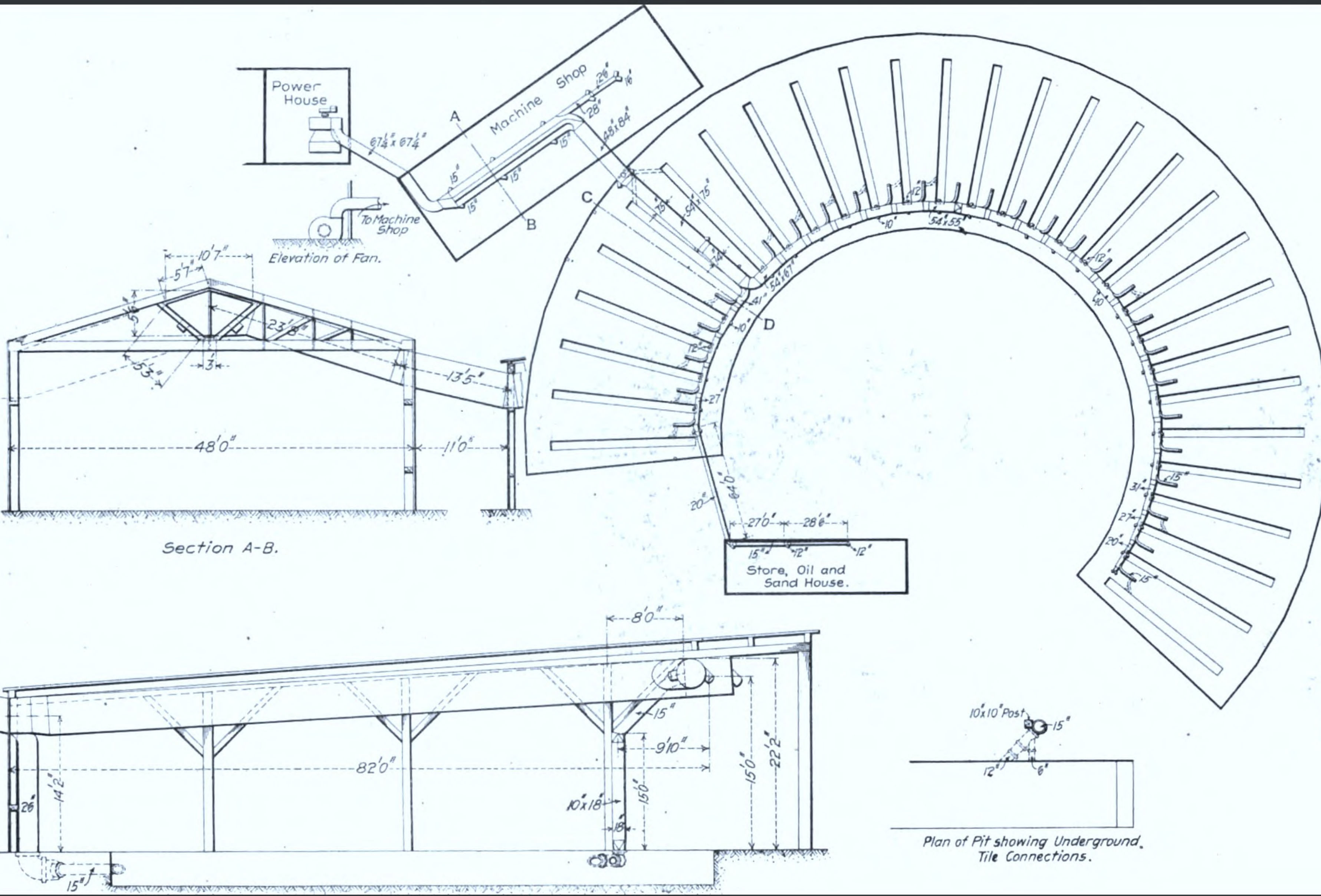

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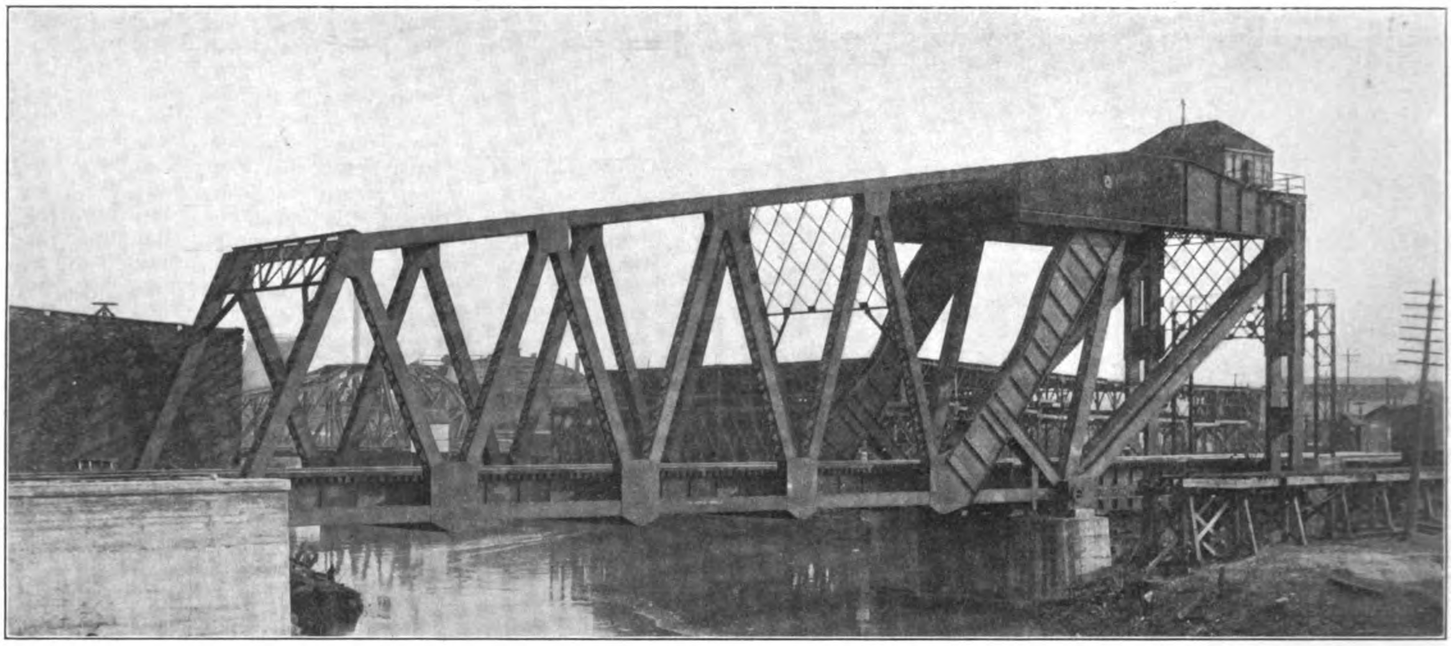
Page Single-Leaf Double-Track Bascule Railroad Bridge over the Chicago River.

BY A. B. EKSTROM.
Assistant Engineer, Chicago & Alton.

In connection with certain improvement work being done to the south branch of the South Fork of the Chicago river it was decided early in 1904 by the owning railroads to replace the old swing bridge at Bridgeport with a bridge of the bascule type to give a clear channel of 100 ft. at right angles to the general direction of navigation. After considering several designs of this type it was finally decided to adopt the single-leaf, double-track bridge of the Page design as being the most economical in cost of construction. The bridge was built jointly and is used by the Illinois Central, the Atchison, Topeka & Santa Fe and the Chicago & Alton railroads. It is also used, under rights granted by the Illinois Central, by the Wisconsin Central. The design and erection were done under the supervision of the