defects which caused the high percentage of breakages at the first mentioned trials have been remedied in the system of manufacture, and it will be this question that the forthcoming trials will have to decide."

American Society for Testing Materials.

The president of the International Association for Testing Materials, L. von Tetmajer, has announced that in consequence of the war between Russia and Japan the international congress of the Association, which was to be held in St. Petersburg, Russia, Aug. 18-24, will be postponed till next year. The seventh annual meeting of the Society will be held at Atlantic City, N. J., June 16-18. The remarkable growth of the Society within the recent past is well evidenced by the following comparison: At the fifth annual meeting held at Atlantic City, N. J., June 12-14, 1902, the membership was 175. The membership at present is 440. The increased volume of the Proceedings is no less gratifying. During the first four years of the Society's existence the published matter averaged 67 pages per annum. The last two annual volumes of the Proceedings contain 388 and 490 pages, respectively. The executive committee has decided to offer an amendment to the by-laws at the annual meeting by which it will be proposed that the membership dues be increased from $3.00 to $5.00 per annum.

Tree Culture, Louisville & Nashville R. R.

The Louisville & Nashville R. R. is arranging to plant a large number of catalpa trees, and some black locust, at different points on the road between Evansville and East St. Louis (St. Louis division). This company recently removed a few catalpa ties which had been in service 20 years. The ties had been rail cut to a depth of 2 ins., and were somewhat decayed on the bottom face, but the tops of the ties were sound. Had tie plates been used they might have lasted several years longer.

The committee appointed by the Traveling Engineers' Association to investigate the subject of "Grease as a Lubricant for Locomotive Bearings" has issued a circular of inquiry to all the members for the purpose of collecting information as to the success which has been attained by the use of grease. This circular asks for sketches of the cups in use and data on miles run per pound of grease and per pint of oil, number of hot pins in each case, etc., as well as for the personal opinion of the member on the subject.

A circular has been sent to the members by the committee of the Master Car Builders' Association on rules for loading long materials, asking for opinions on certain changes in the rules to be presented in the report to the association at the convention in June.

The committee on outside dimensions of box cars of the Master Car Builders' Association has sent to the members a circular of inquiry containing plates showing recommended framing and dimensions, and asking for the opinions as to which is the best to recommend to the convention for adoption.

The St. Louis Terminal railway was fined $400 and costs in the United States District Court on April 16 for operating cars which had not been provided with automatic couplers, as required by the interstate commerce law.

New Counterbalanced Swing Bridge, C., M. & St. P. Ry.

Owing to the necessity of widening the channel in the Menominee river at Milwaukee from 50 ft. to 75 ft. the Chicago, Milwaukee & St. Paul Ry. is replacing its double track draw bridge across the river at that point by another structure of the same total length at track level but which gives a wider channel. This was obtained by changing the location of the center pier for the new bridge to a point about 42 ft. nearer the south bank of the river and weighting the shorter end of the span with concrete until it balances. This style of counterbalanced swing bridge was chosen, after considering bascules and other designs, on account of its simplicity and cheapness.

The new bridge shown in Fig. 1 is seen to be of symmetrical appearance for a structure of this kind. The top members on the short side are carried out to the same angle from the center as on the longer side, up to a point above the end of the floor; beyond this the support for the concrete counterweight is extended in such manner as to add to the symmetry of the whole structure and saves it from that chopped-off appearance so noticeable in most counterbalanced swing bridges, commonly called "bob-tailed" bridges. By using this counterbalanced

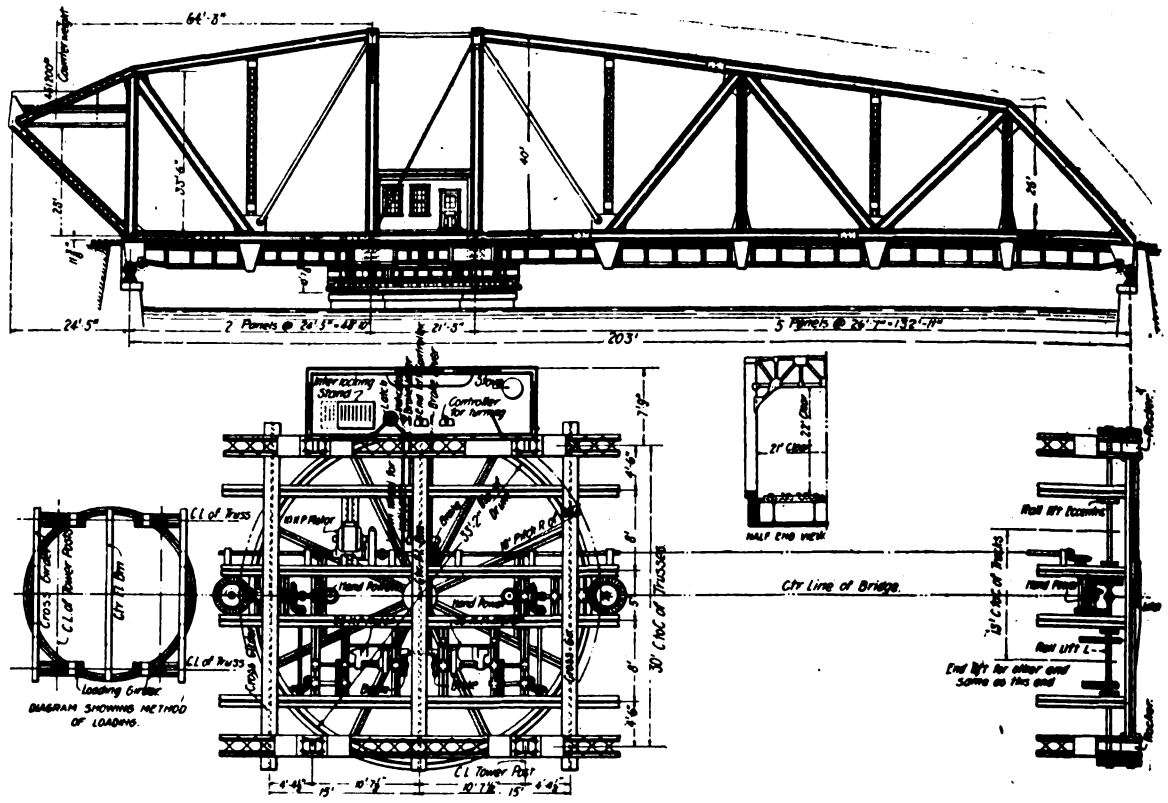


FIG. 1—ELEVATION OF COUNTERBALANCED SWING BRIDGE AT MILWAUKEE.

style of construction it is only necessary to build a new center pier, since the new bridge, being of the same length as the old one and in the same location, the old abutments can be used.

The new bridge will carry a double track and is designed to carry two 177½-ton locomotives followed by 5,000 lbs. per ft. on each track. The turning gear will be driven by two G. E. 25 H. P. street railway motors, and a 10 H. P. motor will operate the rail and end lifts. These motors and their gearing are shown in Fig. 1. It has also been arranged to turn by hand power in case of necessity.

In designing this bridge it was desired to get as small a drum as was practicable, thus being able to place the center pier as near the center of the old pier as could be and still get the desired width of channel. The method of arranging the loading to accomplish this is shown in Fig. 1. Two cross girders, each 15 ft. from the center, are placed crosswise of the drum. Resting one end on these and the other end on the drum itself are four short loading girders, to which the load is brought, near their center, by the tower posts. In this manner a 33-ft. drum is used with a bridge measuring 30 ft. between center of trusses. In order to get equal loading on the sides of the drum when bridge was swinging the diagonal in the center panel was inserted to transfer part of the load from the back tower posts to the front ones. This also resulted in shifting the center forward and gives a longer lever arm to the counterbalancing, thus lightening its weight considerably. Placing this weight overhead also allows it to overhang the floor and thus increase its leverage still more, and makes it possible to use concrete instead of cast iron, as would be necessary if it was placed below the floor, besides eliminating the problem of arranging it so as not to interfere with the locking mechanism. The concrete will be supported by I-beams placed 24-in. centers and a form enclosing them will be filled with wet concrete, which, when set, will furnish a floor for holding the blocks to be put on top and arranged to balance the structure.

The new center pier is of concrete and rests on 4 ft. of grillage on piles. These piles are 75 ft. long and are cut off 16 ft. below the surface of the water. The caisson for the pier was assembled near by and, after enough concrete has been put in to sink it within 18 ins. of the piles, it was floated into place and anchored. The remainder of the concrete was then put in.

