are properly machined he has set the wedges up under ideal conditions, and it should give him no further trouble.

We use babbitt metal on the hub side of our driving boxes and in addition to a dovetail recess we use a number of brass plugs, which are cast a trifle full, of ⅞ in. diameter, are 1⅝ in. long with three grooves ⅛ in. wide and about 3/32 in. deep at one end. These plugs are driven in the box and serve a double purpose: To help hold the babbitt to the face, and in addition the plugs are spaced so that in case the babbitt breaks and loses off, the plugs cover the wearing surface on the driving wheel hub and keep the box itself from the hub temporarily. In addition to the brass plugs on the hub face of our boxes, we have woven copper wire criss-cross around these plugs and have found it very helpful in retaining the babbitt.

We have a large number of our engines equipped with the Markel removable hub plates, a very ingenious device which makes lateral troubles on these engines a matter of small import.

Another source of trouble we experience is the breaking of shoe and wedge flanges on some classes of our power. Of course, there is a logical reason for this and in the majority of cases it will be found that the driving box is of insufficient width and does not have flange bearing enough on the frame jaws and the thrust of the box tends to force the shoe and wedge through the jaw, breaking off the flanges.

Our road is making what we call the flangeless shoe and wedge installation on all of its modern power, and on the engines so equipped broken flange trouble is a thing of the past, as there are no flanges to break. This installation, however, is not faultless, as it transfers wear from the shoe and wedge flanges to the driving box flange and will decrease its life to some extent, while, on the other hand, plates applied to the sides of the frame jaws will prevent any possible frame wear at this point, and is, therefore, a point in favor of flangeless shoes and wedges. If you have broken flange trouble from insufficient box flange bearing, you can overcome or reduce breakages to a minimum by the use of a generous fillet in your shoes and wedges and by planing the side surface of both shoe and wedge on the hub side 3/64 in. lower on the part that extends beyond the jaw faces. This takes all torsion from the box thrust and overcomes the tendency to force the box against the jaw, as the impact is entirely on the flange, which in turn is forced fairly against the side of the jaw.

If correctly designed and provisions made for bronze, not brass, liners on shoe and wedge faces, cast steel boxes are practically indestructible and should last a life time.

Driving boxes finished, except for boring of the journal and the facing of hub side, shoes and wedges finished, except the face, should be carried in the storehouse stock. This practice is followed on the Chicago & North Western.

Boxes for stock are usually machined in lots of 12; they are first placed on a double head planer and the sides are surfaced. Next they are delivered to a large slotter and slotted two or three at a time, for the brass and cellar fit. From the slotter they go to the hydraulic press, close to which is located the lathe, where brasses are turned to fit the boxes. As soon as the brass is turned it is placed on the box and end bearing marked by gage, taken to shaper, shaped, pressed in the box by a hydraulic press at a pressure ranging from ten tons on small cast iron boxes to twenty tons on large cast steel boxes. The boxes are then taken to a double head planer, clamped six to each side of form or parallel block and planed. In planing the insides of the flanges a double tool is used. From the planer, the boxes are taken to a four spindle drill press and drilled for the oil retaining plug and cellar bolt holes. They are then coated with an anti-rust compound and placed in the storehouse stock. The draw-cut shaper is being given preference by most railroads in machining the boxes for the brass fit and is also used extensively in machining the brass for the box fit. I prefer a lathe in spite of another handling at the shaper for this reason.

Most of our boxes are chamber cored or recessed for babbitt, averaging in depth about 3/8 in. The boxes are so designed that the babbitt sets out beyond the box face at least 1/8 in. This leaves at least 1/2 in. of brass not necessary to turn in fitting, and we turn up to it, face off square and then have a shoulder averaging 3/16 in. to press against the face of the box. It is a big factor in the maintenance of tight brasses.

A shop of any considerable size should have the machine tools grouped for repairing driving boxes, with suitable cranes or air hoists to make moves for different operations in as short a space of time as possible. If babbitt is used for hub faces, the turner's bench and fires, preferably gas, should be close to the boring mill.

At the Winona shops of the Chicago & North Western there is an ideal lay-out for driving box work. This was planned and carried out under the supervision of Chas. Coleman, master mechanic at that point. The principal item taken into consideration in locating these machines, in addition to having them convenient for the work, was to eliminate all the trucking possible, and the experience of ten years demonstrates that the objects sought for have been very fully attained, and from the time a driving box, piston, crosshead, or rod arrives for repairs, it is never placed on a truck or any other conveyance, unless it is necessary to send it to the blacksmith shop or in case it needs some unusual repairs.

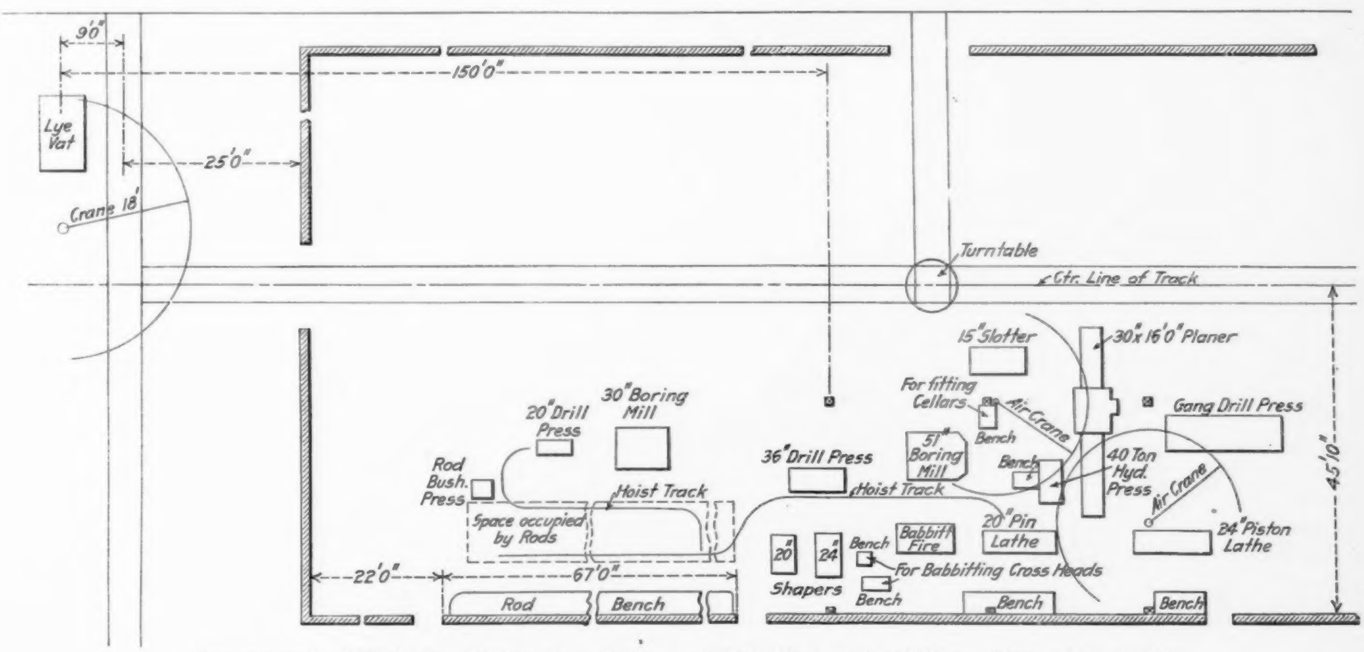
The movements of the different parts are as follows:

Driving boxes, if old, when taken from the wheels, are taken to the lye vat, returning by way of the transfer table, engine hoist track, and track in the center of the shop, and placed alongside the planer near the slotter, from which point they are handled by the crane; first to hydraulic press, to have the brass removed; second to the planer; third to the babbitt fire and are then (if old) picked up with the hoist on runway and drilled on a 36 in. drill press. If the boxes are new, they are removed from the planer with the crane attached to the wall and drilled on a gang drill press, and then placed for babbitting by use of the two cranes. After babbitting the boxes are bored, the saddles and cellars are fitted and are ready to be taken to the wheels for fitting on the axles. A groove is turned in the outside of the brass for a shoulder, after which the brass is slotted on the outside for the box fit ready for pressing in, special tools for calipering being used.

Lathes for fitting the crosshead pins and turning pistons and rods are located closely together near the babbitting machines, so no trucking is necessary. All crossheads are babbitted on machines and no planing is necessary.

Shapers are located handy to the rod benches and the brasses can be planed and babbitted without trucking; when ready to have the bushings pressed in, they are lifted by an air hoist on the runway and pressed in on an air press and taken to the 20 in. press for drilling; the job is completed and they can be returned to horses until wanted or be removed to the engine.

Brasses should be pressed out at once and new brasses fitted and pressed in. Prior to this, cellars have been examined, defective ones scraped and new ones ordered and they are now fitted to the boxes, care being taken that the box is not spread in so doing. I believe time is well spent in close and substantial fitting of cellars. Babbitting to build out loose fitting cellars is radically wrong. Cellars should be of heavy cross section capable of withstanding the closing tendency of boxes, thus maintaining the shoe and wedge faces parallel.



Arrangement of Tools for Driving Box, Piston and Rod Work at the Winona Shops, C. & N. W.

MR. DICKERT'S PAPER.

C. S. Dickert, assistant master mechanic, Central Railroad of Georgia, said in part:

The first and most important step is to perfect your organization. Get a good man lined out on this class of work, get him interested in the work, and you will get results. Have a system of handling the work from one machine to another; keep regular men on the machines if possible, and if this cannot be done, always use the same man on the job, that he may become efficient in this particular class of work; keep in touch with your men, go around and talk to them and see that they have the proper tools and that the machines are kept in good order.

Begin with a shop order covering, say, sixteen driving boxes, to be machined for a certain class of engine. A copy of this order is furnished the machine foreman, who issues a storehouse order for so many pounds of castings. This ticket is given to the material clerk who delivers the boxes to the floating gang, to be transferred to the machine shop and placed at a 52 in. boring mill, where the first operation begins. They are faced both sides and counterbored on the hub side for the liner, all boxes being made of the same thickness. They are handled from the mill to a 15 in. slotter by a jib crane, and are slotted for the brass and cellar fit. When this operation is completed, the brasses are fitted to the boxes on the same slotter. The slotter is equipped with a special chuck and tools for machining brasses, they being finished ready to press in the box in one chucking. The man machining brasses drives them in the box with a hammer to about one inch, to know he has the proper fit. They are then handled with the jib crane from the slotter to a 100-ton hydraulic press, where they are pressed in. The drill press is located just a few feet from the press, where the boxes are next handled for drilling the holes in the hub face for copper plugs, holding the hub liner. Pouring on brass for hub liner is the next operation, and is done in the copper shop in easy reach of the same jib crane. We have a tilting furnace and use scrap brass for pouring on all hub liners; and find it much more economical than bolting the liners on the box. After liners have been poured on, they are placed at the planer, where they are clamped down to the bed, hub face up, and a rough cut is taken off the hub face with head on cross rail, and the flanges are cut down with the side head. This operation may seem useless, but I find by having a true face to bolt up to the angle plate, and flanges true to clamp down to the planer bed, there is some time saved in chucking, as well as there being no danger of boxes moving under heavy cuts and feed, as there is when built up on liners. I have a double angle plate, or sections of angle plate the full length of the planer bed, thereby enabling me to machine a double row of boxes, using two heads on the cross rail at same time. I have, in connection with angle plates, a device attached to the cross rail of the planer and angle plates for flaring the flanges, not having to unchuck the boxes and line behind them to throw them out of line for flaring.*

The boxes are next placed on a draw cut shaper and the cellars are fitted; then they are moved to a drill press for the cellar bolt holes and plug holes to be drilled. The plug holes are all drilled the same size; all plugs are made and driven in.

The boxes are placed in stock to be issued on a storehouse order and charged direct to the engine.

MR. NEWMAN'S PAPER.

C. M. Newman, general foreman, Atlantic Coast Line, Rocky Mount, N. C., said in part:

The data I have is based on the information I have gathered from twenty of the largest railroads of this country, representing about 21,353 locomotives.

The first operation in machining new driving boxes is to strike off the hub side and the opposite side. This is generally done on a heavy planer, requiring from 30 minutes to one hour for steel boxes. This time only represents a few shops.

*See page 414.

The next operation is the cutting of the crown bearing fit and the cellar fit; this in some places is done on a planer or shaper, but usually on a slotter or draw cut shaper. The times on the machines most generally used are as follows: From one to three hours on the slotter and from fifty minutes to one hour and thirty-five minutes on the draw cut shaper. The draw cut shaper shows the best results.

The machining of the crown bearing is the next operation. There seems to be a variety of ways of performing this operation. Some shops turn the circle on a lathe or boring mill and plane the edges on a shaper or slotter; others do the whole operation on slotter, crank or draw cut shaper. The best times given are in favor of the draw cut shaper with special chuck and gage. This is from seventeen to fifty minutes from the start of the operation to the time the brass is ready to press into the box. On the draw cut shaper, one chucking and one tool completes the operation. The brass is then pressed in the box, preferably by a hydraulic press.

The box is now ready for the machining of the shoe and wedge fits. This is generally done on a heavy planer by clamping a number of boxes to an angle plate. The time for this operation per box ranges from one to three and one-half hours.

The cellars are then fitted to the boxes; they are next delivered to the drill press to have the cellar bolt holes, plug holes and oil holes drilled. One road, I find, uses a cutter in the drill press to cut the oil grooves for the shoe and wedge face instead of the hand or pneumatic hammer, which makes quite a saving. At this point, if there are any crown brass retainer plugs to be applied they are put in and then the box is delivered to the machine for crown boring. This is generally done on a horizontal or vertical boring mill. The best time given is on a horizontal boring mill on which the facing of the hub bearing and boring of the brass is done in twenty-five minutes.

The machining of second hand boxes is practically the same, except that the new work has some additional operations.

From the above it will be seen that for economical handling of this work we should have a slab miller for shoes and wedges, a heavy planer, a small powerful quick return planer, a draw cut shaper with attachments, a horizontal or vertical boring mill, a drill press, at least a fifty-ton hydraulic press and sufficient crane service to handle the parts from one machine to the other. With these machines so located as to have the work on the parts a continuous operation, there is no reason why a maximum output could not be obtained at a minimum cost.

Of the shops I have heard from, fourteen have a special machine grouping for driving box work.

On most roads that are using cast steel boxes, brass inserts or liners are applied to the shoe and wedge fits to keep them to a standard. These liners are held secure by the boxes when being molded, having dovetailed recesses or cavities left in the shoe and wedge fits, extending across them. In some cases, on second hand boxes, these cavities are machined diagonally across the shoe and wedge fit, making two cavities diagonally the entire length of the box. The metal is poured on the box, using a mold to give the required thickness to allow for machining. By this method the life of a cast steel box is almost unlimited as far as getting too small across the shoe and wedge fit is concerned.

The hub or lateral wear is taken care of in a number of ways and by numerous applications. In some cases, brass is applied to the boxes or to the wheel hubs; in some cases babbitt is used; one road has made a test of brass on the wheel hubs and removable fiber plates applied to the boxes. The road which has used the fiber plate on the box gave it a three year test on heavy power with good results. It is claimed that the lateral on a ten-wheel locomotive can be taken up in from five to seven hours. These fiber plates are 5/8 in. thick and are held in place by a recess on the box, 5/16 in. deep; this taking care of a 5/8 in. wear.

A test is being made by one road of applying a removable collar to the axle next to the inside of the box, and applying brass liners to take up the wear. This is being done without disturbing any other parts. I do not think this device has had a very long service test as yet.

The method generally practiced is to apply metal to the hub side of the box or the wheel hub. When applied to the box, it is held in place by a counterbored cavity on the box and is made secure by the application of pins. I have a record of one road which has the boxes cast with this cavity, and it is claimed that its roughness assists in holding the metal secure.

When pouring the metal on the boxes, on the hub or on the side for shoe and wedge face, some difficulty has been experienced in locating the oil holes. A method for preserving the holes has been suggested by applying a pin to the holes and placing around it a piece of small copper pipe. After the metal is applied, remove the pin and let the pipe remain in place.

In building up the hub of the wheel, the hub is bored out and a brass plate is applied, being held in place by countersunk rivets or bolts. Another scheme is to have these plates cast in halves, with dovetail ends, and fit them up and then machine to fit the cavity, securing them to the hub by countersunk bolts. Another method is to pour babbitt in the hubs to the proper width and thickness, using molds, which will require no machining to the hubs. Another method is to give the wheel a double dovetail counterbore and brake or make a nick in the sharp edges in several places to prevent the liner from turning and stand the wheels on end and pour brass on the hubs, building up to the required amount to allow for machining.

Of the roads I have heard from, fourteen use brass on the boxes or wheel hubs for taking up the lateral, four use babbitt, two use cast iron on the wheel hub and brass on the box.

DISCUSSION.

The method that has proved so successful on the Lake Shore & Michigan Southern of casting the brass and hub liner in place in the box was described by one of the members.* This practice is also being tried by some other roads.

The cast brass hub liner on the wheel centers, held in place by patch bolts previously applied, was favored by one of the speakers. The necessity for providing good lubrication of the hub liners was mentioned by several speakers.

Because of the cost of keeping up the cutters, the practice of using milling cutters for machining the shoe and wedge channel in the driving boxes has been generally abandoned.

The long main driving box which has been applied by the American Locomotive Company to a few large locomotives† is reported as being fully successful. It appeared to be the general belief that all brasses should be bored as near to a journal fit as possible.

Cleaning the perforated plate used in grease cellars at frequent intervals is necessary. This should be done with steam and never by heating the plate in the firebox or forge. The latter method distorts it and prevents proper lubrication. It seems that old grease can be forced through a fine strainer which will clean it and make it fit for further use.

The practice of using a cast steel box with a cast iron wedge was condemned. The liners should be poured on the shoe and wedge faces of the driving boxes in such cases; brass liners were favored. While the horizontal boring mill was admitted to have some advantages for boring and facing driving boxes, one speaker favored the vertical turret lathe for this work. The Lucas forcing press was also reported to be fully successful for pressing in the brasses.

Air hoists on trolleys, spaced the proper distance apart to handle the boxes to and from the journals and to the various machines, have shown a decided saving. The importance of properly selecting and locating the machines for this work was mentioned by several members.

*For full description see *American Engineer*, April, 1913, page 199.
†See *American Engineer*, August, 1912, page 393.

SHOP SCHEDULE*

By Henry Gardner.

Scheduling and routing work in a railway repair shop is not new. These methods have been and are used successfully on the Chicago & North Western, Atchison, Topeka & Santa Fe, New York Central, Lake Shore & Michigan Southern, Boston & Maine, Canadian Pacific, and in a more or less modified form on many other roads. The system described in this paper is the same as all others in principle but quite different in design and application. It was introduced in the West Albany locomotive repair shops of the New York Central in January, 1912.

This scheduling system is simple and flexible and maintained by the regular shop force and does not displace any portion of or the arrangement of the existing organization and does not antagonize it in any respect. Every feature of the work is fully under the jurisdiction of the local shop management and is not subservient to any outside agency. The whole scheme must be supported generously and enthusiastically by the management; not only the foreman and the shop superintendent, but the superintendent of motive power and the general manager must give it their endorsement and approval.

The fundamental principles of this system have been very extensively and profitably used in manufacturing and industrial plants and there is no tenable reason why these selfsame methods cannot be applied to railroad repair shops. The usual argument made by the railroad officials against the adoption of these up-to-date principles is that the cost of clerical or non-productive labor is much greater than the benefits derived and money saved. These objections have been entirely disproved and overruled at West Albany on account of the low cost of clerical help and the simple and practical nature of the work. It has been further argued that repaired material cannot be successfully scheduled, especially when manufacturing work is done in quantities for outside shops and engine houses, but this can all be provided for by setting aside certain machines and men, if necessary, for this work. At West Albany a leading man is detailed to supervise the manufacture and delivery of all material to outside points. Such work is not dated or scheduled and it can be run through a shop using the scheduling system just as easily as an extra or special train may be run over a division without altering existing time tables. This whole matter does not present an obstacle of any weight if the spirit is ever present to make the new system a success.

"Scheduling" means listing in order of dates or naming in consecutive order. "Routing" means determining the path or route over which material will travel in its natural course through the shops. After determining the route of a part it is scheduled; that is, dates are set for each stop and start that the part makes from the time it leaves the erecting shop until it returns again ready for completing the engine. The problem of scheduling and routing then resolves itself into providing a proper predetermined date or day of the month when each part, or group of parts, will arrive at and leave the various departments comprising the path over which it is to travel and finally arrive at the erecting shop when wanted for completing the engine. In the same manner the principal operations necessary to assemble the engine in the erecting shop are also subdivided and given dates in proper order for its completion.

In most railroad repair shops the date for the delivery of the entire engine is all that is planned ahead, but why is it not just as necessary to plan ahead a date for the cab or the wheels? Will not the same principles of foresight and preparedness hold good in either case? When this planning ahead is not done more or less confusion must exist, especially in the large shop. Frequent delays occur and a delay in one department will usually counteract all the good work of every other department. Parts are misplaced, side-tracked or forgotten, for days and sometimes weeks; suddenly when the engine is nearly finished someone

*See also *American Engineer*, October, 1912, page 539.

discovers that one or another piece is missing and the result is a general hunt, oftentimes unsuccessful, to locate this part and rush it through in order to deliver the engine on the promised date.

The schedule office should be centrally located, preferably in the center of the machine shop and close to the foreman's office. One competent man with shop experience and an assistant for office work and checking is all the force required with this system to route and schedule successfully all the principal operations and material for repairing 90 engines a month. If the shop is a small one, not requiring the full time of a special man for this work, the forms used may be made out by the foreman or sub-foreman.

The first step in introducing this system is to prepare route sheets showing the course of all the material to be scheduled through the various departments. The second step is to determine the number of days to allow engines to remain on pits while undergoing each class of repairs. For example, a Pacific type engine may be given 24 days on pit for a class A, B or C repairs and if it is to get a normal "D general" repair 18 days are allowed; if "E" repairs, 14 days; if "EF" repairs, 10 days and "F" repairs, 6 days. Another engine, a switcher, may be

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SCHEDULE OFFICE
ERECTING SHOP REPAIR CARD
OPERATIONS

SCHEDULE NO. 2
ENGINE NO. —
CLASS OF REPAIRS D
DATE TAKEN IN — 191_
DATE TO LEAVE — 191_
TIME ALLOWED 18 DAYS

ISSUED TO SCHEDULE SHEET FOREMAN SERIES 7-1-12

CLASS OF WORK	DATE WANTED	DATE FINISHED	REMARKS—CAUSE OF DELAY, ETC.
ENGINE IN SHOP UNWHEELED	0		
BOILER IN SHOP MOUNTED	—		
ENGINE STRIPPED MATERIAL DELIVERED	2		
BOILER TESTED (WATER)	2		
VALVE BUSHINGS OUT SIZES IN M. S.	3		
BOILER FITTINGS APPLIED	9		
BOILER TEST (FIRE) BOILER WORK O. K.	—		
CAB AND RUNS UP	—		
MAIN RODS UP VALVES SET	15		
BRAKE RIGGING O. K.	16		
SMOKE BOX WORK O. K.	17		
PIPE WORK O. K. SIDE RODS UP	17		
ENGINE OUT	18		

GENERAL FOREMAN

Fig. 1—Schedule Sheet for the Erecting Shop.

given but 14 days for a D-general repair since there are less and lighter parts to handle. These figures are generally used at West Albany, but cases may arise when an allowance of 20, 16, 12 or 8 days will better suit the conditions.

Schedules must necessarily be flexible, but once a schedule is made out for an engine it should not be revised unless there is a complete change in the nature of the repairs. The condition of the shop and the demand for the power will, of course, influence the selection of a proper schedule. The best way to determine the number of days allowed is to average the days on pits for each class of repairs for several years back; then, to start with, take off two or three days from these figures to represent the increase in efficiency due to the improved methods. In some shops the time on pits is based upon guesswork or upon a date which may be set to conform to the needs of the division superintendent or some other official. Often we find the number of repairs fixed by the amount of money allowed the shop for the month; such practices are very inaccurate.

About 25 forms are at present used by this new system at West Albany. For each engine scheduled there are 15 repair cards, three check lists, two delay sheets and one tickler sheet. Besides these there are three or four other forms of minor importance.

Fig. 1 shows the headings and a few lines of a schedule or constant sheet for erecting shop operations. It is plain that since but very few engines will carry the same dates we must have

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M. P. DEPT.
SCHEDULE OFFICE
MACHINE SHOP REPAIR CARD

SHOP D
SCHEDULE NO. 2
ENGINE NO. 1965
CLASS OF REPAIRS D
DATE TAKEN IN 7-17 1912
DATE TO LEAVE 8-7 1912
TIME ALLOWED 18 DAYS

ISSUED TO E. [illegible] FOREMAN

CLASS OF WORK	WANTED FROM ERECTING SHOP	WANTED IN ERECTING SHOP	WANTED IN SMITH SHOP	WANTED FROM SMITH SHOP	WANTED FROM TANK SHOP	WANTED IN TANK SHOP	REMARKS
MAIN RODS	7-18	8-1	7-30	7-31			
SIDE RODS	7-18	8-3	7-30	7-31			
VALVE BUSHINGS MACHINED	—	7-24					
STEAM CHEST OR PISTON VALVES	7-19	7-26					
ROCKER BOXES	7-19	7-30					
LINKS	7-19	7-30					
MOTION WORK COMPLETE	7-19	7-30					
DRIVING WHEELS AND BOXES	7-18	7-31					
TRAILER WHEELS AND BOXES	7-18	7-31					
ENGINE TRUCK BOXES	7-19	7-30					
SPRING RIGGING	7-19	7-29	7-20	7-23			
GUIDES	7-19	7-29	7-20	7-22			
ENGINE TRAILER TRUCK SIDE PLAY	7-26	—					
DRIVING BOX SIZES	—	7-26					
ENGINE FRAME	—	—	—	—			

E. B. Williams
GENERAL FOREMAN

Fig. 2—Machine Shop Repair Card.

a key or master sheet which does not give actual dates but instead numbers representing the number of days allowed for each operation. For example, the O at the top of the second column means that the engine is wanted in the shop and unwheeled O days after arriving on the pit, which is, of course, always that same day. The number 16 after "brake rigging O. K." means that 16 working days after the engine is placed

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M. P. DEPT.
SCHEDULE OFFICE
SMITH, BOILER, TANK & CAB SHOPS
MATERIAL CHECK LIST ____ 191_
SHEET

ENGINE NO.	DAYS LATE	MATERIAL	WHERE DUE	REMARKS
		VALVE YOKES	M. S.	
		MAIN & SIDE RODS	M. S.	
		ENGINE BRAKE RIGGING	M. S.	
		SPRING RIGGING	M. S.	

Fig. 3—Check List for Blacksmith, Boiler, Tank and Cab Shops.

on the pit the brake rigging must be up and finished. This is for an 18 day schedule; for a 10 day schedule the 16 would be 13 which is proportionately less since shortening the whole time of the engine will almost always shorten the time allowed for its material and operations.

Before making out the constant sheets it is often convenient to write out the schedule in diary form stating each day what is to be done. This form is given below for the first three days of the 18 day schedule:

First day.—Engine in shop—unwheeled.

Second day.—Main and side rods, driving and trailer wheels and boxes delivered to machine shop.

Third day.—Engine stripped complete. Boiler hydrostatic test O. K. valves, links, motion work complete, engine truck boxes, brake rigging, engine brake cylinders and valves, air pump, engine truck wheels, boiler fittings, eccentrics and straps, crossheads and gibs, pistons and rods, shoes and wedges, steam chests, covers, valve yokes, parts of spring rigging and some guides all sent from erecting shop to machine shop. Frame binders, engine springs and some guides sent from erecting shop to smith shop. Ash pan delivered to boiler shop, etc., to 18th day engine out.

Fig. 2 shows part of a machine shop repair card used to route and date all material from the erecting shop to the machine shop and back again when finished and ready for the engine. Material routed by way of the smith or tank shop, such as brake rigging parts and tender brake cylinders and valves are also carried on this form. To better explain it let us refer to the "side rods" shown in the second row from the top. Since we

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M. P. DPT
SCHEDULE OFFICE

MR. E. V. Williams, GENERAL FOREMAN — July 24th 1912

PLEASE NOTE STATEMENT OF FINISHED MATERIAL LATE IN DELIVERY TO DATE:

ENGINE NO.	MATERIAL	WHERE DELAYED	DAYS LATE	REMARKS
352	Side Rods	M.S	XXXX	no brasses in stock
500	Main "	" "	XXX	now in Smith Shop
1296	" "	" "	XX	waiting for keys promised 7-27
"	Piston Valves	" "	XX	waiting for rings promised 7-25
3494	Motion work complete	" "	XX	new links in S.S promised 7-26
132	Driving Wheels & boxes	"	X	one new center promised 7-25
188	Trailer " " "	" "	XX	waiting for side play S.S
742	R. Engine frame	S.S	X	[illegible] promised 7-25
1150	Ash Pan	B.S	XXX	new pan no stock promised 7-27
1001	Tender due for Engine	T.S.	XX	Wheels sent to Eng House

Fig. 4—Material Delay Sheet.

are now in the machine shop these rods are first dated over from the erecting shop on July 18, next they go to the smith shop on the 30th, on the 31st day they return from the smith shop and on August 3 they are delivered to the erecting shop. The date that these rods should be up on the engine on the erecting shop operation repair card is August 6, so that this date, the third, allows two days leeway for unexpected delays. If a delay occurred anywhere along the route the daily delay report, to be described later, would state that fact and explain the cause. Each department gets a repair card similar to the one just described and carrying all of the material or operations with which it is concerned.

In many cases small repair cards are used for still further extending the dates to gang bosses and job foremen. These are made out in the foreman's office and copied from the large repair card issued to that shop. All repair cards are made out by the schedule clerk from the constant sheets already described and each repair card has its corresponding constant sheet; the only difference between the constant sheet and the repair card is that the former carries simply numbers, as already explained, and the latter carries the actual dates. All repair cards should be returned to the schedule office for record and file after the engine goes into service.

Fig. 3 shows the headings for a material check list as used in the smith, boiler, tank and cab shops. Each department has one of these lists since it is imperative to check every piece of material or operation which is scheduled. The assistant in the schedule office takes the list sheet each day and visits all departments, marking the engine number and days late, if any, against the items printed on the sheet. The shop where the part is due is also noted in the fourth column. In the "Remarks" column the checker writes the cause for the delay, if any, and the date promised for delivery.

Fig. 4 shows a material delay sheet which is printed on pink paper to accentuate its importance and to distinguish it quickly from the repair cards which are printed on yellow paper. This sheet, with its mate, the operation delay sheet, is filled out from the check list by the schedule clerk each morning and sent at once to the office of the superintendent and general foreman. The delay sheet tells the whole story in a nutshell; what ma-

N. Y. C. & H. R. R. R. Co.
M. P. DEPT.
SCHEDULE OFFICE ________ 191__

MR. ________ GENERAL FOREMAN

PLEASE NOTE STATEMENT OF MATERIAL AND OPERATIONS DUE TO-DAY

ENGINE NO	ERECTING SHOP OPERATION	ENGINE	MACHINE SHOP MATERIAL	WHERE DUE	ENGINE NO.	SMITH, BOILER, TANK AND CAB SHOP MATERIAL	WHERE DUE
	ENGINE IN SHOP UNWHEELED		MAIN RODS			VALVE YOKES	M. S
	BOILER IN SHOP MOUNTED		SIDE RODS			MAIN AND SIDE RODS	M. S
	ENGINE STRIPPED MATERIAL DELIVERED		VALVE BUSHINGS MACHINED			ENGINE BRAKE RIGGING	M. S
	BOILER TESTED (WATER)		STEAM CHEST OR PISTON VALVES.			SPRING RIGGING	M. S
	VALVE BUSHINGS OUT SIZES IN M. S		ROCKER BOXES			GUIDES	M. S
	BOILER FITTINGS APPLIED		LINKS			ENGINE FRAME	M. S
	BOILER TEST (FIRE) BOILER WORK (O. K.)		MOTION WORK COMPLETE			ENGINE SPRINGS	E. S
	CAB AND RUNS UP		DRIVING WHEELS AND BOXES			FRAME BINDERS	E. S
	VALVE BUSHINGS IN AND BORED		TRAILER WHEELS AND BOXES			TENDER BRAKE RIGGING	T. S
	FRAMES BOLTED JAWS AND BINDERS (O. K.) SHOES AND WEDGES LINED		ENGINE TRUCK BOXES			TENDER SPRINGS	T. S
	CYLINDER BOLTED TO FRAMES AND BOILER		ENGINE BRAKE RIGGING			ASH PAN	E. S
	FRAME RAILS BOLTED MOTION CROSSTIE UP		ENGINE BRAKE CYLINDERS			STEEL CABS AND STEEL RUNNING BOARDS	E. S
	GUIDES LINED		ENGINE BRAKE VALVES			NEW FIRE-BOX OR BOILER	E. S
	VALVES IN		AIR PUMP			NEW FLUE SHEET	E. S
	MOTION WORK UP		TENDER BRAKE CYLINDERS AND VALVES			NEW SIDE SHEET	E. S
	SPRING RIGGING UP ENGINE TRUCK (O. K.)		ENGINE TRUCK WHEELS			TENDER TANK	T. S
	ENGINE WHEELED		TENDER WHEELS			TENDER DUE FOR ENGINE	ON FARM
	FLUES SET		BOILER FITTINGS			CAB RUNS AND PILOT	E. S
	DRY PIPE IN BOILER TEST (WATER)		ECCENTRICS AND STRAPS				
	BOILER WORK O. K.		CROSSHEADS AND GIBS				
	STEAM PIPES IN		PISTONS AND RODS				
	BOILER LAGGED		PISTON AND VALVE PACKING				
	BOILER JACKET O. K.		SHOES AND WEDGES				
	MAIN RODS UP VALVES SET		STEAM CHESTS AND COVERS				
	BRAKE RIGGING UP		VALVE YOKES				
	SMOKE BOX WORK O. K.		SPRING RIGGING				
	PIPE WORK O. K. SIDE RODS UP		GUIDES				
	ENGINE OUT						

Fig. 5—Daily Reminder of Operations and Material Due.

terial or operation is late, to date, where it is delayed and how many days; giving the cause of the delay and the promised delivery date. The general foreman with this report in his hand can visit each department and locate all delays in an incredibly short time; after this he can devote his time to supervision and minor duties.