Chicago & Alton. The bridge crosses the river at an angle of 68 deg. 30 min. and made necessary a leaf of 150 ft. span to give the required clear channel of 100 ft.



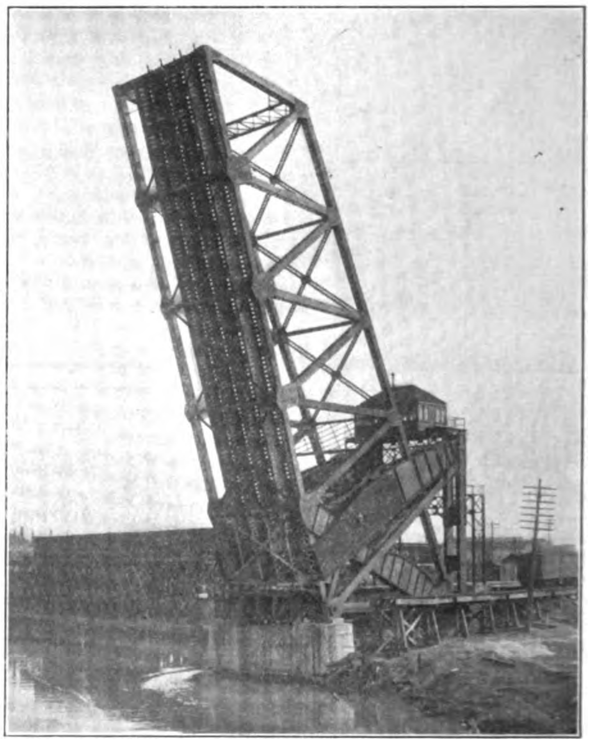
Page Single-Leaf, Double-Track Bascule Railroad Bridge Over the Chicago River.

Work was commenced on the substructure in March, 1905, and was practically completed by the end of December of the same year. The east abutment and the west river pier were located so as not to interfere in any way with maintenance of traffic over the old bridge, the grade and alinement of the new bridge being the same as the old. The east abutment of the new work was located back of the old center pier, while the west river pier was located back of the old pier which supported the end of the swing bridge and deck plate girder approach spans. The east abutment rests on a hard-pan foundation at minus 22½ ft., Chicago city datum, the wing walls of this abutment being connected up to the retaining walls of the track elevation embankment at a point about 53 ft. back from face of abutment.