As this bridge is located near the passenger station and carries the main line tracks, over which all passenger trains run and on which much switching is done, it was necessary to make such arrangements for erection as would allow the river channel to be opened as needed and to keep the track in use. After considering several different plans it was decided to swing the old bridge open and, supporting the north or channel end on a scow, to cut the south end off at the drum and draw it aside on rollers until it cleared enough to allow closing the north end, and use false work to carry the track over the space left open between the south abutment and old center pin. Then the new bridge could be erected complete on its own pier and false work, the trains passing through its center panel meanwhile. In arranging for the track to pass through the center panel it was necessary

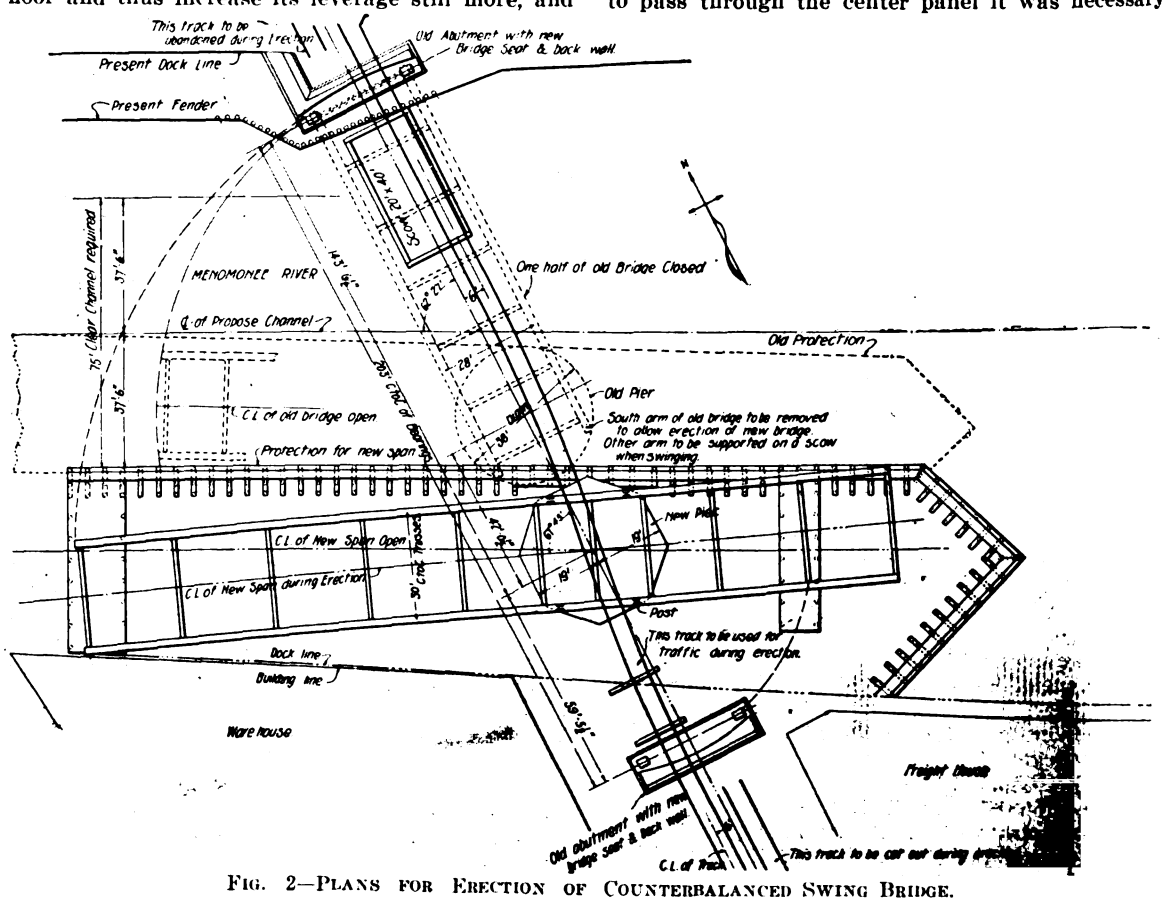


FIG. 2—PLANS FOR ERECTION OF COUNTERBALANCED SWING BRIDGE.

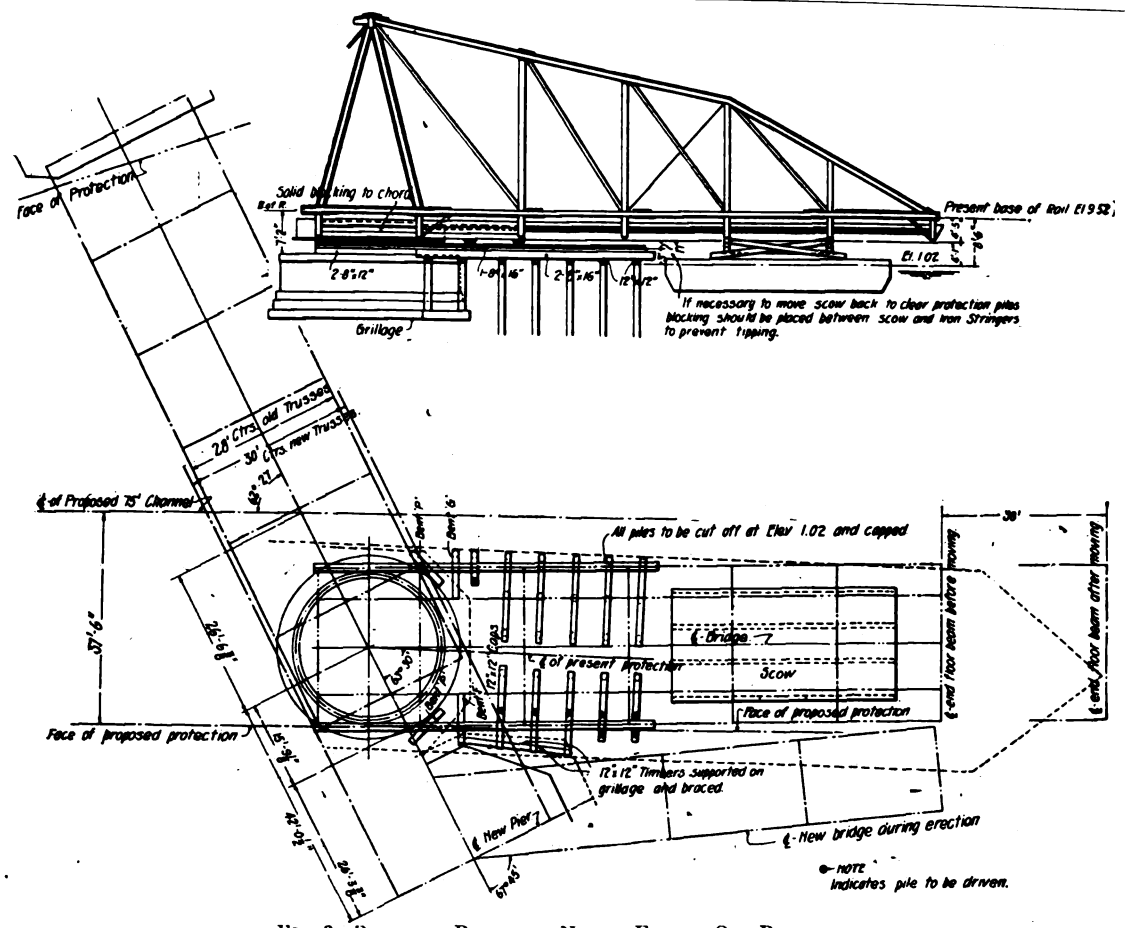


FIG. 3—PLAN FOR REMOVING NORTH END OF OLD BRIDGE.

to abandon one track and put in a single track with a double 17 deg. curve, because of the angle at which the new bridge is being erected. This is shown in Fig. 2. The bottom of the two tower posts nearest the track will also be temporarily swung outwards to give enough clearance for the long passenger coaches which pass through.