Fig. 5 shows the "tickler" or daily reminder of all operations and material due. This is a very important sheet since it conveys to the superintendent and general foreman each morning an exact list of what should be finished or delivered upon that day, according to schedule, on all the scheduled engines in the shop. This sheet does not of course always tell what *will* happen on that day but it reminds the foreman of what *should* happen according to schedule.

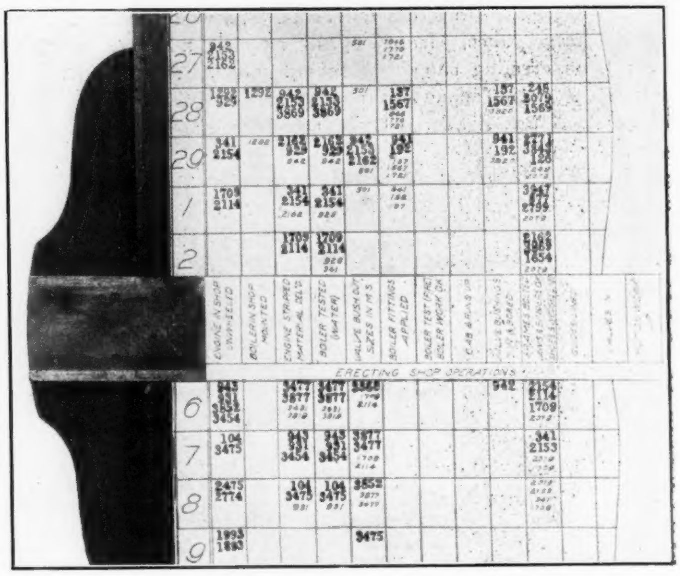
In routing parts under this system it is important to have a cross check on two or more departments. For example, parts of the spring rigging may be sent direct from the erecting shop to the smith shop, next to the machine shop and then back to the erecting shop. In this case the three foremen interested know the dates assigned for the whole route and can therefore check one another if mistakes occur in transit. All of these forms must necessarily be different for each repair shop, since no two shops will route their material exactly alike, but the principles involved will always remain unchanged.

Too much importance cannot be attached to the proper supervision of the engine when stripped since the list of scheduled material depends upon the report made by the stripping gang foreman who should see that no unnecessary parts are removed and should make careful notes as the work progresses, stating which parts should be repaired or renewed. This record should be sent to the schedule office and from it the repair cards will be made out. No repair card can have the full confidence of all concerned unless it is based upon exact conditions. The master mechanic's report of repairs necessary should be made out and sent to the shop superintendent as usual and while the engine is still in service. An elaborate detailed report is not necessary since the full extent of the repairs to be made can only be accurately determined after the engine has been stripped.

The Despatch Board and Calendar Rule.—The despatch board is the key to the whole situation in the schedule office. It is simply a board, about 3½ ft. x 4½ ft. carrying a T-square slider. On the back of this slider is pasted a paper strip carrying the names of all the materials and operations scheduled. On the slider at West Albany there are 73 items listed under the several departments concerned. The board proper is covered with paper ruled into small squares which contain the numbers of the engines scheduled. There are about 30 rows of horizontal squares, one for each day in the month, and 73 rows of vertical squares corresponding to each item or group of material or operation as listed on the slider. It is now plain that we can readily stamp up the engine numbers in whatever little square comes in line with the date a certain piece or operation is required to be finished or delivered. When all the engine numbers are stamped upon the board in their proper squares the schedule clerk can see at a glance just where each part should be each day, when it should leave and where it should go. He can also tell when a piece is delayed in any department and how many days it is late according to schedule.

There is no information on the despatch board which is not carried somewhere on all of the printed forms, but the board record is a great time-saver through its ability to present quickly all of the data in a convenient form; it is also of great service in apportioning the work so as not to overload any one department. The schedule clerk can optionally throw the dates ahead or back to better suit the congested conditions. The board record is also valuable when drawing off data for platting curves showing the progress of the work.

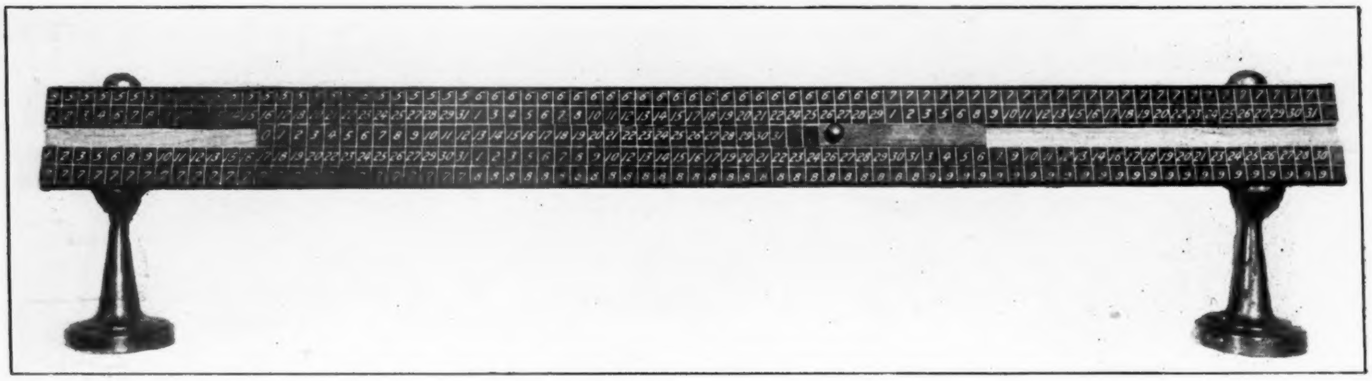
When making out the daily delay reports the T-slider is placed on the line for the day in question and by reading along the whole length of the line, first the engine number and then the material or operation, the entire report can be made out in a few minutes. Since all of the delays are posted conspicuously on the board in red ink, a preponderance of red shows at once which department, if any, is weak. The total time required to stamp upon the board all the operations and material for one engine is, for two persons working together, about eight minutes.



Detail Corner of the Dispatch Board.

The question is frequently asked: "How about the apparently large amount of clerical work required to find and assign all of the many dates required?" In reply we say that the "system" is worked out in the office as well as in the shop; all of the forms and the methods of filling them out are carefully systematized so as to make a minimum amount of writing and figuring.

A simple slide rule is used for finding the dates. This calendar rule carries on its back the days of the month for a six months' period, Sundays and holidays omitted. The slider carries the consecutive numbers from 0 to 31 which represent the constants found on the schedule sheets and already described. When once examined this little rule is found to be very easy to understand and operate and by its use the time for writing on the repair cards all of the 278 dates required for one engine has been cut to 18 minutes for two persons working together; one to read the rule and the other to write down the dates. Every six months the rule must be recovered with the paper strips carrying the dates; the slider always remains the same.



Slide Rule Used in Obtaining the Dates.

Shop Blackboards.—Blackboards are used in the shop in nearly every department for conveying the dates directly to the workmen interested; about 30 are now in use. These boards are ruled into columns and horizontal spaces having the words "Engine No." and "Date Wanted" at the top of the columns. On some boards it has been found convenient to put on the letter indicating the erecting shop wing where the engine is located and also the initials of the man to whom that particular job is assigned. The dates and engine numbers are all chalked up on the board by the shop foreman or his clerk as fast as they are received from the schedule office.

The men work to the blackboard dates, they are not at all interested in the date the engine leaves the shop; it is sufficient for them to know when their particular product is wanted. When the work is finished the workman or job foreman is only too willing to cross off the dates on the board.

The blackboard is simply an added convenience and a time-saver so that a workman can see instantly just what jobs are ahead and can figure so as to apportion them to the best advantage. It is a great incentive to the men to be constantly confronted with their dates and an engine number not crossed off on the date when the part is due is apparent to all foremen and inspectors.

Benefits and Results.—After a trial of 15 months this system has helped bring about many beneficial results. The shops are now more equalized; departments under or over supplied with men have been reorganized so that they are in harmony with the entire plant. A better feeling prevails in all departments; men are not unexpectedly called up to work at night, their work is laid out for them each day and they see that it is done on schedule time if they wish to avoid delay marks and consequent censure. Friction between departments is reduced to a minimum. An erecting shop foreman when trying to hurry some part in the machine shop is told to get out and come back on the day when it is due and he can have it; there is no other argument unless by special order from the general foreman. A workman can no longer say to his foreman, "You didn't tell me you wanted this done on a certain day," because the date fixes the job and stands for the foreman's written order to the man to perform it.

This system may be used as successfully under piece work as with day work compensation. In fact the piece workers like the "system" because they now get more work and it comes in proper order; for days ahead they know about how much they can make and this regularity is gratifying. The fast workers make more money because they get more work and the slow ones earn more because the incentive of meeting the dates stimulates them beyond their normal output. In some cases it was found, under the old methods, that a man would select a high-priced job for an engine going out much later than the low-priced job at hand. The reason for this was that he might be sick or lay off the next week and the other fellow would get the high price. This condition is automatically corrected by the dating system, since the work must be finished on time regardless of its price.

Another surprising benefit comes from the effect on the men of having the work laid out for them each day. The dates represent jobs and any man will work to the best advantage when he is given a specified job or task to finish within a stated time. A man who is constantly "jacked-up" by a foreman cannot do his best work and is not in the humor to do it if he wants to and the days of relying upon the energy and force of any one man to get results by constant driving are past. The daily appearance of the delay sheet with another "X" added each day that the piece remains unfinished stimulates a workman more than can be estimated.

The foremen praise the system since it relieves them of unexpected censure and when the blame is placed it hits the right man and he always knows it is coming. The general foreman's duties are now much less complex. No system can take the place of foremen, but this system can take the place of endless questioning and running about, allowing the foremen to get in touch with their men and answer questions kindly and patiently. The foremen's duties now become not so much a matter of seeing personally that each man is provided with a job and that no work is delayed, but of passing upon the quality of the work and giving instructions as to the best and quickest ways of doing it.

COMMITTEE REPORT.

In addition to Mr. Gardner's paper the committee consisting of L. A. North, general foreman, Illinois Central; Geo. C. Bingham, general foreman, Chicago & North Western, and Mr. Gardner presented the following report:

This schedule must not only deal with one part of the engine or machine, but must cover every part so that the completion of the work will not be delayed by the lack of an important item, which will necessarily hold back constant progress. As an example, in a locomotive shop, that is not equipped with a separate manufacturing department, giving an average output of 44 engines per month of which 11 engines are for thorough, 11 are for general and 22 are light, as well as 15 additional engines that are undergoing repairs for the following month, a shop schedule is of the greatest importance. In the Illinois Central, C. & N. W. and other shops the method used in arriving at the proposed figures is as follows: A meeting is held in the office of general foreman once a week. This meeting is attended by the boiler, the machine side and erecting side foremen. Each has the necessary information ready as to about what he can do with the force he has employed. The engines are marked down on a sheet of paper in numerical order as follows: 16 - 46 - 47 - 96 - 109. The first engine is then called off and the boiler foreman asked when he can furnish the boiler for delivery to the machine shop, provided the boiler has been sent to the boiler shop; after this, the date the boiler will be ready for pressure is obtained. The object of this is to give both the machine and erecting side foremen an idea of what date it will be necessary for them to have the cab fittings and boiler studs as well as the dry pipe and other necessary fixtures mounted on the engine. After this date is set both the machine shop foremen are requested to give figures showing just how much time will be necessary to complete the engine for a trial trip.

The information given on this sheet is then sent to the main office, similar information being furnished from all other points on the system from which a general itemized sheet is made up showing just how many engines are held awaiting repairs, how many engines in shop (date in and date out). This sheet is furnished all the general officers. From the first or original sheet both the machine shop foremen on the day following make up the shop schedule which roughly outlined is as follows:

Pit	Engine	Date in Shop	Boiler Over	Ready for Pressure	Wheels and boxes	Engine on Wheels	Valves set	Date on Trial

This sheet is furnished each shop foreman and gang foreman in the locomotive department as well as the shop and gang foreman in the cab department and is usually tacked up in some prominent place in each gang where the men will have access to it. This relieves the gang foreman to some extent, as all understand that the figures must be met or a reasonable explanation given for not doing so. In the Illinois Central there is no given time for any of the work such as fire boxes, flue sheets, light or general repairs as they do not think that a special time limit on work of this kind is successful for various reasons.

The C. & N. W., however, and others have a time limit, which works very successfully, as follows: Light repairs, 64 hours; heavy repairs, 114 hours; general repairs, 144 hours; general and new fire box, 200 hours.

The aim of the largest percentage of the railroad shops today is to turn out the largest output of good work in the shortest possible time. This can be done by the use of a schedule that can be altered by the shop management as the conditions require and by not being held to first figures submitted. Quite often to give any special engine preference means the loss of two or more deliveries that could have been completed had the work been allowed to go along the regular channels.

We are of the opinion that a shop schedule worked out along these lines will increase the output very materially, conditions, however, at various places will necessarily be met with and changes made to suit.

DISCUSSION.

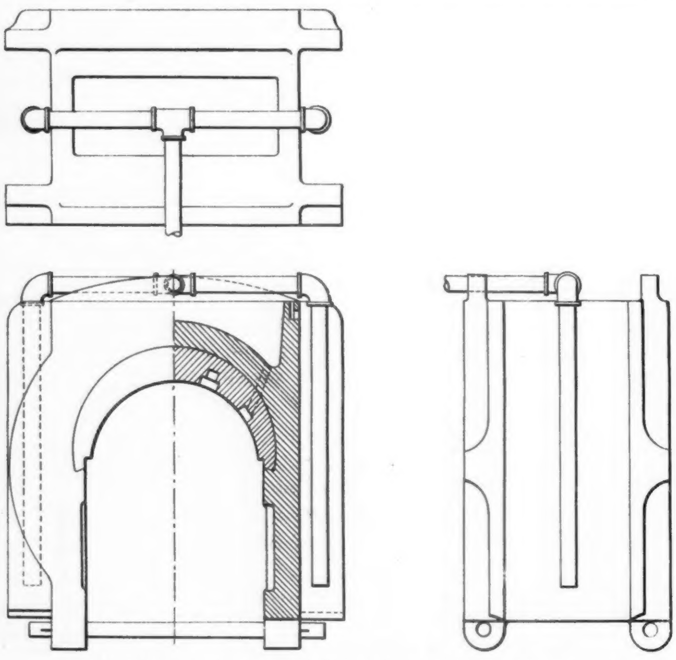
The difficulty caused by men laying off and thus defeating the prearranged plans was the principal subject of discussion. Mr. Gardner explained that this was the greatest source of annoyance that had developed but that its effect was counteracted by the extra allowance of time provided in each schedule. Apprentices that have been properly trained can sometimes be used to supply the deficiency of men on certain important jobs.

ELECTION OF OFFICERS.

The following officers were elected for the ensuing year: President, W. W. Scott, general foreman, D., L. & W., Buffalo, N. Y.; first vice-president, T. F. Griffin, general foreman, C., C., C. & St. L., Indianapolis, Ind.; second vice-president, L. A. North, shop superintendent, Illinois Central, Chicago, Ill.; third vice-president, Wm. Smith, C. & N. W.; fourth vice-president, W. T. Gale, machine shop foreman, C. & N. W.; secretary-treasurer, Wm. Hall, C. & N. W., Winona, Minn. Executive committee: C. L. Dickert, assistant master mechanic, Central of Georgia, Macon, Ga.; J. S. Sheafe, engineer of tests, I. C., Chicago, Ill.; W. G. Ryer, general foreman, N. C. & St. L., Nashville, Tenn., and G. H. Logan, general foreman, C. & N. W., Missouri Valley, Iowa.

BRONZE LINERS FOR CROSSHEADS

The Norfolk & Western is using bronze for lining the wearing surfaces of locomotive crossheads, in place of babbitt metal. When the crossheads are removed from the locomotive the babbitt metal bearing is melted off by the use of an oil heater made from iron pipe. The method of doing this is shown in one of the illustrations. Two cast iron formers are attached

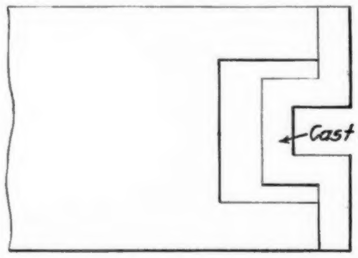


Heater for Melting Off the Old Babbitt Liners.

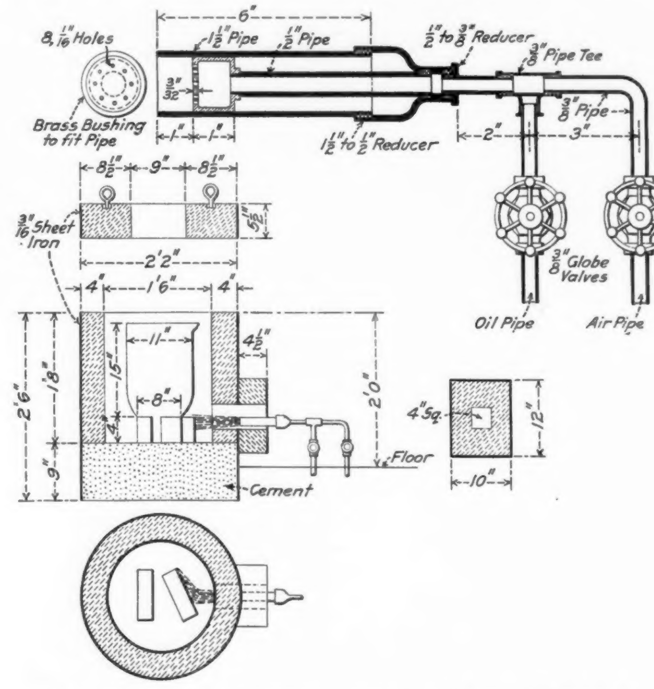
to each crosshead and lined up so that the difference between the inner surfaces equals the distance between the guides. These formers have a taper on the side of 1/64 in. in order to make their removal easy after the metal has been poured.

One of the illustrations shows the crude oil burner for melting the metal. The material required for lining two crossheads is 196 lbs. of scrap brass (old side rod bushings, etc.), and one pound of phosphor copper (½ lb. added with the brass and ½ lb. added before pouring). Three pounds of lead may be added, if desired, after the metal is melted, but this is not considered essential. In heating, the metal should be kept well covered with powdered charcoal after it begins to melt and until it is ready for pouring.

Two men, one at 27 cents an hour and the other at 15 cents an hour, handle this work quite readily with the assistance of a laborer for a few minutes during the pouring. When the furnace is cold it requires about one hour and fifteen minutes to make the heat, but after it has once been heated up, two crossheads may be finished complete in 55 minutes. No finishing is done on the crosshead other than to remove the rough edges by passing a motor driven emery wheel quickly over the bronze surface. Crossheads finished in this way are giving excellent satisfaction and have caused no trouble from not having the surfaces planed.



Former Used for Casting Bronze Crosshead Liner.



Furnace Used for Heating Bronze for Lining Crossheads.

Chesapeake and Ohio Canal.—Five thousand men and boys, assisted by 850 horses, oxen and mules, and a weekly consumption of 9,000 lbs. of gunpowder, are now urging to a completion 102 miles of the Chesapeake and Ohio canal. Sixty-four miles are to be in use on the first of June, and 102 miles on the fifth of October.—*From the American Railroad Journal, April* 6, 1833.

Harlem Railroad.—It is the intention of the company to have one mile of this road completed and in use by the 1st of October, when those who have apprehended danger from its passing through the streets may satisfy themselves to the contrary. We have no hesitation in saying that it will be found altogether more safe than stages.—*From the American Railroad Journal, September* 1, 1832.

INSTALLATION AND MAINTENANCE OF ELECTRIC HEADLIGHT EQUIPMENT

BY V. T. KROPIDLOWSKI.

II.

WIRING DETAILS.

In considering any project, every effort should be made to determine the course which, if followed, will give the cheapest cost of installation and at the same time the lowest cost of maintenance. This has been carefully considered in adopting the system of wiring a locomotive for electric headlight equipment which is described in this article. It is first necessary to procure the fixtures and fittings necessary for the work of wiring, which are as follows:

1 Crouse-Hinds Y-333,603-S junction box.
1 Paiste 88042 enclosed fuse cut-out.
2 Type "B," 40 ampere, 250 volt refillable cartridge fuses.
2 Greenfield box connectors, No. 6131.
1 Combination coupling, No. 6075 (Greenfield).
1 Combination coupling, No. 6073 (Greenfield).
2 Greenfield lead bushings, No. 6042.
1 1¼ in. Street elbow.
1 ¾ in. Street elbow.
1 Pipe nipple, ¾ in. x 3 in.
1 Crouse-Hinds type F. P., ¾ in. splice box.
1 Crouse-Hinds C. C. 1 splice box.
1 Crouse-Hinds porcelain cover, No. 23.
Greenfield flexible steel conduit, D. S., ¾ in. (one coil to start with).

In ordering the above material, a better idea of the appearance and construction of the fixtures and fittings may be obtained by referring to any of the general catalogs of the large electrical jobbing houses, as well as to those of the manufacturers of electrical supplies. The other fixtures that are shown in the illustrations are either furnished by the manufacturers of the headlights or are home-made. Okonite wire with mace braid is a good heat resisting insulated wire, a quality which on a locomotive is very essential.

The first step is to place the junction box on the front face of the cab, locating it high enough so that the flexible steel conduit that leads into the cab will be near the roof, as shown in Fig. 1; the cut-out block should then be fastened in the junction box, Y-333603-s; the assembled junction box, cut-out, connectors, etc., with the cover off, are shown in Fig. 2. Next string the wires through the flexible steel conduit that goes in the cab, and complete the wiring connections in the cab as follows: Insert in the conduit line, so that it will come about opposite the gage and water glass lamps, the type CC splice box, which has a porcelain cover with three holes, and connect the two flexible lamp cords to the proper wires in the junction box, leading them out through the two outer holes of the cover. Connect two No. 14 rubber insulated wires to the same wires to which are connected the two lamps and which are marked + and — in the diagram of wiring shown in the first article of this series (*Railway Age Gazette, Mechanical Edition*, July, 1913, page 367), and lead these two wires through the middle hole of the cover and out to the lamp at the gangway. Next mount the switch on the right side of the cab in a convenient place, connect the positive wire to the switch connection marked +, the negative wire to the one marked —, and the neutral to the one marked ÷. The resistance coil should be mounted right over the switch, as shown in Fig. 4, connecting one terminal of the coil to the positive connection of the switch and leaving the other terminal disconnected, if a Pyle-National or Schroeder generator is used; if the American generator is used, connect the other terminal to the extra contact *A*. These resistance coils can be purchased from the Remy Electric Company, or can be made by the railroad company. The size and quantity of wire required cannot be determined definitely unless certain details of the generator are known, but in the absence of such data 30 ft. of No. 14 B. and S. gage nickeline-II resistor wire, wound on a suitably proportioned and insulated spool, will be about right; in case it does not allow quite enough current to pass to the generator a piece can be cut off and another trial made. After having one rightly proportioned, all others can be made like it.

String three wires through the handrail, two size No. 8 and one size No. 14, the latter from the negative terminal of the cut-out to the headlight; the wires from the terminals of the cut-out to the cab switch should all be No. 8. Be sure that the wires strung through the hand-rail are long enough to reach from the junction box on the front face of the cab to the inside of the headlight. Cut a piece of flexible conduit the right length to reach from the end of the hand-rail nearest the cab to the junction box and string the wires that project from the hand-rail through this conduit; then connect the conduit to the hand-rail, as shown in Fig. 5, pass the wires into the junction box Y-333,603-s, shown in Fig. 2, and connect them to the terminals of the fuse block marked +, ÷ and —; after doing this, fasten the flexible conduit to the junction box with connector No. 6131, Fig. 2.

In connecting the generator to the system, take two No. 8 wires of the length required to reach from the generator to the junction box and string them through a piece of ¾-in. flexible steel conduit of the same length. Use a PF2 entrance hood at the generator and set it on a plate *C*, Fig. 6, pass the wires through it and fasten them to the correct terminals of the generator, as explained in the manufacturer's book of instructions; insert the conduit in the PF2 entrance hood and clamp the latter tight over the conduit by means of screws and a galvanized iron clamp under plate *C*.

The headlight will then be connected. Next string the wires that are projecting from the hand-rail at the front end through a ¾-in. flexible steel conduit of sufficient length to reach from the front end of the hand-rail to the headlight and fasten the conduit to the headlight case by a galvanized iron clamp, as shown in Fig. 8. Pass the wires through into the headlight, fastening the two No. 8 wires according to the instructions given in the book issued by the manufacturers, only in this case treat the neutral wire, marked ÷, as the minus wire referred to in the books. Special care is necessary at this point, as the Pyle and Remy have the large hole in the positive binding post and the Schroeder in the negative. The writer has known cases where the workman has not looked up the instructions and has cross-connected the arc lamp, resulting in the fusing of the copper electrode. Lead the No. 14 wire through to the incandescent lamps *9* and *10*, baring the wires and connecting them to one terminal of the lamps. Take a piece of No. 14 wire of sufficient length, connect one end to the plus binding post of the lamp and the other end to the second contact of lamp No. 9. Take another short piece of the same size wire and connect the second contact of lamp No. 10 with this wire to the minus binding post of the arc lamp, clamping the wires to the lamp cage with cleats, as shown in Fig. 8. The construction of the sockets of lamps *9* and *10* is shown in Figs. 9 and 10, as is also the method of fastening them to the lamp cage; these are the sockets furnished by the headlight manufacturers. The same kind of socket is used for the incandescent lamp at the gangway as shown in Fig. 9.

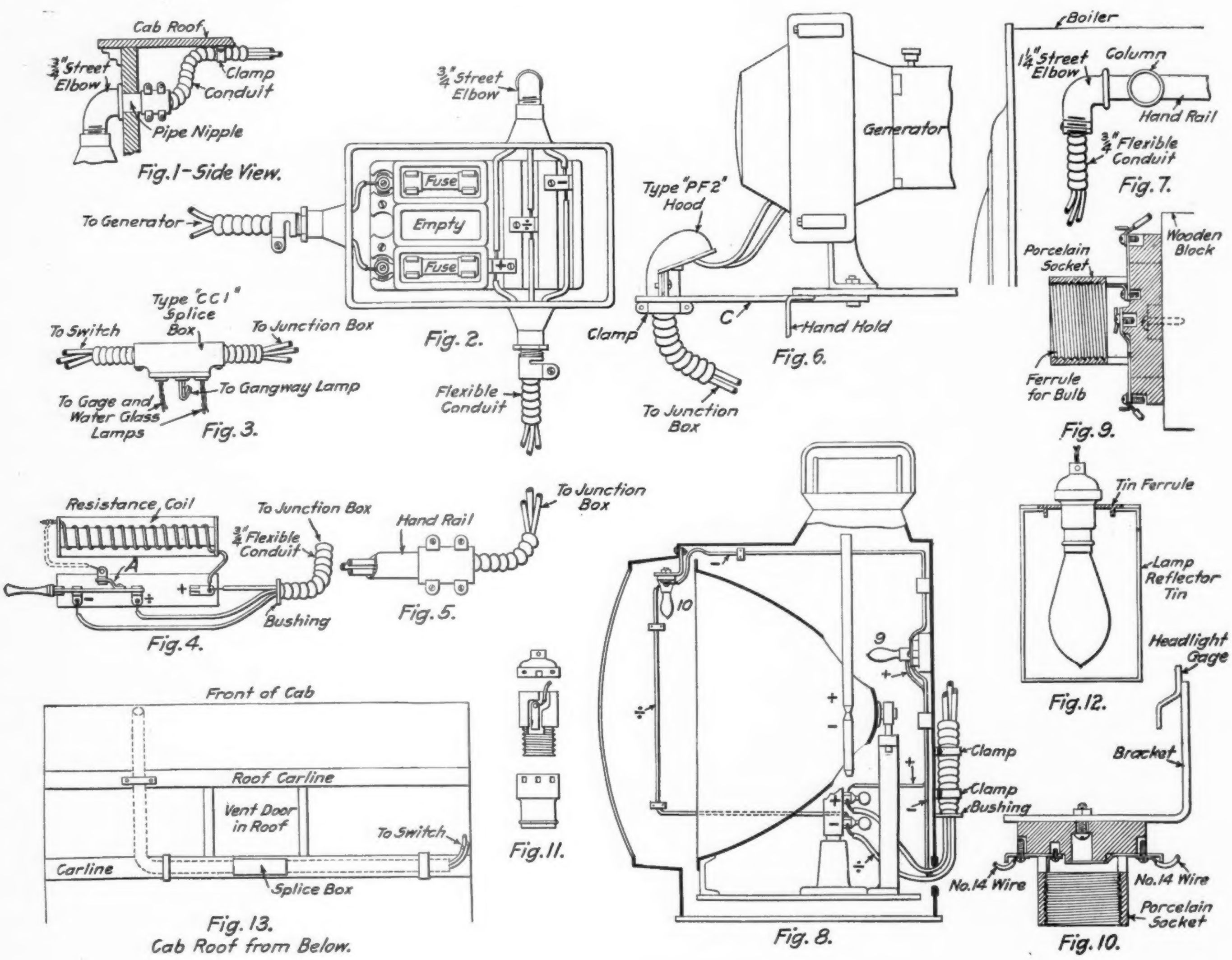
The incandescent lamps for the gage and water glass illumination are shown in Fig. 11. This shows the outer casing removed to indicate the method of connecting the lamp cord. Fig. 12 shows the arrangement of the gage and water glass lamps. The tin cage previously used with the oil lamp may be utilized by soldering a tin ferrule to the incandescent lamp, as shown in Fig. 12. The ferrule is inserted in the hole in the top of the reflector cage, bringing the bulb inside the cage; the cord should be sufficiently long to allow for the jarring of the locomotive.

The idea of protecting the generator by fuses, and consequently the arc lamp and the entire system, was developed from the writer's experience and observation. Almost without exception, cases of headlight failure and damaged parts in the electrical equipment are directly due to its not being protected by fuses. Cases of dead generators can invariably be traced to an open circuit somewhere in the generator winding, caused by the abnormal heat created by an excessive current melting the solder off of a soldered connection. Poor regulation of the arc lamp, as well as complete failure of it to strike an arc, is caused by excessive current overheating the regulating mechanism, warping and distorting the parts. The writer has found, in one or two instances, the solenoid of the arc lamp and the fields of generators overheated to such an extent that the insulating varnish, which is baked on at a fairly high temperature, was dripping off. All the cases of fused copper electrodes can be practically eliminated by the equipment being protected by fuses. The cut-out block recommended herein is of 60 ampere capacity, and as the manufacturers guarantee their equipments for a 50 per cent. overload, a 40 ampere fuse is about right; it will blow at a point between 110 and 125 per cent. of its rating, which means somewhere between 45 and 50 amperes. This capacity cut-out block also has very sturdy contact clips, which are very essential, as one can tighten down the wires securely and thereby eliminate the disconnecting of wires on the road.

It is not absolutely necessary to employ the junction box Y-333,603-s in this system of wiring; a galvanized iron box can be used but it will not withstand the weather and service as well, and is not as convenient for connecting and disconnecting. The writer strongly recommends the use of flexible steel conduit in place of rubber hose, and particularly the "D. S." conduit, as the "S. S." is not as flexible and moisture proof.

Referring again to Fig. 4, the contact *A* is not provided with the switch, but must be made up. The wire terminal can be bought, and a No. 1,578 (Central Electric Company's catalog, page 110), can be used. The offset strip that connects to the blade can be made of sheet copper.

In connecting the flexible steel conduit to the rear end of the hand-rail, as shown in Fig. 5, a ¼ in. sheet rubber gasket should be wrapped around the conduit as the hand-rail is 1¼ in. pipe and the conduit is ¾ in.



Details of Electric Wiring Installation for Headlights.