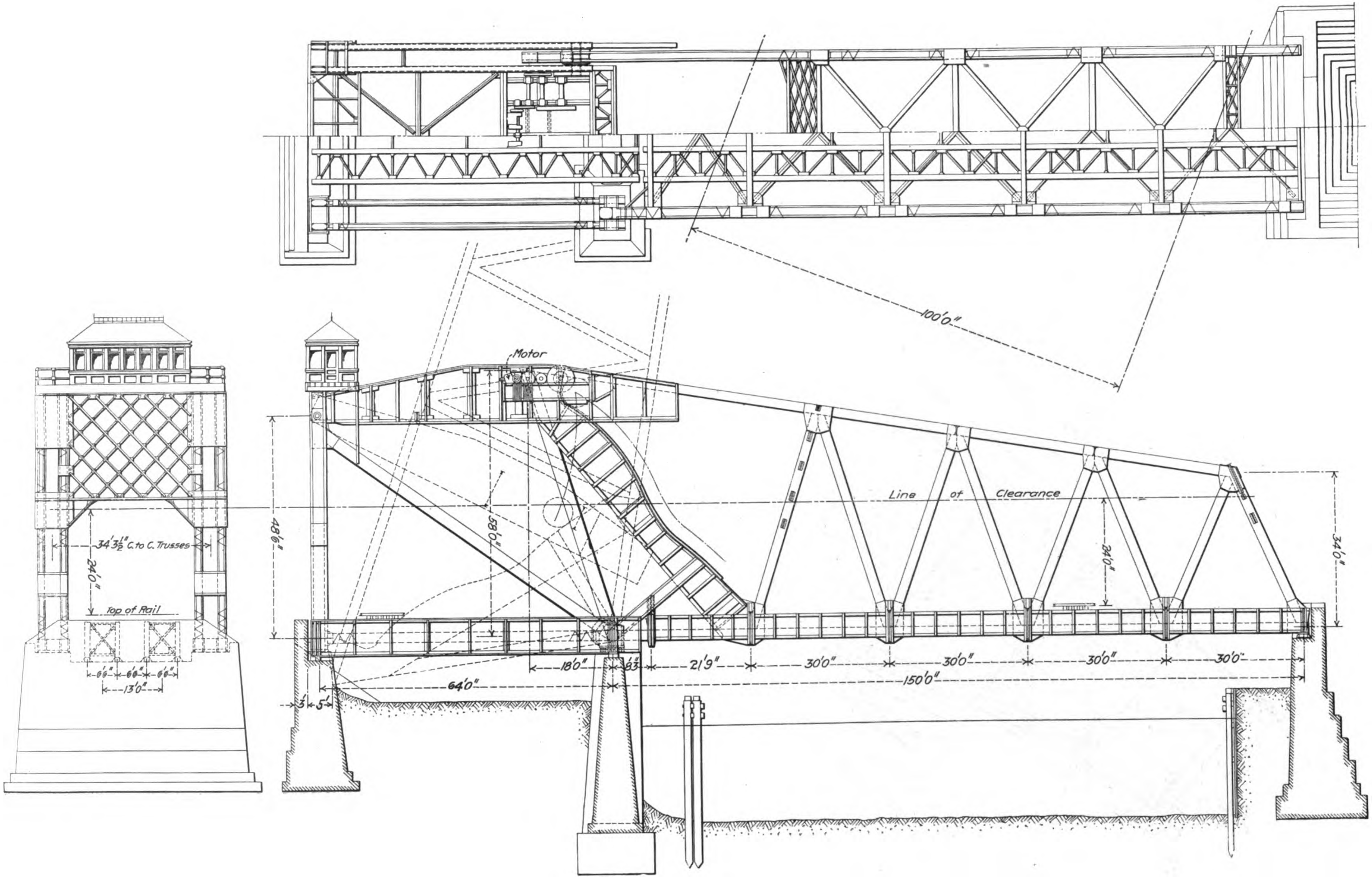
The west-river pier also rests on a hard-pan foundation at minus 27½ ft. Several difficulties were encountered in making excavation for this pier due to water breaking through under the foundation of the old pier, which consisted of grillage resting on piles at about minus 12 ft. After several attempts to stop the leakage it was finally decided to drive Friestedt steel sheet piling inside of the old pier, and after this was done no further difficulties were encountered. The maximum load on the foundation of this pier as designed is about 6,000 lbs. per square foot. Practically no settlement has occurred up to the present time.

The extreme west abutment rests on a hard clay foundation at minus 13½ ft. This abutment, in addition to supporting the embankment, acts as an anchorage to resist the uplift of the superstructure acting as a cantilever under its dead load when in a nearly horizontal position. The substructure, including the wing walls on the east side, comprised a total of about 3,200 cu. yds. The total cost of the new substructure and removal of old substructure, of dredging the channel to a depth of 21 ft. and providing timber protection, was about $50,000.

