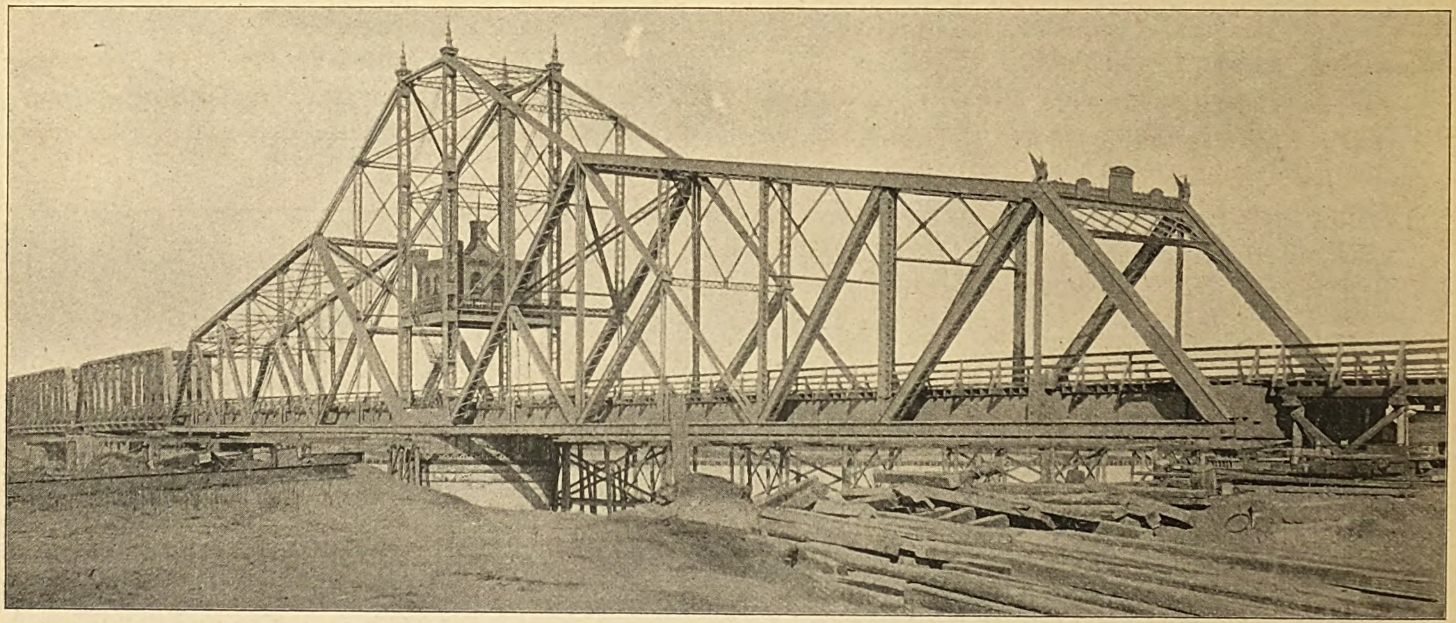
THE LONGEST SWING BRIDGE IN THE WORLD.

The Omaha Bridge & Terminal Company has the honor of being the possessor of the longest draw bridge in the world. The company was incorporated three years ago for the purpose of building a second bridge across the Missouri river at Omaha, and operating steam and street railways in connection therewith. The bridge, which was completed last winter, extends from East Omaha to Council Bluffs. The East Omaha Street Railway will use it to reach Council Bluffs. The span is 520 feet and is swung by electric motors. At present there is only a double track railway on the bridge, but the trusses are provided with places for brackets to carry roadways and sidewalks. It was built by the Phoenix Bridge Company, which does a large amount of this kind of work, and has reason to feel proud of having in this case broken the record for length of draw span. A. C. Stites, the Rookery, is Chicago representative of the Phoenix Bridge Company.

EXPERIMENT WITH ELECTROLYSIS AT ST. LOUIS.

The supervisor of city lighting at St. Louis, A. J. O'Reilley, has recently made the following report to the Board of Public Improvements in regard to an experiment that will be tried in that city to determine the extent of electrolytic action on the water pipes.

"It being desirable to make records of the electrolysis at various places along the water pipe system of the city that comparison may be made of the relative extent to which the electrolysis is going on during a definite time in various parts of the city, and, as this cannot be done with any degree of accuracy with the instruments available for the purpose, without a great increase in the number of observers, the following method has been determined upon by the water commissioner and myself. A connection will be made with the water pipes at convenient stop valve and fire plug boxes with a small copper plate of known weight, and placed in the moist earth close to the water pipe and allowed to remain there for a definite time, its percentage of gain or loss in weight will be a measure of the current passing to or from the pipe through the plate and into the earth at that place. As a check, a similar test piece of copper, not connected to the pipe, will be buried close to the other in such a way that it will be subject to the same conditions from action of soil and moisture on the copper which may take place independent of the electric current from the water pipe. The proper corrections are to be applied on account of the action that may be set up between the iron and the copper independent of the earth return currents under consideration. I am led to believe that by continuing experiments of this kind and keeping proper record thereof, the affected territory can be definitely circumscribed. The determination of the direction of the street railway return currents must be by volt meter and ampere meter methods.



LONGEST SWING BRIDGE IN THE WORLD.

HAVE YOU HAD ELECTRIC MUMPS?

Everything is fast becoming electric, at least in name, but the very latest and decidedly original idea was developed in the courts in Louisville, where the case of Samuel H. Isaacs, administrator, vs. the Louisville Railway Company and the Ohio Valley Telephone Company was on trial.

This was a very peculiar case. Isaacs died in May, 1893, with an attack of mumps. By some means, some active attorney of the bar found out that about six months previous to the time of his taking down with the mumps that he had had a shock from an electric wire, and at once, thinking it a good excuse for a law suit, filed one against the said companies for $10,000 damages.

After hearing the evidence the same was thrown out cent. of the light weight of the car. Since the device will maintain in the brake cylinder a constant minimum pressure of 35 lbs., it will be seen that piston travel may be disregarded so far as brake-cylinder pressure is concerned.

For loaded-car braking the combined volumes of the two reservoirs will give 60 lbs. in the brake cylinder for service application and about 68 lbs. for emergency. In the operation of the brakes in a train of mixed cars of empties and loads, a 5-lb. reduction in the train line will produce from 12 to 15 lbs. pressure in the brake cylinder where the auxiliary reservoir is used alone, and from 25 to 30 lbs. where the two reservoirs are used. Further reduction maintains the same relation between the empty and loaded cars, so that when the former have reached 35 lbs. in the brake cylinders the latter will have reached 60 lbs.

In practice, a card is pasted on the side of the car just over the bleed rod, which card reads as follows:

To Brake for Load—When the train is made up and the air pumped up, push the release rod in to its full travel.

To Bleed—Pull the release rod as usual. When the car is unloaded in the train, being set for loaded braking, pull the release rod to bleed; this will bring to the empty position. When the air leaks off, the parts will automatically assume empty braking position.

A number of these devices were placed on cars of the Burlington & Missouri River last April and additional cars have been equipped from time to time. The part of this line in the region of the Black Hills afforded excellent opportunity for practical tests of the device, grades between Edgemont and Deadwood being as high as 4 per cent. Trains of 12 or 14 cars of 60,000 to 80,000 lbs. capacity are the limit on this branch, and it is said that if such a train have in it three or four cars equipped with this device the engineman can control it upon the grades without difficulty, whereas ordinarily "clubbing" must invariably be resorted to. During the nine months that the device has been in service on this road there has not been a case of flat wheels under the cars so equipped. The Chicago & Alton is having 300 cars, which are building at the Standard Steel Car Co., equipped with these valves.

The device is the invention of Mr. M. W. Hibbard, of Chicago, known as the inventor of the Hibbard triple valve. It is owned and is now being made by Mr. R. Fitzgerald, Vice-President and General Superintendent of the Chicago Junction Railway.

Bridge Across the Missouri River at East Omaha, Nebraska.

This structure crosses the Missouri River between the City of Council Bluffs, Iowa, and East Omaha, Neb. Nearly 10 years ago the old bridge was completed, consisting of one 520 ft. draw span, three 192 ft. fixed spans, and about 550 ft. of timber trestle. The 520 ft. draw span was designed to carry a double track railroad inside the trusses, and electric cars, highway and pedestrian traffic on cantilevered roadways outside the trusses.

The three fixed spans are of temporary construction, and these and the timber trestle approaches were designed to carry only a single track railroad loading, but the entire roadway was floored so as to provide for highway traffic.

All of the piers for the existing structure, excepting the pivot pier, were constructed of piling. The pivot pier was sunk to bed rock, about 120 ft. below low water, by open dredging. Although three of these pile piers are in the channel of the river, they have withstood the high waters for the past nine or ten years, and are at present in very good condition. At times very great scour has occurred around piers Nos. 3 and 4, and they have been forced down stream a few inches, but by riprapping around them, and bracing the piling below water with adjustable chains, this movement was stopped before reaching any serious amount.

When the existing structure was completed, it was the intention to rebuild the temporary portion of the work within seven or eight years, but the structure proved more durable than expected, so the rebuilding was postponed.