Flywheel Breakage.—Overload is a cause of flywheel rupture when the engine is belt connected. Generally the rim of the wheel is made thin and is, therefore, likely to fail, not only from centrifugal force, but from a short circuit of the electric generator, if used, a sudden stoppage of the engine, or the sudden throwing on of heavy machines in the mill. The greater the velocity of the rim of a flywheel the lighter it can be constructed and still prevent fluctuations in engine speed. There is a tendency on the part of the engineer to run an engine to high rim speed in order to obtain additional power from an engine and wheel designed to do less work. Such a wheel is more likely to rupture from overload than if it had been designed with a heavier rim. When speeding up an engine to obtain more work the engineer should not neglect to take the strength of the rim of the flywheel into consideration.—*Power.*

Railway Tool Foremen's Convention

Scrap Tool Steel, Forging Dies and Form of Thread for Boiler Studs Were Principal Topics.

The fifth annual convention of the American Railway Tool Foremen's Association was opened at the Hotel Sherman, Chicago, on July 22, by President J. Martin, machine shop foreman, Beech Grove shops, Cleveland, Cincinnati, Chicago & St. Louis. E. W. Pratt, assistant superintendent of motive power, Chicago & North Western, delivered the opening address, taking optimism as his theme. He urged the members to look on the bright side of things and to search for the best. He believed that conventions of men occupying subordinate positions on railways were of especial benefit. As illustrating the value of a good tool foreman he drew attention to what some of the older shops were doing in repairing modern locomotives. In many cases this excellent work is performed without the advantage of many modern machine tools and is largely due to the development of original devices, methods and tools in which work the tool foreman is prominent. In mentioning the requirements of a modern tool room, it was suggested that a good turret lathe might be of considerable value.

RECLAMATION OF SCRAP TOOL STEEL

By J. J. Sheehan (N. & W.).

In common parlance, any tool steel which is no longer serviceable for the purpose for which it was originally intended, falls within the accepted meaning of scrap tool steel. We have scrap lumber, which is material that can ordinarily be used for stove or kindling wood, or perhaps for other purposes. We have scrap iron, which is one of the supplies for the cupola or furnace, the material being transformed into castings and articles quite different from their original form; but in scrap tool steel we have a material which, at least as far as the average shop is prepared to handle, cannot be remelted, but can be transformed into shapes and sizes of other tools without altering its original characteristics and value as a tool steel.

A better appreciation of what may be done is illustrated by what has been realized in one plant in the way of reclaiming discarded tool steel, and utilizing it step by step in the various ways and opportunities offered, until the ultimate loss has been reduced to what would apparently seem to be a minimum.

For example, 6,500 lbs. of tool steel was purchased during a certain period, and the average cost was, say, 50 cents per lb. All of this material was worked into tools, and having served the desired purpose, it was found that the sum of the parts turned in as scrap amounted to 2,600 lbs., or 40 per cent. of the original quantity purchased, or taken at the value of the purchase price, represented $1,300. The process by which the recovery was made was as follows:

The material is separated and classified as follows:

Grade No. 1. This grade embraced all high speed steel, and was identified by a line of red paint the entire length of each bar, and was stored in a section painted red on the outside. After this steel was worked into tools, which included all turning, boring and planing tools, a number was stamped on the body of each individual tool ranging from 1 to 30, from which the name of the steel, the maker and the grade could at all times be traced.

Grade No. 2 embraced all the higher grade 120-point carbon steel, from which taps, reamers and formed tools are made, and was identified by a line of white paint; the section in which it was stored was painted white on the outside. Tools made from this steel were likewise stamped with a number when completed, ranging from 30 to 60, from which the name of the steel, maker, and grade could be traced.

Grade No. 3. This is a 105-point carbon steel, from which chisels, punches, punch dies, rivet sets, and shear blades are made. This grade was identified by a line of blue paint and the section in which it was stored was painted blue on the outside. Tools made from this grade were also stamped with a number, when completed, ranging from 60 to 90.

Grade No. 4. This was a grade of 90-point carbon steel from which tools for boilermakers, blacksmiths and track purposes are made; it was identified by a line of yellow paint and was stored in a section painted yellow on the outside. Tools from this grade were stamped with a number ranging from 90 to 120.

All tools are issued from the tool room, and returned there when requiring attention. All lathe and planer tools are made from bars having the following dimensions: 1½ in. x 3 in., 1¼ in. x 2½ in., 1 in. x 2 in., ⅝ in. x 1 in., ½ in. x ½ in., and ⅜ in. x ⅜ in.

As tools become too short or unfit for further service, they are placed in the scrap bin provided for the purpose, and corresponding to the number on the tool. When a sufficient quantity of scrap tools has been accumulated, it is sent to the smith shop, weighed, receipted for and placed in bins in the steel workers' section, labeled Grade 1, 2, etc., corresponding to the grade of the scrap. This department is equipped with a furnace that will maintain a heat of 2,500 deg. F. with a preheating chamber attached suitable for annealing purposes. There is also a 1,200-lb. steam hammer. This work should be handled by an experienced steel worker, otherwise the results will not be satisfactory.

When a sufficient quantity of scrap grade No. 1 has accumulated, it is placed in the preheating chamber of the furnace, and allowed to heat slowly and uniformly to a dark red, 1,000 deg. F.; the steel is then transferred, at the convenience of the tool smith, to the other chamber and brought to a bright red heat, 1,550 deg. F., and forged to the required size. Pieces 1½ in. x 3 in. are forged to 1¼ in. x 2½ in.; 1¼ in. x 2½ in. to 1 in. x 2 in.; 1 in. x 2 in. to ⅝ in. x 1 in.; ⅝ in. x 1 in. to ½ in. x ½ in. and ⅜ in. x ⅜ in. sizes. After forging and dressing for service and given the grade number, the steel is placed in the annealing box and allowed to cool before hardening to relieve the forging strains. From 600 lbs. of scrap steel thus treated there were 500 lbs. of serviceable tools delivered to the tool room, at a reclamation cost of 5 cents per pound; from the service rendered they were the equal of tools made from the original bar; hence the reclamation value of the steel after deducting the cost of reclaiming, 5 cents a pound, was 45 cents a pound, or $225.

Of grade No. 1, 315 lbs. were worked into cutters for Davis boring bars, to bore 7-in. After these cutters had served to the limit, there were 250 lbs. of scrap steel annealed and redressed for 6½-in. cutters for boring bars of the same make at a reclamation cost of 5 cents per pound, representing a reclaimed value of $112.50. After having served to the limit for the 6½-in. there was 180 lbs. of scrap which was again redressed and used for 6-in. cutters, with a reclaimed value of $81. After the limit of boring tools was reached, there were on hand 150 lbs. of pieces ⅞ in. x 2 in. x 2½ in., which were sent to the smith shop and forged into turning tools ½ in. x 1 in. x 7 in. long, with a reclaimed value of $56.25.

Chaser Dies for 1½-in. head measured ⅜ in. x 1⅜ in. x 3 in. After a number of re-cuttings for the 1¼-in. machine, there were on hand 200 lbs. of scrap dies, which quantity was annealed and reworked for the 1-in. machine at a reclamation cost of 2 cents per pound, with a reclaimed value of $95. After this service, there were on hand 150 lbs. of scrap dies, which were then worked into tool holder bits, of which there were 50 lbs. ⅜ in. x ⅜ in. x 4 in. at a reclamation cost of 5 cents per pound, or with a reclaimed value of $22.50.

Grade No. 2. From 786 lbs. placed in service at an original cost of 17 cents per pound there were 437 lbs. of scrap annealed for reworking at a reclamation cost of 2 cents per pound, with a reclaimed value of $65.55, the tools consisting chiefly of taps and reamers; taps ranging in size from 4 in. diameter down. Four-inch taps were reworked to the next smaller size, say 3¾-in., and so on down the line. On 1¾-in. taps for flexible staybolts, 1¾-in. diameter, the threads were removed and they were used for reamers for the same purpose. In like manner, after having the threads removed, staybolt taps were used as reamers on boiler work preliminary to tapping for staybolts.

Grade No. 3. From 1,147 lbs. put in service at 12 cents per pound, there were reclaimed 534 lbs. at 2 cents per pound, with a reclaimed value of $53.40, consisting of punches, punch dies, rivet sets, and flue expander pins. These were handled as follows: By the use of a punch post and nut to fit the spindle of the lathe, all punches were dressed to a smaller size on the point. All punch dies of standard and uniform dimensions were rebored and faced to any convenient size needed. Expander pins were re-turned to the next smaller size. Rivet sets due to drawing of temper and losing shape in cup were redressed again, hardened and placed in service, with satisfactory results.

By E. R. Purchase,
Boston & Albany.

The largest wheel lathe tools of high speed steel we keep drawing down until they reach ⅝-in. or ½-in. square, and then use them in the tool holders.

We have a bench in the tool room for all the different kinds of steel. This bench is partitioned off and a boy paints the scrap tool steel the same as the bar stock and places it on the bench in its proper place. The tool makers go to the scrap bench for stock before going to the rack for new stock and in this manner we utilize the bulk of the scrap steel.

We use a bench for short pieces of bar stock, that is, less than 24 in. long, and by doing this we keep the tool steel rack clean and free from short lengths which are liable to fall among other classes of steel.

We keep a separate shelf for all steel that is to be annealed.

All broken pieces of tool steel that cannot be reclaimed are placed in a barrel to accumulate and are sold as scrap to the steel mill. We have tried to use tire steel for rivet snaps with indifferent success, some working nicely and some giving no service. We have used some machinery steel for forging dies but find that a carbon steel for forging dies is economy.

By G. W. Nutt,
Chicago Great Western.

The various tools made from carbon steel which have become worn and unserviceable should be annealed and placed in some convenient place. We have placed a long shallow trough on top of our tool rack in the tool room into which this sort of material is placed. It is really surprising the use to which these pieces can be put. It is a great saver of the bar stock.

DISCUSSION.

It appeared that in most shops there is very little tool steel that needs to be scrapped, especially in the case of tools that are made in the shops where the tool foreman fully understands the quality of material. When the pieces of steel are too small to be used for other purposes they are worked over for use in tool holders or for inserted blade cutters. Several members mentioned the advantage of making worn staybolt taps into reamers for boiler work. In some cases this was done without annealing. It was stated that good equipment is necessary if the best uses are to be made of worn out or damaged tools. In one shop, 319 lbs. of high speed tool steel was reclaimed at a cost of but 5.5 cents a pound. Often it is necessary to design new tools in order to make the best use of the scrap.

The electric welding outfit can sometimes be used to repair broken tools. It is especially good for building new tangs on twist drills. One member mentioned the fact that the original design of the tool often had a controlling influence on the success of reclaiming it.

How to properly anneal high speed tool steel was discussed at length. Heating slowly in a gas furnace to about 1800 degrees and then slowly cooling was reported as being successful. Packing in cast iron cuttings or in charcoal and then heating are both successful.

It was reported that when the Santa Fe adopted high speed steel, it shipped over thirty tons of scrap carbon tool steel to the manufacturers.

SUPERHEATER TOOLS AND THEIR CARE

By Fred Peterson,
Colorado & Southern.

We have the Emerson superheater in our engines, which has 24 flues 5½ in. in diameter. These flues are swaged to 4½ in., eighteen inches from the back flue sheet and the 1¾-in. superheater pipes run from the steam pipes back within eighteen inches of the back flue sheet. When we first received these engines we experienced some trouble in keeping those flues tight at the front end. We found that the flues were not beaded at the front flue sheet and this was the cause of some of the leaks. We turned the flues over, beaded and expanded them and the trouble disappeared. Later on instead of removing the steam pipes to get the tubes out, we sawed the superheater tubes off and then pulled them out, thereby causing us to put a coupling between the steam pipe and the tubes; this makes it easier for us to remove the superheater pipes inside the large tubes.

We found again that the check valves in the boilers were close to the front flue sheet and the water striking the superheater tubes seemed to cause them to leak at different times. It would be better to have the check valve placed back further—30 or 36 inches from the front flue sheet.

In putting in the tubes we swage the firebox end to fit a No. 30 copper ferrule. We roll them with a roller, with five rolls, and after turning over we expand with a sectional leaf expander, and the flue is worked practically the same as the standard two-inch flues in locomotives. We find that in using these rollers, it is not necessary, after the engine has been in service for some time, to roll the flues very hard, and merely the weight of the rollers will make the flue tight and give better results than heavy rolling. The front end is also rolled, and we also use a Prosser or sectional leaf expander after the flue has been turned over. By this means we have no trouble in keeping these flues tight.

After removing the flues the first time, we welded on the large end of the flue. This weld is made by the O'Neill rapid tube welding machine. The flue is scarfed and also the safe end; they are then put together and welded. This machine we are now running by a three-horsepower electric motor and it is doing fine work on our large superheater tubes. The piece that we weld on is generally from 10 to 12 in. long, and the scarf made by this machine is superior to any that can be made in a lathe or in any other machine.

By A. R. Davis,
Central of Georgia.

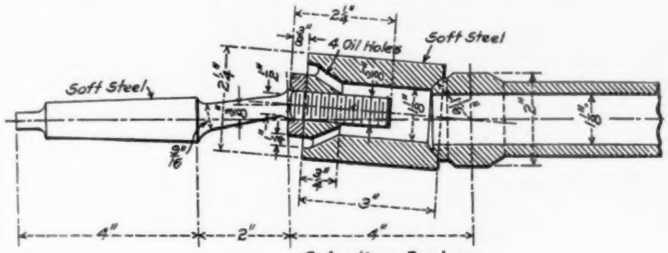
The tools used to install and maintain the superheaters are divided into two classes, the tools for the tubes, and tools for the header and other accessories. In the header are many brass ball joints for the pipes in the tubes which must make a tight joint. To maintain these joints they should be a true radius, as it is impossible to bend the pipes so that any but a true radius joint can be depended upon. The tools shown in the sketch were made as recommended by the Locomotive Superheater Company and will produce a true radius for repairs. These tools may be used with an air motor or under the drill press.

Thin socket wrenches of three lengths will be found most convenient to tighten the header pipe joints.

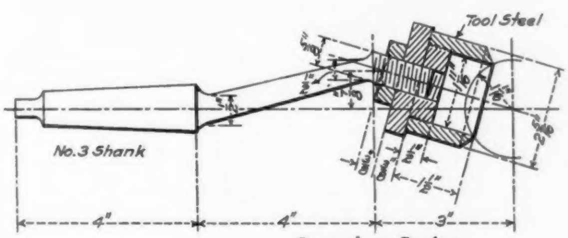
We have made no special tools for the damper control valves so far and any tools necessary will be of the type regularly used on air brake equipment work.

The various designs of oil spreaders in the steam passage require reamers of the design regularly used in the brass department on general work.

We have made but one set of new tube sheets for the superheater tubes and have had good results from the type of pilot cutter regularly used on bridge work for the large pin holes where the requirements are much closer. The pilot cutter is made with a 1¼-in. pilot of tool steel fitted in a machine steel body with a No. 6 Morse shank. There are three cutting tools of high speed steel, ⅝-in. square stock, the tools set with 1-32-in.



Grinding Device.



Scraping Device.

Successful Tool for Finishing the Ball Joint on Unit Pipes.

lead in length and 1-16-in. lead in width. The lead tool is ground as a round nose lathe tool with a rake.

As yet we have not had to enlarge any tube holes to allow tubes that are badly scaled to be removed from the boiler, but in anticipation of this I have made a reamer to enlarge the hole ¼-in., a bushing to be appplied when the tubes are replaced.

The reamer is made with a soft steel body, No. 5 Morse shank, with high speed steel blades, eight in number. The pilot acts as a binding plate for the blades, being fastened by six ⅜-in. cap screws. The blades enter the work at an angle of thirty degrees.

In handling the tube work the tools are similar to the regular tools for flue work. We have no special tool for cutting the tube loose from the sheet.

After the tubes are removed they are cut off and scarfed in the turret lathe. The safe-ends are scarfed to suit and when the tube is heated and the safe-end driven in there is about ⅛-in. overlap, which gives plenty of stock for welding; this is done on a large Draper pneumatic welding machine with good results. The tubes are swaged as usually done on the regular flues, the amount left for the bead being the same. They are cut to length in the turret lathe.

In applying, the tubes are rolled, Prossered and beaded at both ends. The tools for these operations are the same as for flue work except that they are of larger size to suit the diameter of the tube. The beading tool has the radius in the throat increased from 3-16-in. to ¼-in. and is 1-32-in. deeper in the throat.

We have not had enough experience in handling the superheater tubes to state what the expense is apt to be in maintaining the tools for this class of work, but from present indications I do not believe that it will be any heavier in proportion than the regular flue working tools.

DISCUSSION.

In connection with the proper design of tools for fitting the large boiler tubes, rollers are generally used and the straight type seem to be preferable to the self-feeding design. Considerable discussion arose in connection with the grinding of the balls on the units and the seats in the header. The design of grinder shown in the paper is successfully used at many shops. No grinding at all on these parts had been found satisfactory by some of the speakers. Cast babbitt cups used with emery were reported good, as were also copper cups. These cups are not faced but are used as they come from the mold.

MAKING THREAD CUTTING DIES

By August Metz,

Pere Marquette.

Select the steel for the chaser as near the size as possible to avoid unnecessary machining. Cut the chaser from the bar, square one end, and drill a hole as required on the machine in which it is to be used. Place the chaser in the holder and remove all excess stock on the heel or the back face. It is best to remove the metal to the center line. The angle or rake of the front face or cutting edge of the die is important and depends on the grade of stock which the die is to cut.

If the chaser is to be used for cutting copper, brass or the like, this angle should be zero, or coincide with a line passing through the axis of the work. For cutting bar iron the angle should be six degrees; for steel or steel pipe the angle increases to twenty-two or twenty-three degrees, making a hooked die. The chaser is now stamped for size and numbered to designate the relative position in the cases and the die head and is secured ready to be hobbed or threaded. Before hobbing, a reamer of proper size is passed through the blank chaser removing all surplus metal by concaving the cutting edge of the blank and leaving but one or two thousandths of an inch to be removed by the bottom of the hob or tap.

After being reamed a hob or master tap is placed in the vise of the machine and is run through the dies from two to five times, depending on the size of the tap. With the larger size taps the dies are cut with two or three passes; but with the smaller taps, which cannot be subjected to such a heavy strain, a light cut is taken and after each pass the dies are set in a trifle by adjusting the die head. After the dies are hobbed, the chasers are removed from the cases and all burrs are carefully removed and the chaser is ready to be tempered, the method depending on the grade of tool steel used.

After tempering, the throat or entrance of the die should be ground to the proper rake or clearance. This should be done by a special machine for this purpose, or by hand.

In threading a die of this type the cutting is all performed in the throat and the thread is completed by the first full thread encountered by the work, the remaining teeth only serving to feed the work and maintain the lead. From this it can readily be seen that the grinding of the chaser is very important in order to obtain the correct angle and the proper clearance.

When the chasers become dull, they are resharpened by grinding the throat; the average set of chasers can be ground or resharpened from 15 to 30 times, depending largely on the method of grinding. It is possible to resharpen the die until but a full thread or two remain, after which it is generally annealed and rehobbed to a larger size.

By J. B. Hasty,

Santa Fe.

Dies, like all other cutting tools, must be made and kept in good condition to produce good threads. It is safe to say that one-fourth of all the bolt cutters in operation at present do not cut a clean chip. Most threads are only ridges squeezed on the iron, which ruin the dies, and in fact the whole machine.

Bolt cutter dies can be made to cut free when re-cutting dies by seeing that the spindle and vise jaws, or grip, are in line and true. Then take a reamer and true them up to the proper size, ready for hobbing.

If the dies are placed on the center the hob should be from one thirty-second to one-sixteenth inch smaller in diameter than the size of the bolt you wish to cut. Grip the shank or hob in a vise and thread the dies in three or four cuts. Each time the hob runs through, close the dies down and let the last, or finishing cut, be a light one. See that the carriage does not drag. It is a good plan when the hob is half way through the dies on the finishing cut to let the vise off and finish by hand with a wrench. Let the hob remain in the dies and run the head at a fast speed and see that the hob runs true and central; if the dies are not tapped true and in line, they will not do good work.

After the dies are threaded, take a short taper reamer and ream the entrance not over three threads. In filing the face of dies, they must be proportioned to the size of bolt they cut. Use lard oil when cutting dies, as mineral oil spoils the hob. In tempering the dies, care must be taken not to overheat them. Harden in the same manner as chisels, or lathe tools. Draw temper to a dark straw or copper color.

BY G. W. SMITH,
Chesapeake & Ohio.

We are using the hobbed dies without relief on some of our bolt cutters, if a fair quality of iron is used. The back is milled off to the center of the blanks, and face the angle to the center line to suit the diameter of the dies. We find that on soft material a slight lip works very well with a sharp rake; with ordinary speed good bolt-cutting compound or good oil is very essential.

We also use the Landis dies and die-heads on machines which formerly used other style heads. The Landis dies and die-heads gave good service when other forms of dies failed. When cutting soft steel bolts, we ground our dies in every conceivable way without good results, until we got the Landis. Our make of dies would cut splendid threads on good iron bolts, but made a very ragged thread on soft steel.

We use the Hartness automatic die heads on turret lathes, with good results. This is a relieved die, being cut with 2¼ mill, regardless of the diameter of the bolt, hardened on the cutting teeth, and relieved in the center bearing on the back of the thread, which prevents wasting of the finished thread by the drag of the carriage where no lead screw is used. We also use solid square dies 6 in. x 6 in. x 1⅛ in. of high speed steel, split on one side, with an adjusting bolt through the side for making cast iron plugs for side rods. We also use many solid split dies on brass turret lathes, with good results. On stay-bolt work we use the Lassiter dies for cutting and relieving stay-bolts. A patent chaser grinder is used to grind these dies, making a very uniform throat and cutting edge.

We believe that when the bolt cutters and other thread cutting machines are so widely separated and under so many different foremen as is the case in many plants, and when the tool foreman is only appealed to when the dies fail to work or are ruined, it will be hard to get the maximum output.

DISCUSSION.

In making the cutters for the heads of bolt cutters, it is the practice in some shops to use high speed steel stock 1/16 in. larger in size than the finished cutters. This surplus stock is machined off. This practice is justified on the basis that the stock runs very uneven in size and that better tempering can be obtained after the scale is removed. Several members, however, claimed that stock of exact size could be obtained if special efforts were made, and that so far as tempering is concerned they could see no advantage in the machining of the sides. Some are using over-sized stock, but are not machining it, preferring to grind it to the desired thickness. One member questioned the advantage of using high speed steel for dies on the ground of economy. He had experimented with both high speed and carbon steel dies on the same machine and had found that with the rough usage the dies receive in the ordinary bolt cutter, the high speed steel dies did not pay. Some difficulty was also reported with high speed steel dies, in that, with the small sizes, after tempering, the threads would not follow.

One member reported using a hob which is slightly larger at the outer end, and that by closing down the dies as the hob is run through, he is able to obtain a back clearance as well as a side clearance, the latter being obtained by using a hob somewhat smaller than the size of the material which is to be cut by the die.

Considerable discussion arose as to the proper practice for making dies. Some speakers claimed that the dies should be cut only on the machines on which they are to be used, while others make it a practice to cut them to accurate size on a standard head. It appears that if the die-heads are maintained in the proper condition, it is the best practice to make the dies on a standard new head in the main tool-room, while, if the heads on the various bolt cutters are allowed to get in a very poor condition, this would not give as good results as to cut the dies directly on the machine that is to use them.

It was explained that the trouble with warped dies is frequently due to an uneven heat and can be overcome by slower heating. One member has secured excellent results with carbon steel dies in which the temper had been drawn in hot sand.

In one shop, at least, it is the practice to require the bolt cutters to turn in their dies each night and to draw new ones each morning. In this way the tool-room foreman has an opportunity to see that the dies are kept in good condition at all times.

FORGING MACHINE DIES

BY B. HENDRICKSON,
Chicago & North Western.

The process of making wrought iron and steel forgings by the use of a powerful machine and dies consists of four operations, viz.: A gathering of stock from the bar, molding into shape, welding, and punching. Oftentimes one operation only is necessary to form a piece, and again all four may be required. The dies for doing this work have two functions to perform. They must be able to grip the stock and must contain recesses of such a shape that the desired forging may be produced in one or more operations, as the case may be. In conjunction with the dies, a plunger is used whose function is to upset the stock and force it into the recess of the die.

The nature of the work to which they are put determines the material of which the dies shall be made. Cast iron, being the cheapest and most easily worked, is very desirable, but can only be used where the demand for its product is not very great. Where many forgings are required, standard dies are cast steel. Oftentimes the forgings may be done in such a way that more wear takes place on one part of a die than on another. In such a case, what are called sectional dies are used. The main body of such dies is made of cast iron and is so designed that where the excess wear comes, there are inserts of tool steel. These inserts may be removed when worn beyond a certain limit and replaced by a standard size, so the entire die does not have to be scrapped.

The material of which plungers are made depends both on their size and the nature of their work. Nickel steel is the material to be used for heavy work, while common tool steel or special plunger steel will do for lighter work. Where a punching operation is required, the brunt of the work should be borne by inserts made of air hardening steel or plunger steel. Provision must be made in the design of dies for the overflow of excess metal when the die recess is full. A vent should be made varying in size according to the weight of the forging. This vent, of course, becomes unnecessary when enough pieces have been made to enable the foreman to calculate the exact amount of material required. Wherever upsetting is done by means of a hollow plunger, a vent should be placed at the bottom of the recess, to allow the air to escape. Heating of dies from the hot stock does not affect their design. On large work, so much time is consumed in heating stock that the die cools itself. This practice will not do in the case of small dies, however, as they work too rapidly. There are two ways of cooling, either with a jet of water or swabbing off the surface with oil. The former method should be avoided wherever possible as it causes the die face and plunger to check.

DISCUSSION.

Consideration of the proper material to use for making dies of this character formed the principal part of discussion. It seems that in many cases dies made of tire steel, or even of cast iron, give fully as good service as those made of the higher-priced materials. In some cases, for punches or similar dies, nickel steel has given very good results. It is also often used for inserts on cast iron or cast steel dies where the wear is excessive. Where water is to be used for cooling, it has been found that high speed steel is not at all suitable for a die material, but where air is used, this expensive steel is satisfactory so far as service is concerned. Some of the members used high speed steel where the dies have to withstand an intense heat, claiming that it is the best material for use under these conditions.

As to the different parts which can be made on a forging machine, it appears that the opportunity is almost unlimited. On the Santa Fe, it was reported that about 50,000 grease cups are being made each year from old flues. The dies are made of tire steel, and it is stated that one set of dies will run for over a year. Other members mentioned various unusual parts that were made on these machines.

In connection with the advisability of punching the tell-tale holes in staybolts, the discussion showed the members to be generally opposed to the practice on the basis that the metal would crystallize and harden in the center, causing the bolts to become less flexible and more liable to breakage.

FORM OF THREAD AND DEGREE OF TAPER FOR BOILER STUDS AND PLUGS.

The committee on "The form of thread and degree of taper for boiler studs and plugs" presented several reports as the members could not agree. Abstracts of these individual reports follow:

By A. M. Roberts,
Bessemer & Lake Erie.

I believe the U. S. standard, 12 threads per inch, is preferable for the following reasons: For the convenience of the manufacturing of the studs; the simplicity of applying it; stronger and more durable stud; because of its standardization; the maintenance of the taps and dies; holes can be changed from "V" thread to "U. S." without any difficulty.

I would recommend a 1¼-in. taper in 12-in. for standard mud plugs.

By Jas. E. Dosser,
Southern Railway.

Many of the leading roads have investigated the superiority of the new form, or U. S. standard thread, and are using it exclusively. Some roads that have adopted the U. S. standard thread exclusively for boiler work are the Pennsylvania, Louisville & Nashville, Norfolk & Western, Southern, Central of Georgia, Delaware, Lackawanna & Western, Chicago, Rock Island & Pacific, and the International & Great Northern.

The U. S. standard thread gives much greater strength and life to taps and dies in use than that of the old "V" forms. There is also the advantage of re-tapping the old "V" form holes with the U. S. tap and replacing studs with the U. S. thread without changing the size of the stud.

I believe that the ¾-in. taper for studs is the most practical.

By Daniel Freyler,
Illinois Central.

I recommend the "V" thread for boiler studs and plugs. It has a greater cross-section than the U. S. standard, with flat top and root of thread, for an equal number of threads per inch. The depth of the U. S. standard thread is not as great as the V thread and is narrower at the base. However slight the difference may be, it is sufficient to reduce the area of the cross-section of the thread and as a result, the shearing strength. It may be objected that by reducing the depth of the thread the area of the screw at the root of the thread is correspondingly increased, hence the tensile strength of the stud is increased. This is true, but this objection is met when it is remembered that as the thickness of the boiler plate ordinarily is less than the diameter of the screw, the principal strain is on the thread, not on the core of the screw. The result is that if the cross-section of the threads engaged is reduced, the efficiency of screw or plug is reduced; therefore, since the cross-section of the U. S. standard thread is less than the V thread for the same number of threads per inch, or pitch, then the V thread is the thread to be used as it offers the greater resistance to the shearing strength on the thread.

I would adopt the V thread also because it adapts itself more readily to the slight variations in the angle of the thread and still makes a tight joint.

I believe ¾-in. taper per foot to be the correct taper, because as the angle of the taper recedes from the perpendicular, the shearing strength of the thread, which is perpendicular to the diameter of the screw, is decreased owing to the difference in the area of the threads in contact in the line drawn parallel with the center of the screw. I have found in practice that a taper bolt is stripped easier than a straight bolt of equal length of thread and the greater the taper the more readily it gives away, especially if it exceeds ¾-in. taper.

On the ¾-in. taper or less the friction produced by drawing up the stud or plug acts as a grip, tending to still further secure it, whereas, on a greater taper, this is largely neutralized since the line of pressure is nearest the apex of the thread.

By H. C. Wilson,
Southern Railway.

I am in favor of the United States standard form of thread, because it, not having a sharp point, will not wear so fast, and, therefore, will retain its size and form much longer.

I have found that a V form of tap or die will soon wear off at the point of the thread losing its size and form, causing trouble from tight or loose bolts. We have used many tapers and find that ¾-in. taper in 12-in. gives the best service.

By W. J. Eddy,
Rock Island Lines.

My recommendations for a standard form of thread and degree of taper for boiler studs and plugs are as follows:

Number of threads per inch for all boiler work	12
Form of thread	U. S. Standard
Taper, plugs and fittings	¾-in. per ft.
Wash-out plugs	1¼-in. per ft.

DISCUSSION.

After a thorough discussion of the subject a motion was unanimously passed that it was the opinion of the association that all holes in a boiler and all studs and bolts, with the exception of staybolts, should be made with a ¾ in. taper to the foot and twelve U. S. standard threads per inch. This decision was made on the basis that it was practically impossible to cut an exact V thread in boiler steel and that when in an imperfect condition they were frequently the source of considerable leakage. A. R. Davis (Central of Georgia) presented some interesting figures in connection with the result of some tests he had made between the two types of threads. In tapping 25 holes with a V tap he found the tap to wear .008 in., while the standard tap with the same number of holes under same conditions wore only

.001¾ in. With 50 holes the V tap wore away .011 in., while the U. S. standard tap only wore .003 in. It was found that 20 per cent. of the holes tapped by the U. S. standard tap were better than those with the V tap. It was further found that the U. S. standard thread tap required but 76 per cent. of the power required to operate the V thread tap.

All the members were agreed on the desirability of the standard taper, and it was stated that there were cases where three different tapers were used on one road. This naturally leads to the possibility of putting a stud of one taper into a hole of another with disastrous results so far as tightness is concerned. It was stated that one road uses straight taps only and finds no difficulty, but it was pointed out that the opportunity of getting tapering studs in a straight tapped hole was always present.

ELECTION OF OFFICERS.

The following officers were elected for the ensuing year: President, A. M. Roberts, Bessemer & Lake Erie, Greenville, Pa.; first vice-president, Henry Otto, Atchison, Topeka & Santa Fe, Topeka, Kan.; second vice-president, J. J. Sheehan, Norfolk & Western, Roanoke, Va.; third vice-president, E. R. Purchase, Boston & Albany, Springfield, Mass.; secretary-treasurer, A. R. Davis, Central of Georgia, Macon, Ga.; chairman of executive committee, C. A. Shaffer, Illinois Central, Chicago, Ill. The following four men were also elected to the executive committee: J. Martin, Cleveland, Cincinnati, Chicago & St. Louis, Indianapolis, Ind.; O. D. Kinsey, Illinois Central, Chicago, Ill.; C. Helm, Chicago, Milwaukee & St. Paul, Milwaukee, Wis.; A. Williams, Pennsylvania Railroad, Ft. Wayne, Ind. There were 56 members registered.