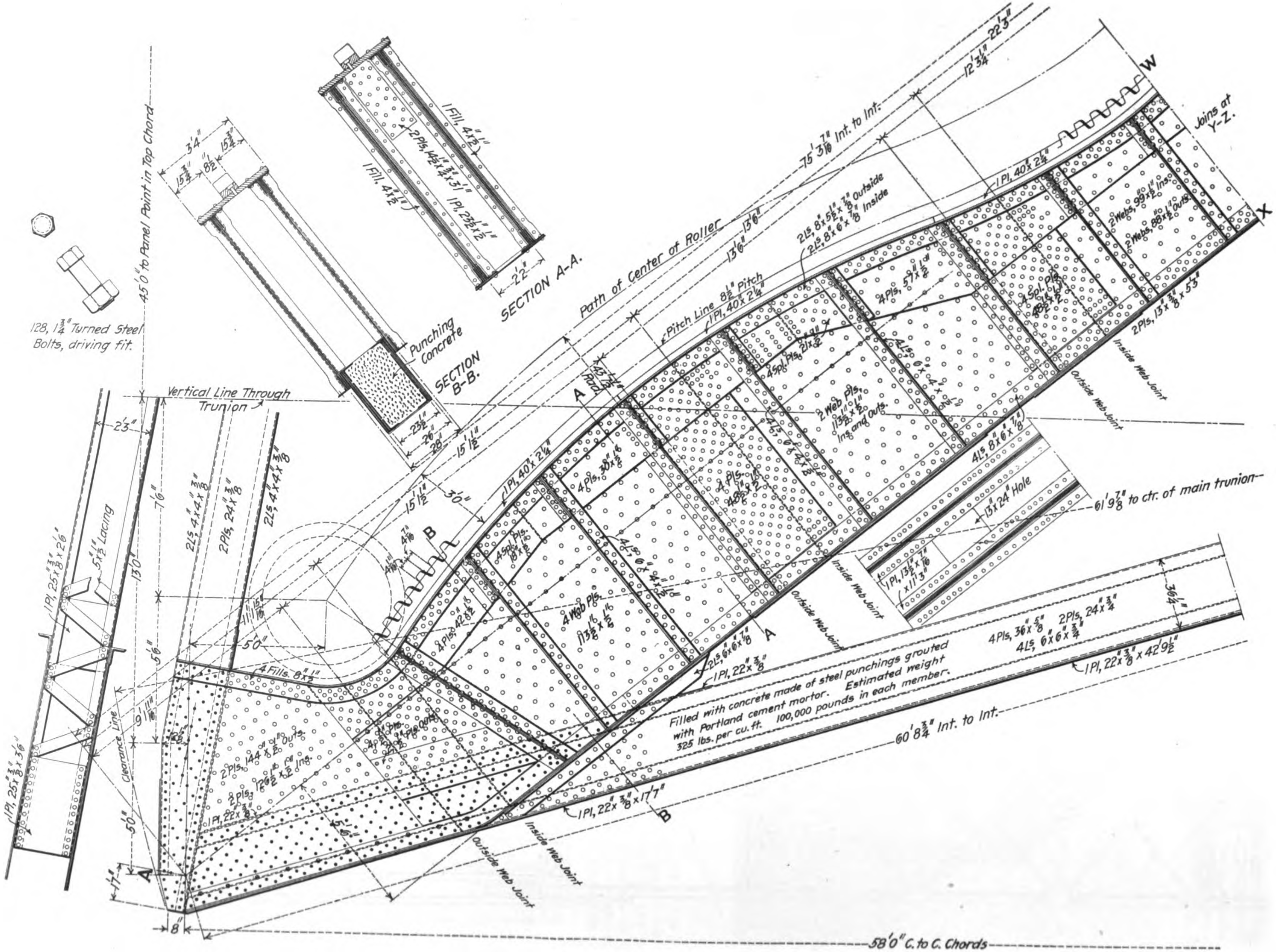
The superstructure consists of a single leaf of 150 ft. with an approach span of 64 ft., and designed to carry on each track a moving load of two locomotives weighing 192½ tons each, followed by 5,000 lbs. per lineal foot. The most important feature of the design is that all movable parts are theoretically in balance during operation, the only power required being that to put the bridge in motion and overcome the effect of wind and friction. The girders carrying the counterweight are hinged each on a pin near the top of the vertical end posts, and the opposite ends of the girders rest on a shaft which carries the load to rollers running on the rack girders. In designing the bridge, the drop of the counterweight girders was made such as to give a clear headroom of 17 ft. for the movement of trains during erection, which necessarily had to be in nearly vertical position. The main driving pinions are keyed to the roller shaft, each being between a pair of rollers, and engaging the rack mounted centrally on the rack girder. To the end of the roller shaft on the inside of the counterweight girder is attached the main driving gear, from which a train of gears leads down to the motor operating the leaf. The gearing and motors are supported on longitudinal girders, these being connected to cross girders which are attached to the inside counterweight girders; the machinery, motors and the girders supporting them thus serve as part of the counterweight. The remainder of the counterweight required on the inside girders consists of concrete placed on buckle plates riveted to the machinery girders. The counterweight on the out-