Before starting the work of detatching of the south end all rivets which would have to be removed were cut out and replaced with bolts turned to a driving fit. On April 5, the new pier and false work being in place, the old bridge was swung open and the scow placed in position and pumped out until it carried the weight of that end, meanwhile the track and rollers had been put into place under the other end, which was cut loose by driving out the bolts as soon as the strain had been taken off them. A block and tackle fastened to the bridge and some piling had its end attached to a hoisting engine, and the detached part was thus drawn aside on its rollers for a distance of about 12 ft., or enough to clear and allow the rest of the bridge to close. This work was started at 7 a. m. and Fig. 4, showing the bolts being driven out, was taken at 10:30 a. m. The photograph for Fig. 5, taken at 10:45 a. m., shows the loose end just after it started. The photograph for Fig. 6 was taken at 2:40 p. m., and shows the part entirely detached and the north end closed. It also shows the track being laid to a grade 3 ft. 3 ins. above the old one. This was done to allow the bottom chord of the new bridge to be put into place below it. The final grade on the new bridge will be 12 ins. above the old one. Although no special attempt was made to rush the work, there being another roundabout line which could be used with only 10 minutes' delay, the first train went across at 5 p. m., thus interrupting traffic on this line but 10 hours all told, of which one hour was taken out for dinner.

The detached south end has since been taken apart and removed, and when the new bridge is completed the north end will be swung around into the same position that the south end occupied, and will be drawn aside in the same manner. The manner in which this will be done is plainly shown in Fig. 3. When it clears sufficiently the new bridge will be closed and put into immediate operation. The work of taking apart the remainder of the old bridge and the removal of the center pier and false work will then be undertaken.

All work is being done by the bridge and building department of the C., M. & St. P. R. R., under the general supervision of Mr. C. E. Loweth.

The designing was worked up under the direction of Mr. J. J. Harding, to whom we are indebted for photographs and drawings.

Northern Securities Merger Litigation.

On April 19 the United States Circuit Court at St. Paul dismissed the Harriman-Pierce petition seeking to intervene in the suit against the Northern Securities Company and a final decree of court compelling James J. Hill and his associates to return to Harriman the Northern Pacific stock originally held by him. In the decision the court says that the question of the method employed to carry out the order of court to the Northern Securities Company is a matter for another and an original suit. The court's reason for not interfering with the Morgan-Hill plan for redistribution of Northern Securities Company's assets are summarized as follows:

First. The plan of the directors of the Northern Securities Company for the distribution of the stock of the Great Northern and Northern Pacific Railway companies is not violative of the decree in the Northern Securities case. Second. No one but the United States can successfully appeal to the court to enjoin the execution of that plan on the ground that it is in violation of the Sherman anti-trust act, and the United States expresses satisfaction with the present decree. Third. The stock of the two railway companies is not in the custody of the court. Fourth. An intervention is not necessary to enable the petitioners to protect any pecuniary interest or equity they have. In elaboration of these reasons the court called attention to the fact that applications to be allowed to intervene in litigation subsequent to a final decree are very unusual and are never to be permitted as a matter of course. In fact, owing to the danger of prolonged litigation, they should never be granted unless it be to preserve some right which otherwise cannot be protected. Although a supplemental bill can be filed after final decree in the event of unforeseen circumstances which would prevent the enforcement of the decree without further order, such an emergency did not exist in the present case. The decree of the supreme court is stated to be wholly prohibitory, enjoining the doing of certain threatened acts, and so long as these acts are not done the decree enforces itself and needs no further action in aid of it. A later development of the case was a new suit, covering substantially the same ground as that filed in St. Paul, brought in the United States court at Trenton, N. J., by E. H. Harriman and W. S. Pierce, the Oregon Short Line R. R. and the Equitable Trust Co., to obtain a restraining order against the carrying out of the distribution plan proposed by the Northern Securities Company. A temporary restraining order was issued, and on April 25 arguments will be heard on a motion to make the order permanent.

Differential Rates on Foreign and Domestic Traffic.

The Interstate Commerce Commission has issued an order instituting an inquiry and investigation concerning the differential rates on foreign and domestic traffic by all-rail, and water and rail, lines in both directions between interior points in the United States and the various North Atlantic ports, including New York, Boston, Philadelphia, Baltimore, Newport News, Norfolk, Portland, Halifax and Montreal.

The first hearing will be held in New York City on the 18th day of May, at which time and place the various railroad companies operating lines to and from North Atlantic ports and the commercial bodies interested are required to appear and fully disclose the facts and circumstances bearing upon the inquiry. All persons, commercial bodies or carriers interested in the matter are also invited to appear before the commission and to present such evidence or make such argument as they may desire to have considered.

This investigation has been commenced by the commission upon applications filed by the following commercial bodies: Merchants' Association of New York, Joint Committee on Freight Differentials for Philadelphia, representing the Commercial Exchange, Board of Trade and Trades League of that city: the Boston Merchants' Association, the Boston Chamber of Commerce, and the Baltimore Chamber of Commerce. The substance of these applications is to request the commission to institute an inquiry respecting the differential freight rates to and from North Atlantic ports, the conditions and circumstances heretofore and now affecting such traffic and rates, and the interests therein of the North Atlantic ports and the various lines reaching the same, and thereupon to make and file a report and opinion as to whether such differential rates are just and reasonable and

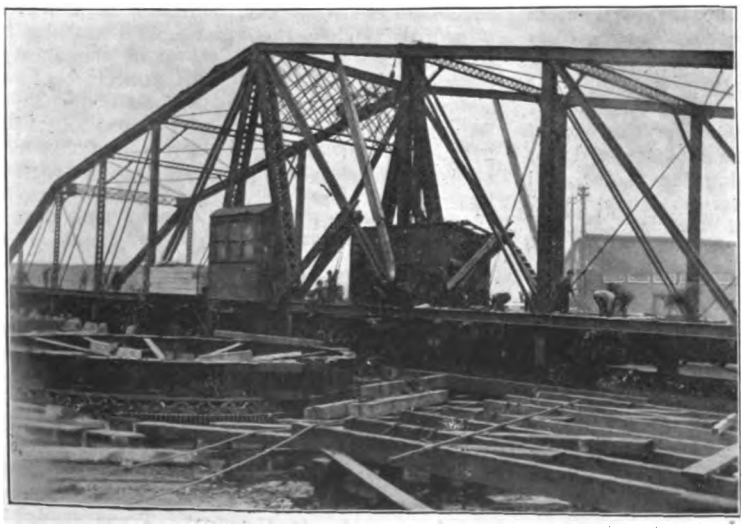


FIG. 4—CUTTING OLD BRIDGE APART, 10:30 A. M.

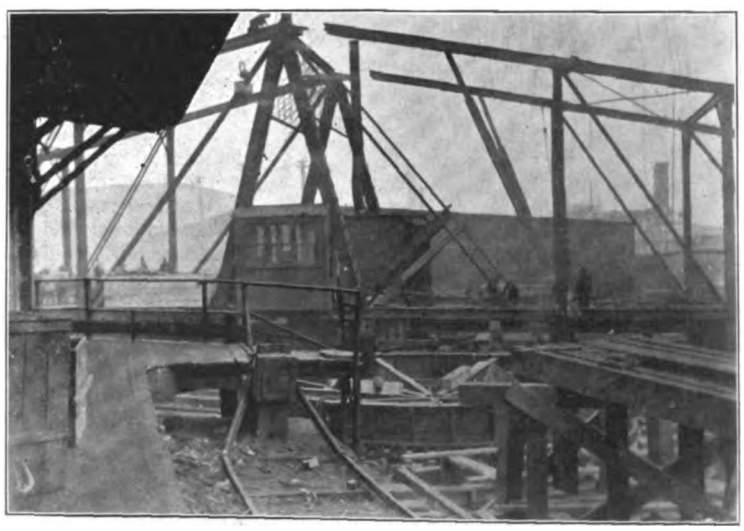


FIG. 5—DETACHED PART BEING DRAWN ASIDE, 10:45 A. M.

FIG. 6—NORTH END CLOSED AND TRACK BEING LAID, 2:40 P. M.

whether they should be continued in force or abolished, or a different adjustment substituted therefor.

Following are the carriers named in the order: The New York Central & Hudson River Railroad Company, the Pennsylvania Railroad Company, the Baltimore & Ohio Railroad Company, the Lehigh Valley Railroad Company, the Philadelphia & Reading Railway Company, the Delaware, Lackawanna & Western Railroad Company, the Erie Railroad Company, the New York, Ontario & Western Railway Company, the Central Railroad Company of New Jersey, the Chesapeake & Ohio Railway Company, the Norfolk & Western Railway Company, the Southern Railway Company, the New York, New Haven & Hartford Railroad Company, the Boston & Maine Railroad, the Grand Trunk Railway Company, and the Canadian Pacific Railway Company.