In order to facilitate the erection of the permanent structure, the old structure was erected on a line making an angle of 10 deg. 53 min. with the final bridge tangent as shown on general plan, the center of the pivot pier of the existing draw span forming the common point of the two structures, or the axis of rotation. The new structure can be erected clear of the old work, and traffic maintained on the old structure until the new spans are completed, when by revolving the old span the traffic will be diverted to the permanent structure.

The new superstructure will consist of a 520 ft. draw span and nine 60 ft. plate girder approach spans. The new substructure, beginning on the Iowa side of the river, will consist of the following: Abutment A, concrete resting on the sand; pier No. 1, masonry shaft, concrete base, pile foundations; pier No. 3, masonry shaft, pneumatic caisson, to land in the sand at a depth of about 84 ft. below low water; pier No. 4, pivot pier, masonry shaft, double steel shell, filled with concrete, sunk to bed rock by open dredging, depth of bed rock below low water 120 ft.; pier No. 5, masonry shaft, pneumatic caisson, to land in the sand at a depth of 74 ft. below low water; piers Nos. 6 to 12, concrete shafts and bases, pile foundations; abutment B, concrete shaft and base, pile foundations.

The following are the approximate quantities in the substructure: Mass in cribs and caissons of pneumatic piers, 4,180 cu. yds.; mass in base of new pivot pier, 5,390 cu. yds.; mass in bases of pile piers and abutments, 2,330 cu. yds.; masonry in shafts of four large piers, 2,135 cu. yds.; concrete in shafts of shore piers and abutments, 1,550 cu. yds.; piling below bases of concrete piers and abutments, 19,900 lin. ft.; metal in new pivot pier, 580,000 lbs.

The shafts of all river piers are to be built of concrete and faced with Kettle River sandstone. The shafts for all the small piers and for the two abutments are to be of concrete throughout.

The copings of the concrete piers will be formed of granitoid, mixed in the following proportions: Portland cement, one part; clean coarse granite sand, two parts; granite chips to pass ½ in. ring, three parts.

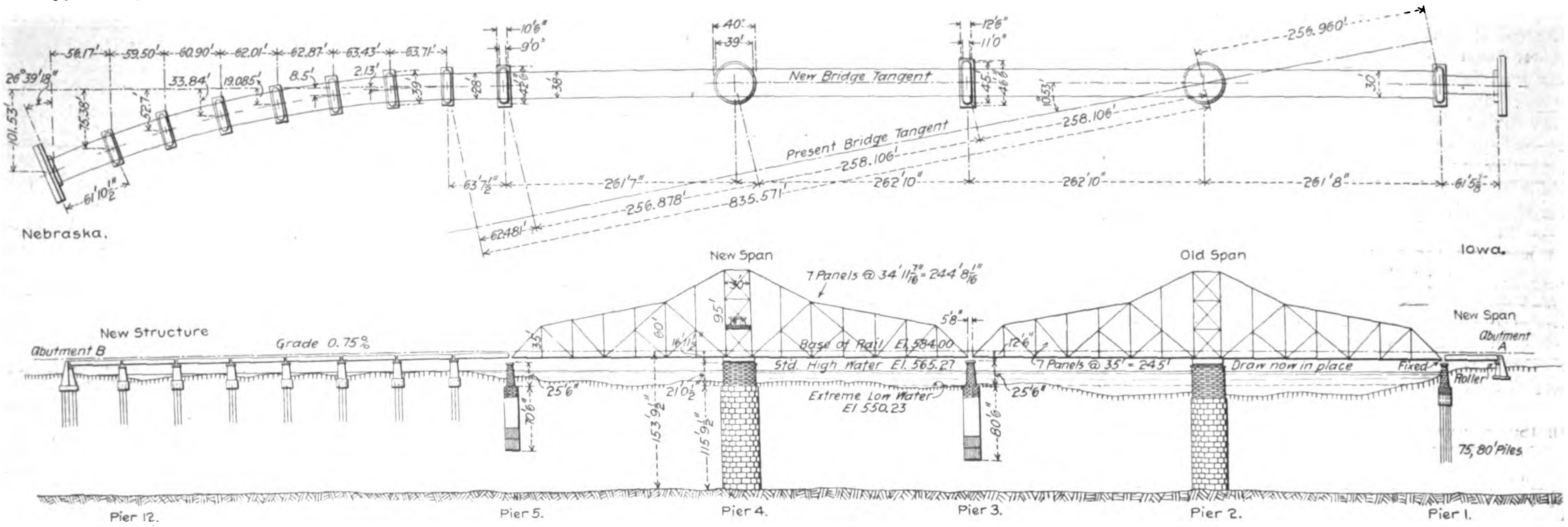
The concrete for shafts and bases of piers where not deposited in the water will be mixed in the following proportions: Portland cement, one part; clean coarse sand, three parts; broken limestone to pass 2½ in. ring, five parts.

In the bases of the piers sunk by open dredging, will be deposited enough of the concrete through the water to seal the bottoms of the cribs. For all concrete so deposited the following proportions will be used: Portland cement, one part; clean sharp sand, two parts; broken stone to pass ¾ in. ring, three parts.

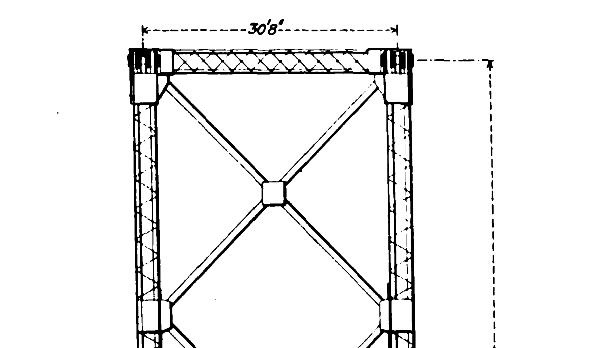
The new pivot pier is almost an exact duplicate of the old pivot pier. The inside cylinder forming the dredging well is 20 ft. in diameter, and the outside cylinder is 40 ft. in diameter. At the bottom, the inside cylinder is flared to connect with the outside cylinder, thus forming a cutting edge. The two cylinders are well braced together, and the annular space between them is to be filled with concrete as the sinking progresses. The metal for the inside cylinder is ⅜ in. thick, and that for the outside cylinder ½ in.

No difficulty was encountered in sinking the old pivot pier, there being ample weight to settle it, as the material inside was removed by the dredges. Provision has been made for using a number of water jets around the cutting edges, should this be required for sinking.

The new superstructure has been designed to carry two railroad tracks between the trusses and highways, and motor tracks, and sidewalks outside the trusses or girders. The old draw was designed to carry the same traffic, but the live loads used for the new structure are very much heavier than those used for the old, as will be seen from the following comparison:



General Plan and Elevation Showing Position of Old and New Spans—East Omaha Bridge.



Section at Center of New Draw Span.

	Old span.	New span.
Live load for railroad stringers, lbs. per ft. per track	5,180	8,450
Live load for railroad floor beams, lbs. per ft. per track	4,150	6,320
Live load for trusses, lbs. per lineal ft. of bridge	9,000	11,180
Dead load for trusses, lbs. per lineal ft. of bridge	6,100	9,020

The total weight of metal in the old span is 2,768,000 lbs., while that for the new span will be 3,900,000 lbs. The weight of metal in the nine approach girders will be 1,773,000 lbs. These weights do not include the metal outside of the trusses or girders, as the cantilevers will not be put on at present.

The draw spans will be operated by motors installed in duplicate. The time for raising the ends and turning the spans through one-fourth of a revolution under ordinary conditions will be about two and one-half minutes. The machinery houses will be fireproof with steel frame work, concrete floors, and walls of Portland cement plaster on expanded metal lath.

The superstructure metal will be of medium steel, subpunched and reamed. All gears, tracks, rollers, rack and pedestals will be of cast steel. All high speed gearing will have cut teeth.

The principal points in which the design for the new draw span differs from that of the old draw span designed ten years ago are as follows:

(1) In the new draw the live loads are very much greater, consequently the span is much heavier.

(2) All lateral and sway bracing is much more rigid in the new span than in the old.

(3) All castings in the new draw span are cast steel while in the old span they were made of cast iron.

(4) The new draw span has a double webbed drum and two circles of rollers, while the old span has a single webbed drum and one circle of rollers. The loading of the drum by means of ball and socket bearings is also a new feature.

(5) The ends of the new draw will be raised by means of wedges, while toggles are used for the old span.

(6) The lower tracks for the new draw are of a much stronger and more rigid form of construction than that used in the old draw span.

When the structure is completed the entire channel of the river will be spanned by the two draw spans. The additional draw span was put in instead of the 560 ft. fixed span originally intended, for two reasons:

(1) On account of the constantly changing channel of the river.

(2) The cost of the additional draw and the substructure for the entire bridge on this basis was considerably less than for the structure with the fixed span.

As the structure is now designed the channel must move outside the present banks to get from under the two draw spans.

The total cost of the entire new work will be about $600,000. The substructure work is being done by the Foundation & Contracting Co. of New York. Mr. Geo. Adgate has direct charge of the work. Work was begun on Oct. 22, 1902, and the contract time for completion is June 1, 1903.