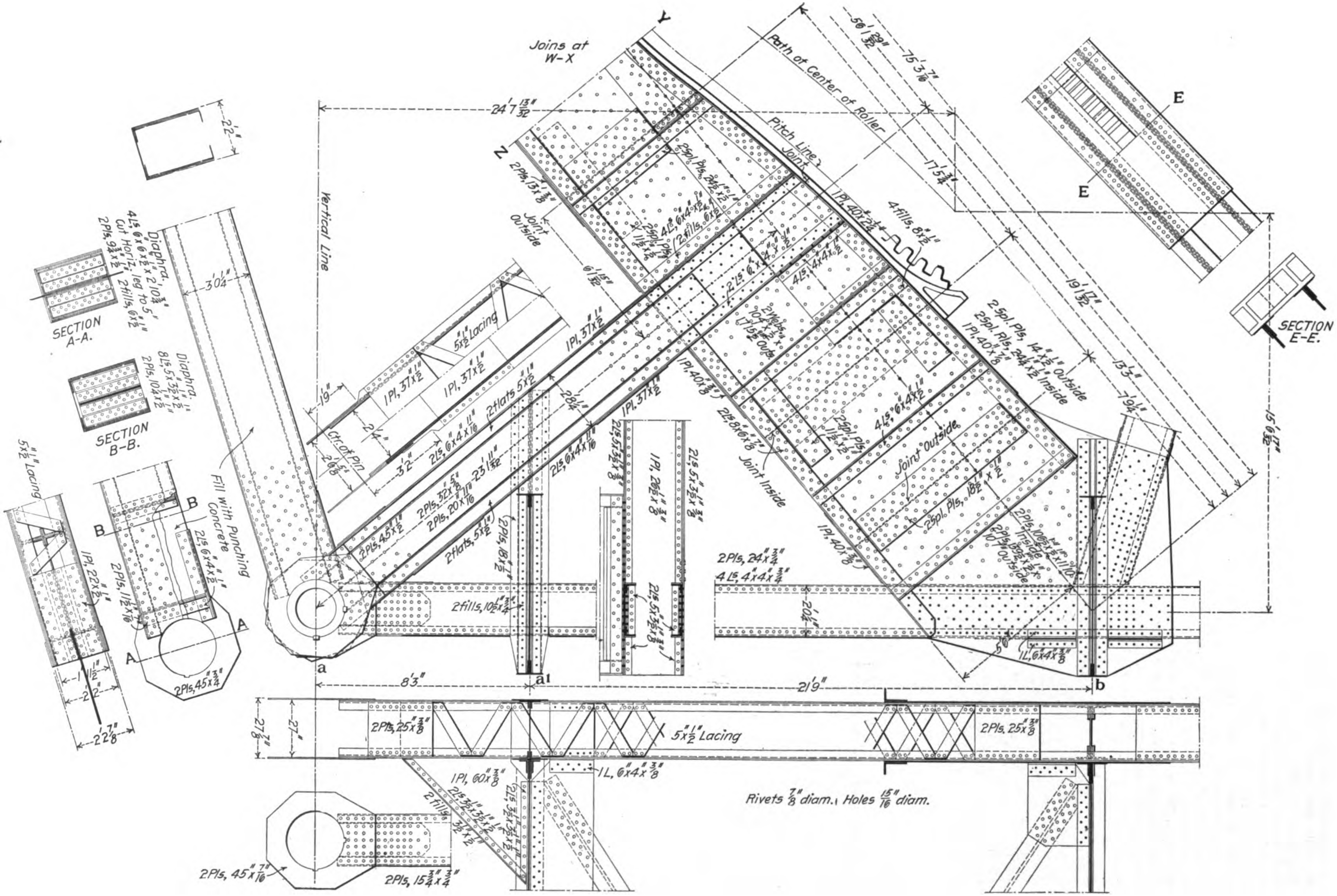
Page Bascule Bridge in Open Position.



Details of Superstructure; Page Bascule Bridge.



Truss Details; Page Bascule Bridge.