In its order the commission says that these differential rates have long been a subject of contention between the different ports and carriers and are the alleged cause of a pending contest between important lines leading from Lake Erie ports to some of said North Atlantic ports, and that the public interests would be served by an inquiry and investigation, with a report and opinion thereon, as has been requested.

Gravity Box-Car Loader, Northern Pacific Ry.

The loading of coal into box cars is something of a serious problem at mines where a large proportion of the "empties" are of that class, and it is an equally serious problem with coal-handling roads the equipment of which consists largely of box cars. The loading of these cars by ordinary methods is a vexatious cause of delay to both the mining interests and railway traffic during seasons when orders are rushing the market.

About four years ago the Northwestern Improvement Company, which operates the coal department of the Northern Pacific Ry., installed a device at Roslyn, Wash., for tilting box cars into position for loading one end at a time from a chute delivering at the door. This machinery was designed by Mr. S. Kedzie Smith, at that time chief engineer of the Northwestern Improvement Co., but now a resident of Billings, Mont. The operation has been so satisfactory that the same company has since installed machines of the same design at CleElum, Wash., and at Red Lodge, Mont.; and the Crows' Nest Pass Coal Co. has installed one at the Morrisey Colliery, in British Columbia, which we show by the accompanying illustrations; and a second machine is now on the ground to be installed at a new mine in the same field.

The operating machinery is hydraulic, and consists essentially of a 16x8½x12-in. duplex pump capable of working under 250 lbs. pressure; a pair of 14-in. horizontal, movable cylinders, moving longitudinally on a track made of railroad T-rail; a cradle with two circular sides and a floor and track; four rollers upon which these circular sides rest and move, and suitable chairs supporting the rollers. The pistons in the movable cylinders are fixed and also the piston rods, which are made of extra strong 4½-in. pipe. To the heads of the cylinders are fixed 1¼-in. steel cables, which are also fastened to the circumference of the circular side of the cradle.

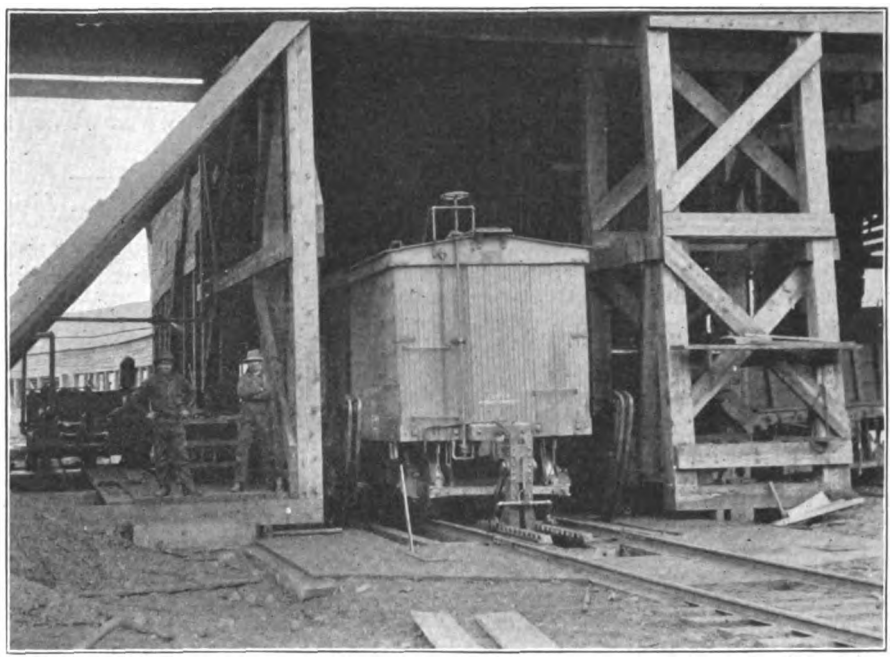
As water is forced into one end of the pair of cylinders, through the hollow piston rods, the pistons being fixed, the cylinders move in one direction, and the water in the other end is forced back into a tank and is taken up by the pump, so that the same water is used over and over again. The direction of the tilting is governed by a four-way valve. The movement of the cylinders is conveyed to the cradle by means of the wire cables, so that the cradle tips one end down and the other up, at will.

To operate the loader, the car is run on the cradle and locked on by means of two stops, which are raised and lowered by the pump. The stops are pushed up to the drawhead of the car by man power and dropped into grooves in the racks. Four of the loaders built were provided with another pair of cylinders for moving the stops horizontally toward and from the car, but as two men can easily push the stops, these cylinders have been discarded. The instant the car is stopped the chute is put in position and loading is begun. Several pit cars can be dumped before the cradle need be tilted, and while this is being done the stops can be put in place. The stops can be attended to by the car droppers. No special chute is needed to load the coal. It is simply made small enough to go easily a few inches inside the car.

When the car is locked on, it is slowly tilted, as dumping goes on, up to its maximum of about 37 deg., and held tilted until the first end is loaded. It is then brought rapidly back to the horizontal and slowly tilted in the opposite direction. Dumping need not be stopped from the time it is begun until the car is loaded. By tilting the second end slowly very little of the coal runs down from the first end. The coal coming from the chute, with considerable velocity, will slide down over that already loaded, which will not start from a position of rest. When the car is loaded the stops are pulled back over the end of the cradle by the car droppers and lowered out of the way by the man running the loader, and the car is run off.

The loader handles the coal with a minimum of breakage, it loads box cars to capacity and the manipulation does not break or injure the cars. One man operates it. It loads the coal as fast as it can be dumped, and practically as many box cars can be loaded in a day as open cars. It takes but a trifle longer to change box cars than it does to change open cars. Dumping is stopped from 1½ to 2 minutes and can be resumed the instant the car is stopped and the chute in place.

Mr. Smith, to whom we are indebted for illustrations and information, has made arrangements with the Dodge Coal Storage Co., of Philadelphia, for the manufacture of the loader for handling anthracite coal throughout the United States, and bituminous coal in Pennsylvania, Maryland and West Virginia; and with the Duncan Foundry and Machine Works, of Alton, Ill., for the manufacture of the loader for handling bituminous coal in all the states and territories except those above mentioned.



SMITH GRAVITY BOX CAR LOADER, AT MORRISEY COLLIERY, B. C.—FIG. 1.

New York Railroad Club.

BOILER DESIGN AND TIMBER TREATMENT.

At the meeting of April 15, Mr. R. H. Soule opened a discussion on boiler design. In speaking of the best form of radial stays, he mentioned the use of the button head type and stated that the principal objection to its use lay in the difficulty of securing the requisite amount of accuracy in its manufacture, and in addition to this was its liability to burn off.

The length and arrangement of the tubes has been attracting a great deal of attention of late, and while it has been found that no trouble has been experienced on account of the increased length of tubes it is of the utmost importance that they should be properly spaced. The intense heat that is apt to localize in one place has made it advisable to even plug some tubes and thus give those tubes in operation a greater body of water. In England the flue troubles that are so common here are unknown, and for this there must be some reason. It is suggested that possibly the use of the copper firebox may account for much of this immunity. The conductivity of the copper sheet being about three times that of steel, it does not become so hot and therefore the variations of contraction and expansion are not so great. In the case of the steel tube sheet it has a body of metal that in expanding decreases the size of the hole and thus squeezes the tube, which has a tendency to expand in the opposite direction, beyond its elastic limit; with the result that, when normal temperatures have again been reached, it is loose. The use of nickle steel seems to afford the most promising solution of the difficulty, because of its higher limit of elasticity by which it is protected against a permanent set.

The cause of the overheating of side sheets was given as the failure of the air to come up the sides, and thus keep the sheets cool. In corroboration of the statement of the intense heat of the sheets the Atchison, Topeka & Santa Fe Ry. experiments were quoted, whereby it was ascertained that when the engine was working hard, gage cocks set to within ⅛-in. of the sheet discharged steam, those at ¼-in. a mixture of steam and water, and those at ⅜-in. solid water, showing the rapidity of evaporation at the sheets. In order to prevent this over-heating it, a mid-feather arch, as it is called in England, was suggested, by which the air currents would be prevented from concentrating at the center. This would, of course, involve the use of two doors. Another suggestion to assist in the accomplishment of the same end was to restrict the grate opening at the center.