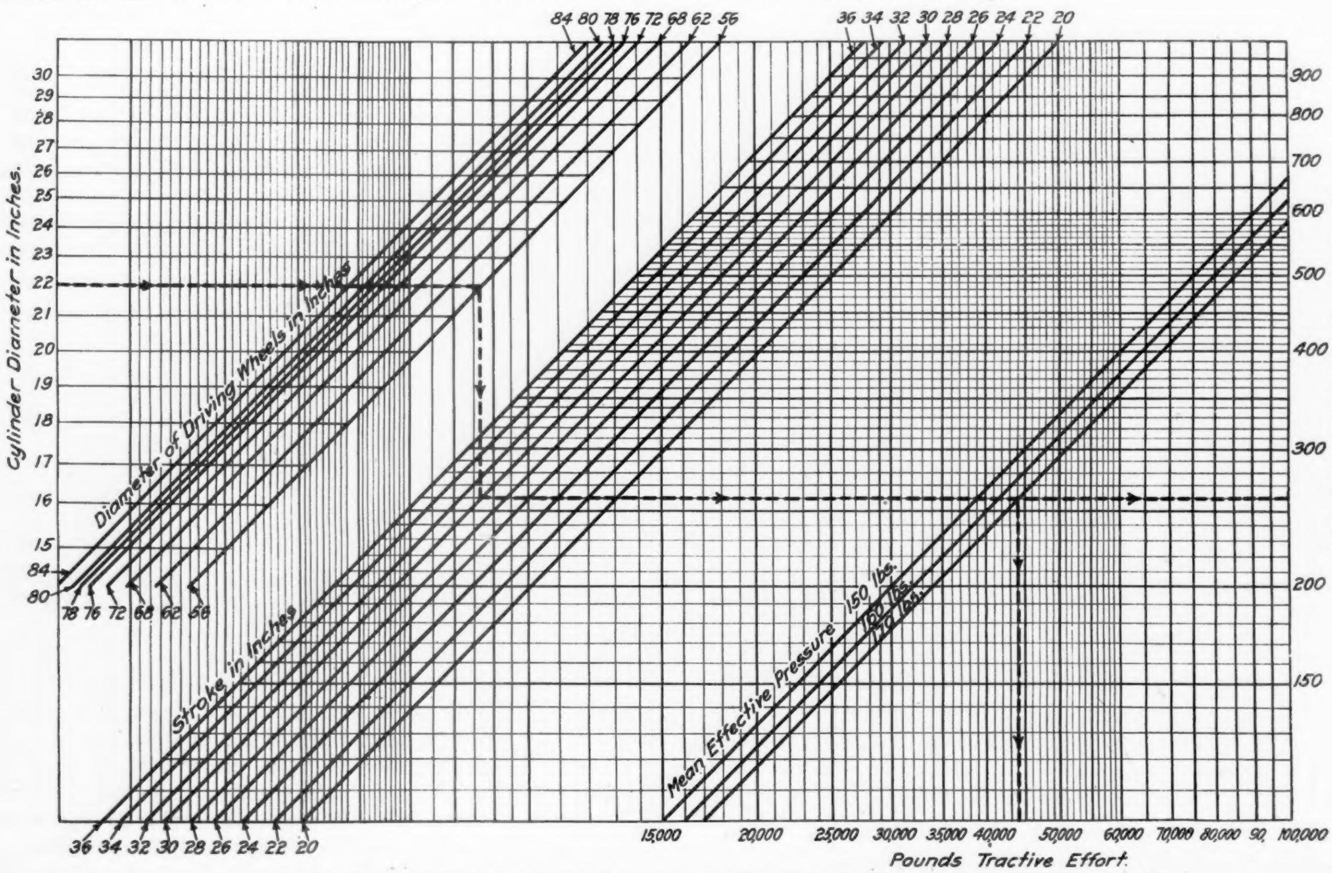
TRACTIVE EFFORT CHART

BY L. R. POMEROY.

The accompanying chart for obtaining the tractive effort of locomotives is very largely self-explanatory. It is arranged to include locomotives having cylinders between 15 in. and 30 in. in diameter and 20 in. and 30 in. stroke, combined with wheels from 56 in. to 84 in. in diameter and steam pressure which, with the proportion of boiler pressure that is selected as the proper mean effective pressure, will give either 150 lbs., 160 lbs. or 170 lbs. mean effective pressure. Scales are provided for giving the tractive effort per pound of mean effective pressure, if that is desired, or to give the total amount of tractive effort when using one of the three mean effective pressures given.

The method of using the table is simple and is well illustrated by the dotted line. The diameter of the cylinder is found on the left-hand scale and the line is followed horizontally to the intersection of the diagonal giving the diameter of the driving wheels. From this intersection, continue vertically downward to the intersection with the line corresponding to the length of the stroke and then horizontally to the right, continuing to the right-hand scale for the tractive effort per pound of mean effective pressure. From the intersection of this last horizontal line with the diagonals showing the mean effective pressure, continuing vertically downward will give the total tractive effort on the bottom scale of the right-hand part of the chart.

RAILWAY BUSINESS FOR MAY.—During May the railways of the United States received for their services to the public an average of $8,230,000 a day; it cost to run their trains and for other expenses of operation $5,920,000 a day; their taxes were $341,500 a day; their operating income $1,972,322 a day for the 220,897 miles of line reporting, or at the rate of $8.93 for each mile of line for each day. Thus for every six dollars of their earnings which remained available for rentals, interest on bonds, appropriations for betterments, improvements and new construction, and for dividends, the railways had to pay more than one dollar in taxes. All of these amounts are substantially greater than the similar returns for May, 1912. They are from the summary of the earnings and expenses compiled by the Bureau of Railway Economics from the monthly reports of the steam railways of the United States to the Interstate Commerce Commission. They include over 95 per cent. of the mileage and earnings of all of the railways of the country.



Tractive Effort Chart Giving the Pounds Pull for Any Size of Locomotive.

CAR DEPARTMENT

IMPROVED METHODS OF FREIGHT CAR CONSTRUCTION*

BY R. W. SCHULZE,

General Foreman Car Department, Gulf, Colorado & Santa Fe, Cleburne, Texas

The cost of freight car maintenance has been steadily advancing month by month and year by year. The desire for larger cars, the demand for greater capacity, and the effort to handle more tonnage are adding continually to the cost of maintaining the car body and the draft rigging. The car designer and the repairmen have not complained. They welcome the opportunity to increase the railroad's handling capacity. They see the improvement in locomotive tractive effort and strive to keep the freight car abreast of the engine.

The designer, with various data before him, endeavors to build a strong, durable car; one that will stand the drawbar stress over heavy mountain grades, the speed of the fast freight and the buffs of the "hump" yard. He lives with the car until it leaves the builder and joins the flow of commerce. Then the repairmen step in and begin the endless renewing of damaged, broken and worn out parts. Does the designer always consider the repairmen? Often, Yes! Often also, No! The purpose of this article is to note different features that have been overlooked.

Every new type of car as it joins its fellows is inspected, discussed and debated; sometimes optimistically, and sometimes, I am sorry to say, pessimistically. Not that its increased size or capacity are questioned, but all too frequently the designer has revelled in the great strength of his design and has forgotten the little kinks, ideas and possibilities of making the new type accessible to and economical of repair. It has often seemed that if the designer could listen to these "switch shanty" talks of car men and inspectors, many good ideas could be introduced into the design of the thousands of new cars being built every month.

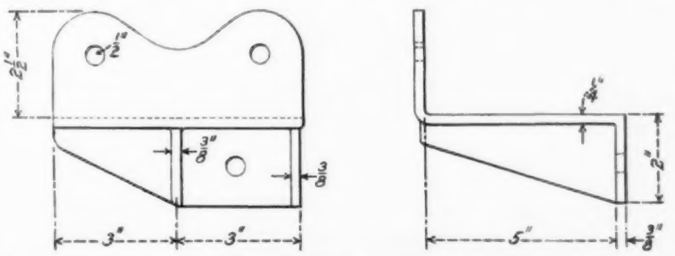


Fig. 1—Top End Post Casting for Use when End Posts are Removed from the Inside.

There is the one big question of end braces and posts—wooden ones that are broken, and iron ones that are bent. What should be done to make their renewal as economical as possible? It should not be necessary to tear out an entire end to renew one of the posts, or to tear off part of the roof to release a tie rod that is run through the post when it should have run clear or have been placed to one side. A little forethought on the part of the designer would allow an end post to be so applied that its renewal would only be a question of a foot of siding renewed or an end of lining removed and replaced—and not an entire end renewed.

The trouble usually lies in the pattern of the post top casting, or the tie rod being too close to, or too much a part of the post. Why not make the top casting with a lip extending up on the inside of the end plate and bolt it securely through this lip to the plate? Then let the designer decide whether he wishes the posts removed from the inside or the outside. Suppose that he decides to remove them from the inside, on account of the construction of the car. Then why not extend a lip down on the outside of the post casting, leaving the inside clear, and bolt the post and braces to this lower lip of the casting, as the upper lip is bolted to the end plate? Figs. 1 and 2 show a post casting which includes these ideas. By such construction a post or brace can be renewed by simply removing the siding or lining attached to the post or brace. The rigidity of the end is not affected, much material is saved, and the actual labor of renewing the post or brace is small as compared to the cost of renewing a post with a post pocket casting.

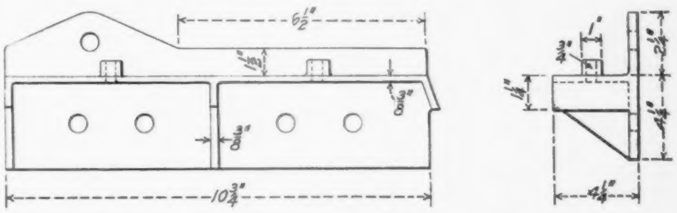


Fig. 2—Top End Post Casting with Top and Bottom Lips on the Same Side.

Another post and brace casting which requires careful design, is the lower casting on stock cars. Owing to the many shocks and blows incident to cattle swaying or moving in these cars, the posts, braces and castings must be rigidly fastened at both the top and the bottom. In some cars of recent design, these castings have been well designed; but in others it has been found practically impossible to remove the side sills, posts or braces without a considerable amount of extra work due to improper design of the casting. These improper castings have the vertical bolt so applied that the bolts cannot be removed without destroying the posts and braces. A slight modification in the design of the casting, so that the vertical bolts can be removed without interfering with the posts or braces would greatly simplify the work in making repairs. The most practical design of stock car side post and brace casting is the one which sets flat on the sill, with lips on the sides, and which is so designed that the lips extend down inside the side sill and are bolted to it with horizontal as well as vertical bolts, which bolts can be removed

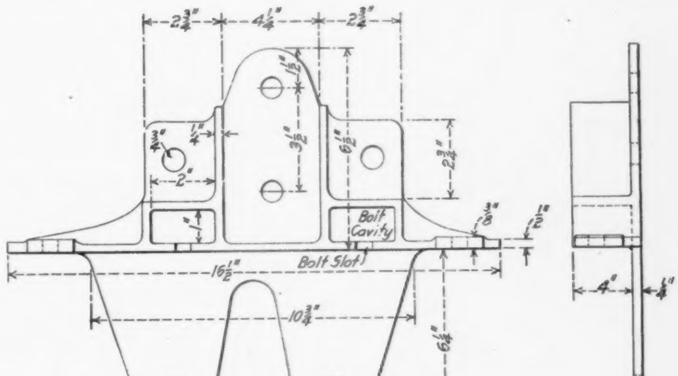


Fig. 3—Stock Car Bottom Side Post Casting Showing Method of Applying Vertical Bolts.

*Entered in the Car Department competition which closed February 15.

without interference with the posts or braces. Fig. 3 shows a post casting of this design.

Much labor and material are wasted in removing tie rods. These must be removed before broken parts can be renewed, as they are often run through posts, post castings and braces, when the same results could be attained if they were applied free of the posts and castings. It may often be difficult to confine these rods to their limited and proper places, but it would be far more economical and advisable for the designer to study all phases of the car construction and apply the rod in such a way that it would not be necessary to remove it when broken parts are removed. Much money is spent removing roofing, tearing off siding, and removing good material which is destroyed while being removed, in order to get at some particular tie rod which should have been entirely free from parts needing repairs.

The light tongue and groove lining should be abandoned and replaced by material 1⅛ in. thick, with a ship lap. In spite of all the efforts to securely pack cars to keep the load from shifting, it will no doubt never be entirely eliminated. When a heavy blow strikes the light lining, the boards break and splinter, the sides of the grooves split and break off, and it is only a question of a short time until car lining is damaged to such an extent that it must be renewed or the car will be unfit for bulk grain loading. Where the lining is increased to a 1⅛ in. thickness, a blow of extra heavy force would be required to break it, such a blow as would almost pierce the siding. Furthermore, the lap of the ship lap is so much heavier than the sides of the groove of the tongue and groove, that it will stand a heavier blow and will seldom split and break. Bulk grain leakage with ship lap lumber would be greatly reduced; and in renewing posts and braces, the lining could be reapplied with less waste of good material.

Fig. 4—Carline and Method of Applying It to Side Plates.

Probably less consideration and thought have been given to the car repairmen in the design and application of roof carlines than to any other part of the car. Seldom can a design of metal carline be found that can be removed without first practically removing the entire roof. The desire has been to tie the top of the car together and brace the roof without thought of the many cars which are so damaged that light repairs to the roof and body would place them in service with a proper design of metal carline, whereas with the present carline the entire roof must practically be removed in order to remove and repair one which is bent or damaged. They should be so designed and constructed that a bent or damaged one could be removed from the inside of the car without disturbing or loosening any part of the roof. In addition, the carline should be designed to securely brace and tie the car. In place of the ends extending on the top and over the outside of the side plate, they should extend down on the inside of the plates and be bolted through them. A reinforcement may be applied at each end of the carline in the shape of an "L." This can extend over the top of the plate, be bolted to the carline with two vertical bolts and be held to the plate with the same bolts that hold the inside lip of the carline to the plates. Such a carline can be removed by simply taking out the plate and carline bolt. The roof would not be disturbed, and would be just as securely braced and the cost of renewing or repairing a damaged metal carline would be exceedingly small as compared with the present expensive methods. Fig. 4 shows the arrangement of such a carline.

Many designers have built the steel underframe cars with short steel channel center sill extensions, extending from the end sill to the body bolster and riveted to the body bolster, while the center sills proper extend from one body bolster to the other. This design may be likened to the old short draft timbers as compared with more durable and efficient long timbers. The short steel channel center sill extensions should rightly extend from the end sill to a point beyond the body bolster. At this point there should be a standard sill splice. Such construction will strengthen the end of the car; will more equally distribute the load or shock on the body bolster; will have the same effect as a continuous sill, and will be more readily accessible for repairs.

A check of the design of steel underframe cars in any repair yard will demonstrate that even in the latest cars this feature has been almost entirely overlooked. The majority have a one-piece continuous center sill; very few have the ends spliced. The result is that where the steel center sills of a car are damaged, they must either be straightened by crude methods or must be entirely removed from the car and be cut and spliced at a heavy cost. Had these sills been spliced behind the bolster, as noted above, the ends could be removed and repaired at a small cost and with little delay.

Every year many thousands of dollars are spent paying bulk grain leakage claims, and placing cars in condition to prevent such leakage. The usual precautionary method is to prevent leaks around the sides and ends of the car along the siding by the triangular grain strip. This is applied on the floor of the car, between the siding and the lining, and also serves as an incline to empty grain lodged behind the lining. The strip fits closely against the siding of a new or newly sided car, but after it has been in service for some time and the sheathing has worked loose, the grain works down behind the grain strip pressing the siding further away from the car and finally finds its way through the opening to the ground. The shape of the strip should rather be that of an obtuse angle of about 105 deg. Such a strip clings to and follows the siding as it works away from the sill and holds the grain securely in the car. This change could be made at no cost, and yet the saving in the loss of grain can hardly be estimated.

Another wise precaution against loosened siding is the application of a light angle iron strip with bolts through the strip, sheathing and sill with nuts on the outside. It can easily be applied to even those cars already in service. It stiffens the car and its cost of application is almost nothing.

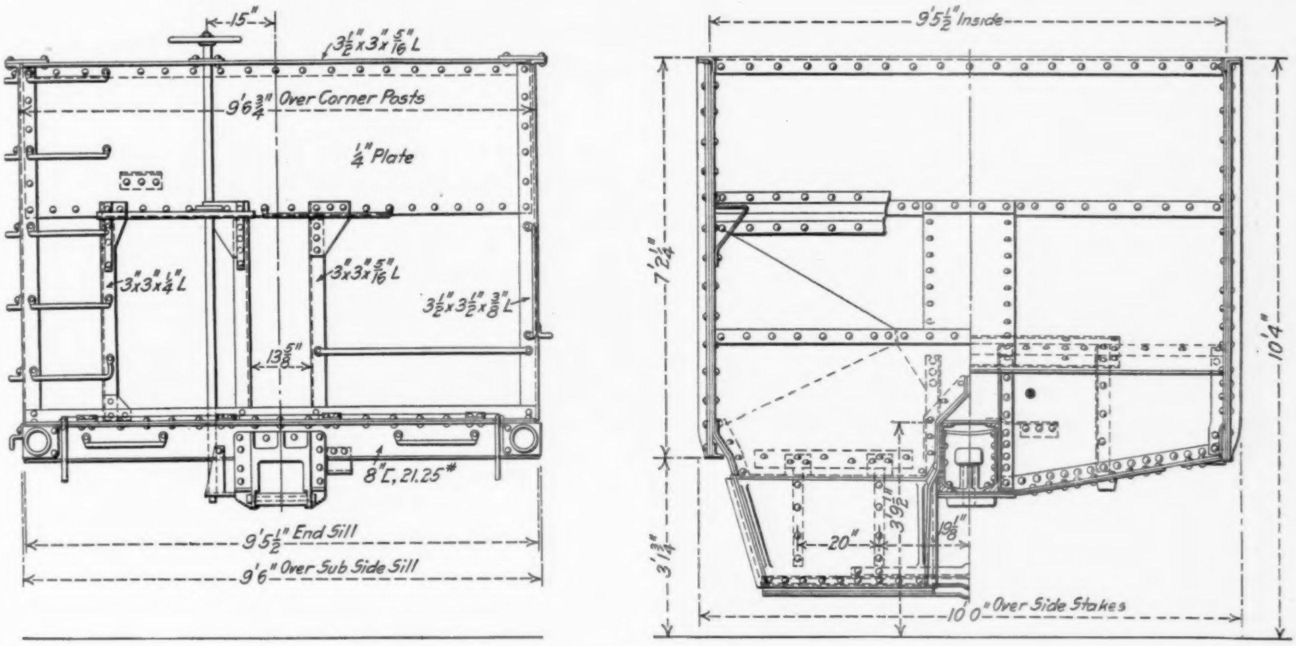
The entire hope of the car repairmen for future lightening of their labors is centered in the efficient design of new cars. The old car of obsolete construction will slowly but surely disappear. The strong and durable reinforced car will take its place. Cost of repairs must not increase. The tendency must be to decrease gradually and surely; but always the idea should not be overlooked that strength and durability are not everything. Easy repairs of seldom thought of parts and a minimum amount of work for small repair points should be the chief aim and desire of the car designer and car man. A number of these easy repairs have been noted in this article. Too much stress cannot be laid on the necessity of reducing repairs, so that small repair points can handle quickly and efficiently at low cost wrecked or damaged cars without the necessity of maintaining large forces of men where work should be of the lightest nature. We are getting the strong car. Sometimes we get the easily repaired car, and this is the car that must come into general use so that car maintenance costs will descend to the low level that should and can be attained.

NEW YORK CANALS.—We perceive by the Albany *Evening Journal* that the New York Canal Commissioners have reduced the tolls upon the Erie Canal. The *Journal* says that "This reduction was demanded by considerations which deeply affected the prosperity of the state. Rival channels of communication are opening which threaten to divert the trade of the far west from our great commercial emporium."—*From the American Railroad Journal, March 23, 1833.*

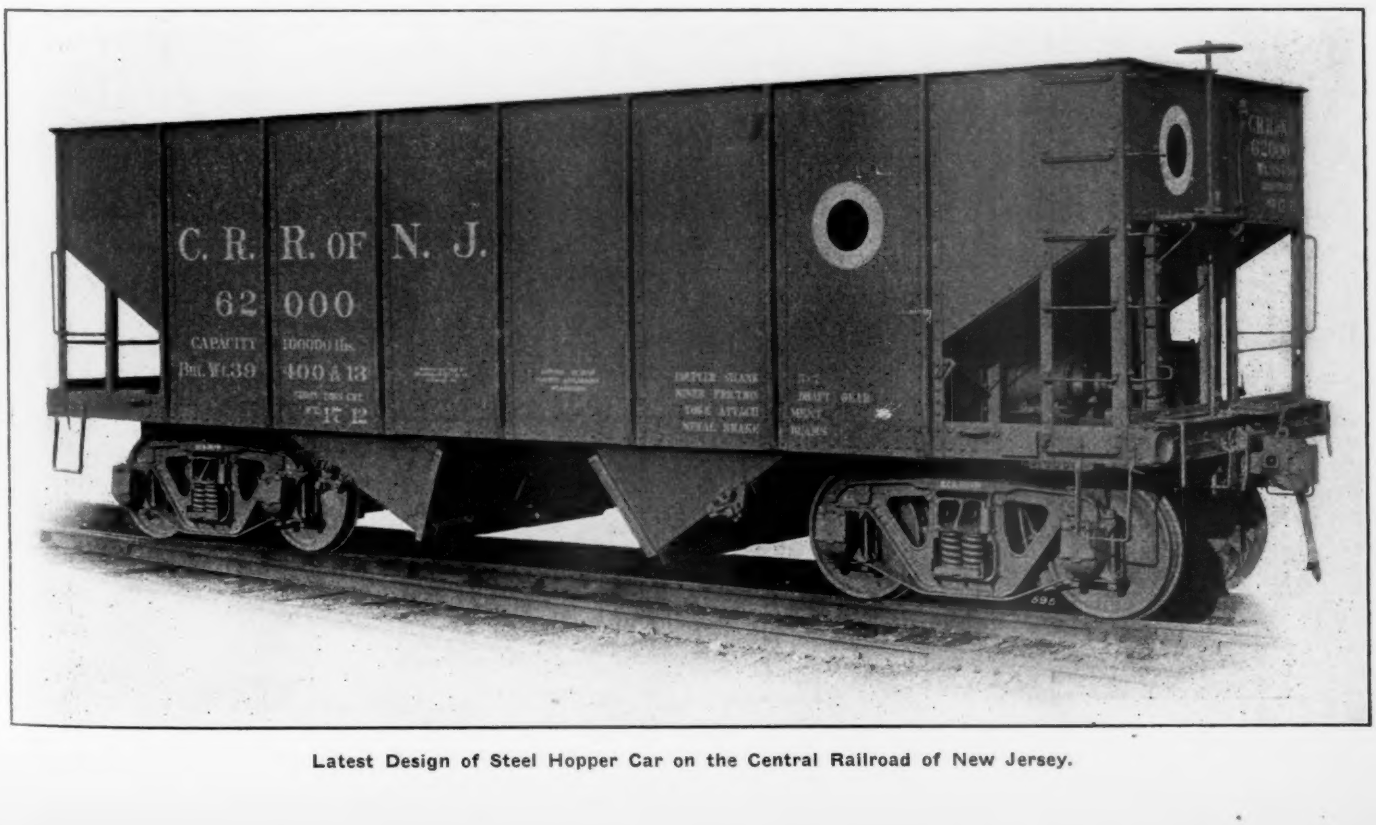
FIFTY-TON STEEL HOPPER CAR

The Central Railroad of New Jersey has in operation about 7,000 steel hopper cars, of which nearly 3,000 are 100,000 lbs. capacity. The remainder have a capacity of 80,000 lbs. These cars have been ordered in lots of about 1,000 each, during the past 10 years, and in each case the design has been somewhat revised on the basis of the service of the previous order. Various parts have been made heavier, the design of details has been revised and improved attachments have been applied, until it is believed that the latest cars meet the present conditions as perfectly as is possible. These changes in the last order of cars have increased the weight somewhat over the previous order which, in turn, were about 200 lbs. lighter than the first 50-ton cars ordered. The present cars have a light weight of 39,200 lbs. while those of the previous series weighed 37,300 lbs. This increased weight is accounted for largely by stronger center sills and a more substantial end sill construction. In other respects the changes did not make a material increase in the weight.

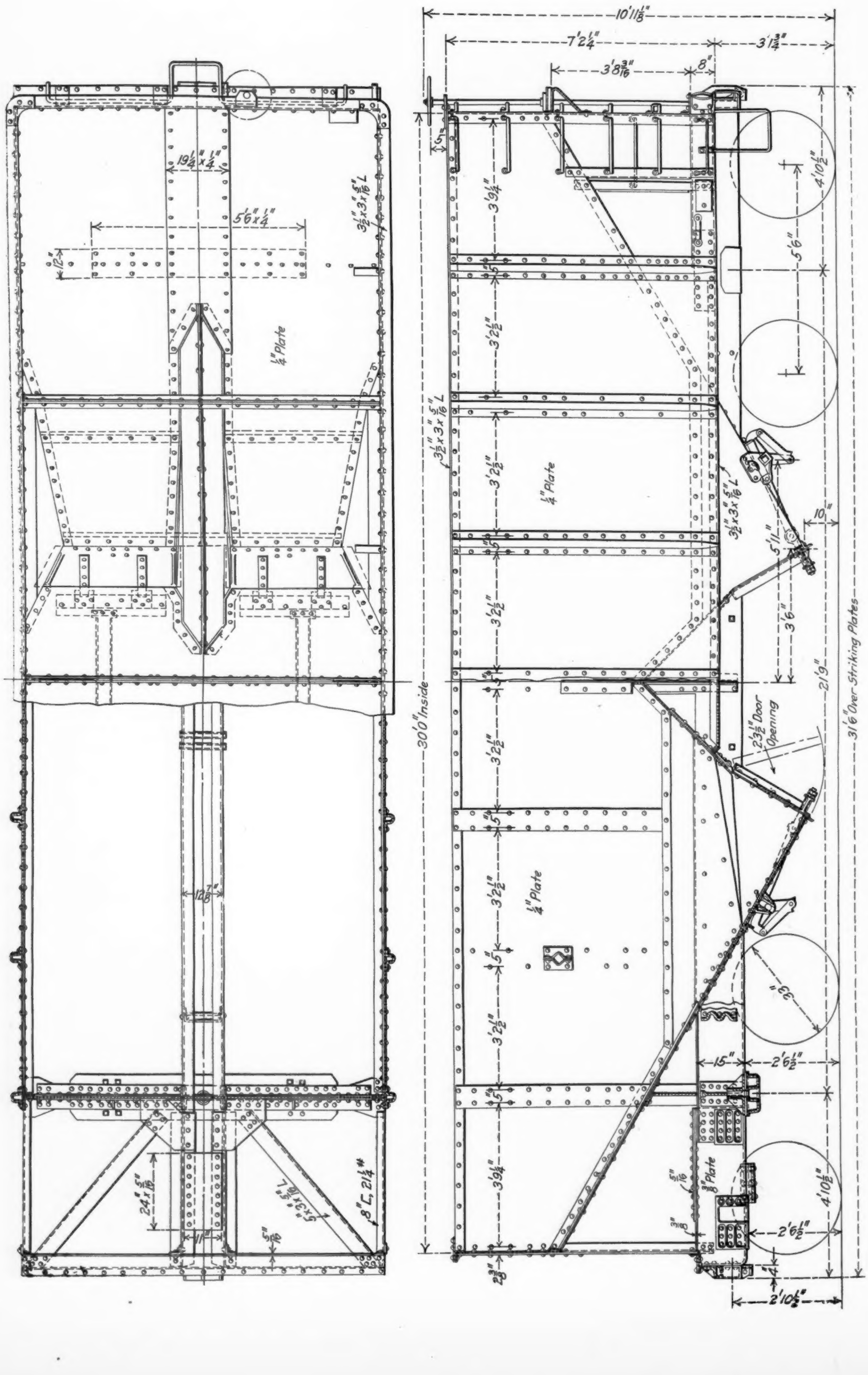
While the illustrations show the details of the construction quite clearly, attention will be drawn to a few of the more important features. The center sills are formed of two 15 in., 50 lb. channels with the flanges facing in. No cover plates are used, but suitable spacing pieces have been incorporated at various points. These heavy channels extend but a short distance beyond the bolster at each end, and to these extensions, the draft sills, which consist of ⅜ in. plate pressed in Z section, 15¾ in. deep, are secured. The draft sills are on the outside of the center sills



End Elevation and Sections of C. R. R. of N. J. 50-Ton Hopper Car.



Latest Design of Steel Hopper Car on the Central Railroad of New Jersey.



Fifty-Ton Hopper Car for the Central Railroad of New Jersey.

and are held by ¾ in. rivets arranged as shown. They have a 5/16 in. top cover plate 24 in. in length. The side sills proper extend only from the end sills to the bolster and are formed of 8 in. 21¼ lb. channels. The end sills are of the same size channel and include a 5/16 in. cover plate, bent to angle section. It will be noticed that this cover plate is of sufficient width in a horizontal plane to add greatly to the stiffness of the end of the underframe. The bolster is formed of a ¼ in. vertical plate of the very deep section made possible on this type of car. The arrangement of the reinforcing angles is clearly shown in the illustrations.

The sheets forming the car body are ¼ in. thick and the top reinforcing angle is 3½ in. x 3 in. x 5/16 in. The corner posts are 3½ in. x 3½ in. x ⅜ in. angles and the intermediate angle supports from the end sills to the body of the car are 3 in. x 3 in. x 5/16 in. The side stakes are of pressed steel in the usual form.

These cars are equipped with Miner friction draft gear, class A-18, with yoke attachment and Simplex couplers. The trucks are of the Andrews cast steel side frame type with 33 in., 725 lb. cast iron wheels. The truck bolster is of the American Steel Foundry Company's design and the springs were furnished by the Simplex Railway Appliance Company. Gould 5½ in. x 10 in. malleable iron journal boxes and Waycott brake beams are used. These cars, built by the Standard Steel Car Company, have following general dimensions:

Length over end sills	31 ft. 6 in.
Width of car over side stakes	10 ft.
Width of car inside of body	9 ft. 5⅝ in.
Height from top of rail to top of body	10 ft. 4 in.
Length of hopper opening at the bottom	2 ft. 11 in.
Width of hopper opening	2 ft. 3½ in.
Height from top of rail to under side of hopper	9¾ in.
Distance from center to center of truck	21 ft. 9 in.
Wheel base of truck	5 ft. 6 in.

TESTS OF ALCOHOL HEATER CAR

In shipping perishable products during the winter months some precaution must necessarily be taken to prevent freezing, and the practice commonly followed is to line box cars with building paper and equip them with false floor racks and small stoves. The objections urged against this practice are the initial cost for equipping the cars, which are not always returned for repeat loads, and the cost of attendance along the road, as well as the risk from damage by fire. Specially fitted heater cars are in use to some extent for such traffic, but the objection commonly raised against this type of car is that it is necessarily non-revenue producing for about nine months of the year, unless used as an ordinary box car during that time, and the heater car necessarily costs more than the ordinary box car.

A solution of the problem would seem to be a combination heater and refrigerator car that would be available for use the year round. There are several types of this car in existence, one of which has been developed by the Alcohol Heating & Lighting Company, Chicago. After making tests with a number of fuels, it was concluded that denatured alcohol was the best adapted to the purpose in hand, as it does not vitiate the air to the same extent as other fuels, and it can be used as a heating agent without any detrimental effects on food products. Considerable time was spent in developing an automatic alcohol burner, and one was finally produced that could be safely operated for from eight to fifteen days without any attention other than an inspection made at divisional points.

These cars have now been in service during three winters, and the illustrations accompanying this article show the result of a temperature test made on one of them in use on the Canadian Pacific. The recording thermometer was placed in the car at 11 a. m., March 2, at which time the doors were closed and sealed, the car remaining in this condition until 8:30 p. m., March 11. The full line on the diagram represents the temperature inside the car, and it will be noted that it was maintained almost constantly between 40 and 45 deg., a variation of less than 5 deg., while the temperature outside varied 58 deg., as shown by the dotted line on the diagram. During this time the car traveled a distance of 1,475 miles.