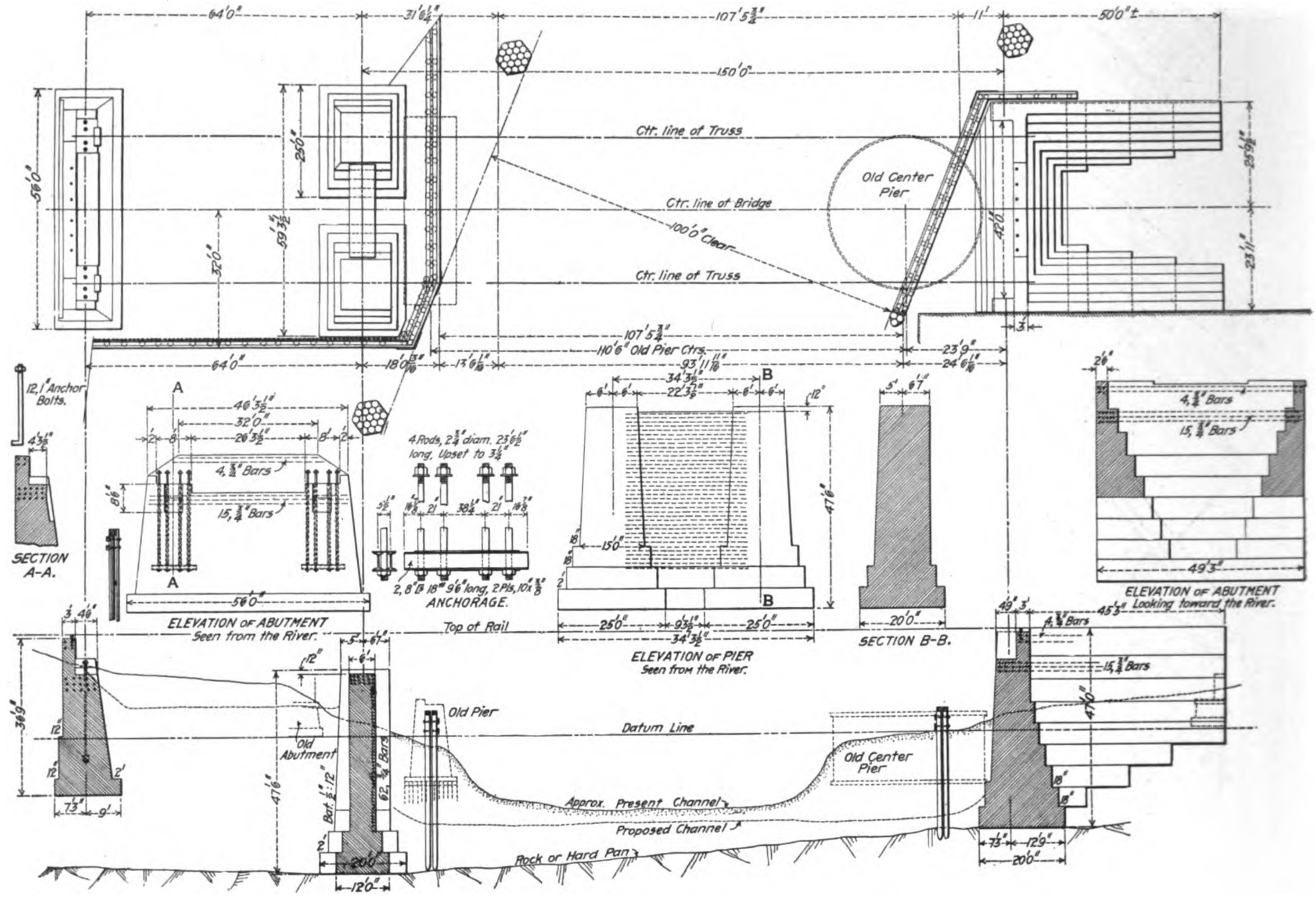


Truss Details; Page Bascule Bridge.

side girders consists of cast iron blocks bolted to the webs, the blocks so distributed that the load is practically equal on each of the rollers. The bearings for the trunnions, roller shafts, rollers and the rear pins on which the counterweight girders are hinged are phosphor bronze, and all shaft bearings are babbitt metal. The total cost of the superstructure, including the erection and electrical equipment, was about $115,000.

The bridge is moved by two 125 h.p. railway type motors, connected to a series-parallel controller in the main bridge tender's house, which is mounted above the tracks over the vertical end posts. An indicator consisting of a number of electric lamps is placed in view of the tender and shows the position of the bridge in four consecutive positions during the operation, by lighting or extinguishing the different lamps. This is accomplished through a specially designed contact device connected mechanically to the leaf. time. The work of dismantling the old draw span, however, proved so difficult, owing to rusted pin connections with worn false shoulders, that there was actually an interval of 24 hours and 50 minutes before the first train crossed the new structure. Prior to the change the bridge could be operated backward and forward through part of its arc, which enabled the operation to be thoroughly tested before making the change. An all-electric interlocking plant is now being installed for the safe handling of trains.

The bridge was designed by W. M. Hughes, Consulting Bridge Engineer, Chicago, under the Page and Schnable patents. The American Bridge Co., New York, was contractor for the superstructure, the steel work being fabricated at the Lassig plant of that company in Chicago. G. P. Nichols & Bro., Chicago, installed the electrical equipment. The Thomas Phee Co., Chicago, was contractor for the substructure, and the Kelly-Atkinson Construction



Details of Substructure; Page Bascule Bridge.