In the designing of the crown sheet care should be taken to so proportion it that, with the ordinary amount of water in the boiler, it will not be apt to be bared.

It should, therefore, be given a fore and aft slope sufficient to keep the back end at least no higher than the front when the engine is standing on a 2 per cent down grade, which will amount to about ¼ in. to the foot. Transversely there

of action; that the men selected may not be safely trusted with so much authority. The answer would be to get only the best, well-tried men obtainable, and then pay them as much as their type of services will command in any market outside of the railroad service. In this way the men selected will be anxious to do their best and to become fixtures with the company, instead of constantly hoping an opportunity will present itself in some other place to get a salary more commensurate with the services required and given. The knowledge of a man's past accomplishments should be a reasonable assurance of his future possibilities.

On this basis build an organization which will be noted for permanency of office and which will make a point of taking in young men of promising character and ability and of educating and developing them in their line of work so that after a period of five, ten or more years the necessity of looking outside for strong men to fill advanced positions will be obviated, by having at home well-trained and efficient men, thoroughly imbued with the fundamental principles on which the progress of the company was founded years before. In this way stability can be assured, strong railroad men educated and the highest type of results obtained. In this country, happily, there can be seen at least one or more examples of the results of over two decades of organized development on these lines, which speaks for itself.

In the past there has been a tendency on the part of railroad companies to so restrict the salaries paid chief officers in many departments as to make them unable to obtain and retain the high class of ability needed in many of their most important lines of service. It is an undoubted fact that the railroads have been losing to outside manufacturing and engineering companies many of their strongest men, due to there being insufficient inducement, either in salaries paid or in prospects for future advancement, to warrant them in entering or remaining in the railroad service. There is perhaps no industry or profession that calls for higher skill and talent in the engineering or mechanical lines than our great railroad systems. To prepare for positions of high responsibility in these lines at the present time requires not only years of study on technical lines, but a practical experience and education that can only be obtained by many years of exacting work at a small remuneration. In Europe these facts are recognized and the heads of these two important departments of railroading have a recognition that is rarely accorded in America, but which goes a long way toward making the positions sought for by a high type of men.

One very noticeable and questionable policy prevails on the railroads in the United States which is seemingly not considered wise or feasible in European railroad practice. It is the tendency of officials who are not versed either in theory or practice along the two engineering lines of the service to interfere and interpose their ideas in preference to the knowledge born of study and long experience, of those who have given their lives to the pursuit of their particular line of work. In England a general manager or a board of directors would look to the chief mechanical engineer for advice as to the class of equipment which ought to be purchased and would not think of setting up his own preconceived notions as superior to the knowledge and skill of an officer whom his company had employed to give his time to the especial study of such matters; neither would he pretend to say how he should operate his department as to its men, methods or standards.

In America such interference is too frequently attempted, to the discouragement of the department chief, and to the demoralization of the department organization and progress. It is, on the face of it, absurd to think that a chief executive officer or a board of directors can wisely assume to know more about technical department details than those who have made such matters a life study. If such an occurrence happens it is evidence either that there is an incapable man at the head of the department, or that those in superior authority are taking the best means possible to disrupt organized work and good discipline. A happy medium would be for chief executive officers not to arbitrarily decide on department questions, but to outline the general policy desired to be pursued and the results wished for and then leave the experts in the respective lines to indicate what is needed to fill the requirements; the responsibility being fully placed on them as well as the authority to go ahead. If the head of the department is not to be trusted with so much authority a new man should be selected who is competent and worthy of trust in full. Expert heads of departments should be allowed full freedom in their own departments, both as to methods, men, organization and the qaulities of materials and devices used.

Unfortunate results are often forced on a department by the unwise practice of directors or officers who are quite ignorant of the possible effects of their requests forcing the adoption of methods, materials, or the employment of men in places where expert knowledge would show that bad results were sure to follow. This is wrong in principle and in the end is bound to produce bad results. When such bad results do follow the ones really responsible are very loath to accept the blame, but the operating officer who carries out their ideas is in most cases loaded with the criticism which properly belongs higher up.

One serious lack on the railroad systems of the country is the almost total want of a definition of duties and responsibilities of the various departments and of the different officers operating in such departments. We find not infrequently "books of rules" for some of the departments in a few of which rules are incorporated carefully outlining the duties and jurisdictions of minor officers in such departments. On most roads there is a lamentable indefiniteness as to the extent of the jurisdiction of the various departments and as to the range of jurisdiction of the various vice-presidents, general managers, general superintendents, chief engineers, superintendents of motive power, purchasing agents, etc., resulting in some cases in certain officers assuming to claim jurisdiction over everything in sight, with much resultant friction, unpleasant feeling, interference, delay and general disorganizing results.

On some roads a purchasing agent in the absence of specific definition of duties to the contrary, will assume that he is competent and is authorized to decide as to the quality and kind of material to be used by the various departments, instead of simply being delegated to purchase the supplies called for on requisitions on the best possible terms, and keeping in touch with the heads of departments, advising them of possible ways of saving money in the purchase of supplies for their use; he thereby puts himself at loggerheads with and as superior to the ones at the head of the special departments, who are being paid to study and to know about such matters. Hundreds of illustrations of this kind will present themselves to railroad officers, and there are many cases where the purchasing agent's saving (?) had to be expended many times over, to repair the bad results consequent upon his unwise assumption of superior technical and practical knowledge.

The history of some of the largest and most successful manufacturing concerns shows the beneficial results attained by the selection and appointment of a competent, high-salaried chief operating officer who has been given complete control of the affairs of the company; the president and the directors keeping their hands off, and allowing the manager full and free authority and jurisdiction, subject to their control only so far as financial matters involving great outlay were concerned. It must not be considered that everything depends upon the man in charge of the operations, for unless such a man is supported and backed financially it may be impossible for him to lift a company out of the ruts of old practices and lack of progress and place it on the hard road bed of success and advancement. A mistake too often made is to withhold financial aid until too late. Many a railroad company has suffered and is suffering to-day from withholding a liberal expenditure of money for modern facilities to provide up-to-date methods and adequate provisions for rapid-growing business, because it could not bring itself to make the needed appropriations until after much lost time, when a period of business depression had arrived and lessened earnings had put a seal on continued lack of proper facilities to conduct the work in an economical manner for perhaps many years to come.

A very interesting feature in English railroad practice, which could be imitated with advantage in this country, is the custom of holding monthly meetings of the heads of all departments with the general manager. These meetings are not a matter of convenience simply, but they are regularly scheduled gatherings which are considered as fixed and as important as the regular meetings of the board of directors, and they serve to put each department in actual touch monthly with every other department and enable matters of importance to be talked over and understood by every department chief.

Much might be said and written as to the two distinctive plans of general organization for railroads, examples of which, together with modifications of each, are readily seen and studied. The "departmental" plan and the "divisional" plan each has its advocates. As railroad systems are assuming such large proportions now there seems to be a leaning toward the departmental plan as being more conducive to rapid results in developing a good strong system organization from a heterogeneous one, which was the result of merging of several differently organized railroad companies.

In such departmental organization the tendency can be avoided of loading on any one division officer the burden of details of various departments, any one of which could be handled well, but responsibility for all of them causes some to be slighted. In a divisional organization the division has to be made a department organization, and there are many who believe it is better to keep each department separate, maintaining harmony between the various departments by the intercourse and conferences of the general department chiefs rather than by trying to keep all in harmony through many divisional department heads. The writer knows that some who for years have advocated and practiced the divisional system are now convinced of the superiority of the departmental system for large and widely spread interests. The general organization as established and developed by our national government seems to combine features best calculated to successfully administer the regulation and direction of the business of a large railroad system.

The above suggestions may be summarized as follows:

1. Departmental system of organization the best for large railroad systems.

2. The board of directors should direct the financial matters of the system and select the best obtainable men to handle the various phases of administration.

3. The executive and administrative officers should be ably and promptly supported in all reasonable calls for financial help to properly equip and organize the system.

4. The board of directors to be divided into small committees, who will meet at stated times, at least monthly, with the head of the department which is especially assigned to them, and keep in touch with the developments and financial needs of that department, granting proper special appropriations for its improvement and development, in harmony with the generally approved policy of improvement agreed upon at the general meetings between the general executive officer and the heads of departments.

5. Select the best expert heads of various departments who will combine executive and organizing ability with technical knowledge of their special department work, and who will command the respect and absolute confidence of the directors and the chief executive.