The test was conducted under the direction of A. W. Whiting, inspector of refrigeration of the Canadian Pacific, and was run between West St. John, N. B., and Fort William, Ont. The car was equipped with what is termed the double unit system, there

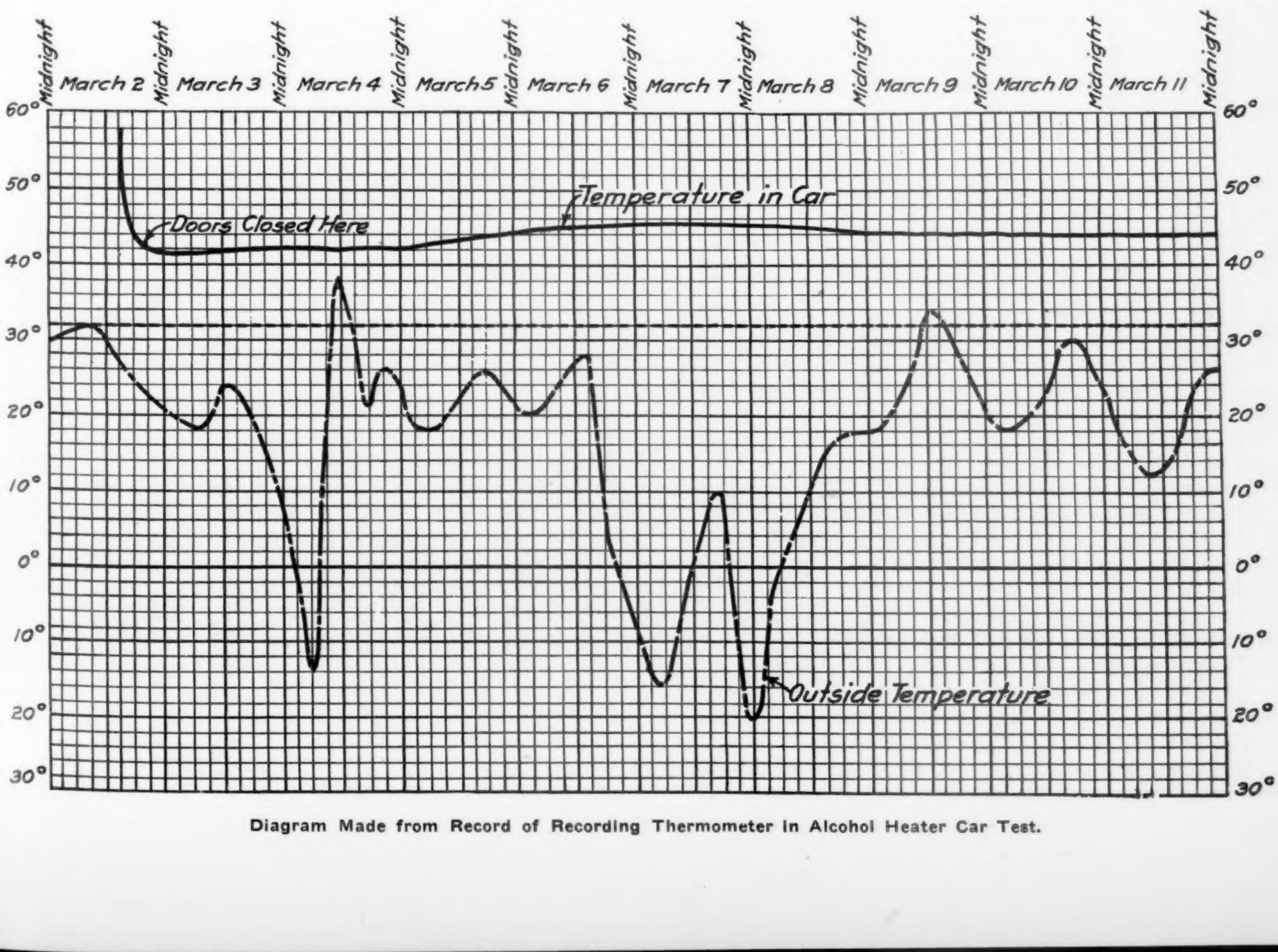
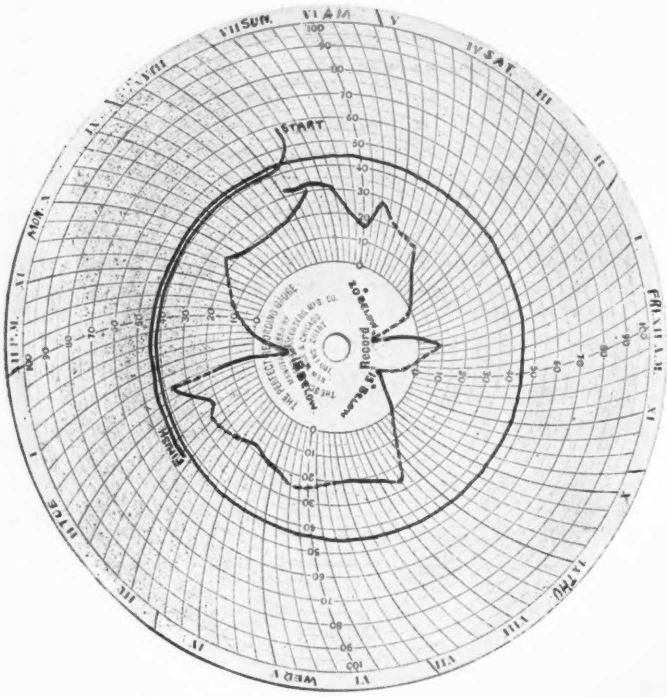


Diagram Made from Record of Recording Thermometer in Alcohol Heater Car Test.

being four burners, two on each side of the car. These burners are exactly the same, but for convenience in conducting the test were numbered 1 and 2. By using four burners the maximum amount of heat can be applied quickly at the point of loading, and when the car and contents have been thoroughly warmed two of the burners are extinguished, the two remaining ones being sufficient to protect the lading. The duplicate system insures a longer run without the necessity of cleaning the burners; each burner will burn continuously for seven days without cleaning, and if the car is reconsigned it is only necessary to extinguish one burner and light the other.

The car was loaded with boxed merchandise to a height of about 4 ft., there being no space between the boxes or at the doors. Both the No. 1 burners were lighted at 11 a. m., March 2, 1913, and a self-recording thermometer was placed inside of the car, 6 ft. back from the door, 2 ft. above the floor and 2 ft. from the side wall. The thermometer wassurrounded entirely by freight in order to determine the temperature of the freight rather than the temperature of the air inside the car. The car left West St. John at 8:45 p. m. March 3, with the two No. 1



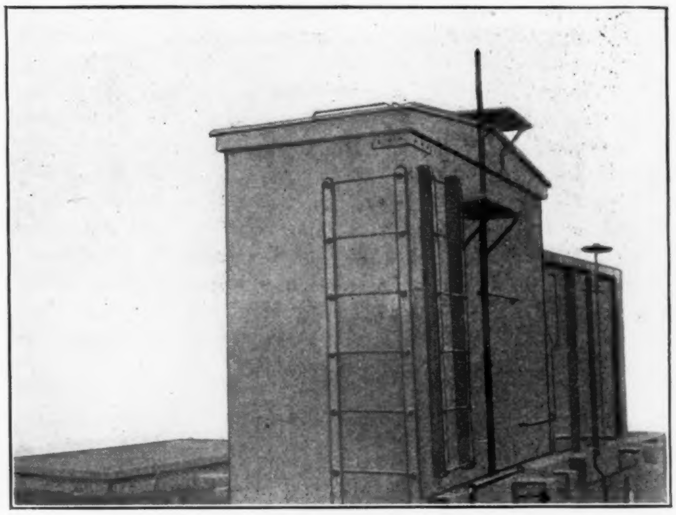
Record of Temperature Test of Alcohol Heater Car.

burners in use; the No. 2 burners were lighted at 8:45 p. m., March 4, at Megantic. The burners were inspected at each divisional terminal and were found to be operating satisfactorily in every case. The reservoirs were refilled once during the test, each box being supplied with 7½ gal. of alcohol at Smith's Falls, Ont., at 10:30 p. m., March 6, at which time the two No. 1 burners were extinguished and the car continued to its destination with the two No. 2 burners operating. The fuel reservoir can be made of any desired size, but it has been found in practice that four days' supply is the most economical and satisfactory on account of the character of the train schedules and the length of time that the perishable freight must be protected. On account of the location of the thermometer it is not probable that it could have been greatly influenced by the warm air entering the car at either end, but instead received only the benefit of the warm air rising from the floor of the car. High winds and snowstorms prevailed at several points during the trip. The car arrived at Fort William, Ont., at 8:30 p. m., March 11, and the thermometer was then removed and the test closed. The burners were operated a total of nine days, ten hours, the actual running time of the test being eight days.

CAR REPAIR NOTES FROM THE NORFOLK & WESTERN

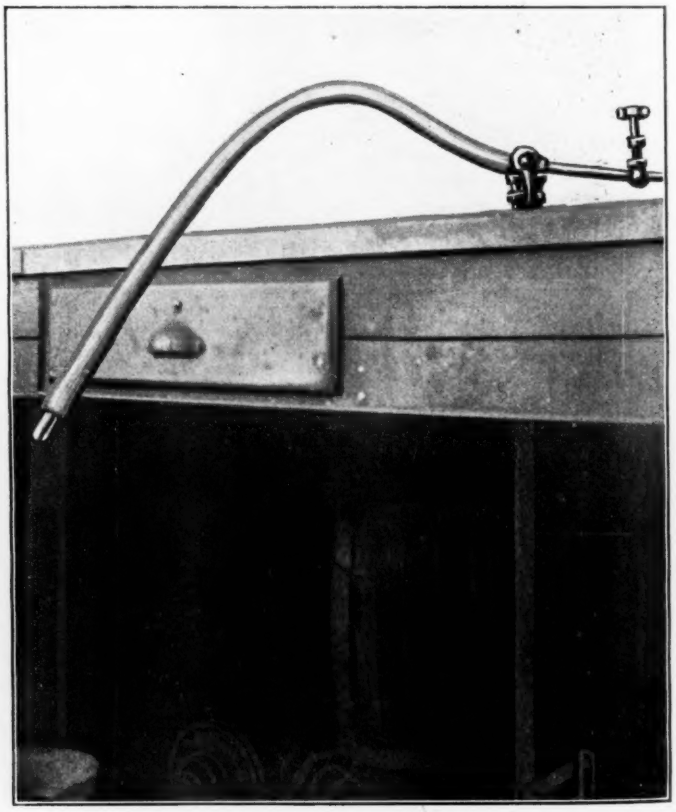
SAFETY APPLIANCE MODELS.

It is frequently difficult to obtain men to work at car repairs who are familiar with the reading of blue prints. The re-



Models of Freight Car Ends for Reference in Applying Safety Appliances.

quirements of the government in the application of safety appliances to cars are such as to necessitate blue prints or some other standards for the men's guidance. At the car repair yards of the Norfolk & Western at West Roanoke, Va., it was found



Valve and Treadle to Prevent Waste of Compressed Air.

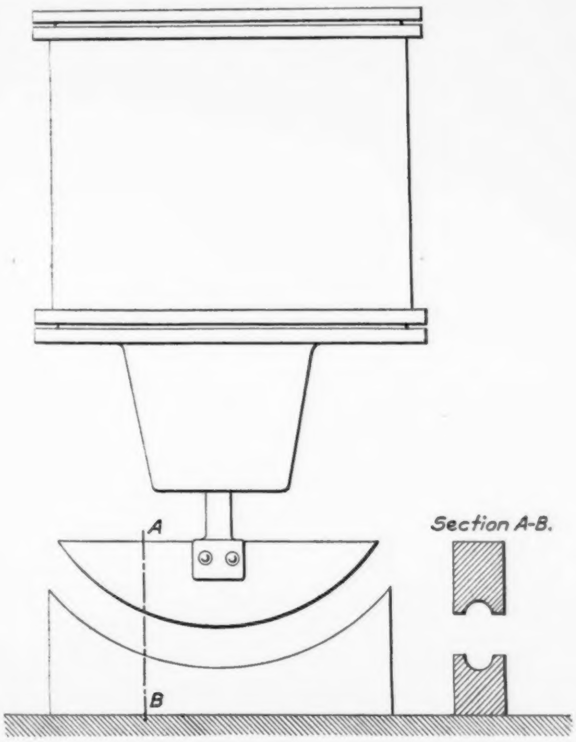
that much time was lost by the men in trying to read the blue prints; in order to simplify matters, full size models of the ends of a box, gondola and flat car were built and set up in a convenient position near the repair tracks. These models are equipped with the United States safety appliances, and when a man desires information regarding these he may readily obtain it direct from one of the models.

PREVENTING WASTE OF COMPRESSED AIR.

In using compressed air for blowing out repaired triple valves, etc., considerable air is lost during the time that the globe valve is being opened and the hose picked up, etc. This waste of air is avoided at West Roanoke by the use of the device shown in one of the illustrations. An additional globe valve is placed in the air pipe beyond the main valve; this valve is closed by a spring and the spindle is connected through the bench to a treadle below. When it is desired to use the air hose for any purpose the main globe valve is first opened, after which the air used is controlled by the second valve through the treadle.

PIPE BENDING DEVICE.

It is necessary in car repair work to do a great deal of pipe bending, and it is very common to see a repairman insert a piece of a train pipe between truss rods or in a truck in order to bend it to the desired angle. The pipe bender illustrated is made from a 14-in. brake cylinder and two castings. Almost any angle can be obtained with this device by regulating the amount of air admitted to the cylinder.



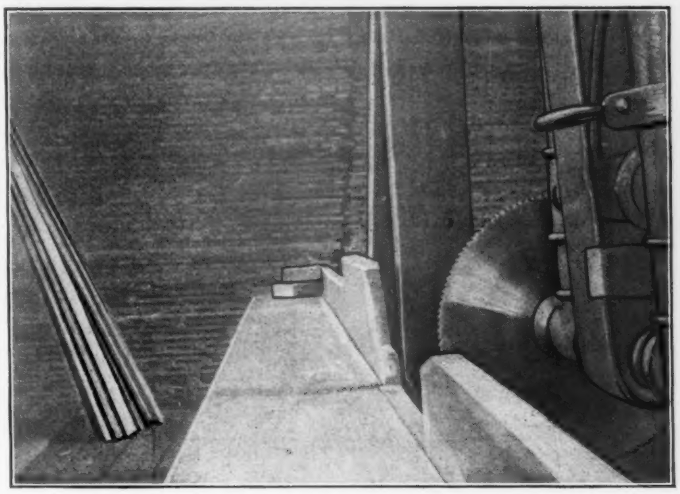
Brake Cylinder Fitted for Bending Pipe.

PREPARING DOPE FOR JOURNAL BOXES.

The mixing of dope for car journal boxes is taken care of at West Roanoke in the following manner: The car oil is held in a large tank raised several feet above the floor and is passed from this tank to a smaller tank resting on the floor in which the waste and oil are mixed. Above this mixing tank is placed vertically an 8 in. brake cylinder with an additional piston connected to the outer end of the piston rod. This piston is a loose fit in a 12-in. brake cylinder, which is drilled with a number of holes about ⅜ in. or ½ in. in diameter. After the waste is mixed with the oil, a quantity of it is placed in the 12-in. cylinder and the air is turned on in the 8-in. cylinder. The piston squeezes out the excess oil, which runs back through the perforations into the mixing tank. The dope is then placed in a storage tank from which it is supplied for use in cars.

CUT-OFF SAW.

The swing cut-off saw shown in another of the illustrations has been developed at West Roanoke for the cutting off of sheathing, etc., to required lengths. The swing arrangement is quite simple, being very similar to the link grinding apparatus used in locomotive repair shops. Three standard lengths of sheathing are used, and when the material is unloaded from the car it passes directly in front of the saw and is cut to the desired length, which is governed by a block placed on the bench.



Swing Cut-off Saw for Car Sheathing.

The prepared sheathing is then piled at the other end of the bench, as shown in the illustration, where it is available for the car men at any time.

STRAIGHTENING SPRING PLANKS.

Another handy device in use at West Roanoke is a crude oil burner for straightening spring planks, etc. This furnace has directly in front of it a heavy slab of cast iron about 4 ft. x 8 ft. Such pieces as spring planks are very readily straightened on this plate after being heated in the furnace and a great deal of material which would otherwise have been scrapped has been made available for use again. The furnace also frequently makes it possible to save the time required in transferring bent pieces from the repair yards to the shops and back again.

A CARELESS TRAVELER.—A few days since as the train was passing on the Newcastle & Frenchtown Railroad, the baggage car took fire, as is supposed, from a spark from the engine, by which a great proportion of the baggage was destroyed, and amongst the rest a bag belonging to one of the passengers containing United States Bank notes to a large amount, designed for the Fayetteville, N. C., branch, was considerably burned. One package of $60,000 in hundred dollar notes was lost, and another package much burned. The guardian of *such* a bag should never lose sight of it when traveling.—*From the American Railroad Journal, January* 19, 1833.

CLEARING SNOW IN 1833.—We have another proof of the promptness with which the obstruction caused by deep fall or drifting of snow is removed from the Baltimore & Ohio Railroad. The snow which fell on Friday last was thrown on the railroad in drifts, in many instances from two to three feet deep during that night and the next morning, yet it was so promptly cleared off the whole distance of sixty miles between Baltimore & Frederick, that not a single trip of the cars was omitted and the passenger cars on Saturday were only detained about six hours beyond the usual time. This has been at all times the case since the first opening of the road for travel, and furnishes most gratifying evidence of the energy with which the business of the company is prosecuted.—*From the American Railroad Journal, March* 16, 1833.

TABLES FOR DESIGNING CENTER SILLS

BY C. H. FARIS.

The accompanying tables giving the section moduli of the various members of a center sill girder, have been found most convenient in designing steel underframes. They cover sills built up of standard angles and flat plates, and give the section modulus separately for the different angles, web and cover plates, for depths of sill from 12 in. to 40 in. The section modulus for any combination of parts is found by taking the sum of the values, as given in the tables, for each of the parts.

The table for cover plates is computed for one cover plate, 1 in. wide and the section modulus for any desired width is found by multiplying the value for the required depth of girder and thickness of plate, by the width. The section moduli for rivet holes are computed on the same principle. The column headings in the tables are depths of girder over angles. The values for web plates are computed for plates one-half inch less than the nominal depth. The tables are computed for an assumed axis at the center of depth. The moment of inertia about this axis is equal to the section modulus multiplied by one-half the depth for which the valve is taken.

For sections made symmetrical about the horizontal axis, the assumed axis will also be the neutral axis through the center of gravity of the section, but for sections not symmetrical, which is the most usual case for this class of girders, the center of gravity will not fall at the center of depth, and it will be necessary to adjust the values taken from the tables from the central axis to the axis through the center of gravity by the formula

$$I = I^1 - Ad^2$$

where I^1 is the moment of inertia about an axis that does not pass through the center of gravity, I is the moment of inertia about a parallel axis through the center of gravity, A is the area of the section in sq. in., and d is the distance between the axes. The adjusted moment of inertia thus found divided by the distance from the neutral axis to the outermost edge of the section gives the true section modulus sought.

This adjustment is usually small in amount, so that the tabular values closely approximate the true section modulus and trial sections can usually be determined without computation. The final section should always be corrected unless it is symmetrical.

SECTION MODULI FOR ONE COVER PLATE ONE INCH WIDE.

	Depth of Girder.															Area.
Thickness.	12 in.	14 in.	16 in.	18 in.	20 in.	22 in.	24 in.	26 in.	28 in.	30 in.	32 in.	34 in.	36 in.	38 in.	40 in.	Sq. in.
1/4 in.	1.54	1.82	2.04	2:31	2.56	2.81	3.06	3.31	3.56	3.80	4.06	4.31	4.56	4.81	5.05	.250
5/16 in.	1.96	2.25	2.59	2.90	3.21	3.53	3.83	4.15	4.46	4.78	5.10	5.40	5.69	6.02	6.31	.312
3/8 in.	2.38	2.74	3.15	3.51	3.89	4.26	4.64	5.01	5.38	5.76	6.13	6.51	6.87	7.24	7.63	.375
7/16 in.	2.82	3.23	3.64	4.13	4.57	5.00	5.44	5.86	6.30	6.74	7.17	7.61	8.04	8.48	8.91	.437
1/2 in.	3.24	3.73	4.29	4.76	5.25	5.75	6.25	6.75	7.25	7.74	8.24	8.73	9.25	9.75	10.25	.500
9/16 in.	3.69	4.24	4.80	5.37	5.93	6.50	7.07	7.61	8.20	8.75	9.30	9.85	10.41	11.00	11.56	.562

SECTION MODULI FOR TWO WEB PLATES.

	Depth of Girder.														
Thickness.	12 in.	14 in.	16 in.	18 in.	20 in.	22 in.	24 in.	26 in.	28 in.	30 in.	32 in.	34 in.	36 in.	38 in.	40 in.
1/4 in......	10.5	14.6	19.4	24.8	30.8	37.7	45.2	53.1	61.7	71.3	81.4	92.0	103.3	115.3	128.3
5/16 in.....	13.2	18.3	24.2	31.0	38.5	47.0	56.3	66.3	77.2	89.0	101.6	115.0	129.2	144.2	160.4
3/8 in......	15.8	21.9	29.1	37.2	46.2	56.4	67.6	79.6	92.6	106.8	122.0	138.0	155.1	173.1	192.4
7/16 in.....	18.4	25.5	33.9	43.3	53.8	65.7	78.8	92.7	108.0	124.5	142.2	160.8	180.7	201.5	224.0
1/2 in......	21.1	29.2	38.8	49.6	61.7	75.3	90.2	106.3	123.7	142.6	162.8	184.1	207.0	231.0	256.7
9/16 in.....	23.7	32.9	43.6	55.7	69.3	84.6	101.3	119.5	139.0	160.0	183.0	207.0	232.4	259.5	288.5
5/8 in......	26.4	36.6	48.4	62.0	77.2	94.1	112.8	132.7	154.4	178.0	203.5	230.0	259.0	289.0	320.5

SECTION MODULI FOR TWO ANGLES 3 IN. x 3 IN.

Thick-	Depth of Girder.															Area.	
ness.	12 in.	14 in.	16 in.	18 in.	20 in.	22 in.	24 in.	26 in.	28 in.	30 in.	32 in.	34 in.	36 in.	38 in.	40 in.	Sq. in.	x
1/4 in......	13.2	15.8	18.8	21.5	24.4	26.8	29.7	32.9	35.8	39.1	41.4	44.3	47.1	50.1	52.9	2.88	.84 in.
5/16 in.....	16.1	19.6	22.9	26.5	29.9	33.2	36.8	40.5	44.0	47.6	51.1	54.8	58.4	61.6	65.3	3.56	.87 in.
3/8 in......	18.9	23.0	27.0	31.2	35.3	39.4	43.4	47.9	52.1	56.2	60.4	64.7	68.9	73.0	77.2	4.22	.89 in.
7/16 in.....	21.6	26.3	31.0	35.8	40.5	45.2	50.1	54.8	59.6	64.5	69.3	74.0	78.9	83.9	88.6	4.86	.91 in.
1/2 in......	24.2	29.9	34.8	40.2	45.6	51.4	56.7	62.0	67.4	72.9	78.2	83.8	88.9	94.3	99.9	5.50	.93 in.

x = Distance of center of gravity from base.

SECTION MODULI FOR TWO 3 IN. x 4 IN. ANGLES.

Thick-	Depth of Girder.															Area.	
ness.	12 in.	14 in.	16 in.	18 in.	20 in.	22 in.	24 in.	26 in.	28 in.	30 in.	32 in.	34 in.	36 in.	38 in.	40 in.	Sq. in.	x
5/16 in.....	19.6	23.7	27.8	31.8	35.9	40.2	44.3	48.4	52.6	56.7	60.9	65.2	69.2	73.4	77.4	4.18	.76 in.
3/8 in......	23.1	28.0	32.8	37.5	42.6	47.3	52.4	57.2	62.3	66.9	72.2	76.9	81.9	86.7	91.7	4.96	.78 in.
7/16 in.....	26.6	32.2	37.7	43.2	48.9	54.4	60.4	66.0	71.8	77.5	83.1	88.9	94.6	100.2	105.7	5.74	.80 in.
1/2 in......	29.8	35.9	42.3	48.7	55.1	61.4	67.8	74.4	80.8	87.5	93.9	100.1	106.9	113.0	119.7	6.50	.83 in.
9/16 in.....	33.0	39.8	46.9	54.1	60.9	68.2	75.4	82.5	89.8	96.9	104.1	111.1	118.4	125.7	132.6	7.24	.85 in.
5/8 in......	35.8	43.5	51.2	59.0	66.9	74.7	82.7	90.4	98.2	106.4	113.8	121.8	129.8	137.8	145.9	7.96	.87 in.

x = Distance of center of gravity from longer base.

SECTION MODULI FOR TWO 3½ IN. x 5 IN. ANGLES.

Thick-	Depth of Girder.															Area.	
ness.	12 in.	14 in.	16 in.	18 in.	20 in.	22 in.	24 in.	26 in.	28 in.	30 in.	32 in.	34 in.	36 in.	38 in.	40 in.	Sq. in.	x
3/8 in......	27.8	33.7	39.7	45.6	51.6	57.6	63.5	69.7	75.7	81.8	87.7	94.0	99.8	105.9	112.1	6.10	.86 in.
1/2 in......	35.8	43.5	51.3	59.0	66.8	74.8	82.6	90.6	98.6	106.2	114.5	122.2	130.0	138.1	146.0	8.00	.91 in.
5/8 in......	43.4	52.8	62.3	72.1	81.5	91.1	100.8	110.5	120.5	130.0	140.1	149.3	159.5	169.3	179.0	9.84	.95 in.
3/4 in......	50.1	61.3	72.6	83.9	95.3	106.6	117.9	129.3	141.0	152.3	163.9	175.6	187.1	198.7	210.1	11.62	1.00 in.

SECTION MODULI FOR RIVET HOLES THROUGH ONE INCH OF METAL.

	Depth of Girder.															Area.	
Diameter.	12 in.	14 in.	16 in.	18 in.	20 in.	22 in.	24 in.	26 in.	28 in.	30 in.	32 in.	34 in.	36 in.	38 in.	40 in.	Sq. in.	x
5/8 in......	2.26	2.44	3.68	4.38	5.11	5.83	6.56	7.30	8.04	8.77	9.50	10.25	11.00	11.70	12.48	.750	1¾ in.
3/4 in......	2.63	3.44	4.26	5.11	5.95	6.80	7.65	8.50	9.38	10.21	11.10	11.95	12.80	13.65	14.57	.875	1¾ in.
7/8 in......	2.67	3.58	4.50	5.43	6.40	7.35	8.33	9.30	10.28	11.25	12.25	13.20	14.24	15.21	16.20	1.000	2 in.

An example will illustrate the use of the tables. Given a maximum bending moment of 5,000,000 in. lbs., and an allowable fiber stress of 16,000 lbs. per sq. in., it is required to find the necessary section. The required section modulus is

$$\frac{5{,}000{,}000}{16{,}000} = 312.5$$

Assume a depth of 26 in.

	Section moduli.	Area.
From the table for web plates,		
2 web plates ⅜ in. thick..................	79.6	19.12 sq. in.
From tables for angles,		
2 — 3 in. × 4 in × ⅜ in. angles (top)....	57.2	4.96 sq. in.
4 — 3 in. × 4 in. × 7/16 in. angles (bottom)	132.0	11.48 sq. in.
For cover plate (top) 22 in. wide × 5/16 in.....	91.3	6.86 sq. in.
Total	360.1	42.42 sq. in.
¾ in. rivet holes (bottom) 2½ × 8.5..........	21.2	2.19 sq. in.
Net	338.9	40.23 sq. in.

The total depth of the assumed section is 26. in. + .31 in. (thickness of the cover plate) = 26.31 in.

The section of gravity of the section (found by rule given in "Cambria," page 157, 1912 edition, or graphically, as explained in *American Engineer,* March, 1912, page 112) is 13.88 in. from the bottom, or 12.43 in. from the top. This makes d = .88 in.

$$I^1 = 338.9 \times 13 = 4{,}405.7$$
$$I = 4{,}405.7 - 40.23 \times .88^2 = 4{,}374.6$$

The true section modulus (bottom) is then found to be

$$\frac{4{,}374.6}{13.88} = 315.1$$

TANK CAR DESIGN*

BY H. E. PARSONS,
Berwick, Pa.

The problem of tank car design is comparatively simple, and is therefore considered a side line by most car companies; for this reason the draftsman does not give the shop and repair end of the work proper consideration. For several years the writer has been observing the various tank car designs, some of which were without defects, and others with very serious ones. For instance, one car equipped with end anchor blocks had such a weak underframe from the bolster to the end sill that the buffing force of the tank against the blocks forced the end sill down about 3 in. This underframe had 12 in. channel center sills, with cover plates between the bolsters. Had the cover plates extended to the end sills, the center sills would have been very much strengthened, perhaps sufficiently to properly resist the force.

Another car had 15 in. channel center sills, with top and bottom cover plates, the top plate running from some distance back of the bolster to the end sill, and the bottom plate from the bolster

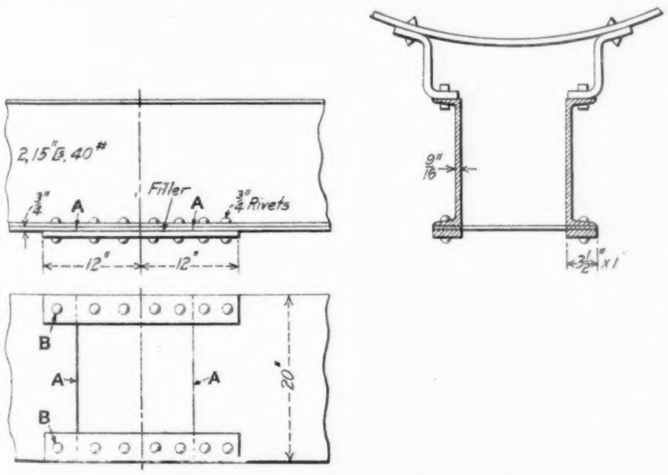


Fig. 1—A Useless Attempt at Reinforcement.

to A, Fig. 1. The net area of the plate was about 7.1 sq. in., and at 12,500 lbs. per sq. in., it would resist a force of 88,750 lbs., which is the force the designer tried to carry across the valve opening through the two 3½ in. x 1 in. bars, which are good for about 67,000 lbs.; he should have used about 20 rivets on each side of the opening instead of two shown at B. This underframe has sufficient strength without the cover plates, yet the designer through carelessness or insufficient knowledge of strength of materials, wasted much material.

There are a number of tank car underframes built of channel section center sills with cover plates between the bolsters. The reason for using the cover plates I cannot undertsand, as they are nearly severed at the center to make an opening for the valve chamber; surely they are not there to resist bending moment, for if the bending moment necessitates cover plates, undoubtedly their full section should run through the center where the bending moment is a maximum.

*Entered in the Car Department competition which closed February 15.

There are a considerable number of pressed shapes used on some cars which are not only expensive, but at times are very difficult to get; furthermore, there are very few owners equipped to make repairs to these parts, and for these reasons each detail should be made as simple as possible. Details are sometimes made complicated by careless designers adding a bend here and there without considering that it might necessitate the mak-

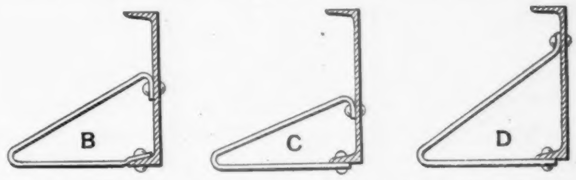


Fig. 2—Wrong and Right Ways of Applying Cylinder Plates.

ing of a set of dies, and of heating the metal to repair the part or make a new one.

I saw a cylinder plate on a car made as shown at *B* in Fig. 2, the designer failing to see that it would be easier to make it as shown at *C,* which takes one heat and two operations. If made like *D* one operation and one heat would be sufficient.

When a draftsman designs a lever guide and applies it as shown by *E,* Fig. 3, he does not consider the strength of the sill or the labor required; the guide is unnecessarily bent and

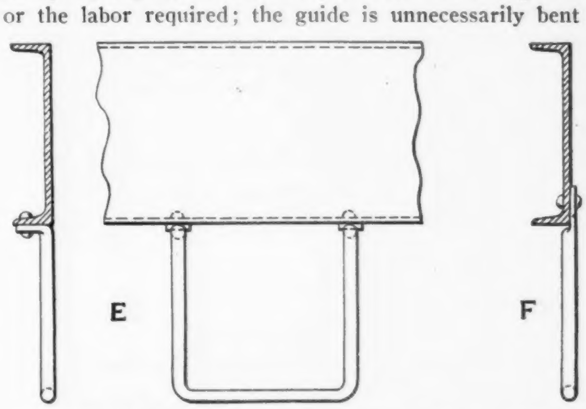


Fig. 3—Bad and Good Applications of a Lever Guide.

the moment of inertia of the sill, or its strength to resist bending, is reduced more than if applied as at *F.*

On a certain car it was necessary to use a sill step similar to the one shown at *G,* Fig. 4, as there was very little clearance for the truck while rounding curves; for some unknown reason

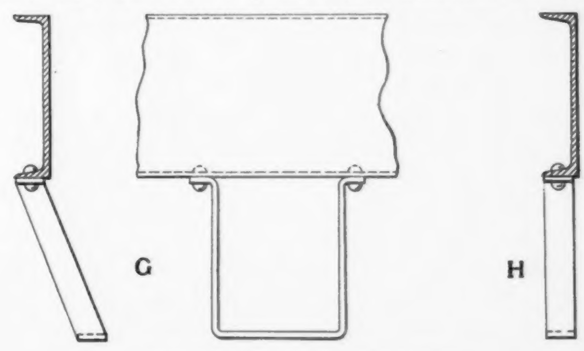


Fig. 4—Sill Step Applications.

this step was used on other cars where there was sufficient clearance with no necessity whatever for not using the step *H,* which requires one less operation to form it.

Shop men know what would happen to the lever guide, Fig. 5, when it gets in the shop. I am sure they would not make those fancy reverse bends; it should be made in accordance with the dotted lines at the right, unless there is a fancy for this curve of beauty. The draftsman who designed it was very much in need of shop experience.

The guide in Fig. 6 was designed to carry a cylinder lever and a push rod having a total weight of less than 100 lbs. Can you see any reason for not making it in the shape of the dotted lines at the right? Surely, two 5/8 in. rivets, though in tension, are good for more than the load it is likely to carry. These are

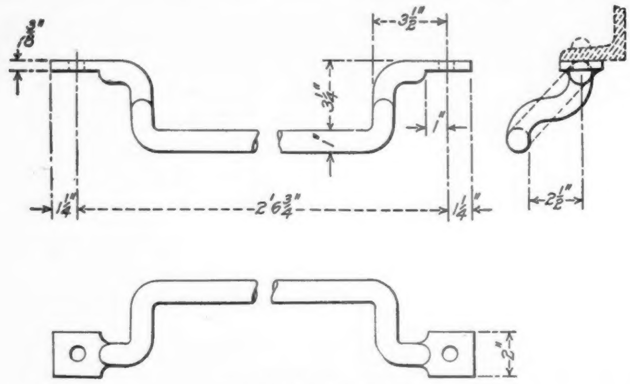


Fig. 5—Lever Guide.

minor details which, if carefully watched, would save a surprising sum of money on a 1,000 car order, not to say anything about the repair end of it.