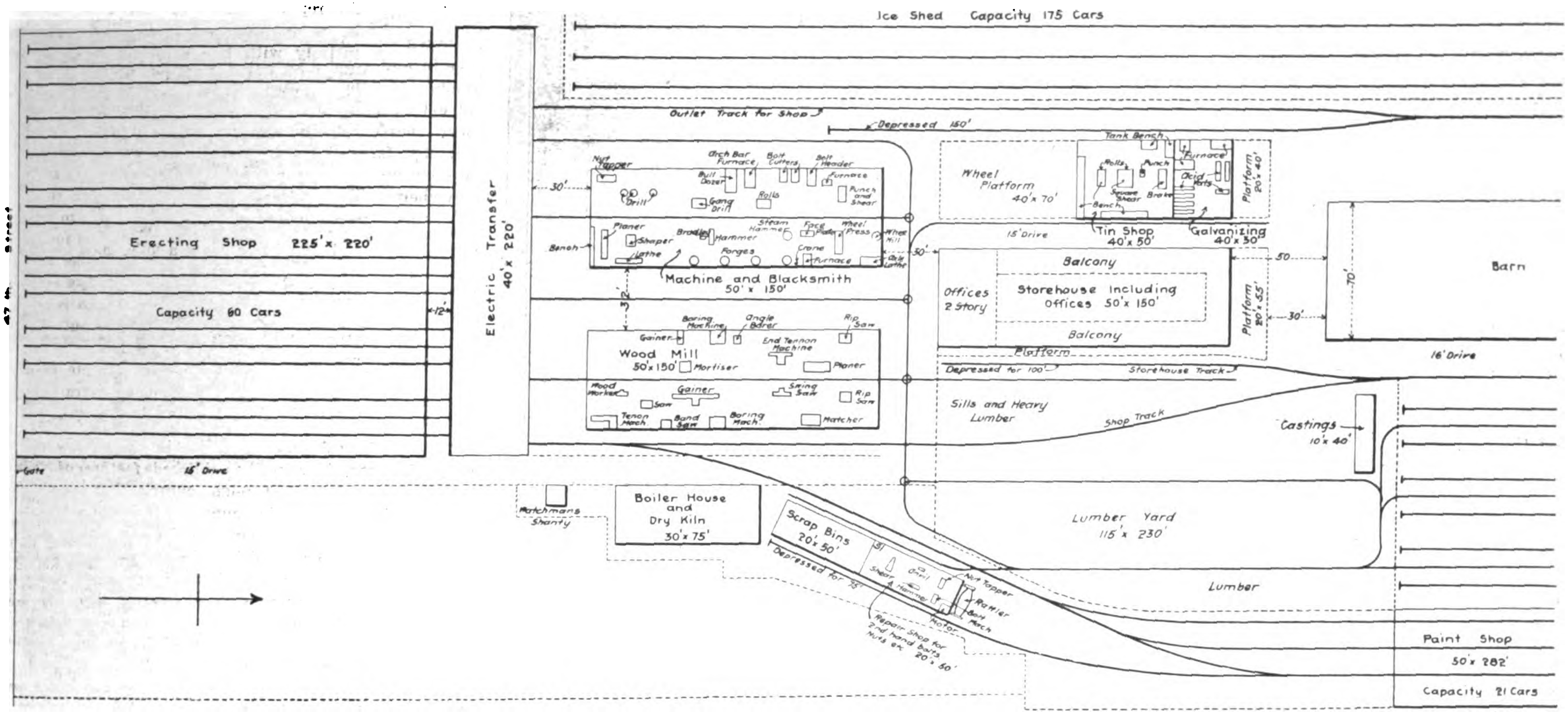
The superstructure will be made by the American Bridge Co. The contract time for the completion of the superstructure is Nov. 1, 1903.

Waddell & Hedrick, Consulting Engineers, Kansas City, Mo., have designed and are superintending the work.

A Modern Car Shop.*

The accompanying drawings are the proposed shops of the Armour Car Lines, to be built at the Union Stock Yards, Chicago, to take the place of the present shops. The new shops will have a capacity of four new refrigerator cars per day, in addition to the rebuilding and repair work, and, I believe, are situated so as to obtain the best results, considering the site.

A reference to the engravings will show the various shops contemplated and their location. The erecting and heavy repair shop is 225 x 220 ft., containing 12 tracks with 18-ft. centers, each track holding five cars when set for repairs, the total capacity of this building 60 cars. These cars are handled into and out of the shop by means of an electric transfer table. Attention is called to the fact that only two tracks (except narrow-gage material tracks) connect with this transfer table, the one at the extreme east end being the feeder track, or track on which the bad order cars are accumulated and enter the shop; and the track west of the center of the transfer pit being the outlet track.



General Layout of the Proposed Shops of the Armour Car Lines—Chicago.

The blacksmith and machine shop is 50 x 150 ft., with full equipment of machines and tools. At the north end of this building is the wheel platform, the wheels being unloaded and loaded on cars from the depressed track, bringing the level of the car floor to the level of the platform. This building is located 82 ft. north of the main repair shop, the material being handled over the transfer table, except that which is handled through the store department.

The wood mill is 50 x 150 ft. This building is also located 82 ft. north of the main repair shop, the supplies being handled over a narrow-gage track and the electric table.

The store-room, with the office attached on the south end, is as near the center of the plant as possible. Material received and forwarded at the storehouse in carload lots is switched on the depressed track at the east side of the building, the level of the car floor being the level of the store room floor; and materials handled by team being received and delivered at the north end of the building at the elevated platform, this platform being the height of a wagon body. From this store room or central location, the material is handled to the several points of the yard by means of the narrow-gage system already referred to.

The boiler house, fan rooms and dry kiln is one brick building, 30 x 75 ft. The scrap bins, 20 x 50 ft., are open on both sides, for the purpose of delivering the scrap to the bins from the west side and loading it from the bins on the east side on cars set on the depressed track, where the car floor will be level with the floor of the scrap bins. This also provides a building 20 x 50 ft., for a repair shop for handling second-hand material, and is equipped with shears, bolt and nut machines and small hammer, all second-hand material being worked over at the scrap bins and delivered direct to the yard, where it will be used again.

The paint shop, 50 x 275 ft., has a capacity of 21 cars, the cars being handled from the erecting shop to this paint shop by means of an electric motor, the track being a 4 per cent. down grade, starting at a distance of 150 ft. north from the transfer table.

The oil and paint house is located at the extreme north end of the yard, or as far away as possible from all other buildings. In this are handled all the mixed paints, oils and other inflammable materials.

The casting shed, where materials are stored for use in light repair, is located as near as possible where light repairs are made.

The plan of operation is to have all cars going to the shop stopped opposite the boiler room and storehouse, where all of the old material of the bodies of the cars will be stripped off. The wood material will be deposited in the boiler room to be burned up, and the forgings and castings delivered at the scrap bins. All the materials to be used on the repairs to each car will be loaded into the car before it is passed over the transfer table into the repair shops, and while it is located conveniently to the shop, mill and storehouse.

Tracks for the light repair yard are provided for west of the paint shop. These tracks are laid at 18-ft. centers. The capacity of this yard is 75 cars, when set for repairs. These shops will be operated on a piece-work basis.

*Abstract of a paper presented to the Western Railway Club Jan. 20, 1903, by W. E. Sharp, Superintendent Armour Car Lines, Chicago.

Locomotive Inspection in Contract Shops.*

The subject of inspection of engines under construction is one which is of vital importance to both the builders and the railroad companies, and this being the case too great care cannot be exercised in the selection of men to fill these positions, both as representatives of the railroads and representatives of the builders. In the best building shops the inspection of work under construction is generally organized under the head of a general inspector with a number of assistants, who take up the detail of inspection in the various departments. In addition to this, of course, the foremen and assistant foremen are also inspectors.

The key to the situation of a building shop is the general inspector, and this man should be one who appreciates both the railroad's and the builder's position; he should be one who is thoroughly conversant with the engine in all of its details and be a mechanic of the very highest grade, who will, on account of his ability, have the confidence of the mechanics in the shop and of the railroad inspectors who may be assigned to the plant, and his decision should be absolutely final so far as the builders are concerned; in other words, there should not be an appeal by foremen over his head. He should, however, keep in constant communication with the general superintendent or manager of the plant, and in case of any critical matters, should, before making a decision, take up the matter with the manager or the general superintendent for discussion; but the decision, so far as the shops are concerned, should be made by him, so that the foremen, assistant foremen, mechanics and others should feel that he was the final tribunal on all matters of workmanship.

In some of the long established shops where the men are thoroughly trained there will be little need of inspection, for the men themselves will take sufficient pride in their work to turn out work of good quality, but in the majority of cases, where the contract or piece work system is adopted, there is great danger of men slighting quality to get out quantity. It is, therefore, better to have too many inspectors than not enough.

The assistant inspectors should be furnished with proper report blanks, on which should be shown the nature of the defect, the workman's name, the contractor's name, the foreman's name and what action has been taken. Frequently the work is not entirely condemned, but may have to be sent back to the machines for proper finish, but all such cases, whether they can be corrected or not by the workmen, should be reported to the general inspector, and the report should state the action taken. If the defects are of such nature, however, that the parts have to be condemned and new parts gotten out, it should be the inspector's duty, as a rule, to so mar or damage the parts that they would not be possible of use, and he should promptly notify the foreman so that they may be replaced at once to avoid delay. From the individual reports of the assistant inspectors, the general inspector should have made up daily a statement to the general superintendent giving a report in full of all defects found during the day, and this statement should also show what action has been taken.