6. Grant freedom of action to department heads in matters pertaining to the specific details of their department organization, men, methods and quality of materials used.

7. Chief executive officers and department chiefs to have a sufficient staff of able men to relieve them from routine and detail work and also to have a corps of assistants who are free from confining routine work who can be assigned to special investigations of important matters in department work.

8. Able department heads having been selected, leave them unfettered in the government of matters pertaining to their departments, except that they should be kept in harmony with other department work and with the general policy of the company.

9. Pay salaries which will give the system the pick of the best men in the country in their respective lines for department chiefs, and which will retain high-grade men in the service.

10. Place full responsibility and authority on the department officers and let their continuance in office hinge upon their producing successful results.

11. Have a carefully prepared and comprehensive printed schedule defining the jurisdiction of the various departments and the authority and duties of all the officers of the company.

12. Have regular monthly meetings of the department chiefs and the chief executive officer of the company for the discussion of all questions of mutual interest and policy, and for the clearing up of difficulties which may have arisen.

13. With a foundation laid as outlined, plan to attract and educate young men so that there may be regular advancement in the service and a corps of men may be developed from which to fill all vacancies in the official staff from those who have grown up in the company's service.

14. Get good men; practice good methods; use good materials, and establish as a fundamental principle the maxim that "Whatever is worth doing is worth doing well."

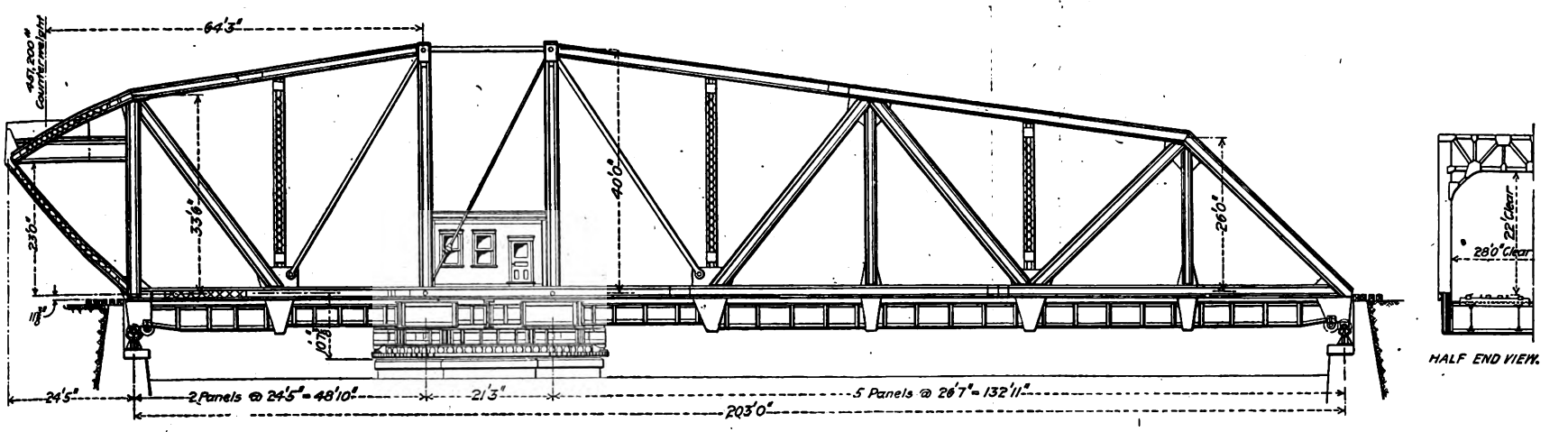
Counterbalanced Draw Span on the Chicago, Milwaukee & St. Paul.

The Menominee River runs through the City of Milwaukee, Wis., from west to east. Extending south from the river is a system of canals which furnish shipping facilities to elevators and industrial plants occupying a considerable tract along the river. As a result there is a large and constantly growing traffic on the river between its mouth, or confluence with the Milwaukee River, and these canals. The Chicago, Milwaukee & St. Paul Railroad crosses the Menominee on a swing drawbridge at a point quite close to its mouth. It is a 203-ft., double-track, rim-bearing structure, built in 1886 by the Edgemore Bridge Company, and crosses the river at a skew of about 63 degs., allowing a clear channel of 50 ft. The bridge is in first-class condition and fully equal to the demands of present traffic, but the increasing river traffic made a widening of the channel to 75 ft. necessary, requiring the replacement of the bridge by one of increased channel span.

The new structure will have the same length as the old, the increased channel width obtained by a change in location of the center pier to a point 42 ft. nearer the south shore, as shown on the erection plan. The new bridge will therefore be of the counterbalanced swing type, with a long arm 132 ft. 11 in. long, divided into five equal panels, and the short arm 48 ft. 10 in. long, divided into two equal panels. This does not include the portion carrying the counterweight, which extends 24 ft. 5 in. beyond the short arm. The structure is designed to carry on each track two 177½-ton locomotives followed by 5,000 lbs. per lineal foot of track. Other designs, including bascule types, were considered, but the counterbalanced swing design was adopted because of its simplicity and less first cost. Furthermore, the local conditions are such that none of the adjacent property can be used for wharf purposes, requiring no sacrifice of valuable dock frontage. Also, the abutments of the old bridge can be used, requiring only a new center pier.

The small distance between base of rail and high water made the matter of obtaining a satisfactory design for loading the drum, one of considerable difficulty. In the scheme adopted, the load is taken from the tower posts to loading girders, one end of which rests on the drum, the other being connected to a cross girder, as shown in the diagram of method of loading. The weight of the structure, exclusive of counterweight, will be about 650 tons. The counterweight, which will be concrete, will weigh approximately 450,000 lbs. It is placed over the track and projects beyond the end of the bearing, increasing the lever arm and therefore materially reducing the amount of weight needed.

The new center pier is concrete, resting on 4 ft. of

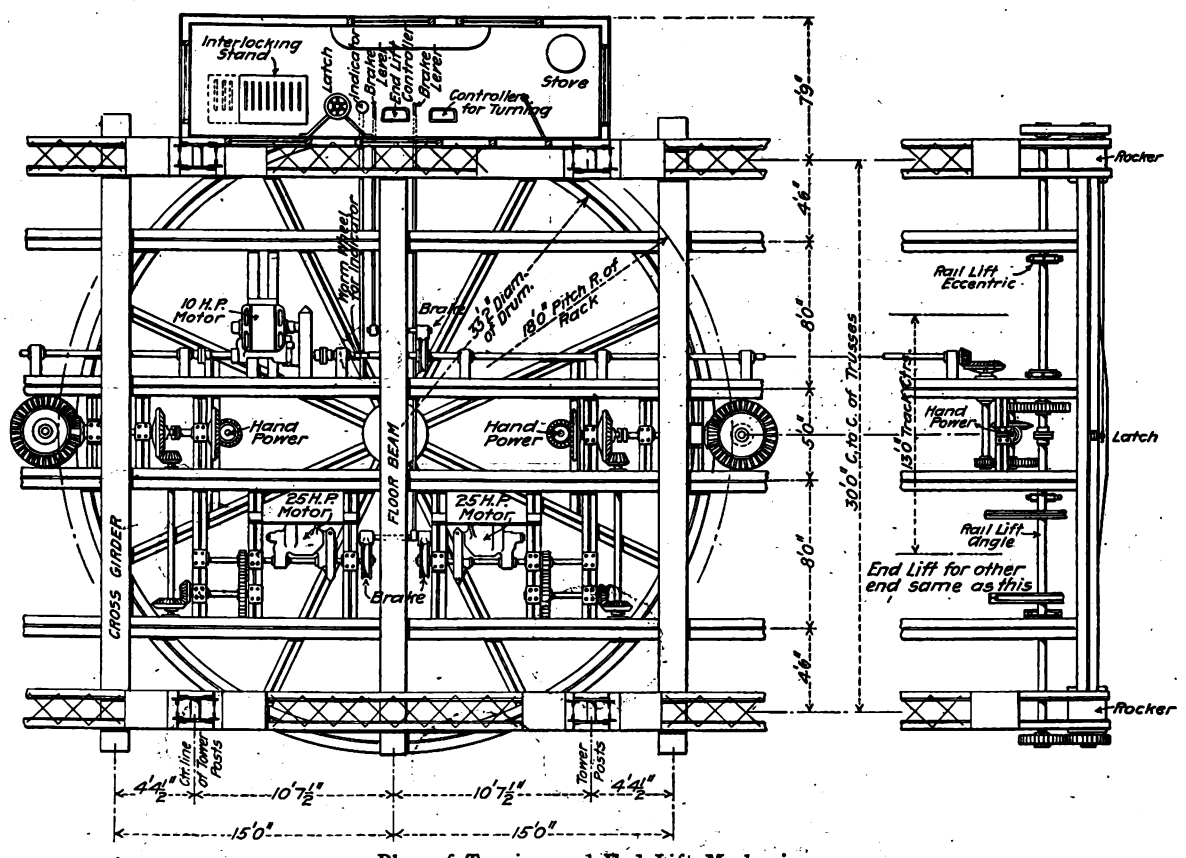


Elevation and Half End View of Counterbalanced Swing Draw Bridge, C., M. & St. P., at Milwaukee.