While in conversation with a conductor of one of the Pennsylvania work trains, I asked if he had ever experienced any trouble with tank cars. He said he had, and that one had left the track at a curve not far from that place, the investigating committee reporting the same old cause, surging of the oil and the high center of gravity.

There are a number of tank cars in service that have no underframe, but have a continuous bottom sheet of sufficient area to meet the M. C. B. requirements. These cars have the lowest center of gravity of any in service, yet the distance from the center of the coupler to the center of gravity of the bottom sheet causes such a leverage on the rivets which connect the draft and bolster casting to the tank that about 50 per cent. of the tanks leak.

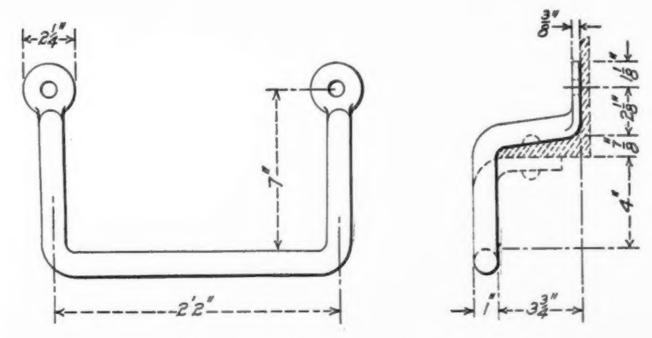


Fig. 6—Cylinder Lever Guide.

The high center of gravity is not only dangerous because of the possibility of derailment, but also because it is destructive to the underframe. I have in mind a design in which the oscillating and centrifugal forces were so great that it was extremely dangerous to operate the car. There is a way to correct these defects, and therefore, I would suggest an end construction as per Fig. 7, whereby we get the lowest possible center of gravity.

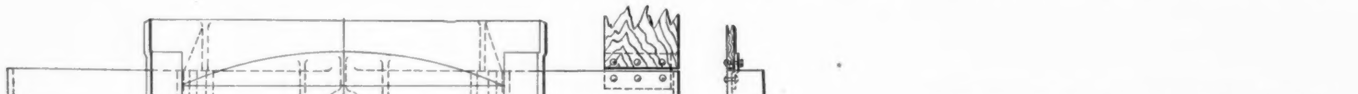


Fig. 7—End Construction Providing for a Low Center of Gravity.

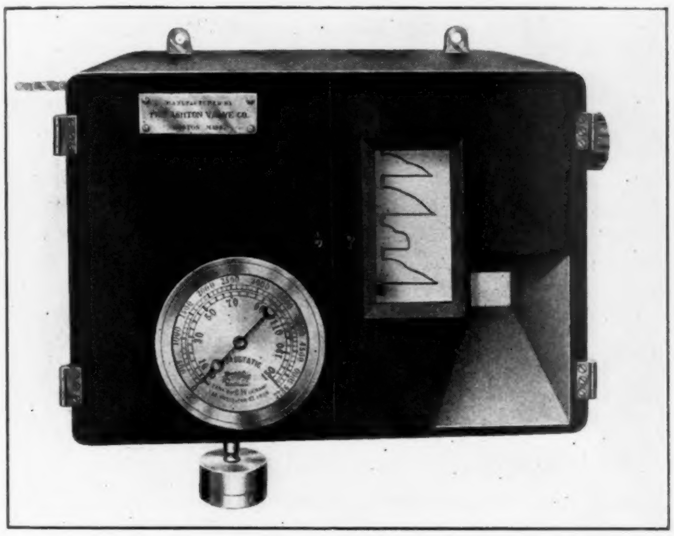
Another good feature about this construction is that the center of gravity of the continuous bottom sheet and the center line of the coupler are practically in a line. This casting is provided with push pole pockets and a place for jacking, and above all, it meets the M. C. B. requirements throughout. The tanks are of the same diameter from end to end, the only difference being a small portion cut out of each end to fit the castings which form the bottom of the tank.

This article is submitted for publication with the hope that it may arouse interest enough to bring forth a more complete discussion on tank car construction.

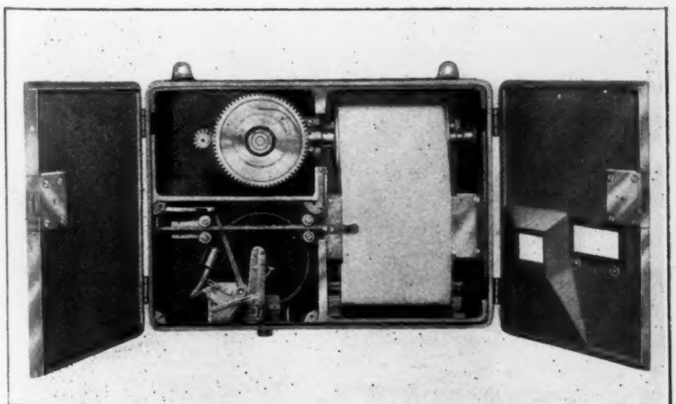
New Devices

WHEEL PRESS RECORDING GAGE

One of the important items in mounting wheels on their axles is to know exactly how much pressure it takes to force them on, and that this record may be obtained automatically and without any interference of the operator. J. W. Motherwell has invented the automatic recording gage shown herewith, which is sold by the Ashton Valve Company, Boston, Mass. This gage not only shows on a dial the hydrostatic pressure acting on the ram, but is arranged for operating a pencil which records the pressure on a sheet of paper that travels in a direction at right angles to the recording pencil, and at a speed proportional to the travel of the ram. By this device a complete record of the pressure required to force the wheel to its required position is obtained. If the record shows a straight diagonal line terminating at a point which measures the proper pressure, it will be known that a proper wheel fit has been obtained. A hollow spot in the axle or the bore of the hub will be shown in the diagram by a dip in the diagonal line, and vice versa, a high spot will be shown by a hump in the diagonal line.



Ashton Wheel Press Recording Gage.



Interior Arrangement of Wheel Press Recording Gage.

One of the important features of the recording gage is that it is inaccessible to the operator and represents the true story of the wheel fit. An opening is provided at the right of the diagram for the signatures of the wheel fitter and the press man, and the recording of the wheel number. Each record roll has a capacity of 300 diagrams or 150 pairs of wheels. The recorder is protected from over pressure by a 3/8 in. hydraulic relief valve set at about 150 tons. A 1/2 in. pulsating check valve protects the movement, the registering and the recording hands from sudden fluctuations in pressure. The recording gage is cut in or out by a 1/2 in. stop cock which may be locked in the open position so that it will be impossible for the operator to cut out the gage if it is found that an imperfect fit is being made. When dismounting wheels the recording gage can be cut out of service.

The gage is so designed that the paper travels in one direction and only when the ram is on its outward stroke. The winding drum is operated through a train of gears and a pawl and ratchet which are in turn operated by a chain running over a sprocket wheel and connected to the ram, the other end of the chain being weighted, as shown, to pull it back to the starting position. On the advance stroke of the plunger the pawl engages in the ratchet and turns the paper, while on the return stroke it slips back over the ratchet without moving the paper; in this way one continuous record of wheel fits is obtained. A special scale is provided with each recording gage with which to measure the pressure and travel of the wheel from the diagrams.

CONVERTIBLE SEAT FOR COMPARTMENT CARS

Sleeping car berths are not as wide as could be desired because of the limitations placed on the width of the cars, and the necessity of providing sufficient aisle space. In compartment cars, however, where there is a separate passageway through the car outside the compartments, there is no objection to using the aisle for extending the berths, and some of the compart-

Lower Berth Showing Convertible Seat End.

ment sleeping cars running in the Twentieth Century Limited are equipped with a device for this purpose. The seat ends are hinged so that they can be swung down and supported by an angle brace and form a horizontal extension of the seat. When the two seats are pulled out, as is ordinarily done in making up a lower berth, a filler is placed between the two ends after they

Seat End in Extended Position.

have been lowered, thus forming a full size bed. In traveling long distances passengers frequently become tired and wish to rest during the day, and with this type of seat the end may be swung down at any time and a comfortable couch provided on which a person may stretch out at full length. This extension seat was invented by Mrs. R. C. Smith, Chicago, Ill., and the patents are controlled by the Pullman Company.

TURNTABLE TRACTOR

A type of turntable tractor which is made by the Weir & Craig Manufacturing Company, Chicago, is shown in the illustrations.

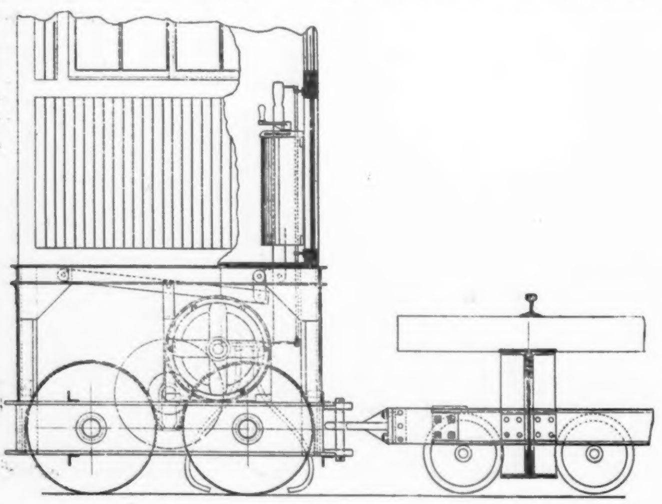


Fig. 1—Turntable Balanced, with Truck Wheels Slightly Above Rail.

It is designed to readily move the largest turntables when loaded with Mallet or other heavy locomotives and also to stand practically as an independent unit on the pit rail, so that no shock or vibration will be communicated to it or any of its parts when the locomotive is placed on the table; this is obtained by connecting the main frame to the table by sliding links.

Trouble has been experienced in some designs because the entire machine was pivoted on one wheel and had a comparatively rigid connection to the table. Considerable shock and vibration was thus communicated to the tractor, causing trouble with the wiring to the motor and the controller, as well as with the bearings and other parts, and this method of eliminating the vibration should reduce the cost of maintenance and increase the efficiency of the device. The tractor is designed, primarily, for electric power but may be equipped with a compressed air motor if electricity is not available, in which event the air motor may be replaced by an electric motor at any later time without alterations to the remainder of the machine.

By reference to the diagrams it will be seen that the tractor remains on the rail in its normal position, regardless of any vertical movement of the table. Fig. 1 shows the table balanced with the truck wheels slightly above the rail; in this position the sliding link connection is in line with the main portion of the frame. Fig. 2 shows the table in the highest position, caused by a locomotive passing on at the opposite end, the sliding connection in this case being at the upper portion of the frame. It will be noticed that whatever the position of the table, the tractor remains stationary.

The machine with the housing removed and part of the cab cut away is shown in Fig. 3. This view shows the location of the tractor wheels, gearing, sanding device, brake lever, motor, etc. The cab is furnished with sliding windows and is 4 ft. 6 in.

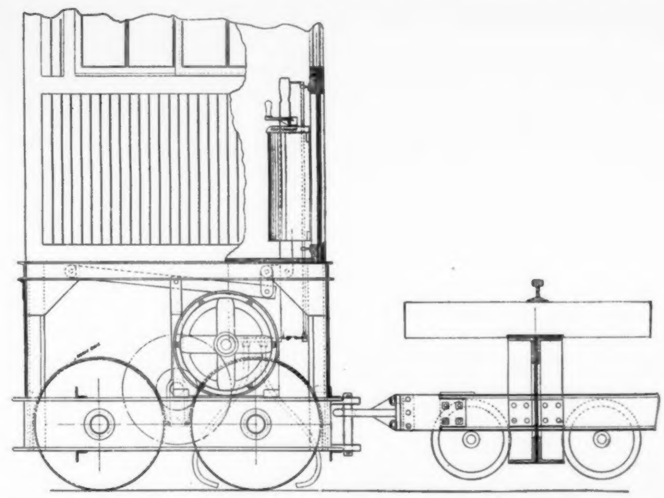


Fig. 2—Turntable in Its Highest Position Relative to the Tractor.

x 5 ft. 6 in., providing abundant room for the operator after the installation of the apparatus. The traction wheels are 30 in. double plate, with flat chilled treads, and each is furnished with a steel driving gear, securely bolted to a faced shoulder on the inside of the wheel; all the gears and pinions are steel, carefully machined and accurately cut. The electrical equipment may be furnished according to the railroad's specification.

Steel band brakes, controlled by a hand lever in the cab, are applied to each of the wheels and have a positive action, avoiding the danger of stripping the gears as may be the case when brakes are applied to a drum on the motor or intermediate shafts. The positive action of the brake removes the temptation or the necessity on the part of the operator to reverse the motor in order to stop at a given point, thereby materially reducing maintenance charges on the electrical equipment.

The sanding device consists of a cast iron hopper which is tapered at the bottom and contains about 1½ cu. ft. of sand; it is furnished with a cast iron cap set level with the floor of the cab and the hopper can be filled from the inside of the cab, so that there is no opportunity for the sand to get wet; the plug valve in the bottom of the hopper is controlled by a lever in the cab.

The frame, which carries all the equipment, is of a heavy design and is cast in one piece; a structural steel frame, on which

Fig. 3—Arrangement of Apparatus on Turntable Tractor.

the cab rests, is riveted to it. The sliding link which connects the tractor to the table is fastened to this frame. As shown in Fig. 4, this frame is supplemented by a structural steel A-shaped frame which extends toward the center of the table and is also

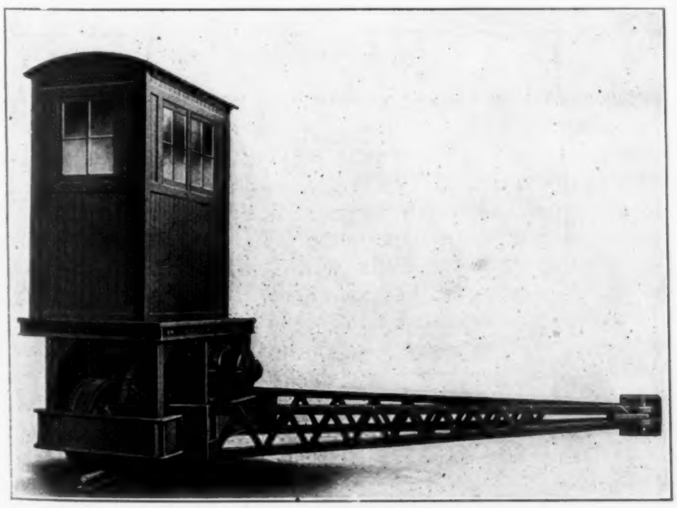


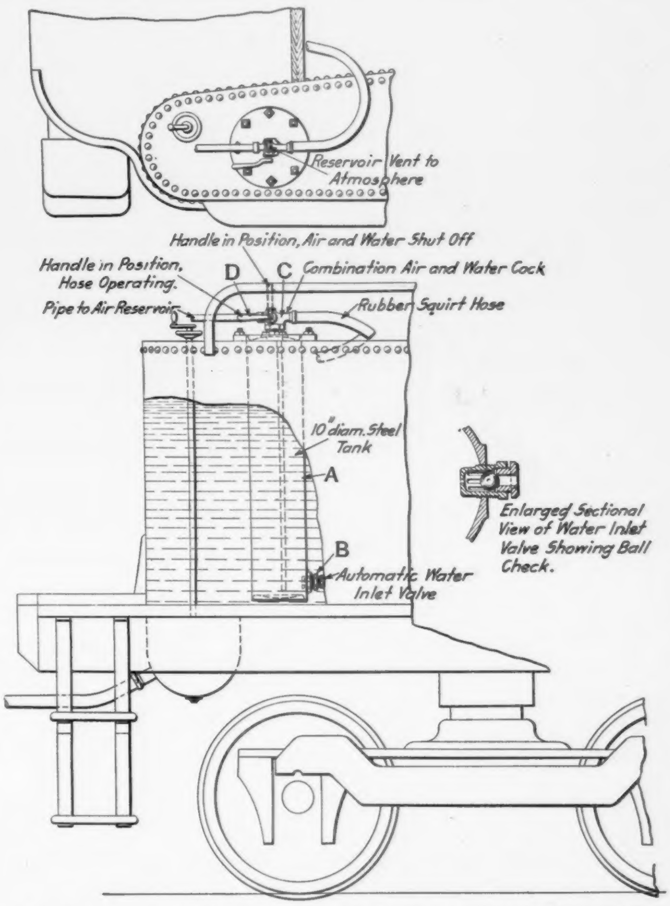
Fig. 4—Turntable Tractor.

connected to the girder by a sliding link. The motor and all the working parts are enclosed by sheet steel plates in which are provided doors of ample size; all the working parts are thus easily accessible for inspection and repairs.

SAFETY SQUIRT HOSE

The necessity for a substitute for the common squirt hose used by firemen in wetting down coal, and operated with hot water from the injector, is shown by the fact that out of a total of 856 accidents in 1912, the chief inspector of locomotive boilers reported to the Interstate Commerce Commission that 243 were due to defective squirt hose and connections. As long as hot water is used the danger of scalding will be present and to avoid this the Watertown Specialty Company, Watertown, N. Y., has placed on the market a device for supplying cold water direct from the tender.

The apparatus consists of a steel cylindrical tank *A*, an automatic water inlet valve *B*, and a combination air and water cock *C*. The tank is flanged at the top so that it may be secured to the tender by bolts or studs, and is 10 in. in diameter while



Application of Watertown Safety Squirt Hose to Locomotive Tender.

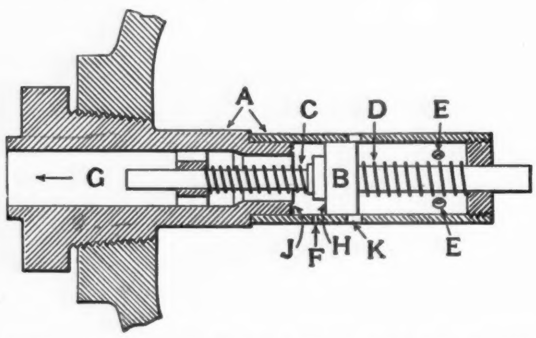
the length is made equal to the inside depth of the tender. At the bottom of the tank is the bronze ball check valve *B*, which is of simple construction; when the hose is inoperative this valve is open, allowing the tank to fill to the same height as the water in the tender. The tank is connected by means of a ½-in. pipe to the main air reservoir and a three-way air port in the combination air and water valve *C* allows air to enter the tank or shuts it off and vents the tank to the atmosphere. A water port in the valve carries a pipe that runs to the bottom of the tank, and on the other end another pipe to which is attached the squirt hose *C*.

With the air shut off by means of the handle *D*, the tank is vented to the atmosphere, the ball check in *B* opens and the tank fills ready for use. When it is desired to operate the hose all that is necessary is to throw down the handle *D*, which admits air to the reservoir and closes the vent to the atmosphere; the air pressure then closes the check valve *B* and the water in *A* is forced up through the pipe and out through the hose. To shut off the hose the handle *D* is thrown up, the air in the tank escapes through the vent and the tank immediately starts to refill. The tank is never under pressure except when the hose is in use and always fills automatically when the hose is not in use.

This squirt hose may very easily be installed on any locomotive by cutting a 10-in. hole in the top of the tender tank where it is desired to locate the operating valve. The device is extremely simple in construction and should the bottom check valve become clogged with mud or refuse it may easily be cleaned by disconnecting the air line and fastening bolts and lifting the entire apparatus out of the tender. No part is built into the tender or located in such a way as to be inaccessible for cleaning or inspection.

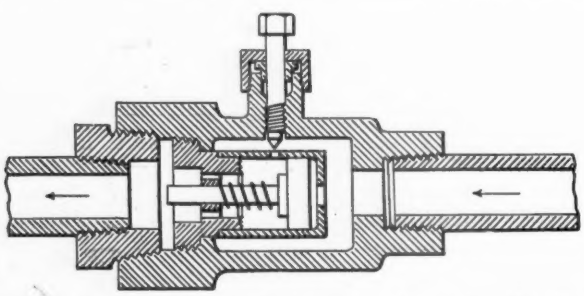
AUTOMATIC SHUT-OFF VALVE

The valve which is shown in the illustrations, is so designed that when used as an outlet fitting on a holder or main containing gas or other fluid under pressure, a free passage of the fluid is permitted; if, however, the pressure in the distributing line



Automatic Shut-Off Valve Applied to a Gas Holder.

falls due to a leak or break in the line, the valve automatically closes off the flow and remains closed until the pressure is restored on the outlet side of the valve, when it at once readjusts itself to its normal position. It is also suitable for a charging fitting, as the excess charging pressure forces back the valve piston and uncovers a series of ports in the cylinder, permitting a free flow of fluid into the holder. The illustrations indicate the construction of the valve, one of them showing a type for use in



Automatic Shut-Off Valve with Adjusting Screw for Varying the Flow of Gas.

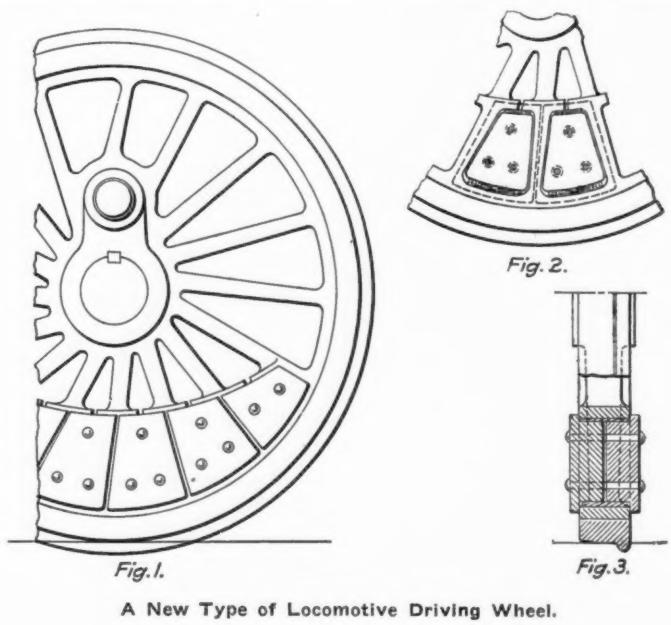
a holder and the other a type designed for use in a distributing system where the flow of fluid is always in one direction.

Within the body *A* of the valve is a piston *B* constrained in its normal position by two springs *C* and *D*; the pressure within the holder is always free to act upon one side of this piston, having access through the ports *E*. The orifice or port *F* is of such a size that it will permit a flow of fluid sufficient to retain a pressure in the outlet passage *G* practically equal to that in the holder itself. It is evident that if the pressure in the passage *G* is materially reduced below that in the holder, as would result from a leak or break in the distributing piping, the full holder pressure acting upon the inner face of the piston *B* will force the piston out, cutting off further flow of fluid through the port *F* by pressing the seat *H* of the piston against the surface *J* of the casing; upon restoring the pressure in the passage *G*, the piston is returned to its normal position. An excess of pressure in passage *G*, such as occurs during the process of charging the holder, acts upon piston *B*, pushing it back against the resistance of spring *D* and uncovering a series of ports *K* which are of sufficient area to provide for unrestricted flow into the holder.

The operation of the other form of the valve is similar to this except that no provision is made for its use as a filling device. The illustration shows a means of varying the flow by the use of an adjusting screw; by a modification of design this adjustable feature may be applied equally well to the other type. This valve was invented and patented by M. P. Stevens, manager of the Edward Schroeder Lamp Works, Jersey City, N. J.

NEW LOCOMOTIVE DRIVING WHEEL

The increase in the weight of locomotives has made it necessary to add to the weight of rails, and the high-carbon rail is, it would seem, a step in the right direction. Undoubtedly a large amount of rail destruction is due to vertical bending under the weight imposed by the driving wheel, but few have



A New Type of Locomotive Driving Wheel.

seriously thought of solving the problem by changing the construction of the wheel. This is perhaps due to a realization that the weights of locomotives are more likely to increase than decrease; however, the damage to the rail is not all caused by the weight alone. Another factor which enters is the passage of the counterbalance over the point of support. Because of rigidity it is possible to concentrate an enormous mechanical effect upon a restricted area, an instance of which is furnished by the Shore hardness tester, an instrument employed in testing and comparing the hardness of metals. A kind of hammer is permitted to fall freely in a vertical glass tube and to strike a blow upon the surface whose hardness is being investigated; the height of the rebound is taken as the measure of the hardness. The steel hammer has a length of about ¾ in., a diameter of less than ¼ in. and a weight of 40 grains and is pointed on the lower end so that the area of impact is very small. Because of the rigidity of its material, a very large percentage of the force of the drop is concentrated upon this small surface and it has been found that the existence of a flaw in the hammer is sufficient to interfere seriously with the rebound. Further, it has been learned that the work which is under test must be well supported and these facts suggested that if it were possible to break up the continuity of the counterweight of a driving wheel, or reduce its rigidity to a minimum, it would result in less damage to track and equipment.

The wheel shown in the illustration was devised and patented by A. F. Shore, the inventor of the instrument for testing hardness, working along these lines. The counterbalance is broken up into a number of units, and it is claimed that it is impossible for it to deliver to the rail as severe a blow as is given by a rigid one of equal weight. There is, it is claimed, a dissipation of shock because of the interruptions to the continuity in the mass of the counterbalance. A still further dissipation is effected by means of wooden blocks interposed between the metal blocks and the rim of the wheel. This construction is shown in Figs. 2 and 3.

The inventor has also sought to dissipate the shock by angularly displacing the spokes. From Fig. 1 it will be seen that the spokes are arranged in such a way that their axes pass off to the side of the center point of the wheel, each becoming tangent to a small circle concentric with the wheel itself. The spokes are, therefore, not radii of the wheel, and it is claimed by the inventor that this splits up the impact force into local and lateral vibrations within the wheel itself, and diminishes the force on the rail.

BAXTER CHARCOAL CAR HEATERS

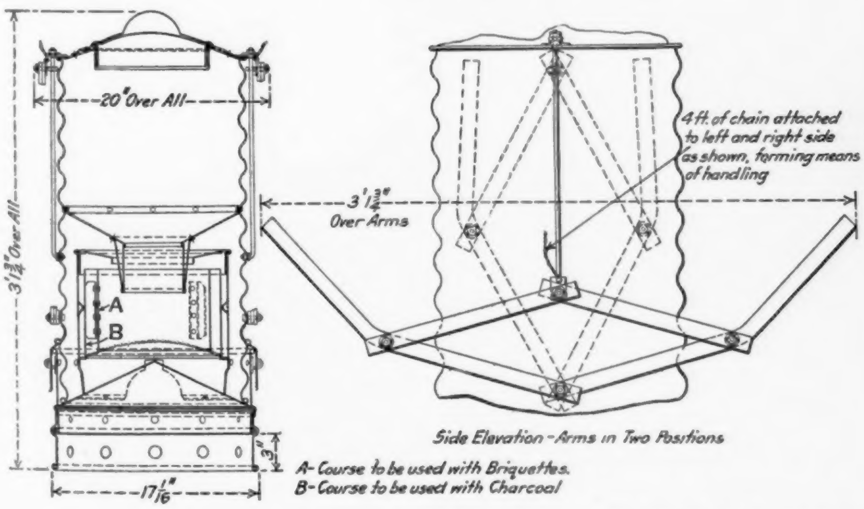
A charcoal heater that is inexpensive to operate, and one that has given efficient service in extremely low temperature, is shown in the illustrations. The outside shell is made of corrugated metal and forms the body of the heater, supporting the magazine at the top and creating a radiating surface around the fire pot of such area as will insure boxes and packages not catching fire should they fall against it. A positive lock on the base secures the fire pot to the shell, preventing the hot coals from being emptied from the heater into the car in the event of accident. The hasp on this lock is provided with slots for two positions, permitting the fire pot and its grate to be varied in its distance from the feed spout of the magazine, thus creating a simple means of regulating the rate of combustion by changing the thickness of fire without altering the inlet draft passage areas.

The heaters are started by means of an igniter or "starter," which is made of blotting paper saturated in a solution of potassium nitrate and then pressed into the shape of a pie plate, being provided with a hole in the center. These starters are placed on the grate and a lighted match is applied to the edge of the hole in the center of the igniter, which burns without a flame; the magazine is then replaced and the supply slide opened. The heater is then in full operation.

A report on one of these heaters in use on a Canadian road tells of a carload of potatoes, passing through temperatures of 38 to 42 deg. below zero, being received in perfectly good condition when the outside temperature was38 deg. below. A carload of beer, passing through temperatures of from 28 to 36 deg. below, was received with an inside temperature of 60 deg. above with the thermometer registering 35 deg. below outside of the car.

These heaters are manufactured in three sizes; the No. 1 or the large size is designed for use in protecting less than carload business, in which service the car door on local trains is not only opened often, but is frequently allowed to remain so for many minutes, thus requiring the generation of considerable heat in a short time to again raise the temperature in the car to the proper degree. The No. 2 heater is designed to fit into the ice bunkers of refrigerator cars, and is provided with an automatic brace, as shown in one of the illustrations, which locks it fast in the center of the bunker. Two of these heaters are used with each car, one in each bunker. The No. 3 is a heater designed to meet the requirements of breweries where a suspended heater is preferable. These heaters are in a size between the No. 1 and No. 2, and are provided with heavy hooks which fasten into the screw-eyes applied to the carlines, thus suspending the heater out of the way of the kegs which are rolled on the floor of the car. The No. 2 heater will operate 36 hours without refilling, at a cost of 15 cents for the charcoal; the other heaters will operate up to 96 hours without refilling. It will be noted from the drawing that briquettes may also be used. An additional feature of the charcoal heater is the giving off of the carbon monoxide gas which not only helps to preserve any fruit or vegetable freight carried, but also kills any animal life that may be confined in the car, such as rats, mice, tarantulas, etc. For this reason the car should be opened a few minutes before any person is allowed to enter.

These heaters are in service on 15 railroads; they are made by the Klauer Manufacturing Company, Dubuque, Iowa.

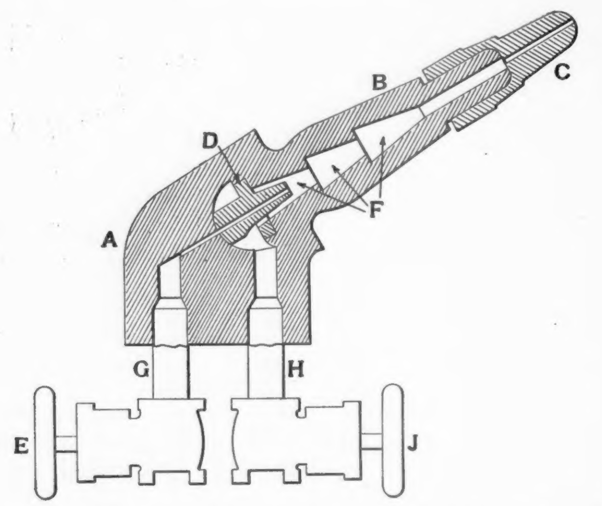


Baxter Charcoal Car Heater for Perishable Freight.

Forestry in France.—France has spent $35,000,000 in planting trees on the watersheds of important streams.

WELDING AND CUTTING WITH OXYGEN AND ILLUMINATING GAS

The success that has attended the use of high temperature gases and electricity for the welding and cutting of metals has been so marked that any development of these systems is of interest. The system described in this article uses a combination of oxygen and illuminating gas taken from the city mains. One of the illustrations shows the apparatus as set up in a permanent installation, although, by the use of flexible connections a portable outfit may easily be constructed. The illuminating gas passes from the meters to a water jacketed booster *K* which is driven by a small electric motor; this booster is used to raise the pressure of the gas, its maximum capacity being 30 lbs. per sq. in., although more than 14 lbs. is never required for even the heaviest cutting, as this pressure has proved sufficient when cutting steel bars 8 in. square. From the booster the gas passes upward through the pressure regulating waterseal *L*, then through the pipe *M* to the pressure gage and the specially constructed reducing valve *N*, which reduces the pressure to that required for whatever class of work is being done. From the reducing valve the gas passes directly through the pipe *O* to the burner where it is combined with the oxygen.