It very frequently happens that the trouble is not altogether with the workmen, but is partially, if not altogether, due to the condition of the machinery, or possibly imperfect drawings or prints, and if such is the case, of course the machine should be put in proper condition at once, or the drawings corrected. It again happens that the workman has not been properly instructed by his foreman. If this is the case, it should be looked into and seen that proper instructions are issued. At the end of each month the daily reports should be divided, first to the various departments, second to the various contractors, and last to the individual workmen themselves, and in this way the department foremen who are careless will be detected and can be checked up, and they in turn can check up the contractors and workmen.

The inspectors and the foremen are practically partners in the same business, that of producing first-class work, and if the foremen find out that their advancement, either in position or salary, depends upon the quality of their workmanship first and quantity second, they will soon appreciate the assistance which a good inspector can give them, for he should be nothing more than an additional pair of eyes for a good foreman. The same relationship which exists between the assistant inspectors and assistant foremen should exist between the general inspector and superintendent and the general foreman.

The discipline of the various workmen should be in the hands of the general foreman and his assistants, and not in the hands of the inspectors. The ideal condition which the general inspector should strive to obtain for his force would be such careful and thorough inspection as to make it entirely unnecessary for the railroads to require inspectors at all. In other words, the shop inspector should discover defects in advance of the railroad inspector. The same qualities which make a good general inspector should obtain so far as assistant inspectors are concerned, that is, they should be competent

*Abstract of a paper presented to the Richmond Railroad Club, Dec. 11, 1902, by Mr. H. A. Gillis.

man, the manager must keep a watch on the trainmaster who is ambitious to make a great record in car movement; and the superintendent who, to please the brotherhoods or to avoid too many interviews with the aforesaid avaricious individual is inclined to keep his force of trainmen always too small, thus necessitating overwork. But the manager's task is by no means impossible; strength to his elbow!

What is believed to be a record in locomotive erection was recently made in the new shops of the Pittsburg & Lake Erie at McKee's Rocks, Pa. A consolidation engine which had been sent to the shop for general repairs and a new fire-box was erected and sent to the roundhouse ready to be fired up in seven hours from the time the boiler, completely stripped, was delivered from the boiler shop and placed on the frames. The boiler was set on the frames at 9 o'clock in the morning and the engine in working order was sent out of the shop at 5 o'clock on the afternoon of the same day. The work done on the erecting pit included reaming the saddle bolt holes and making the necessary taper bolts, lagging the boiler, fitting the cab and new running boards, connecting up eccentrics and valve gear and setting the valves, making all steam connections and applying cab fittings, coupling up main rods and painting wheels and front end. Ten years ago a week was not considered as an unusual length of time for doing this same work, and two weeks was often required. The tendency in all shops now is to get work through as fast as possible and make room for the next engine and at the same time get the repaired engine back into service again so that it can earn money. Fast work in the machine shop is of little value unless the other departments of the shop turn out work equally fast. The use of cranes and pneumatic tools in the erecting shop has done much to decrease the delay in assembling locomotives, but ingenuity and skill on the part of the workmen under the intelligent direction of a competent foreman count for more here than, possibly, in any other department of the shop. A record of this kind reflects credit on the designers of the shops, on the foreman in charge, and on the men themselves.

Announcement is made in another column of the change of title of Mr. W. J. Harahan from General Manager to Fourth Vice-President, and of Mr. I. G. Rawn from Assistant General Manager to General Manager, of the Illinois Central. No new position is created by this, but the former title of Assistant General Manager is dropped. In accordance with the rather unusual organization of the Illinois Central, the duties of the General Manager have much resembled those of a Vice-President. The Chief Engineer, Engineer of Construction, Bridge Engineer, etc., report direct to the Assistant General Manager, as he was heretofore called, and that officer, who spends much time on the road, is really the active, directing, head of both construction and operation. It is fitting that the breadth of his duties should be recognized in the title of General Manager, while his superior officer becomes a Vice-President. The Fourth Vice-President reports to the Second Vice-President, just as he did before the change of title.

TRADE CATALOGUES.

The Chicago & North Western.—The passenger department of this road has printed in pamphlet form Frank H. Spearman's article on the Chicago & North Western, which appeared in his work on "The Strategy of Great Railroads," the reprint is made by the permission of the publishers. A review of Mr. Spearman's book was given in these columns Jan. 27, 1905.

Bolt and Nut Machinery.—The National Machinery Company, Tiffin, Ohio, maker of bolt and nut machinery, forgings and bending machines, wire nail spike and special machinery, sends its illustrated catalogue. Detailed descriptions of machines for the above purposes are given as well as a full detailed description and line drawings of the National open die head. The catalogue is 8 in. x 10 in. and contains about 170 pages.

Railroad, Mill and Factory Supplies.—The Walter A. Zelnicker Supply Co., Fourth and Locust streets, St. Louis, is distributing a new issue of its catalogue of railroad, mill and factory supplies, heavy hardware machinery, etc. It is a large volume, containing over 800 pages, and describes and illustrates the large and varied line of supplies given above, which this company carries. There are also tables of statistics, measurements, weights, etc.

Railroad Repair Shops.—The Arnold Electric Power Station Co., Chicago, Ill., sends its bulletin No. 10, which describes in detail the equipment and the plans of the new Oak Lawn shops of the C. & E. I. R. R. at Danville, Ill. The above company acted as constructors and supervising engineers of the complete power plant, including the lighting, heating, water and compressed air systems.

CONTRIBUTIONS

The Barschall Joint.

Nice, France, Feb. 9, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The *Zentral Organ für die Bauverwaltung*, Feb. 4, 1905, says (literal translation):

> The molecular connection is lacking at the gap, without regard to whether it be transverse or longitudinal. This will never be replaced by mechanical connection with fish plates and screws, wherefore the expansions and shrinkages and the corresponding spanning and pressing tensions at the rail end cannot find an equalization.

The same idea can be expressed as follows:

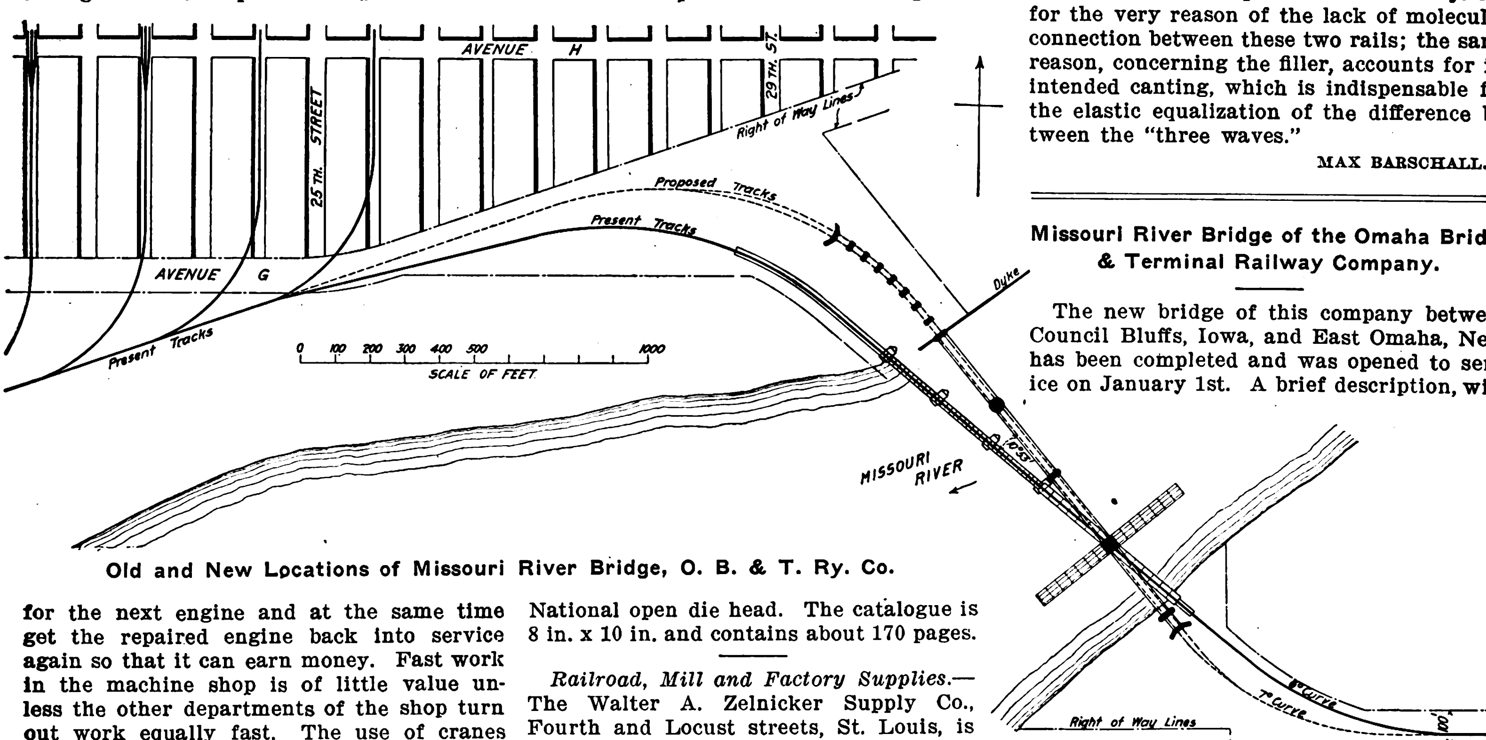
> The continuity of wave is confined to the length of each rail; the ending wave of one rail and the beginning wave at the next rail, succeeding each other, result in the loosening, bending or breaking of any mechanical fastening (loosening of joint ties, crushing of ballast, bending or breaking of bolts, deteriorating the bearing surfaces of bars or breaking the latter).