The operating motors are each provided with a magnetic brake. The brakes are automatically applied at the time of stopping the motors at any point and released when the motors are in operation. The locking of the bridge in place is effected by means of two wedges moving horizontally at the extreme end in the center of the lower chords. These wedges in turn slide under rollers mounted in upright standards that are anchored in the abutment, and in operating tend gradually to draw down and lock the bridge into place. The end lock is operated by a 3-h.p. enclosed type motor near the end and supported on a platform between the stringers under the tracks. The position of the end lock is shown to the tender by an indicator similar in design to that showing the positions of the operating leaf. The switchboard in the tender's house carries the necessary complement of instruments, including circuit-breakers, cut-outs, switches, etc.

While the bridge has been in operation only a comparatively short time, it has been fully demonstrated that the amount of power provided in the motors is more than ample, though some difficulty has been experienced in securing the constant voltage requisite to their satisfactory operation, current being taken from a trolley line nearly a mile distant. Tests made before the machinery and moving parts had time to get smoothed up showed that the bridge requires approximately 70 h.p. to raise or lower, the complete movement, with the motors connected in series, being performed in either direction in about 90 seconds.

Preparatory to putting the new bridge into commission, arrangements were made to detour all trains for a period of 24 hours, though it was confidently expected that 10 hours would be sufficient Co., Chicago, for the erection of the superstructure. The work was carried on under the direction of W. D. Taylor, Chief Engineer of the Chicago & Alton, the writer being in immediate charge of the construction.

Rest Houses on the Baltimore & Ohio.

The first appropriation by a railroad company for the founding of an employees' relief association was made by the Baltimore & Ohio in 1880. This company, too, has been liberal in providing in other ways for the comfort of its employees. Formerly at many of its division points there were poor accommodations or none at all for train crews while waiting over for their return runs. In order that the expense and temptations of public hotels and boarding houses might be avoided by the employees, the Baltimore & Ohio has established at ten different division points—Brunswick and Cumberland, Md.; Keyser, Grafton and Fairmont, W. Va.; New Castle Junction, Pa.; Cleveland, Lorain and Chicago Junction, Ohio, and South Chicago, Ill.—rest houses, where the men can secure good accommodations at no more than the cost to the company. In these rest houses trainmen can get clean and comfortable beds and tub and shower baths for the cost of laundering the linen and towels. There are also libraries with reading matter and games. Restaurants are also run by the company in connection with the rest houses. In order to insure the best of service throughout, the rest houses have recently been placed under the supervision of the superintendent of hotels, who is to manage them as carefully as the hotels open to the public controlled by the Baltimore & Ohio.

Co. The tender has a fuel capacity of 9½ tons of coal, and the tank contains 5,500 gallons.

The builders feel that the duplication of an order for compound locomotives is of interest, as proving that these engines, when properly maintained and handled, are successful and economical. The fact that the new locomotives are equipped with the Walschaerts motion is also of interest, as indicating the increasing favor with which this gear is regarded. A few of the principal dimensions are here offered for reference.

Boiler—Type, wagon top; material, steel; diam., 64 ins.; thickness of sheets, 11/16 & ¾ ins.; working pressure, 210 lbs.; fuel, soft coal; staying, radial.
Firebox—Material, steel; length, 120 ins.; width, 41⅞ ins.; depth, front, 75½ ins.; back, 68¼ ins.; thickness of sheets, sides, ⅜ ins.; back, ⅜ ins.; crown, 7/16 ins.; tube, ½ ins.
Water Space—Front, 4 ins.; sides, 3 ins.; back, 3 ins.
Tubes—Material, iron; wire gauge, No. 11.
Driving Wheels—Outside diam., 66 ins.; journals, main, 10 x 10½ ins.; others, 9 x 12 ins.
Engine Truck Wheels—Front diam., 30 ins.; journals, 5½ x 12 ins.
Wheel Base—Driving, 12 ft.; total engine, 26 ft.; engine and tender, 55 ft. 2 ins.
Weight—On driving wheels, 125,000 lbs.; on truck, front, 45,000 lbs.; total engine, 170,000 lbs.; with tender, about 280,000 lbs.
Tender—Wheels, diam., 33 ins.; journals, 5 x 9 ins.; service, passenger.

Bascule Bridge on the C. & A.

If you have ever stepped on the upturned pointed end of a crowbar and seen the handle rise up or if you have ever put your foot on the edge of a barrel hoop and brought the circle up standing, you may easily get in a general way some idea of the principle upon which the Page Bascule Bridge on the Chicago & Alton works. This bridge was built under the direction of Mr. W. D. Taylor, chief engineer of the Alton.