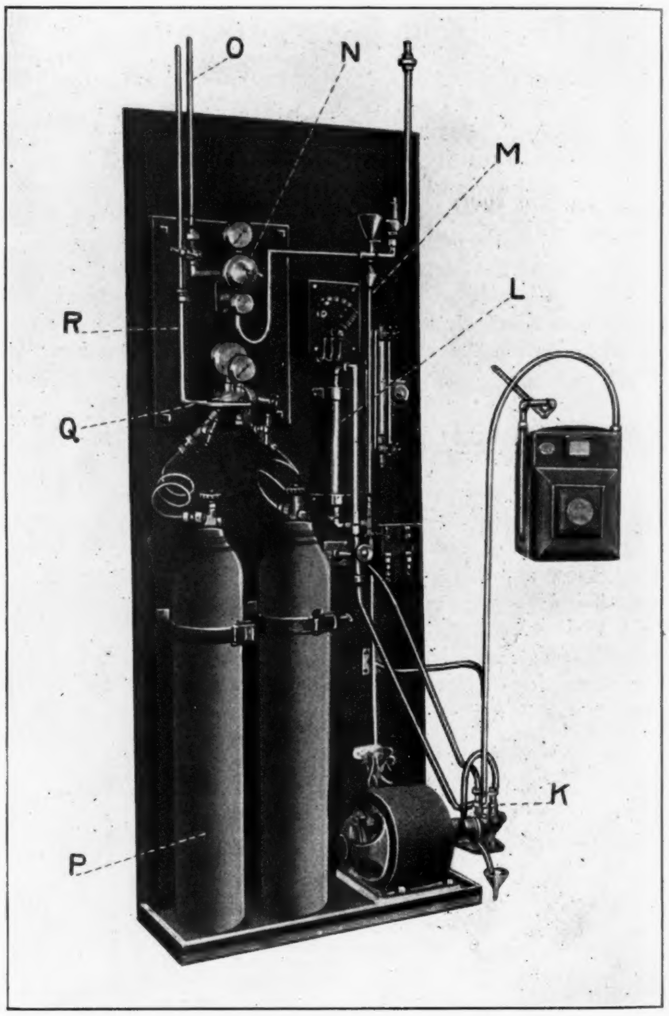


Burner for Welding and Cutting with Oxygen and Illuminating Gas.

The use of tanked oxygen, as in other welding processes, is recommended. The oxygen is stored in the tanks *P* and passes through the small coil pipe to the reducing valve *Q*, from which it passes through the pipe *R* to the burner. The maximum pressure used in the oxygen for welding is 25 lbs. per sq. in., and for heavy cutting up to 90 and 100 lbs. The illustration shows a two-torch outfit, but they may be built to any required size and there is one 14-torch outfit in successful operation.

The other illustration shows the construction of the burner or torch. This burner insures the complete mixture of the gases by means of the multiple stage system of mixing chambers and has been approved by the New York Municipal Explosives Commission. It will be seen that the two gases are separated until they enter the mixing chamber through the parallel ports of the transformer. Each torch is equipped with 10 tips, which are numbered and permit a full range of work, and the ground joints facilitate the changing of the tips. Referring to the illustration, *A* is the head piece, *B* the stationary nozzle, *C* the tip, *D* the transformer, *F* expansion mixers, *G* the oxygen conduit, *H* the illuminating gas conduit, and *E* and *J* are needle valves.

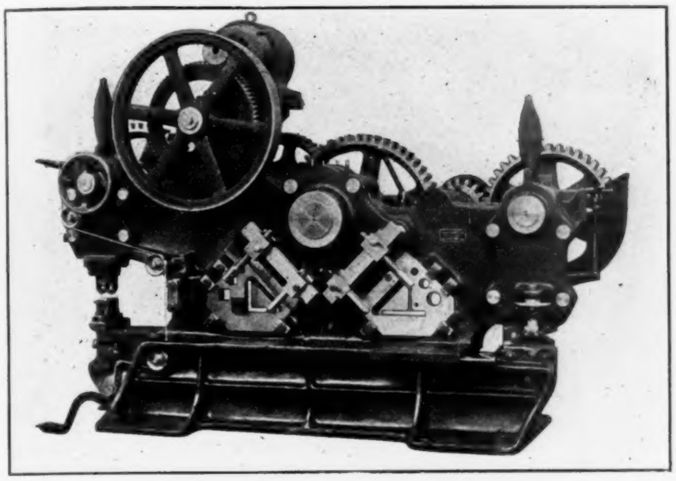
It has not yet been found possible with this system to weld either wrought iron or steel, but the welding of cast iron in medium thicknesses has proved successful and economical. Steel and wrought iron may be readily cut and steel bars up to 8 in. square have been cut with great success. The process is especially adapted for the smaller sizes of iron castings and is most economical and efficient on brass and aluminum work. It is quite applicable to such work as the repairing of brass castings, the filling in of blow holes and in boiler shops, particularly, for the cutting of plates; there are also many opportunities for its use in electric railroad repair shops as well as in signal work. The process has been developed by E. Raven Rosen-Baum, consulting engineer on high temperature gases, 607 West Forty-third street, New York, and all the apparatus has been patented by him.



Apparatus for Welding and Cutting with Oxygen and Illuminating Gas

QUADRUPLE COMBINATION MACHINE

The design of this machine was the result of the experience with the Oeking solid steel frame triple combination machines. It is a quadruple combination machine, which the manufacturers term the "Imperator" type, and is being placed on the market by the Wiener Machinery Company, New York, as managers for the Oeking Company, Dusseldorf, Germany. The machine is the result of careful study and contains in one frame, ready for work, all the tools for a large variety of cutting, shearing, coping, mitering and notching. It is claimed that it is the only machine of the kind that is in actual operation. The frame is made of steel in one piece and the machine is sufficiently compact to make it suitable for use in crowded shops; it can also be used in plants where driving power is limited. It will, without changing tools, split plates of unlimited length; cut flat bars; shear off rounds and squares; cut and miter angles and tees, right and left, at any degree; and punch plates and structural

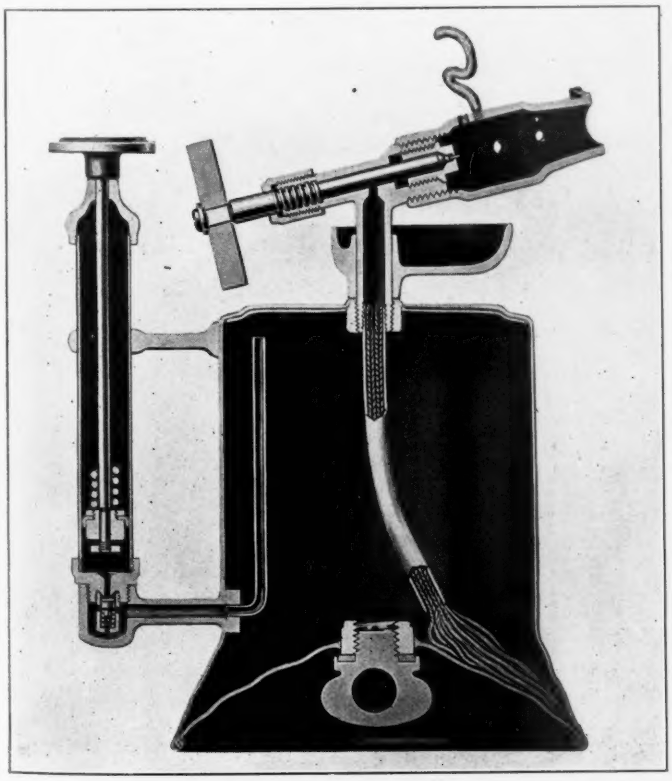


Imperator Quadruple Combination Machine.

material, both webs and flanges. With interchangeable tools, beams, channels, etc., can be cut. The punching tools may be interchanged for coping, mitering, etc. The machines are built in three sizes and are furnished with tight and loose pulleys for belt drive or can be arranged for direct motor drive; if desired they can be equipped with a turntable to facilitate the mitering of long angles. It is claimed that these machines do not cost more than the equivalent in single machines.

UNIVERSAL BLOW TORCH

The gasolene blow torch shown in the illustration embodies a number of improvements which, it is claimed, adapt it to all



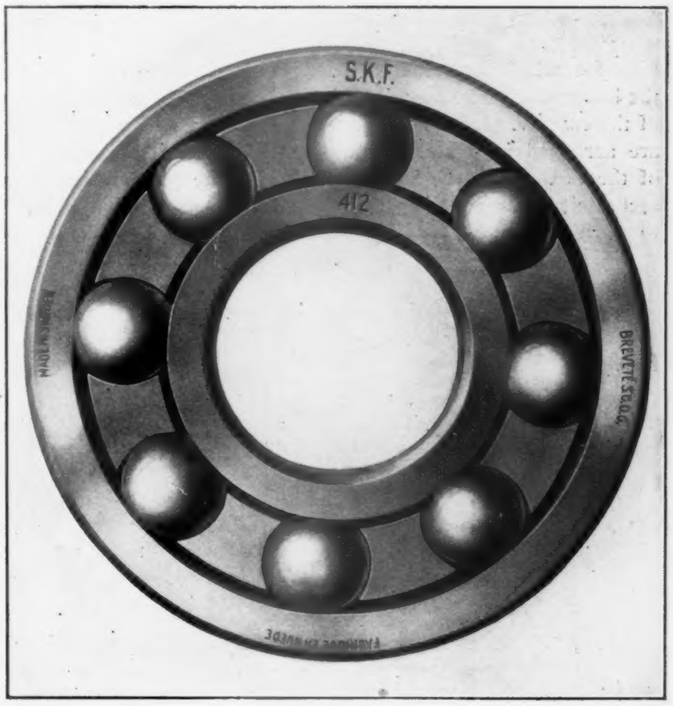
Section Through Universal Blow Torch.

conditions of service. The burner is made particularly heavy so that it will retain its heat and keep the torch burning in cold or windy weather, while the drip cup is made especially deep so that it will start the torch under bad weather conditions. The burner valve is self-cleaning, the needle at the end of the valve stem cleaning the hole automatically when the valve handle is turned. This avoids injury to the valve seat caused by picking at the opening to clean it. The valve seat is a separate replaceable plug and the handle of the valve is of fibre which will not burn or become hot. It is claimed that the tank is made of the heaviest gage brass ever used for this purpose; it is reinforced with an extra corrugated brass disc covering the entire inner surface of the tank pot, which insures the tank keeping its shape under very rough handling. The pump valve works in a cylindrical guide which assures perfect seating and it can be taken apart and any part replaced separately.

The illustration shows the quart size of the torch; a pint size is also made, differing only in the shape and size of the tank. These torches are being placed in the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

BALL BEARINGS IN AXLE LIGHTING GENERATORS

It has been found that in automobiles, electric motors, etc., ball bearings provide a solution of the costly and annoying troubles oftentimes caused by plain bearings. Large numbers of passenger equipment cars are being fitted with electric light-

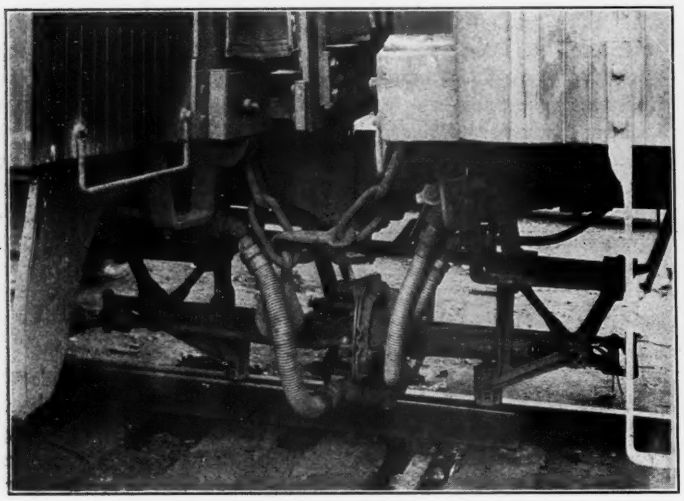


S. K. F. Railway Type Ball Bearing.

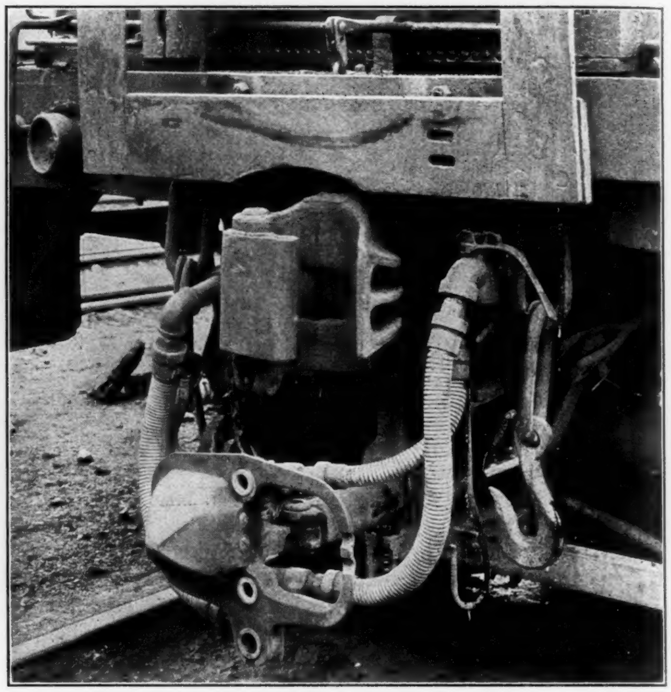
ing systems, and it is claimed that considering the saving in attention required and in the amount of lubrication, the prevention of the danger of dropping armatures as a result of worn bearings of the plain type, and the consequent expense, that it would be economical to discard the old type bearings and use ball bearings on the axle generators. The S. K. F. Ball Bearing Company, New York, has had a pair of its railway type double row self-alining ball bearings, similar to that shown in the illustration and fitted with 16 1-in. balls, applied to an axle lighting generator in constant service for over 19 months on a car running between New York and Chicago, during which time over 170,000 miles were run. These bearings were removed for inspection June 20, 1913, and were found to be in such good condition that they have been put back in service in the same generator.

AUTOMATIC TRAIN PIPE CONNECTOR

The Blue Grass Special of the Queen & Crescent has been equipped with the Durbin automatic train pipe connectors, which automatically couple the air, steam and signal lines, and also provide for telephone communication between all of the cars and the locomotive. The connector is attached to the car independent of the coupler. It is of the butt-face type and all the connections are arranged in a vertical line coincident with the center line of the car. With the butt-faced coupler the ports will register accurately when coupling, and the gaskets will not be subjected to such severe treatment as in the side-face type; it is also possible to keep a more perfect joint between the gaskets without relying on springs to keep the heads together. The gaskets can also be replaced without separating the cars. Having the connections in a vertical line has been found to be an improvement over having them in a horizontal line, for there is less liability of the connections springing apart and creating a leak when the train is passing around a curve.

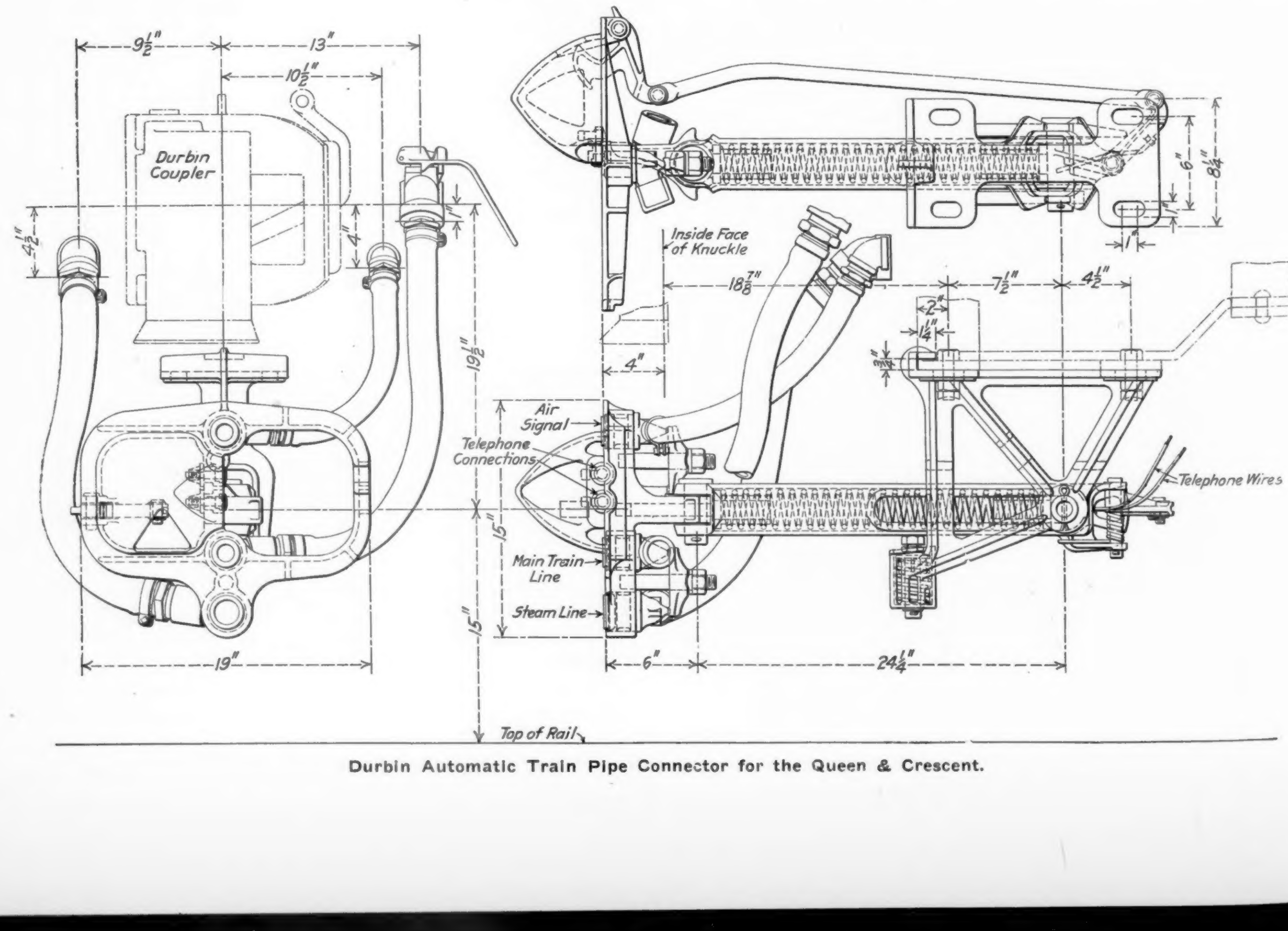


Durbin Automatic Train Pipe Connector as Connected in Service.



Durbin Automatic Train Pipe Connector Applied to a Locomotive Tender.

The design of the connector is clearly shown in the illustrations. It is made of malleable iron and is pivoted 6 in. behind



Durbin Automatic Train Pipe Connector for the Queen & Crescent.

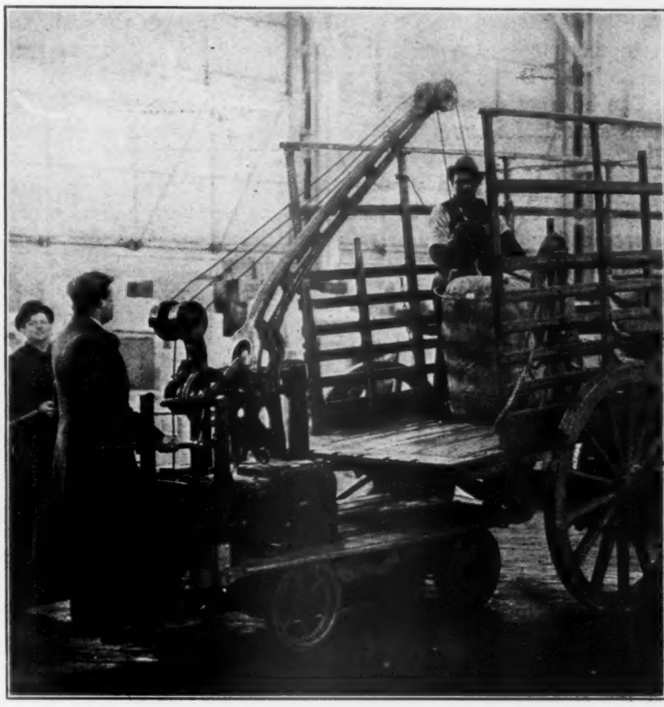
the face of the connector to allow for the curvature of the track. It is free to move 30 deg. each side of the center, and has a vertical travel of 10 in., which is sufficient to allow for uneven track. The coupler has a gathering range of 4½ in. in a vertical direction and 5 in. in a horizontal direction, which insures its engagement on any curve. It has a horizontal travel of 10 in., and is forced out by a spring made of vanadium steel. Even though the connectors are forced together by these springs when the cars are coupled, they also are automatically locked so that there is no possibility of their jarring open while on the road. This lock will only trip when the cars have been uncoupled and have started to separate. The hose couplings are held in the coupler head by a bridge bolt as shown in the drawing. This makes it possible for the hose coupling to be removed from the connector head for a new gasket without it being necessary to uncouple the cars. A metal gasket is used on the steam line. The plugs for the telephone connection are located between the signal line and air brake line couplings.

One of the greatest advantages of this connector is that it obviates the necessity of men going between the cars to couple the hose. It keeps the hose in an almost rigid position which will tend to reduce the hose failures due to abrasion, and on account of its construction it will practically eliminate torn hose. This device will also save considerable time in connecting up a train of cars. It is sold by the Durbin Automatic Train Pipe Connector Company, St. Louis, Mo.

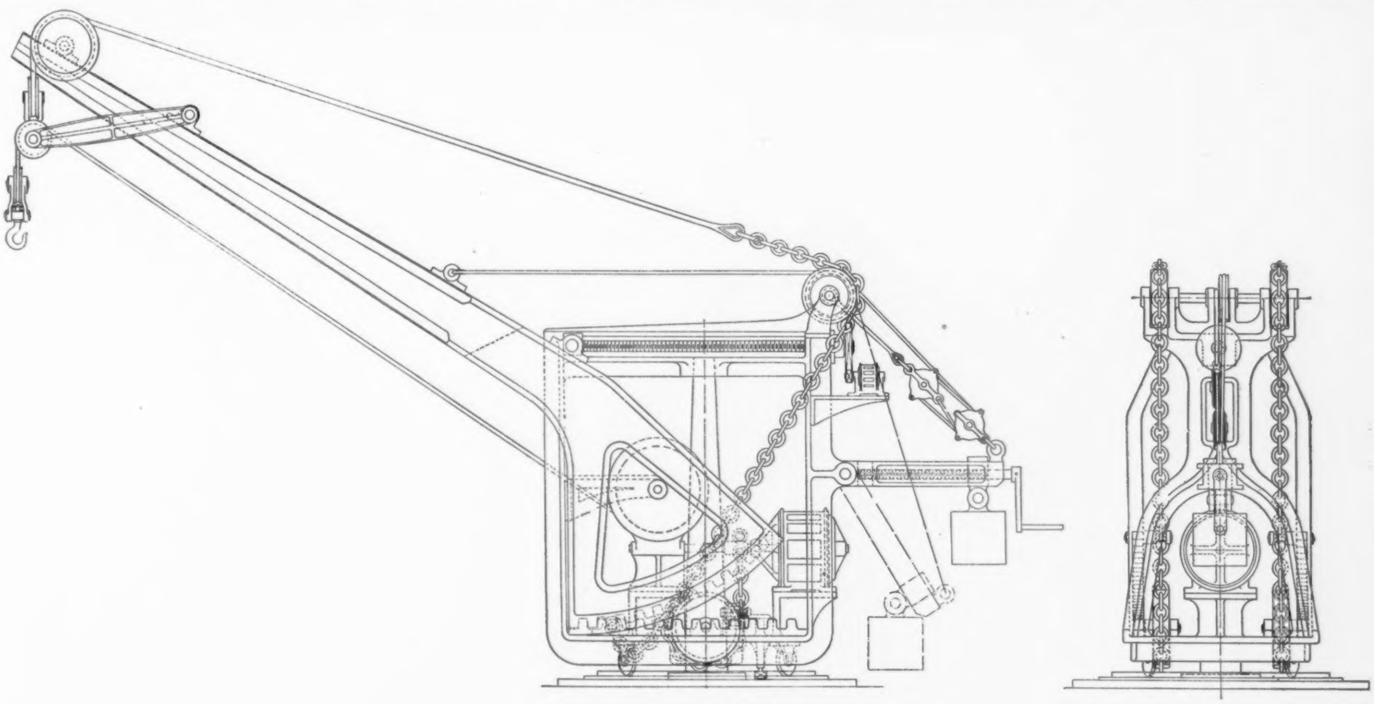
COMPENSATING QUADRANT CRANE

In the ordinary derrick type of crane, when the jib is raised to bring the load inward, the load itself is also lifted and any movement of the jib results in a change of level of the load. This is particularly inconvenient when the headroom is small or where the possible height of the lift in any position is limited. A crane which overcomes these objections and is designed to allow the load to be swung in and out without change in its level is illustrated herewith.

The compensating quadrant crane is of the derrick type, with the jib securely fastened at its lower end to two quadrants; in the smaller cranes the jib and the quadrant are cast in one piece. The quadrant is provided with a finished rolling surface and teeth that engage in a rack and roll in a slot on the bottom plate, a frame work being built on the latter. The actuating screws work in bearings in the top connecting piece of the crane, this piece also holding the bearing at the top of the post; the bearing at the bottom of the post is a part of the bottom plate. The actuating screw swings the quadrant by means of a nut which slides on a guide on the top part of the frame. For slewing, the bottom plate is provided with four rollers that roll on a beveled flange on the post plate.



Truck Crane of One Ton Capacity.



Compensating Quadrant Crane.

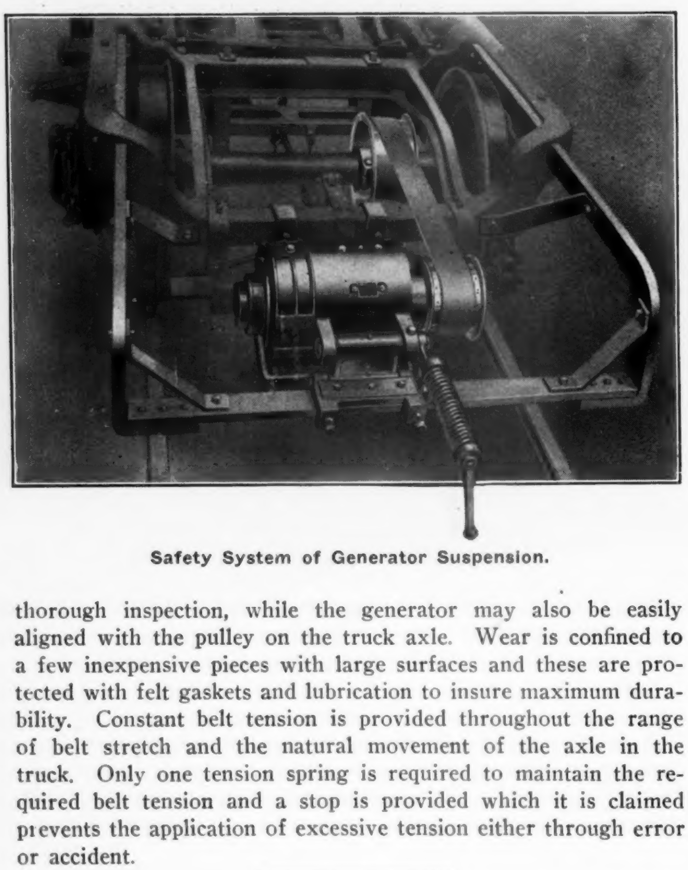
There are two different compensating devices. The first is obtained by the use of two parallel links pivoted at one end near the top of the jib, and at the other end holding two sheaves over which the hoisting ropes run. This end of the links is held by a chain that runs over the sheave at the top of the jib, and is connected by means of a rod with a three-arm dog pivoted at the top of the back frame. The other two arms of the dog are connected with the lower back end of the quadrants by means of two chains running over sheaves on the bottom plate. In the second device for compensation, the fixed end of the hoisting rope is fastened to the jib at a suitable point near the top, and from this point runs back and forth over sheaves on the back part of the frame and on the top of the jib.

The hoisting machinery is of the usual kind, made of dimensions suitable for the purpose for which the crane is to be used. The slewing is done by a system of gears under the bottom plate, which engage an annular rack in the post plate. The derricking is accomplished by means of the actuating screw, which is provided with a worm or spur gear drive; the necessary counterbalancing is accomplished by a weight. The driving power can be of any desired kind, but the cranes are generally provided with electric motors.

This type of crane is readily adaptable for use about scrap yards and also as a wrecking or locomotive crane. It is manufactured by the Welin Marine Equipment Company, Long Island City, N. Y.

SAFETY AXLE GENERATOR SUSPENSION

Owing to the many designs of car trucks in use it has been necessary to design a special suspension for axle lighting generators to meet the requirements of each type. The suspension used by the Safety Car Heating & Lighting Company, New York, is designed for application to any car truck, without losing the advantages of parallel suspension. With the exception of the few supporting irons, which have to be adapted to the various trucks, all the parts of this suspension are standard. The elimination of links as part of the suspension produce an open construction, giving easy access to the generator and permitting of



Safety System of Generator Suspension.

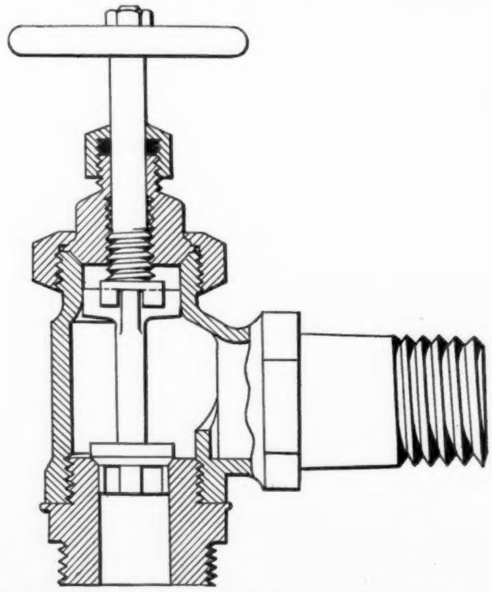
thorough inspection, while the generator may also be easily aligned with the pulley on the truck axle. Wear is confined to a few inexpensive pieces with large surfaces and these are protected with felt gaskets and lubrication to insure maximum durability. Constant belt tension is provided throughout the range of belt stretch and the natural movement of the axle in the truck. Only one tension spring is required to maintain the required belt tension and a stop is provided which it is claimed prevents the application of excessive tension either through error or accident.

INDO-CEYLON RAILWAY CONNECTION.—Work on the Indo-Ceylon connection, South Indian Railway, is proceeding steadily. More than two-thirds of the earthwork is finished.

OSMAN BOILER CHECK

The boiler check is one of the most important accessories of the locomotive, and one which, if not given proper attention, may cause a great deal of trouble. The Osman boiler check, which is shown in the illustration, has been developed after a number of years' experience with different types of checks, and it is claimed that it will reduce difficulties from this source to a minimum.

The valve is constructed with a spindle and four wings at the top acting as guides. The main spindle, to which is attached the hand wheel, has on the lower end a clutch which engages



Osman Boiler Check with Removable Valve Seat.

with these wings so that in case the valve sticks in an open position due to scale, etc., it can be closed by simply screwing down the main spindle, the clutch then forcing the valve to its seat. The cap through which the main spindle enters is made with a ball joint on the lower side, which can be reground in position by turning the spindle. This ball joint prevents steam getting at the threads of the union nut which holds the cap in place, thus preventing corrosion. The clutch also serves as a means of regrinding the check valve. The valve seat is made in a piece separate from the casing of the valve so that it is easily removable for repairs and may be replaced when worn out without the necessity of scrapping the entire casing. At the entrance to the boiler a bridge, or baffle, is provided in the casing which, it is claimed, prevents oscillation in the valve with consequent one-sided wear. This valve is manufactured by the Swenson Valve Company, Decorah, Iowa.

MOTOR BUSES IN LONDON.—In 1903 there were 3,500 horse omnibuses in use in the streets of London. There are now only 100 in use and it is expected that by the beginning of 1914 this type of vehicle will have been entirely done away with.—*The Engineer.*

NEW PORT RAILWAY IN URUGUAY.—The Montevideo Port railway, inaugurated on May 16, runs from the main station of the Central Uruguay Railway around the port to the docks where the steamers tie up. The road is only a few miles long, but by establishing direct communication between the sea and land carriers, it represents a commercial link of the utmost importance. The docks are provided with traveling electric cranes of high power, and now that steamers are berthed at the docks and railway cars may be run to the water's edge alongside the steamers, the transshipment of cargo from railway car to steamer and vice versa may be effected without loss of time and at a minimum of cost.

NEWS DEPARTMENT

According to the Canadian forestry association 50 per cent. of Canada is capable of growing nothing but timber crops.

The Mobile & Ohio has increased the pay of locomotive engineers, the average rate of increase being somewhat less than 5 per cent.

The Delaware, Lackawanna & Western has ordered the abolition of pens and inkstands in telegraph offices and the use of indelible pencils instead.

The two-cent passenger fare became effective on the principal Missouri lines on July 1. The freight rates fixed by the state law will go into effect on July 15.

CASINO TECHNICAL NIGHT SCHOOL

In a footnote concerning the Casino Technical Night School of East Pittsburgh, Pa., used in connection with the article entitled "You Have Received, What Will You Give" in our July issue, page 351, two errors were made. Tuition is not free. A complete year costs each student between $25 and $30. This pays about half of the expenses, the Westinghouse Electric & Manufacturing Company paying the balance. There are 40 teachers on the faculty and not 13, as stated in the footnote.