This indicates clearly that the connection must not be supported on the "waving" rail ends (head and flange), but on the joint ties, in a manner to smoothly carry the wheel on a *third* wave over the place, where the wave of the main rail is broken. Alternate joints involve the advantage of confining the interruption to one side, this advantage being increased by means of replacing the lack of molecular connection on the other side by the continuous third wave, instead of mechanical fastenings. The tire, consisting of one piece, will by means of the pressure, equalize according to shape of tread the deflection of the suspended double rail joints for the very reason of the lack of molecular connection between these two rails; the same reason, concerning the filler, accounts for its intended canting, which is indispensable for the elastic equalization of the difference between the "three waves."

MAX BARSCHALL.

Missouri River Bridge of the Omaha Bridge & Terminal Railway Company.

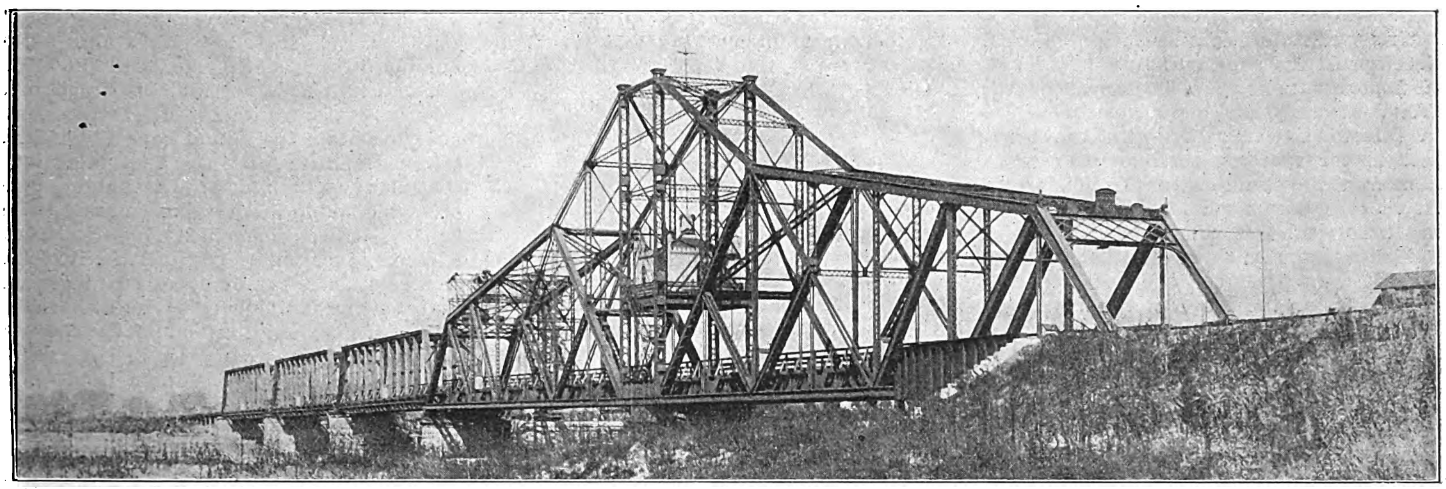
The new bridge of this company between Council Bluffs, Iowa, and East Omaha, Neb., has been completed and was opened to service on January 1st. A brief description, with



Old and New Locations of Missouri River Bridge, O. B. & T. Ry. Co.

a general plan, an elevation and a section were printed in these columns two years ago (*Railroad Gazette*, Jan. 23, 1903). The history of the structure was given at that time, which it will be of interest to repeat briefly here.

The original bridge of this company, now controlled by the Illinois Central, was built in 1893 and was notable for the length of the draw span—520 ft.—the longest ever built. Besides this swing span, the structure consisted of three 192-ft. combination fixed spans and about 550 ft. of timber trestle approach, the swing span being the only permanent part of the structure. All of the piers except the pivot pier of the swing span were made of piling. It was thought that the com-



Old Bridge of the Omaha B. & T. Company Across the Missouri River (From the Iowa Side).

pletion of the permanent bridge would probably be necessary in seven or eight years, but some time longer elapsed before it was actually undertaken, the temporary structure standing up better than was expected.

In order that the permanent bridge might be erected in its rightful position without interruption to traffic, the old structure was placed on a line making an angle of 10 deg. 53 min. with the line of final location, the two intersecting at the pivot pier of the swing span, as shown by the accompanying plan. Traffic was diverted from the old structure to the new simply by swinging the old draw span into line with the latter. The old draw span is 520 ft. long, center to center of end pins; depth of tower, 95 ft.; depth at end of truss, 35 ft.; width center to center of trusses, 30 ft.; center to center of tracks, 13 ft. Besides the double-track railroad inside the trusses, the span was designed to carry electric cars, highway and pedestrian traffic on cantilevered roadways outside the trusses. The temporary spans and trestle approach carried only a single track, and the roadway of the entire structure was floored to provide for highway traffic.

The final structure includes a new swing span having the same general dimensions is the first, and nine 60-ft. plate-girder approach spans, one being on the east side and the rest on the west. The new structure, with its two adjoining draws spanning the entire channel of the river, is unique. The original intention was to have a 560-ft. fixed span, but this was abandoned in favor of the swing span for two reasons, given in the article referred to at the outset:

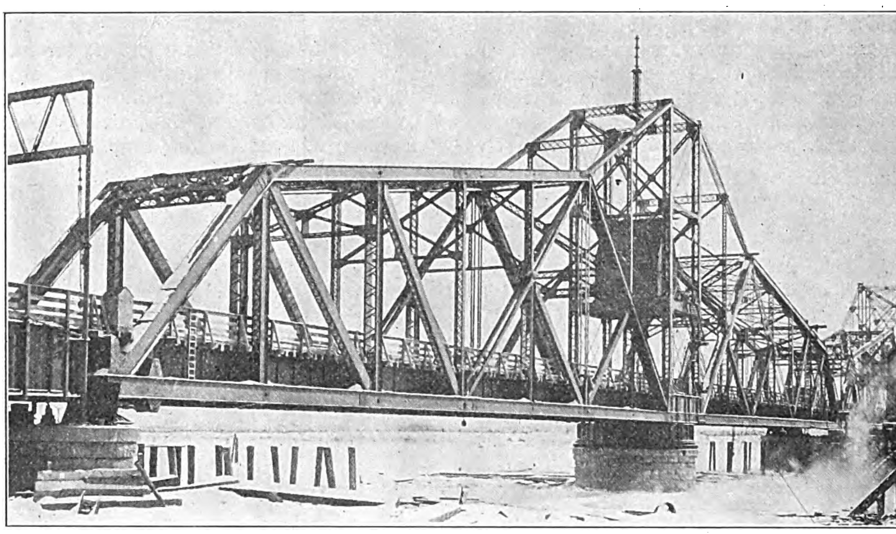
(1.) On account of the constantly changing channel of the river. It now must move outside of the present banks to get from under one or the other of the draw spans.

(2.) The cost of the additional draw and the substructure for the entire bridge on this basis was considerably less than for the structure with the fixed span.

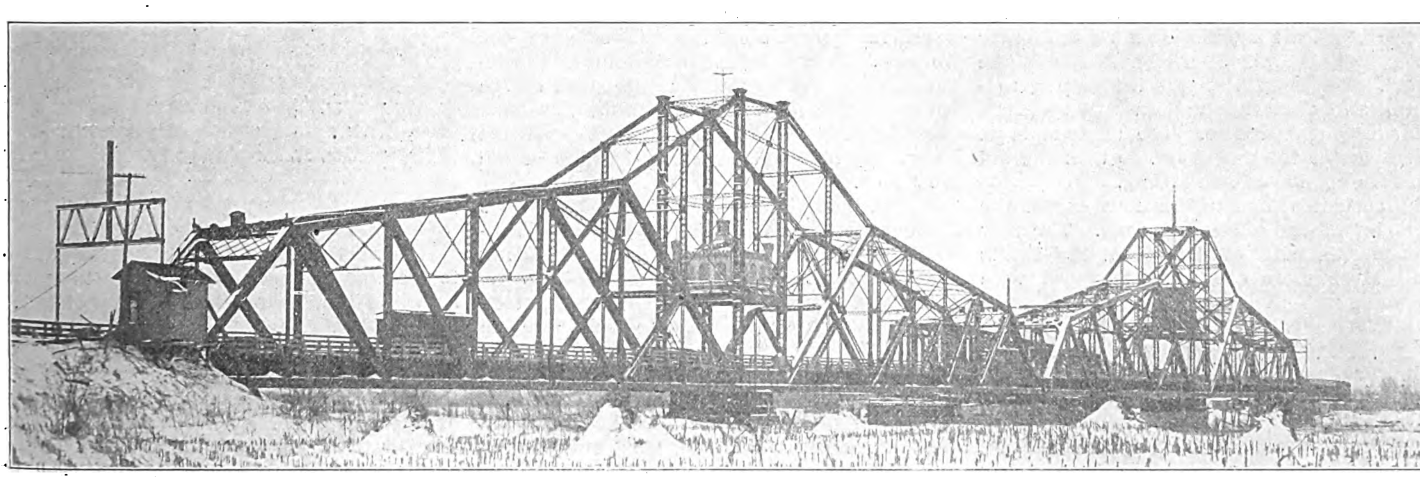
The new swing span, although having the same general dimensions as its older companion, is designed for heavier loading. The first span provided for two 110½-ton locomotives followed by 3,400 lbs. per lineal foot of bridge, while the latter loading is for two 162½-ton locomotives and 5,000 lbs. per lineal foot. The following comparison of live loads in the two spans is taken from the article of two years ago:

Live loads, per ft. of track:	Old.	New.
Railroad stringers	5,180 lbs.	8,450 lbs.
Railroad floor beams	4,150 "	6,320 "
Live load for trusses, per lin. ft. of bridge	9,000 "	11,180 "
Dead load for trusses, per lin. ft. of bridge	6,100 "	9,020 "

In the details of their design and construction these two draw spans present a fine example of the progress made in bridge design in the interval between their respective times of building. The new span is more than a million pounds (40 per cent.) heavier than the old, the figures being 2,768,000 lbs. and 3,900,000 lbs. respectively, which does not include the cantilevered roadways outside of the trusses, not yet built. Another important feature of difference is in the turntable, a double-webbed drum with two circles of rollers and two concentric roller tracks being used in the new design, as against a single circle of rollers and single-webbed drum in the old one. The span has eight bearing points on the drum, a cast ball and socket bearing being used at each point, constituting a new feature in draw span design. The



New Draw Span of the O. B. & T. Co.'s Bridge at Omaha.



New Bridge of the Omaha B. & T. Co. Across the Missouri River (From the Iowa Side).

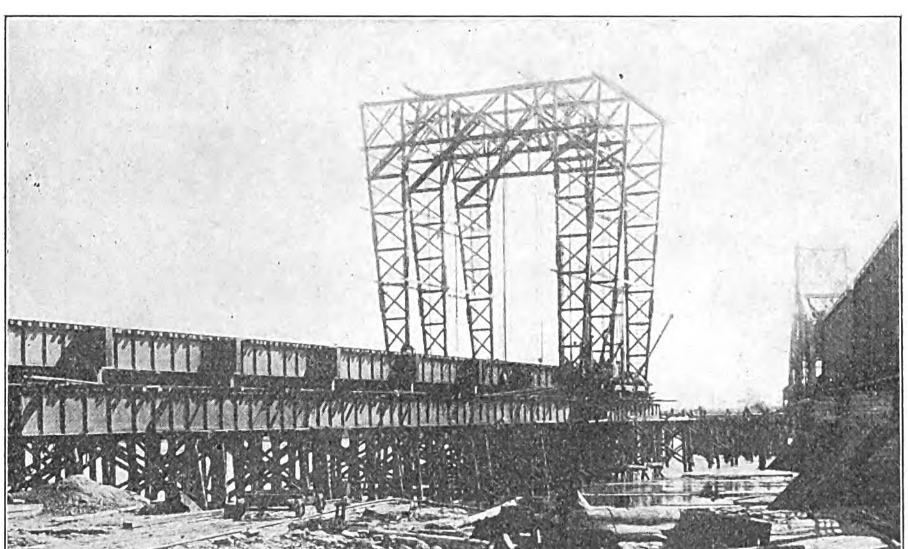
two circles of rollers contain 56 rollers each.

Erection of the superstructure was begun last September. A view is shown of the traveler erecting the draw span. Double-bent falsework was used, with the bents placed as far apart as possible in order to minimize the possibility of trouble from drift in case of a flood in the river. The bents were spaced to come under the truss panel points, approximately 35 ft. apart. The length of span precluded the use of a timber runway for the traveler and the outer pair of track stringers was employed. The inner pair of stringers was put in place to form a track on which to convey material.

The swing span is operated by two 35-h.p. electric motors located under the track just above the drum. The end wedges are driven by separate electric motors, placed one at each end of the bridge between the stringers. The rail locks are driven by compressed air from a small compressor in the engine house. The latter is of fire-proof construction with steel framework, concrete floors and walls of Portland cement plaster on expanded metal laths. This engine house contains the switchboard, the compressor and its reservoirs, and the interlocking machine for the bridge. The bridge is protected by four single-arm two-position semaphores set 400 ft. and 1,350 ft. on the west side, and 950 and 1,950 ft. on the east side, from the center of the new draw span. All movements of the operating machinery, signal system, etc., are controlled by the interlocking machine in the engine house, which is a combined electrical and mechanical machine. The design is such as to prevent any consecutive operation being made out of its turn. The semaphores are controlled by a separate set of levers, but all signals must be at danger before the operating mechanism can be started. The details of this interesting controlling and operating system will be given in a subsequent article. The channel is at present under the new span, so that the old span does not have to be swung.

The entire substructure is new except the pivot pier of the old swing span. The new pivot pier is built of cut stone, the shafts of all river piers are concrete faced with sandstone, and the small piers and the two abutments are concrete throughout. Particulars regarding the substructure were given in the former article.

Waddell & Hedrick, Consulting Engineers, Kansas City, Mo., designed the entire bridge and supervised all work. The substructure was built by The Foundation Company, New York, and the superstructure was built and erected by the American Bridge Company. The operating, interlocking and signal appliances were designed and installed by Geo. P. Nichols & Bro., Chicago.



Traveler Erecting Draw Span.

Who Own the Railroads.

BY H. T. NEWCOMB,
Of the Bar of the District of Columbia.

The progressive concentration of railroad control under a few great corporations and closely allied financial interests has apparently been confused, in the popular mind with an actual concentration of ownership. In other words, multitudes of otherwise intelligent people are so misled by the existence of the artificial, state-created entities known as corporations, that they fail to observe, in the backgrounds, the millions of natural persons who are the real owners of the corporate properties. The writer has recently conducted a somewhat hasty and incomplete investigation of the ownership of railroad property and has thus come into possession of statistics of unquestionable accuracy which serve in some degree at least to indicate the wide diffusion of the actual beneficial interest in the railroads of the country. This brief memorandum of the results of the investigation is prepared in the belief that it will do something to dispel the erroneous impression that railroad ownership is vested in a small group of the very rich.

As the inquiries of the present winter have dealt principally with the ownership of railroad bonds, it may be well, before stating the facts which they have elicited, to recapitulate some of the data concerning stock ownership which were made public in an article by Mr. Slason Thompson in *The World of To-day* for January, 1904.

Mr. Thompson ascertained that 43 railroad corporations controlling 115,641 miles of railroad, or less than 57 per cent. of the mileage of the country had registered shareholders to the number of 225,037. As the share capital of these railroads aggregated $3,034,495,046 it follows that the average holding of each stockholder was but $13,484. This amount does not indicate much in the way of concentration of ownership, but it does overstate the actual concentration, for anyone familiar with the real facts knows that many of the 225,037 shareholders of record are banking institutions (mostly savings banks), trust companies, insurance companies, educational institutions, executors and administrators of estates and other institutions or individuals whose ownership is of a fiduciary or quasi-fiduciary character. In addition, Mr. Thompson discovered that a single railroad, the Illinois Central, had 9,123 shareholders, of whom 7,174 owned less than 100 shares each, their average holding being less than 23 shares. Mr. Thompson's table relating to this company merits reproduction. It is as follows:

ILLINOIS CENTRAL RAILROAD COMPANY.
Distribution of shares as Registered on the Company's books at the close of business, September 29, 1903.

Holdings.	No. of stock-holders.	Shares of $100 each held.	Per cent. of entire capital.	Average holdings in dollars.
1 share to 99	7,174	164,989	17.36	$2,299.82
100 shares even	391	39,100	4.11	10,000.00
101 " to 499	1,281	270,581	28.47	21,123.64
500 " even	38	19,000	2.00	50,000.00
Total of small holdings	8,884	493,670	51.94	$5,556.84
501 shares and upward	239	456,714	48.06	191,093.72
Total of all holdings	9,123	950,384	100.00	$10,417.45

Mr. Thompson, properly, directed attention to the fact that the average annual income of the 8,884 small holders from a 6 per cent. dividend was but $333.41, while the largest holders among them would receive but $3,000 each yearly from their investments.

The present writer's investigations have been confined to the holdings of institutions which may properly be described as acting as trustees for large masses of the people. Prominent among institutions of this class are the savings banks of the country. Banks of this class are before all else the depositaries of the poor and the moderately well-to-do. The millions of patrons who entrust to them their scanty accumulations cannot directly avail themselves of the investment opportunities open to their wealthier neighbors, nor can they afford to assume the risks which are implied by promises of high returns. What they seek is safety and stability with the highest return compatible with both. The savings banks thus become an agency for the concentration of the capital of hosts of the smallest investors and the utilization of the aggregates in ways not directly open to any of them separately. Savings banks have invested very largely in railroad securities, as is shown by the following table in which statistics compiled from the latest reports of the banking departments of the six states named are presented.

Savings Banks.