grillage on piles. These piles, which were 75 ft. long, were cut off 16 ft. below the surface of the water and about 8 ft. above the river bottom. Rip rap was placed about them to within 2 ft. of the cut-off. The caisson was assembled in a slip some distance up the river, and after putting in enough concrete to sink the grillage to within about 18 in. of the cut-offs, it was floated down the river, anchored in position and the remainedr of the concrete put in place.

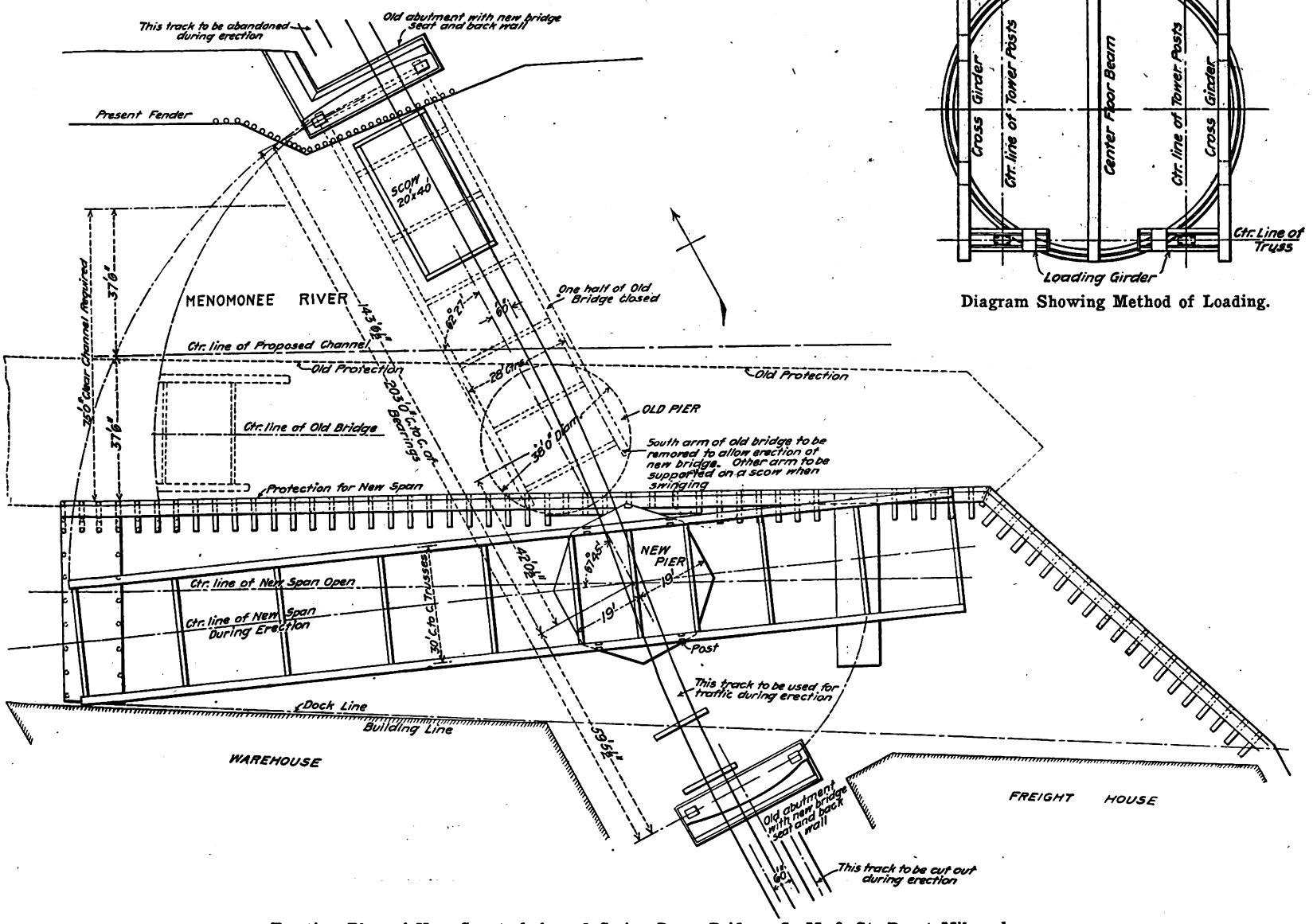
The erection of the new structure presented a difficult and interesting problem, it being necessary to do the work without interfering with either railroad or river traffic. The bridge is only a few blocks from the Union station and the switching and passenger traffic on this part of the line is heavy and continuous. The Menominee River at this point is kept open for the passage of boats the entire year, and a good idea of the amount of river traffic is afforded from the statement that this bridge was opened 9,000 times in 1902—oftener than any other drawbridge on the road.

One of the illustrations outlines the method to be used in erection. Falsework for a single track will be put in between the south abutment and the new center pier and across the latter. The bridge will then be swung clear of the river channel and the north half blocked up on a scow. The south half will then be jacked up, and after placing it on rollers, it will be cut at the bridge center and moved far enough to allow the north arm to be closed. The north arm, with the falsework, will carry the single track which the trains will use during the erection of the new structure. The erection of the new span will be done on falsework parallel to the river channel and the bridge will be in place on its pier, as shown in the plan, the trains passing through its center panel. When erection is complete the north arm of the old span will be swung to the east, jacked up from the protection,



Plan of Turning and End-Lift Mechanism.

Diagram Showing Method of Loading.



Erecting Plan of New Counterbalanced Swing Draw Bridge, C., M. & St. P., at Milwaukee.

placed on rollers and moved far enough to allow the new bridge to close. It is expected to be able to do this between the passage of trains.

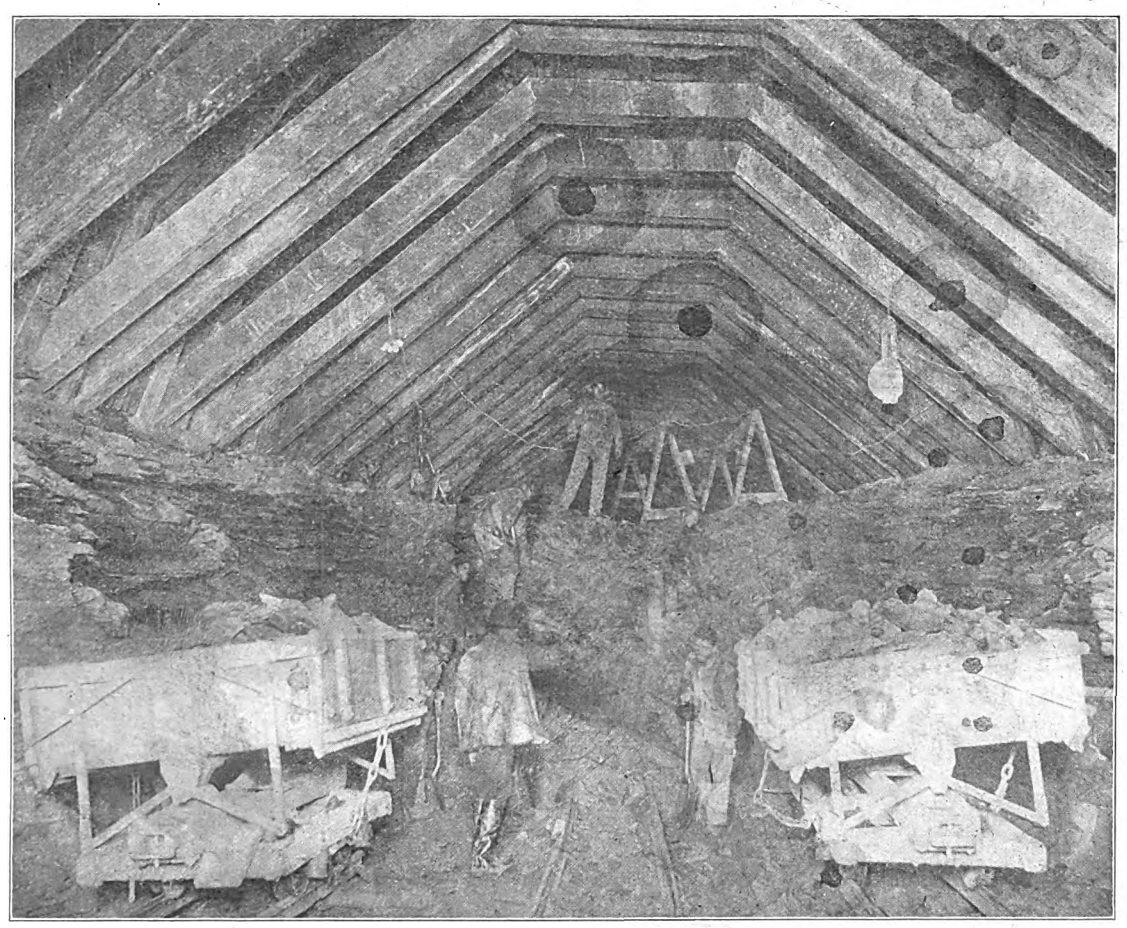
The new bridge will be electrically operated. There will be two General Electric 25-H.-P. street railway continuous-current motors for turning, and one 10-H.-P. motor, located in the center, for operating the rail and end lifts. A plan showing the turning and end-lift mechanisms is included in the engravings.