RECEPTION TO R. H. BRIGGS

A surprise reception was tendered to R. H. Briggs, retiring master mechanic of the St. Louis & San Francisco at Memphis, Tenn., July 29, by officers and employees of the road. Mr. Briggs was born in Schenectady, N. Y., February 2, 1833, and at the age of 16 entered the Schenectady Locomotive Works as machinist apprentice, remaining in their employ until their liquidation, when he removed to New York, securing employment in the Morgan Iron Works. Here he remained until August 6, 1852, when he decided to go south, where he worked as a marine engineer, running on a steamer from Little Washington, N. C., to Buford and Newborn; he later procured the same position on a steamship operating between Wilmington and Charleston. Upon the completion of the Wilmington and Manchester, in 1854, he gave up the marine service and first entered railroad service as a locomotive engineer for that road. In 1856 he went to the Montgomery and West Point in the same capacity, and in 1859 was appointed master mechanic of the Mobile and Girard, which position he retained until 1863, when he was made supervising engineer for the United States government, having charge of repairs to government steamers at New Orleans, La. In 1865, at the close of the civil war, he secured employment as a machinist in the shops of the Mobile & Ohio at Whistler, Ala. One year later he was made roundhouse foreman and was later promoted to general foreman of shops at that point. In 1872 he was appointed master mechanic, with headquarters at Jackson, Tenn., and in 1877 was appointed general master mechanic, with office at Whistler, Ala. It was during this period, in the yellow fever epidemic of 1878, that he took charge of the local situation, distributing provisions, caring for the sick and providing burial for those who had met death through the terrible scourge. In 1883 he was appointed superintendent of motive power of the Chesapeake & Ohio Southwestern, and in the latter part of 1886 went to the Atchison, Topeka & Santa Fe as master mechanic at Argentine, Kan., remaining there until February 2, 1888, when he accepted the position of master mechanic at Memphis for the K. C., M. & B., now the St. Louis & San Francisco Railroad, which position he retained until the date of his retirement, July 1, 1913.

DR. GOSS APPOINTED TO CHICAGO SMOKE ABATEMENT COMMITTEE

W. F. M. Goss, dean and director of the College of Engineering, University of Illinois, has been elected chief engineer of the Chicago Association of Commerce committee for the investigation of smoke abatement and electrification of railway terminals, to succeed the late Horace G. Burt. Dr. Goss will be granted leave of absence from the university for one year, during which time it is believed that the investigation will be completed and a report of the committee's conclusions issued. He has been a member of the committee since its organization three years ago. Dr. Goss was born at Barnstable, Mass., in 1859, and was educated at the Massachusetts Institute of Technology, at Wabash College and at the University of Illinois. He organized the department of practical mechanics at Purdue University in 1879, and was professor of experimental engineering, dean of the schools of engineering and director of the engineering laboratory at Purdue from 1890 to 1907. He has held his present position at the University of Illinois since September, 1907.

ANNIVERSARY OF OPENING OF THE WEST SHORE

At a dinner at the Hotel Astor, New York City, July 9, about 150 railroad men celebrated the thirtieth anniversary of the opening of the first division of the New York, West Shore & Buffalo, now the River division of the New York Central. Representative railroad men from Maine to the Missouri Valley and from the South were in attendance. The guest of honor was Charles W. Bradley, seventy-five years old, who was the first of the minor employees to be made a general officer of the company. He is now the superintendent of telegraph of the Chesapeake & Ohio. Among those who made speeches were: John B. Kerr, vice-president of the New York, Ontario & Western; J. McCulloch, of the New York Telephone Company; F. E. Harriman, local traffic manager of the New York Central; J. H. Hustis, vice-president of the New York Central; C. D. McKelvey, inspector for the New Jersey Public Utility Commission; Ira A. Place, vice-president of the New York Central; Walter B. Pollock, manager marine department, New York Central, and Percy R. Todd, president of the Bangor & Aroostook.

MEETINGS AND CONVENTIONS

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting of mechanical associations.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.

AMERICAN RAILWAY MASTER MECHANICS' ASSOC.—J. W. Taylor, Old Colony building, Chicago.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—A. R. Davis, Central of Georgia, Macon, Ga.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Annual meeting, December 3-6, Engineering Societies' Building, New York. Railroad session, Thursday morning, December 5.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 North Fiftieth Court, Chicago; 2d Monday in month, Chicago.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. G. Hall, 922 McCormick building, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 829 W. Broadway, Winona, Minn.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, Lima, Ohio. Convention, August 18, 1913. Richmond, Va.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOC. OF U. S. AND CANADA.—A. P. Dane, B. & M., Reading, Mass. Convention, Sept. 9-12, 1913, Ottawa, Can.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y. Convention, August 12-15, 1913, Hotel Sherman, Chicago, Ill.

PERSONALS

It is our desire to make these columns cover as completely as possible all the changes that take place in the mechanical departments of the railways of this country, and we shall greatly appreciate any assistance that our readers may give us in helping to bring this about.

GENERAL

HENRY B. BROWN has been appointed general fuel inspector of the Illinois Central, with headquarters at Chicago, Ill.

P. T. DUNLOP, mechanical superintendent of the Gulf, Colorado & Santa Fe, has been appointed general superintendent of motive power of the St. Louis & San Francisco, with headquarters at Springfield, Mo., succeeding George A. Hancock, resigned on account of ill health.

J. F. GRAHAM, assistant general manager of the Oregon-Washington Railroad & Navigation Company, has been appointed superintendent of motive power with headquarters at Albina shops, Portland, Ore.

WILLIAM P. HAWKINS has been appointed assistant fuel agent of the Missouri Pacific and the St. Louis, Iron Mountain & Southern, with headquarters at St. Louis, succeeding W. J. Jenkins, resigned. Mr. Hawkins heretofore has been claims assistant in the office of Vice-President E. J. Pearson.

FRANK TAYLOR HYNDMAN, formerly mechanical superintendent of the New York, New Haven & Hartford, whose appointment as superintendent of motive power and cars of the Wheeling & Lake Erie, with headquarters at Cleveland, Ohio, was announced in the July issue of the *Railway Age Gazette, Mechanical Edition,* was born September 29, 1858, and began railway work in 1872, as machinist apprentice on the Central of New Jersey at Ashley, Pa. From 1874 to 1877 he was an apprentice in the shops of the Lehigh Valley at Wilkesbarre and then, for about three years, was brakeman and fireman on the Central of New Jersey. From March to November, 1880, he was a machinist on the Atchison, Topeka & Santa Fe at Raton, New Mexico, and from March, 1881, to August, 1883, was machinist on the Pittsburgh & Western and at the Pittsburgh Locomotive Works, becoming engineman on the Pittsburgh & Western in August, 1883. He remained in that position until September, 1895, when he was made trainmaster, and from April, 1896, to November, 1902, was master mechanic of the same road at Allegheny. He was then, for one month, master mechanic on the Baltimore & Ohio at Pittsburgh, and from December, 1902, to July, 1904, was master mechanic on the Buffalo, Rochester & Pittsburgh. In July, 1904, he was appointed superintendent of motive power of the same road at Dubois, Pa., and the following November went to the New York, New Haven & Hartford as general master mechanic at New Haven, Conn. He became mechanical superintendent of the same road in May, 1906, resigning from that position on July 15, 1907, to enter the railway supply business, and at the time of his recent appointment as superintendent of motive power and cars of the Wheeling & Lake Erie, was the Philadelphia, Pa., representative of S. F. Bowser & Co., Inc., Fort Wayne, Ind.

F. T. Hyndman

J. T. LANGLEY, assistant general manager of the Oregon-Washington Railroad & Navigaton Company, has been appointed assistant superintendent of motive power with headquarters at Albina shops, Portland, Ore.

G. W. LILLIE has been appointed acting mechanical superintendent of the second district of the Rock Island Lines with headquarters at Topeka, Kan., in place of C. M. Taylor, who has been granted leave of absence on account of ill health.

W. N. MITCHELL, formerly at the head of the railway department of the International Correspondence Schools at Chicago, has been appointed fuel supervisor of the Chicago Great Western, with office at Chicago.

H. J. OSBORNE has been appointed superintendent of motive power of the South Dakota Central, with headquarters at Sioux Falls, S. D.

R. Q. PRENDERGAST has been appointed mechanical superintendent of the Bangor & Aroostook, with headquarters at Milo Junction, Maine, succeeding H. Montgomery, and the position of superintendent of motive power and equipment is abolished. Mr. Prendergast was educated in the high schools and at a business college. After serving his apprenticeship as machinist on the Baltimore & Ohio, at Benwood, W. Va., he was promoted to division foreman at Cameron, and then for a number of years was general foreman at various shops of the same road, including the Mount Clare shops at Baltimore. He then went to the Cumberland Valley as general foreman at Chambersburg Pa., and three years later was appointed general foreman of the Delaware & Hudson at Carbondale, Pa. He remained in that position for two years, and then for five years was division master mechanic on the Denver & Rio Grande at Pueblo, Colo. He left that road to go to the Cincinnati, Hamilton & Dayton as division master mechanic at Indianapolis, Ind., where he remained for one year, leaving that position to become mechanical superintendent of the Bangor & Aroostook, as above noted.

R. Q. Prendergast

W. H. SCRIBNER has been appointed supervisor of mechanical examinations of the Lake Shore & Michigan Southern, the Dunkirk, Allegheny Valley & Pittsburgh, the Chicago, Indiana & Southern and the Indiana Harbor Belt, with headquarters at Cleveland, Ohio, having direct assignment of duties in the examination of locomotive firemen for promotion, also for instruction of locomotive firemen at times not conflicting with examinations.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

A. G. ARMSTRONG has been appointed master mechanic of the Atchison, Topeka & Santa Fe at Needles, Cal., succeeding M. P. Cheney, granted leave of absence.

H. W. CULVER has been appointed road foreman of engines of the Canadian Northern at Winnipeg, Man., succeeding J. A. Carroll, transferred.

W. C. GROENING has been appointed master mechanic of the Pere Marquette, with office at Wyoming, Mich., succeeding J. E. Hickey, resigned.

C. B. DAILY, assistant superintendent of shops of the Rock Island Lines at Silvis, Ill., has been appointed master mechanic of the Cedar Rapids division with headquarters at Cedar Rapids, Iowa, succeeding F. W. Williams, transferred.

JAMES M. FORD has been appointed assistant road foreman of engines for temporary service on the St. Paul division of the Northern Pacific.

S. F. HANCHETT has been appointed road foreman of equipment of the Rock Island Lines at Trenton, Mo., with jurisdiction over Missouri division territory, Trenton and west, succeeding J. E. Mourne, transferred.

W. T. LEYDEN, master mechanic of the Minneapolis & St. Louis, with headquarters at Marshalltown, Iowa, has resigned.

F. S. ROBBINS, assistant general foreman at the Pitcairn, Pa., car shops of the Pennsylvania Railroad, has been appointed assistant master mechanic, Pittsburgh division, with headquarters at Pittsburgh, succeeding C. D. Porter, promoted.

HUGO SCHAEFER has been appointed master mechanic of the Atchison, Topeka & Santa Fe at Clovis, New Mexico, succeeding James Kiely, resigned.

H. H. STEPHENS has been appointed master mechanic of the Atchison, Topeka & Santa Fe at Wellington, Kan., succeeding Hugo Schaefer, transferred.

F. W. WILLIAMS, division master mechanic of the Rock Island Lines at Cedar Rapids, Iowa, has been transferred in that capacity to the Minnesota division, with headquarters at Manly, Iowa.

CAR DEPARTMENT

J. DEANE has been appointed general car foreman of the Rock Island Lines at Horton, Kan., succeeding J. J. Acker, promoted.

IRA W. FLEMING has been appointed general car foreman of the Atchison, Topeka & Santa Fe at La Junta, Colo., succeeding William Stapp.

J. H. MILTON has been appointed superintendent of the car department of the Rock Island Lines with headquarters at Chicago, Ill.

J. H. THOMAS, foreman of the Mifflin shop of the Pennsylvania, has been appointed assistant general foreman of the car shop at Pitcairn, Pa., succeeding F. S. Robbins, promoted.

GEORGE THOMSON, division general foreman in the car department of the Lake Shore & Michigan Southern at Englewood, Ill., has been appointed assistant master car builder, Michigan Southern division of that road, also of the Chicago, Indiana & Southern and the Indiana Harbor Belt, with headquarters at Englewood.

SHOP AND ENGINE HOUSE

O. S. BEYER, JR., has been appointed general foreman of the Rock Island Lines at Horton, Kan., succeeding P. Linthicum, promoted.

THOS. BOOTH has been appointed general foreman of the Atchison, Topeka & Santa Fe at Clovis, N. M., succeeding J. R. Cook.

JOHN H. CLARK has been appointed night roundhouse foreman of the Atchison, Topeka & Santa Fe at Dodge City, Kan.

J. W. FLICKWIR has been appointed division foreman of the Atchison, Topeka & Santa Fe at Los Angeles, Cal., succeeding A. G. Armstrong, promoted.

RUFUS H. FLINN has been appointed general foreman for the Louisville division of the Pittsburgh, Cincinnati, Chicago & St. Louis (Pennsylvania Lines), and the Pennsylvania Terminal Railway Company, with headquarters at Louisville, Ky.

T. P. JONES has been appointed general foreman of the Rock Island Lines at Manly, Iowa.

L. H. HAHN has been appointed boiler foreman of the Atchison, Topeka & Santa Fe at Albuquerque, N. M., succeeding D. A. Eddleston.

P. LINTHICUM, general foreman of the Rock Island Lines at Horton, Kan., has been appointed assistant superintendent of shops at Silvis, Ill., succeeding C. B. Daily, promoted.

S. LOGAN has been appointed general foreman of the Grand Trunk at Toronto, Ont., succeeding G. M. Wilson, assigned to other duties.

C. C. RHINEHART has been appointed acting night roundhouse foreman of the Rock Island Lines at Manly, Iowa.

F. E. SHAFFER has been appointed foreman of the locomotive and car department of the Rock Island Lines at Inver Grove, succeeding H. Tatum, resigned.

W. B. TROW has been appointed roundhouse foreman of the Rock Island Lines at Armourdale, Kans., succeeding E. P. Eich, promoted.

PURCHASING AND STOREKEEPING

H. G. COOK has been appointed general storekeeper of the Southern Pacific, with headquarters at San Francisco, Cal., to succeed H. C. Pearce, resigned.

W. L. COOPER, division storekeeper of the Mobile & Ohio at Murphysboro, Ill., has been appointed division storekeeper at Jackson, Tenn., succeeding W. C. Blake, transferred.

A. A. GOODCHILD, auditor of stores and mechanical accounts of the Canadian Pacific at Montreal, Que., has been appointed general storekeeper for lines east of Fort William, Ont., with office at Montreal, succeeding M. J. Power, deceased.

J. F. MARSHALL, purchasing agent of the Wheeling & Lake Erie, has been appointed manager of purchases and supplies of the Chicago & Alton, with headquarters at Chicago, succeeding E. S. Wortham, assigned to other duties.

D. E. MCODIE has been appointed division storekeeper of the Mobile & Ohio at Meridian, Miss., succeeding R. O. Woods, transferred.

H. C. PEARCE, general storekeeper of the Southern Pacific at San Francisco, Cal., has been appointed to the new position of general purchasing agent of the Seaboard Air Line, with headquarters at Norfolk, Va., in charge of both purchases and stores.

SAMUEL PORCHER, assistant purchasing agent of the Pennsylvania Railroad, with office in Philadelphia, Pa., has been appointed purchasing agent, with office in Philadelphia, succeeding Daniel S. Newhall, deceased.

R. O. WOODS, division storekeeper of the Mobile & Ohio at Meridian, Miss., has been transferred in the same capacity to Murphysboro, Ill., succeeding W. L. Cooper.

OBITUARY

G. MCROBERTS, division foreman of the St. Louis & San Francisco at Salem, Mo., died on July 10, aged 56 years.

DANIEL SMITH NEWHALL, purchasing agent of the Pennsylvania Railroad, died on July 13 in a hospital at Philadelphia. He was born on April 7, 1849, at Germantown, Philadelphia. On February 21, 1882, he was elected assistant secretary of the Pennsylvania Railroad, and since June 1, 1898, was purchasing agent of the same road, with office at Philadelphia.

New Shops

Alabama, Tennessee & Northern.—A steel and galvanized iron general repair shop 110 ft. x 165 ft., with concrete foundations, is being built at York, Ala. The Decatur Bridge Company has been given a contract for the superstructure, and the foundation work is being carried out by the railway company's forces.

Canadian Pacific.—A contract has been given to Henry Post, Woodstock, N. B., at $100,000, it is said, for putting up new concrete and steel shops at McAdam Junction, N. B.

Denver & Rio Grande.—This road has announced that new shops will be erected as soon as possible on the site of the shops destroyed by fire on June 18, at Salt Lake City, Utah. Work has already been started on temporary shops.

Gulf, Colorado & Santa Fe.—Contracts have been let to H. D. McCoy, of Cleburne, Tex., for a 12-stall brick and concrete roundhouse, a machine shop 60 x 80 ft., and a power house 37 x 80 ft. at Brownwood, Tex.

Houston & Texas Central.—This company has purchased a tract of 260 acres near Mexia, Tex., on which will be erected a 12-stall roundhouse, car sheds and shops to handle running repairs. Plans for the improvement are now being prepared by the engineering department.

Illinois Central.—This company will double the capacity of its shops at Paducah, Ky. Details are not yet available, but new buildings will be erected and new machinery installed.

Intercolonial Railway.—This road will build extensions, it is said, to the present freight car shops at Moncton, N. B.

Lake Shore & Michigan Southern.—This company will open bids shortly for the car shop which is to be built at Ashtabula, Ohio. The shop will be 200 ft. x 450 ft. and will cost about $40,000.

New York, New Haven & Hartford.—This company has just completed at Readville, Mass., an extension to its locomotive repair shop. This addition, which is 200 ft. x 150 ft., is designed as a boiler repair shop and cost $200,000. It will be opened August 1. The boiler repair work has previously been done chiefly at New Haven, but hereafter all of it will be done at Readville.

Western Maryland.—This company has completed the construction of a roundhouse, a power plant, a machine shop and engine terminals at Maryland Junction, near Cumberland. The roundhouse has 20 stalls and is of steel and concrete construction. The contract for furnishing the structural steel for this building was awarded to the McClintic-Marshall Construction Company. The machine shop is equipped for light repairs to engines and cars but particularly to engines. The engine terminals will be of sufficient size to meet the needs of the company at that point. These improvements are a part of the general terminal development at Cumberland.

Early Trial of First Baldwin Locomotive.—On a subsequent day, when Dr. Patterson, of the University of Virginia, was in the tender, the mile on a straight line was run through in 58 seconds, according to the estimate of one computer, whilst another observer of time counted 52 seconds. That the distance might have been run in less time was obvious to all, for Mr. Baldwin made the engineer cut off the steam entirely to check a career which he feared might be too great for the strength of the road or the tenacity of the parts of the locomotive. At 58 seconds the speed was more than 62 miles per hour. From this rapid movement no inconvenience was felt by the passengers but a stiff breeze was produced by the quick motion through the air so as to endanger the security of the hats.—*From the American Railroad Journal, January* 19, 1833.

Supply Trade Notes

The General Electric Company, Schenectady, N. Y., has opened a branch office at Madison, Wis.

F. J. Lepreau has been made assistant western sales manager for the primary battery department of Thomas A. Edison, Inc., Orange, N. J., for Central Western territory, with office in Chicago.

The U. S. Metal & Manufacturing Company, New York, has recently added to its line of railway specialties the sale of the Lincoln arc welding and cutting machines, made by the Welding Materials Company.

The H. W. Johns-Manville Company, New York, has opened a branch office in the Commercial Bank building, Charlotte, N. C., in charge of E. U. Heslop as manager. P. J. McCusker and Paul W. Whitlock are also located at that office.

Harrison G. Thompson, manager of the railway department of the Edison Storage Battery Company, Orange, N. J., has been made a vice-president of that company. Mr. Thompson was born in Weston, Mass., in 1875. His railroad experience began with the Pullman Company in 1896. When he had been with that company for two years he was made foreman of electricians. In 1900 he resigned to become foreman of the battery department of the Riker Motor Vehicle Company. Leaving this concern at the time of its absorption by the General Vehicle Company of Hartford, Conn., Mr. Thompson became associated with W. L. Bliss, one of the pioneers in electric car lighting development. He resigned from the Bliss Company in 1905 and went to the Pennsylvania Railroad, where he was in charge of electric car lighting, with headquarters at Jersey City, N. J. In 1906 he went to the Safety Car Heating & Lighting Company, New York, as electrical superintendent. He was in charge of this company's electrical laboratories during the development of its first electric car lighting system. In December, 1909, he was appointed manager of the railroad department of the Westinghouse Storage Battery Company. He was later with the United States Light & Heating Company, New York, for a short time. On July 1, 1910, he was made manager of the railway department of the Edison Storage Battery Company, which position he held until his appointment as a vice-president, as mentioned above. He is a member of the executive committee of the Telephone and Telegraph Appliance Association, and for three years was vice-president of the Association of Railway Electrical Engineers.

H. G. Thompson

W. E. Jenkinson has been made railroad representative for S. F. Bowser & Company, Inc., Fort Wayne, Ind., covering that territory vacated by E. F. G. Meisinger. In addition, he will take over the Southwestern and Pacific coast territory. He will cover the states from Texas to Oregon.

Ground was broken on July 23, for the new plant of the Baldwin Locomotive Works in East Chicago. The plant is to be built in several units, the first unit to occupy a building 1,400 x 600 ft. of concrete and steel. The H. A. Strauss Company, of Chicago, has the contract for the construction of the concrete work on the first unit.

W. F. Girten, representative of the railroad department of the Garlock Packing Company in Eastern territory, and formerly general storekeeper of the Central of New Jersey and of the Delaware, Lackawanna & Western, died at the Presbyterian Hospital, Newark, N. J., on July 27, of a complication of intestinal and stomach troubles.

Samuel S. Eveland, owner of the Eveland Engineering & Manufacturing Company, Philadelphia, has sold the entire production of electric riveters of his factory for the first year, approximating in value $1,500,000, to Manning, Maxwell & Moore, New York. The Eveland company is installing a large amount of new machinery to increase its output, and will manufacture transformers and electric tempering and hardening machines as well as Eveland electric riveters.

The employees of Wells Brothers Company, Wiley & Russell Manufacturing Company and A. J. Smart Manufacturing Company, of Greenfield, Mass., which are the firms forming the Greenfield Tap & Die Company, held their annual joint outing at Island Park, Brattleboro, Vt., Saturday, July 26. A special train of fourteen coaches was provided to accommodate the 726 men and women who attended. The day was occupied in the competition by teams and individuals from the different shops in athletic events.

The Stark Rolling Mill Company, Canton, Ohio, have made an arrangement with The Pedlar People, Ltd., Oshawa, Ont., whereby the latter become general distributors of Toncan metal sheets and products for the Dominion of Canada. The Pedlar People have branches at Montreal, Toronto and Winnipeg, and are equipped to distribute rapidly and efficiently. A. T. Enlow, formerly sales manager of the Stark Rolling Mill Company, is now engaged as manager of sales of The Pedlar People, Ltd., and is also a director.

The Locomotive Arch Brick Company has taken over the patents and business of the Fire Clay Development Company, 1201 Chamber of Commerce building, Chicago. The company has recently been organized with the following officers: President, J. W. Moulding; vice-president, E. P. Stevens; vice-president and general manager, John L. Nicholson; secretary, T. C. Moulding. The Moulding family has been in the fire brick business since 1861, and now owns five large modern plants, for which the Locomotive Arch Brick Company will be the selling agents.

Manning, Maxwell & Moore, Inc., New York, together with their subsidiary companies, will move their general offices on or about October 1, from 85-89 Liberty street to the new Lewisohn Building, 113-119 West 40th street. This change is being made to meet the demand for a more convenient and central location, as well as larger space to handle material increases in their various lines. They will occupy the twentieth and twenty-first floors of the building, which will give them 28,000 square feet of space. This space will be exclusively for offices and is almost double that at present occupied for offices on Liberty street.

The annual report of the American Car & Foundry Company, New York, for the fiscal year ended April 30, 1913, shows gross earnings of $5,539,000, an increase of $1,346,000 over the preceding year. The net earnings were $3,328,592, an increase of $489,360, and after the deduction of $250,000 for maintenance and improvements the balance available for dividends was $3,078,592. Dividends of 7 per cent. were paid on the $30,000,000 of preferred stock, and of 2 per cent. on the $30,000,000 of common stock, leaving a surplus for the year of $378,592. Added to the previous surplus this makes a total surplus at the close of the fiscal year of $25,255,168. At the annual meeting of the stockholders on June 26, the retiring directors were re-elected.

CATALOGS

The Otto Cycle.—An interesting, brief history of the development of the internal combustion engine, with illustrations of the earlier types issued by the Otto Gas Engine Works, Thirty-third and Walnut streets, Philadelphia.

Cling-Surface in Railroad Shops.—An eight page booklet issued by the Cling-Surface Company, Buffalo, N. Y., illustrates some of the advantages that have resulted from the use of this compound in five different railroad shops.

Forging Bolt Heads.—National Header Talk No. 10, issued by the National Machinery Company, Tiffin, Ohio, is devoted to a discussion of the features of design of the National Wedge Grip Header, which allows it to make a perfect bolt head in one blow.

Drill Presses.—Heavy duty drill presses of various sizes are illustrated and very fully described in several leaflets issued by the Colburn Machine Tool Company, Franklin, Pa. The 24-in. and 36-in. swing machines are shown in bulletins Nos. 49, 50 and 51.

Drills and Reamers.—A new catalog from the Celfor Tool Company, Buchanan, Mich., gives illustrations, a brief description and table of the complete range of sizes, with the price of the types of drills, reamers, flue cutters, countersinks, chucks, tool holders, milling cutters, and boring tools manufactured by it.

Street Locomotive Stokers.—Illustrations, together with a list of the general dimensions, of a number of the largest locomotives in service in this country, which are now being fired by the Street locomotive stoker, form the principal part of a booklet being issued by the Locomotive Stoker Company, 30 Church street, New York.

Fuel Oil Data.—Circular No. 142, prepared by Tate, Jones & Company, Inc., Pittsburgh, Pa., is devoted to the discussion of fuel oil and presents much interesting data in connection with the use of this fuel in both boilers and furnaces. Many tables giving the results of actual tests with both oil and coal of various grades are included.

Direct Current Motors.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. A-4121, describing direct current motors, type CVC, which is a revision of previous bulletins on direct current motors of the commutating pole design. The bulletin is thoroughly illustrated and contains information on the proper method of handling.

Starett Tools.—Catalog No. 20, issued by the L. S. Starett Company, Athol, Mass., contains 320 pages of interesting descriptions, illustrations and prices of all kinds of tools for machinists, carpenters, draftsmen, engineers, and other mechanics. In addition there are many convenient tables, such as metric conversion tables, decimal equivalents, wire gage tables, etc.

More Chips.—An illustrated pamphlet is being issued by The Electric Controller & Manufacturing Company, Cleveland, Ohio, which consists very largely of an article by H. F. Stratton, entitled "The Automatic Control of Machine Tools," which appeared in the May 29, 1913, issue of the *American Machinist.* This article is an interesting discussion of the advantages that have actually been obtained by the use of the automatic control on motor driven machine tools.

Bolt Cutters.—The National Machinery Company, Tiffin, Ohio, had on exhibition at the mechanical conventions at Atlantic City several designs of bolt cutters, some of which were in operation. Unusually satisfactory results were obtained under the most adverse conditions of shape and size of the stock used, and this company is now issuing a catalog descriptive of the work performed at that time. The machine itself is also fully illustrated and described.

Most Powerful Locomotive.—Bulletin No. 1014 from the American Locomotive Company, New York, is devoted to an illustrated description of the Mallet type locomotives built by that company for the Virginian Railway, which are the heaviest and most powerful ever built. The bulletin discusses the design in general, and also gives a very complete description of the more interesting details. Comparative tests made between these and some Mikado locomotives on fuel and water consumption are briefly referred to and the general results are presented.

File Filosophy.—The eighth revised edition of the interesting booklet prepared by the Nicholson File Company, Providence, R. I., and entitled "File Filosophy," is now being issued. It contains 45 pages and is fully illustrated. To a certain degree it is a text book on files and contains much valuable information in connection with the proper methods of using the various styles. A section is devoted to the definition of the various terms used in connection with files and instructions are given as to the best practice in cleaning and taking care of these tools.

Electric Riveter.—Standard and portable electric riveting machines of various sizes are fully illustrated and described in a catalog issued by the Eveland Engineering & Manufacturing Company, Philadelphia, Pa. These riveters are suitable for any size or length of rivet of iron, steel, brass, copper, or other metal, and are claimed to be absolutely safe to use, there being no possibility of an electric arc forming, nor of any danger from shock from the electric current used. It is stated that the two contact points may be held in the hand without producing any sensation whatever.

The Keystone Driving Box.—Comprehensive illustrations are depended on very largely for the information presented in a pamphlet being issued by the Keystone Lubricating Company, Twenty-first, Clearfield and Lippincott streets, Philadelphia, Pa. This box is designed to permit the brass to be readily removed when the box is in its place in the pedestal and the weight has been removed from the top of the journal. Also to permit the lateral being taken up without dropping wheels and to allow taking up the shoe and wedge wear without lining down the wedges. The illustration in each case shows exactly how these desired results have been accomplished.

Markel Devices.—Several of the devices designed by Charles Markel, shop foreman of the Chicago & North Western, at Clinton, Iowa, including a removable driving-box brass, flangeless shoes and wedges, lateral motion plates, and a solid end main rod, all of which designs have been illustrated in these columns, are now being furnished by the Equipment Improvement Company, 30 Church street, New York. This company has issued a catalog which contains illustrations and descriptions of these various parts, and also substantiates its claims for saving in maintenance expense by actual figures that have been obtained from the service on the Chicago & North Western.

Locomotives.—Three new records of construction have recently been issued by the Baldwin Locomotive Works. Record 73 contains a reprint of a paper presented by George R. Henderson, consulting engineer of the Baldwin Locomotive Works before the Franklin Institute, Philadelphia. This paper is entitled "The Recent Development of the Locomotive," and discusses the subject at considerable length. It is thoroughly illustrated, giving many interesting details of some of the larger modern locomotives. Record No. 74 discusses gasolene locomotives, which are manufactured in sizes suitable for industrial purposes. Different examples are illustrated and the book contains a discussion and illustrations of the various important details of the machine. Record No. 75 is devoted to illustrations, a brief description and a complete list of specifications of Mikado locomotives that have recently been built by this company. These are shown in practically all sizes, and include some of the most powerful simple locomotives now being used in freight service in this country.

Compressed Air Machinery.—"Ingersoll-Rand Products," is the title of a 140-page catalog now being issued by the Ingersoll Rand Company, 11 Broadway, New York. This book fully illustrates the entire line of this company's productions, and includes in each case, dimensions and capacity tables which are of decided assistance in selecting machines to meet certain specified requirements. Compressed air in a wide range of adaptability is covered by the machines shown in this book. Practically twenty pages are devoted exclusively to tables of horse power required to compress air from atmospheric pressure to various gage pressures, as well as efficiency tables of air compression at different altitudes, drill capacity tables and indicator charts.

Boring and Turning Mills.—Colburn new model boring and turning mills are very thoroughly illustrated and described in an attractive catalog being issued by the Colburn Machine Tool Company, Franklin, Pa. These machines are built to withstand the heaviest cuts with high speed steel and are claimed to embody every known improvement for the rapid production of work. The catalog gives a thorough description of the mechanical construction of the mills, and includes clear and concise instructions pertaining to their operation. An extensive use of illustrations is found throughout the catalog, each showing some important detail of the machine, The machines are shown in five sizes, from 42 in. to 72 in., and are fitted with two regular swivel heads. Arrangement is also made for applying a turret head on one side, if desired. A thread cutting attachment which can be applied to any of these machines is illustrated and its method of application and use is described.

Glyco Metal.—Glyco is a scientifically made bearing metal that has been manufactured in Europe for nearly fifteen years and is used there in large quantities. The American rights for its manufacture and sale have recently been secured by Joseph T. Ryerson & Son, Chicago, who are issuing a 70-page pamphlet, descriptive of its qualities and uses. This booklet is No. 13 in the Technical Library Series, being prepared by this company, and discusses the subject from a strictly technical standpoint. Tests that have been made indicate that it is the cheapest substitute for a high-priced alloy, and also that it possesses important technical advantages over other lead base alloys. The last twenty pages of the booklet are devoted to useful information, being a reprint of the conclusions of accepted authorities on the various subjects selected. These include lubrication, the laws of friction, physical characteristics of lubricants, crank pin calculations, length of shaft bearings, specific gravity of alloys, the horse power per pound of mean effective pressure, and various other similar tables and data.

Flexible Couplings for Shafts.—A shaft coupling which will permit misalinement of a line of shafting, to a reasonable degree, without causing damage to the bearings or machinery is fully illustrated and described in catalog from The Francke Company, New Brunswick, N. J. The Smith-Serrell Company, Inc., 90 West street, New York, are general sales agents for this company. In general appearance this coupling is very similar to an ordinary flange coupling and the flexibility is obtained by using flexible instead of rigid bolts to connect the flanges. These flexible pins are made of tempered steel leaves held at each end by a keeper. The keepers are slotted at the outer end and a spring ring fitting in a groove in the flanges holds them in place and keeps the leaves in a radial position for driving. The holes in the ends of the tempered leaves where they are joined to the keepers are slotted to allow a considerable movement longitudinally, and the coupling will permit the shafts to run when the center lines are at an angle, or, when the center lines are in the same plane, but not in alinement.