State.	No. of depositors	Total deposits.	Railroad (steam) securities owned.*	Pr ct. of deposits.
N. Y. ..	2,365,583	$1,131,281,943	$177,444,223	15.69
N. J. ..	242,605	76,316,793	20,334,178	26.64
N. H....	159,956	66,140,710	23,746,521	35.90
Mass. ..	1,723,015	608,415,409	113,397,287	18.64
Conn. ..	474,548	220,597,198	82,265,024	37.29
Maine .	209,011	75,107,203	25,166,853	35.51
Total.	5,174,718	$2,177,859,256	$442,354,086	20.31

*Book value.

It is worth noting that the average amount to the credit of each of the 5,174,718 separate accounts represented by the foregoing table is but $420.87, and that of the security for each average deposit 20.31 per cent., or $85.48, depends upon railroad property. This means that there are upward of five million owners of railroad property whose separate holdings amount to barely $85 each.

The educational institutions of the United States have received many donations of large and small amounts which make up a vast

Experiments With Signal Lenses.

Dr. Charles H. Williams, of Boston, in a paper presented to the Railway Signal Association at its annual meeting at Niagara Falls, gives the record of some photometric tests of a signal light recently made by him, and he says that the best results were obtained with some lenses, designed by himself, which are convex on the front surface, with a greater curvature at the center than at the periphery, and with a concave surface on the back. This design is to be patented.

Dr. Williams started to make his experiments outdoors on the line of the Boston & Maine Railroad, but the smoke from passing trains so disturbed the conditions that he transferred his work to Marblehead, where he had a half-mile view across an arm of the harbor. He took one of Peter Gray's switch lights and had the openings glazed with thin plate glass, so as not to disturb the light when changing the lenses. He screwed the lantern to a small turntable so as to turn the axis of the lens at will 5, 10, 15 and 20 degrees from the direct line. To measure the small amount of light from a common flame at the distance of half a mile he had to improvise a photometer by using a "photographic wedge" such as is used in measuring the light of stars. This photographic wedge consists of a glass photographic negative which has been exposed to light in such a way that when developed the density of the film increases from the clear end to the dense end, in such proportion that for equal distances on the wedge, measured from the clear end, the density of the film will increase in geometrical progression (1, 2, 4, 8, 16, etc.). If such a film is held between the light to be tested and the eye, the light can be seen through the clear end, and by moving the film toward the denser end a point is found where it entirely cuts off the light. This point will vary according to the intensity of the light, and thus various lights can be compared with each other, and with any given standard, by noting the distance from the clear end to the point where the light is cut off.

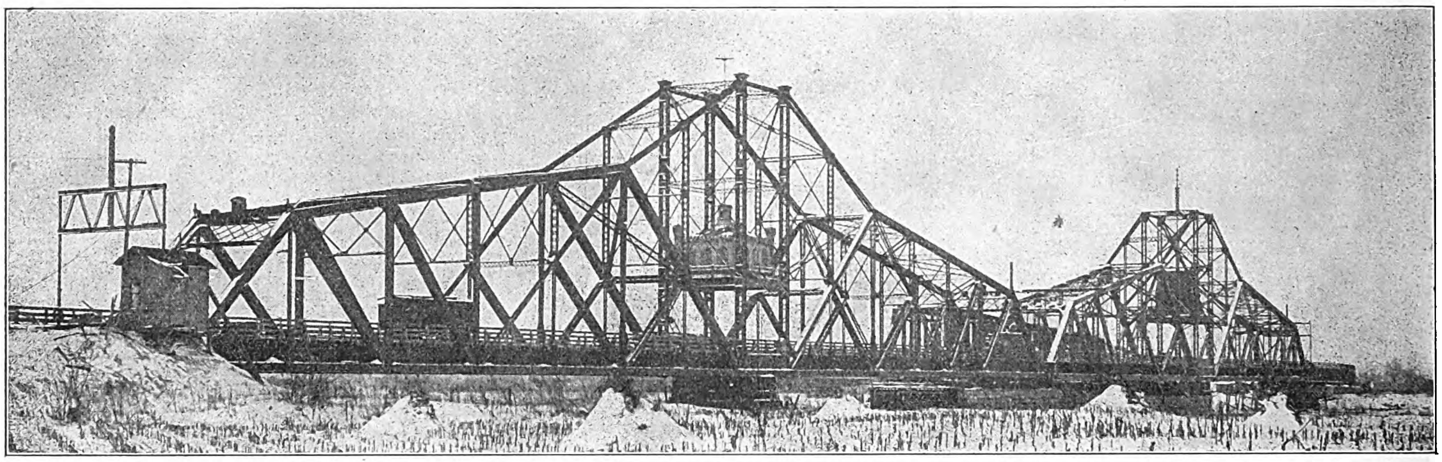
The wedge was mounted so that it could be moved horizontally in front of a tube lined with black velvet. For testing red lights a wedge-shaped cell filled with a green fluid (50 per cent. solution of nickel nitrate) was used instead of the wedge, but this was not enough better than the photographic wedge to warrant its continued use. By the gage on the wedge the comparative value of different lights was measured in centimeters from the clear end of the wedge, the figure in the record showing the point where the light disappeared. Three corrugated lenses were used and three of the new design mentioned above. With uncolored lenses, placed squarely in front of the observer, the corrugated lenses and the new design differed but little, varying from 6.0 to 6.6 centimeters; but when the lamp was turned 10 degrees to one side, the new lenses showed much better than the corrugated, the latter falling to 3.6 and 3.9, while the others gave 5.5 and 5.7. In other words, for a signal or switch on a curve or in case a light is not carefully fixed in position, the new lenses are an improvement. They are also easier to keep clean, light is thrown over a wider angle, there is less light lost from reflection from the back surface of the lens, and there are no dark rings. The new design is, however, heavier than common designs, and it stands out farther from the surface of the lantern. Other tests were made with red lights.

Dr. Williams has designed a pocket photometer. It consists substantially of his photographic wedge, with the scale marked on it at one side, and the film protected by glass. The whole is enclosed in a metal case. He estimates that this will not cost more than $2. To use this photometer the wedge is withdrawn from the case to its whole length; it is then held by one hand between the eye and the light to be tested. One finger of the other hand is held against the side of the scale to mark the level at which the light is seen. The wedge is then moved vertically up and down past this finger, until a point is found where the light is cut off. By the aid of a hand lantern the scale is then read off at the point where the finger nail rests against it.

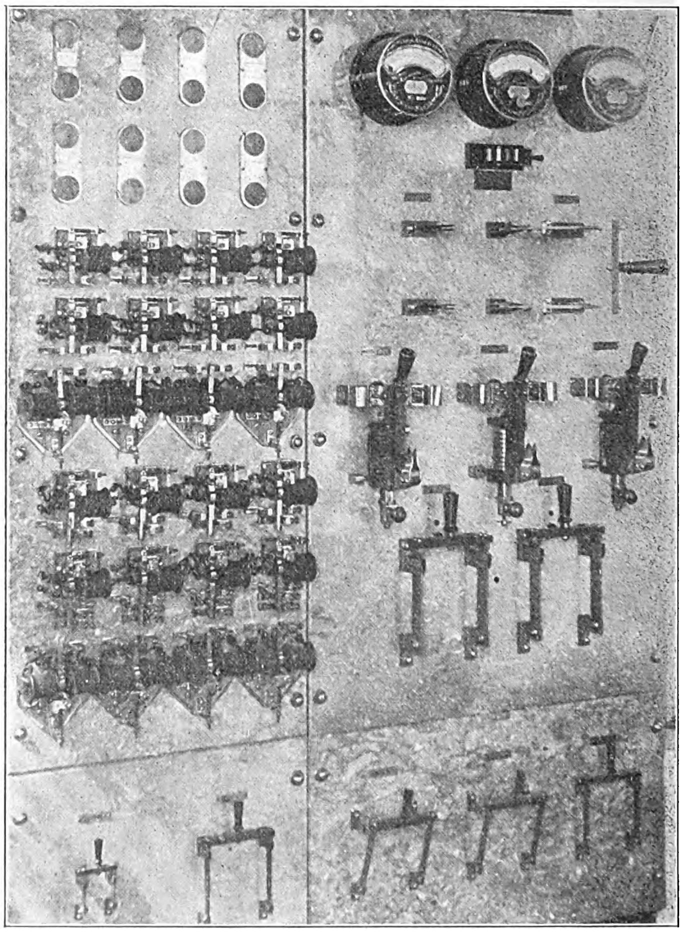
Operating and Controlling Devices of the Omaha B. & T. Co.'s Drawbridge.

The Missouri river bridge of the Omaha Bridge & Terminal Railway Company was described in these columns Feb. 24, 1905. It consists of two 520-ft. draw spans placed tandem, the longest drawbridges in the world. One was built in 1893, and the other was completed in January last.

In arranging for the operating and controlling devices and for the signals guarding the approaches, the idea constantly in mind



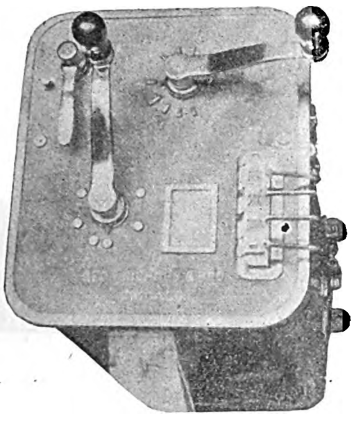
New Bridge of the Omaha B. & T. Co. Across the Missouri River (From the Iowa Side).