Work on the center pier is under way and is being done by the company under the supervision of Mr. J. C. Hain, Engineer of Masonry Construction; the company will also erect the superstructure. The steel work is being furnished by the Lassig plant of the American Birdge Company. The plans, both general and detail, were made by the railroad company under the supervision of Mr. J. J. Harding, Assistant Engineer. All of the work is in direct charge of Mr. C. F. Loweth, Engineer and Superintendent of Bridges and Buildings.

East Portal, Greentree Tunnel, showing Approach and Brick Lining.

The Wabash Extension Into Pittsburg.

The position of the Wabash in years past has been that of a railroad reaching important points in the central West—Chicago, Buffalo, Toledo, St. Louis and Kansas City, but somewhat bottled up by the fact that at each of its important terminal points it has been confronted by exceedingly sharp competition at the hands of rivals with better outlets and inlets in the direction of traffic. In striking at Pittsburg, another route was made into the sharpest kind of competitive territory. The tidewater extension east from Pittsburg would afford the necessary traffic lever, but there is still considerable uncertainty as to the way in which this latter part of the plan will work out. At present, however, the Pittsburg extension opens up a very prolific and valuable local field, and also puts weight behind the desire of the company to secure additional business at other points. Besieged by rivals, arraigned by the city, delayed by the politics of municipal councils, hindered by unexpected natural obstacles and by accidents and strikes, and even peremptorily stopped by the Supreme Court of Pennsylvania, an entrance into Pittsburg has been effected by means of a line 60 miles long to Jewett, Ohio, through extremely difficult country, and the present outlook is that the extension will be open for passenger, express and light freight service about May 1st, or possibly as early as April 15.

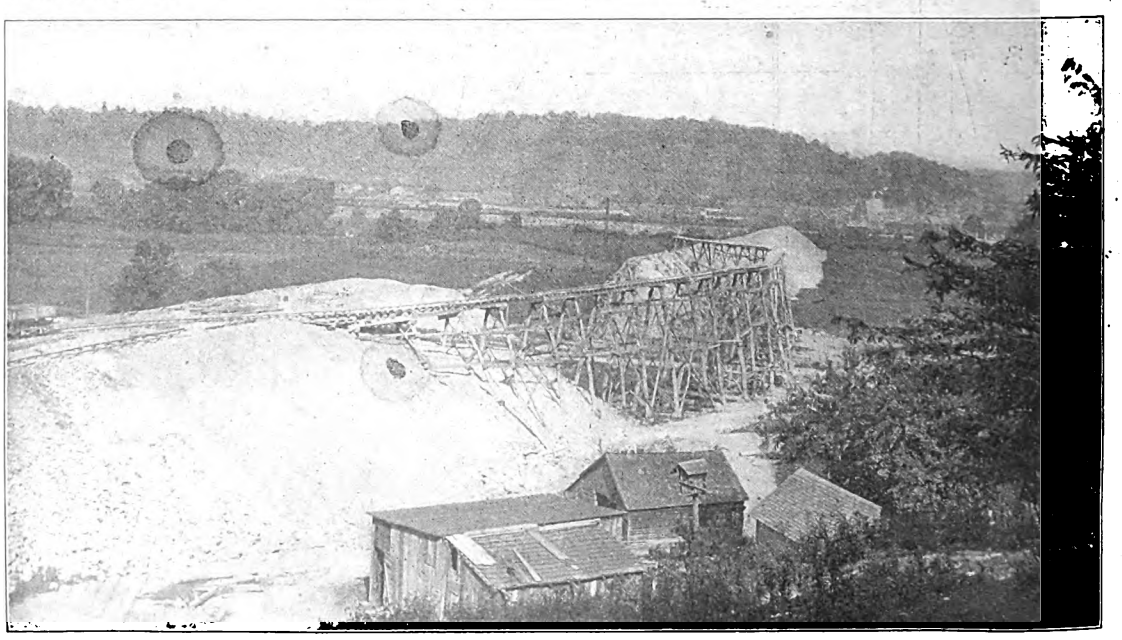


Reinforced Timbering, Mt. Washington Tunnel.

The extension from a connection with the Wheeling & Lake Erie at Jewett, Ohio, to Pittsburg, has been built under the name of the Pittsburg, Carnegie & Western. About 40 miles of track has now been laid, the Monongahela River bridge is practically completed, and the Pittsburg terminal passenger station is well under way. There remain to be built the cantilever span of the Ohio River bridge at Mingo Junction, the elevated line and train shed between the Monongahela River bridge and the passenger station, the tracking of the Greentree and Mt. Washington tunnels and the installation of the telegraph and signal systems. The way stations, trestle filling and other similar work will be done after the line is opened, as will also the construction of the freight branch lines within the terminal limits. With the extension of the Wabash to Pittsburg, the Pacific Express Company's eastern operating terminus will be at that city, while the Wabash extension to Baltimore will give the Pacific Express a transcontinental operating basis.

When Mr. Ramsey was chief engineer of the Pittsburg, Chartiers & Youghiogheny, in 1882, he made a personal survey of a route from Pittsburg to the Ohio River. That was as far as the matter went at that time, however. Late in 1900 the Wheeling & Lake Erie was offered for sale. The Pennsylvania railroad interests were approached in the matter of its purchase, but they refused, seeing no especial advantage because they had already networked the same territory with lines. The Wabash interests took an option on the property, and there was immediately introduced into the Fifty-sixth Congress, then in the closing days of its last session, a joint resolution by the Pittsburg & Mansfield Railroad Company for a bridge across the Monongahela River, within the City of Pittsburg. It was proposed for a railroad upon which electricity was to be the motive power. Fortunately—one might almost say, providentially—the resolution passed both branches. This gave an inlet to Pittsburg for the Ramsey route. That this bridge was intended for the Wabash interests was wholly undreamed of except by those who knew the inside facts of the case. Early in 1901 the Wheeling & Lake Erie deal was closed and work at once began on the extension of this road to Pittsburg, Ramsey and Patterson walking over the original Ramsey route and on from Mingo Junction to Jewett, which portion required a new survey.

The first direct intimation the public had that Wabash interests were backing a project for a new line into the city was an ordinance introduced into Pittsburg City Councils, asking for the right to cross certain streets in the Point and Mt. Washington districts. While this was startling, the dilatory City Councils paid little or no attention to the ordinance, referring it to the "air-tight" corporation committee, where the measure rested undisturbed for almost two years. Meanwhile, the Pittsburg, Carnegie & Western was formed by consolidating the Pittsburg & Mansfield and Washington County Railroad



Fill West of Ohio River, P. T. & W. Ohio River Tunnel (W. Va.) in Background.