Switchboard—O., B. & T. Co. Drawbridge.

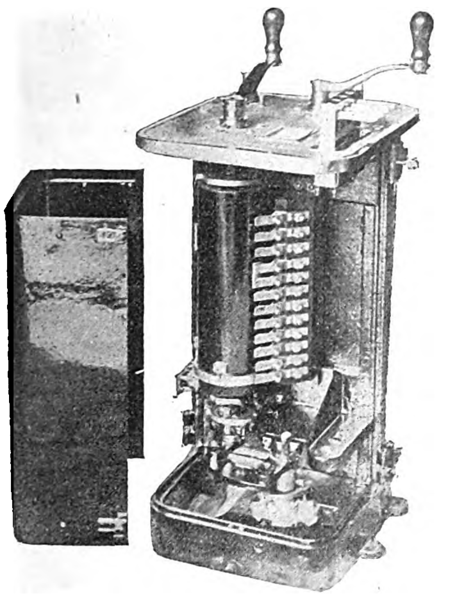
was to render it impossible for the operator intentionally or by any blunder to perform any of the motions or operations out of its proper order; to permit the operation of the bridge when the signals were clear for trains; or to clear the signals when the bridge was not in condition to permit trains to pass over safely. The motive power is electricity, which is taken from two independent circuits, one on each side of the river. The feeders as well as all of the signal and indicator wires are brought to the operator's house through overhead spans ending in a swivel pole, at the bottom of which is a set of insulated collector rings for making connections at all points in the rotation of the bridge. The swinging of the draw span is performed by two 40 h.p. street railway type motors mounted directly on the machinery inside of the drum. The end lifts, which are of the wedge type, are moved by two 20 h.p. compound motors—one at each end of the bridge.

The rail locks at each end of the bridge are worked by compressed air, one cylinder being connected to all of the rail locks at one end. The semaphores are operated by primary batteries, the home signals being placed about 500 ft. from each end of the bridge, and the distant signals about 1,000 ft. in advance of the home signals. The railroad line is single track but the bridge is double track, requiring a double-track signal system. All signals are normally at danger, requiring trains to approach the bridge under control.



Top of Controller Box—O., B. & T. Co.'s Drawbridge.

The entire control of the signal system and the bridge is effected through a single controlling stand designed especially for this bridge. The semaphores being normally at danger, no train is permitted to enter the bridge without the signal of its track first being cleared by the operator. The levers controlling the semaphores are mechanically interlocked to make it impossible to allow trains to approach the bridge from opposite directions on the same track.



Controller O., B. & T. Co.'s Drawbridge.

Taking up the movements in the order of their occurrence, it will be seen in the engraving of the top of the controlling stand, that the left-hand handle, which controls all movements preliminary to the actual swinging of the bridge, is standing at point 1. In this position the signals are under the control of the operator. Moving the handle from point 1 to point 2 breaks the signal circuits, permitting all signals to go to danger; and until this is accomplished it is impossible to move to point 3, the controller drum being locked in position. In position 3 a four-way air valve

WHITE LIGHT—SIGNAL CLEARED **N. TRACK E. BOUND** RED LIGHT—SIGNAL AT DANGER	WHITE LIGHT—SIGNAL CLEARED **N. TRACK W. BOUND** RED LIGHT—SIGNAL AT DANGER	WHITE LIGHT—SIGNAL CLEARED **S. TRACK E. BOUND** RED LIGHT—SIGNAL AT DANGER	WHITE LIGHT—SIGNAL CLEARED **S. TRACK W. BOUND** RED LIGHT—SIGNAL AT DANGER
WHITE LIGHT—SIGNALS CLEAR BRIDGE CAN NOT BE OPENED **SIGNALS** RED LIGHT—SIGNALS DANGER RAILS MAY BE UNCOUPLED	WHITE LIGHT—RAILS COUPLED BRIDGE READY FOR TRAINS **RAILS** RED LIGHT—RAILS UNCOUPLED WEDGES MAY BE DRAWN	WHITE LIGHT—WEDGES DRIVEN RAILS MAY BE COUPLED **WEDGES** RED LIGHT—WEDGES DRAWN BRIDGE MAY BE SWUNG	WHITE LIGHT—RAILS IN LINE WEDGES MAY BE DRIVEN **BRIDGE** RED LIGHT—BRIDGE OPENED WEDGES CAN NOT BE DRIVEN

Operators' Direction Card—O., B. & T. Co. Drawbridge.

at the bottom of the controller box is opened and the air cylinders for moving the rail locks are set in operation. There are eight of these locks, which are connected up in series by an electric circuit. This circuit is completed only when all eight locks are released; and until the circuit is formed the controller is locked, preventing movement of the handle to the next position. Position 4 starts the 20 h.p. wedge-moving motors. When each motor has made the proper number of revolutions to have withdrawn the wedges, the current is automatically cut off by means of a special stop device and the connections left so that the motor cannot be run any further in that direction but can be reversed readily at the proper time. When the wedges have been withdrawn, the handle can be moved to 5, which unlocks the second controller, moved by the right-hand handle. This latter controller, which governs the bridge-swinging motors, is a General Electric standard series-parallel controller for 40 h.p. motors. The first drum remains locked at point 5 until the bridge is back in normal position. When the rails are exactly in line, electric contacts are formed at the ends of the bridge which release this drum and permit the operator to perform in reverse order the several operations already described. The handle, however, continues to move in the same direction through a complete revolution back to point 1. In engraving of the controller will be noticed a rectangular space near the center of the top of the box. This is for the insertion of the card giving exact instructions to the operator.

In addition to having the controller drum locked until the next movement can be performed safely, each movement is visually indicated by means of red and white lights on the switchboard. These indicating lamps may be seen in the engraving at the top of the board at the left-hand side. There is also placed on the board for the instruction of the operator a card, 3 in. x 6½ in., which is reproduced. Each lamp is marked in accordance with its indication, the markings under the lamps corresponding to those shown on the card.

The operator's house, which occupies an elevated position at the center of the span, is fire-proof, with steel framework, concrete floors and walls of Portland cement plaster on expanded metal laths. It contains the switchboard, controller and an electric compressor. The compressor is the regular street car type with a capacity of 50 cu. ft. of free air per minute. It is entirely automatic in its operation, uniform pressure being maintained at all times in the reservoir.

The entire operating, interlocking and signal system was designed and installed by Geo. P. Nichols & Bro., Chicago, from general specifications prepared by Waddell & Hedrick, designers of the bridge.

Effects of Work and Heat on the Quality of Rivets.

At the July meeting of the Academy of Science (France) Mr. C. Fremont presented a note in which he discussed the quality of rivets used in bridges, structural work and boilers.

In order to properly investigate the subject he took seven specimens of Swedish iron, from those in common use, having a tensile strength of 47,000 lbs. per sq. in. and six pieces of steel whose strengths varied from 50,000 lbs. to 78,000 lbs. per sq. in. Three specimens were taken from each of the seven samples intended for tensile and bending stresses, both static and dynamic. One of these three pieces was tested in its original condition, that is to say, just as it was cut from the bar and without receiving any treatment whatsoever either thermal or mechanical; the second was heated in the forge to the temperature at which rivets are usually driven, that is to say from 1,650 deg. to 2,000 deg. Fahr., but received no mechanical treatment; finally the third specimen was made into a rivet, then driven hot by a machine under a pressure of about 55,000 lbs. and then completely removed so that it could be used like the two preceding specimens for the various tests of tension, bending, etc.

The following table gives the results of these tests, and it may be stated that the metal after having been subjected to mechanical contraction in cooling under tension is visibly improved.

The result of the shock tests upon these bars shows that their brittleness was not increased, so that the increase of tensile strength did not have the effect of temper as might have been supposed.

		Limit of elasticity.	Ultimate strength.	Reduction of area per cent.	Resistance to shock.
Swedish iron	Natural.	23,343	47,678	0.55	24,123
	Heated.	23,343	47,678	0.49	26,961
	Riveted.	36,894	61,585	0.54	25,542
Mild steel (marine q'lity)	Natural.	27,671	50,658	0.65	31,218
	Heated.	23,910	49,665	0.63	36,894
	Riveted.	36,894	61,585	0.66	34,056
Mild steel (structural)	Natural.	32,979	64,565	0.62	85,140
	Heated.	34,056	60,591	0.61	28,380
	Riveted.	49,026	78,471	0.59	14,190
Nickel steel (3%)	Natural.	39,023	62,578	0.63	31,218
	Heated.	31,928	59,798	0.65	26,961
	Riveted.	56,760	81,451	0.62	38,313
Semi-hard steel (marine)	Natural.	34,766	69,531	0.57	85,140
	Heated.	31,928	68,538	0.59	70,950
	Riveted.	56,760	92,235	0.59	11,352
Nickel steel (5%)	Natural.	42,570	70,524	0.66	32,637
	Heated.	44,911	70,524	0.64	31,218
	Riveted.	75,491	103,303	0.64	41,151
Semi-hard steel (German)	Natural.	42,570	77,477	0.64	14,190
	Heated.	41,151	79,464	0.65	14,190
	Riveted.	52,148	90,390	0.61	31,218