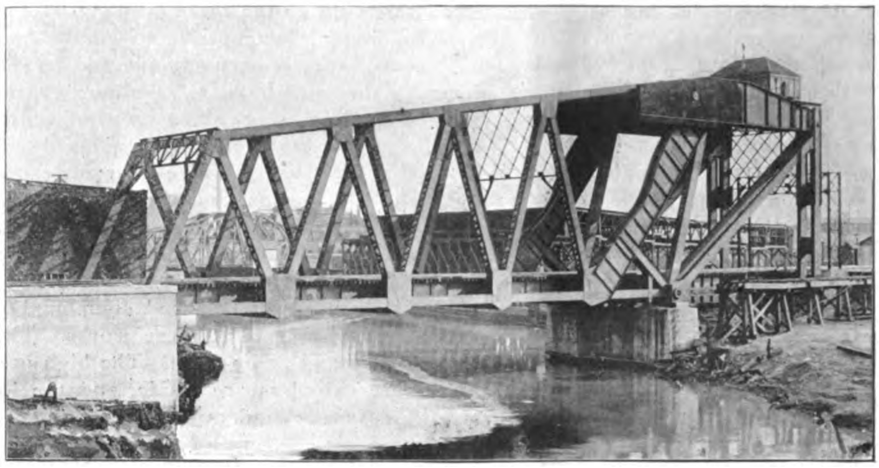
The bridge is of the bascule type, and this word bascule is French for seesaw. This kind of structure is practically a counterweighted draw bridge so arranged that when the weight goes down the footway goes up, and vice versa. The bridge of which we write is at Bridgeport, Chicago, and not only carries trains of the Chicago & Alton, but also those of the Illinois Central, the Atchison, Topeka & Santa Fe, and the Wisconsin Central over the Chicago river. It contains a double track.

The bridge itself is a heavy open truss through bridge, sometimes called the movable leaf, and it is hinged on one abutment. When the bridge is moved it does not roll up on a curved base after the manner of a rocking chair as some bascule bridges do. This one turns on a pivot or pin and swings directly up or down just like the motion of trap door. The lower chord is a strong stiff girder, and the top chord slopes up from the small end to the base, if we may so call the pivot end, for this bridge is frequently put in a position standing on end like a tower. For this reason the top girder and the diagonal braces are made heavier and stronger than would be necessary with an ordinary railroad bridge of the same span.

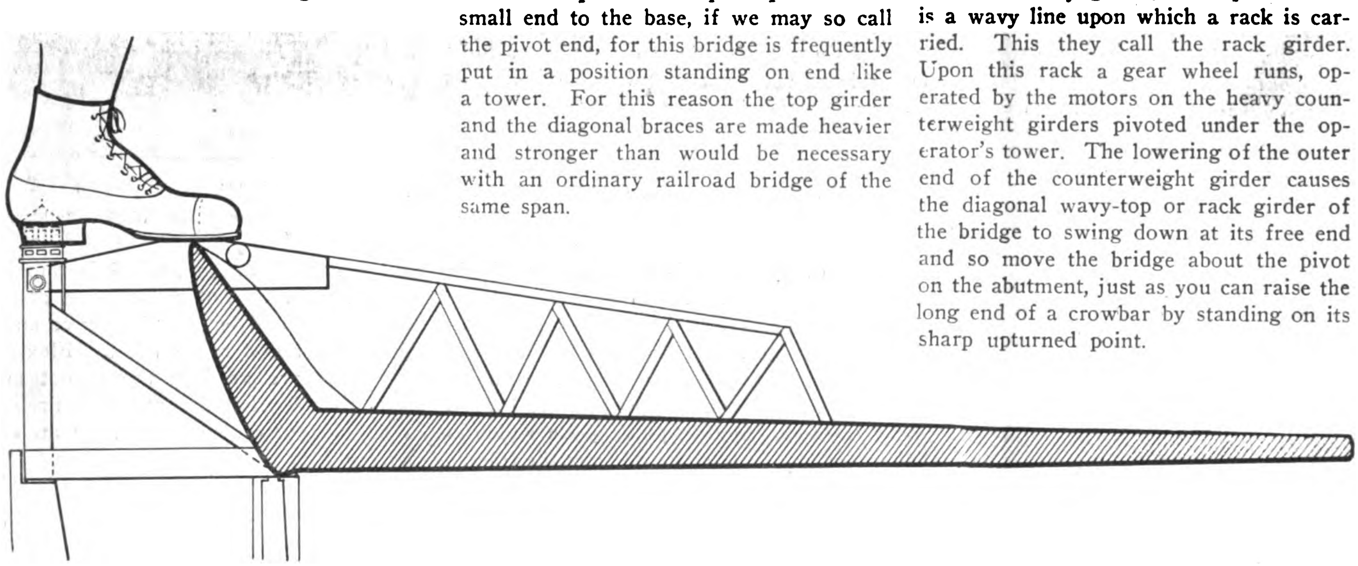
The operator's tower is on top of 4 upright posts, the nearest 64 ft. back of the pivot abutment of the bridge, and these posts are 48 ft. 6 ins. high. Immediately under the tower and supported by these upright posts is the pivot of a pair of heavy horizontal girders; the ends farthest away from the pivots carry cast iron weights. This is a counterweight girder. Between these heavy girders and mounted on a suitable frame is placed the electric motors and gears used in operating the bridge. About 60 h. p. is consumed in the work, and the time required for opening is one minute, and the same time is occupied in closing. The bridge is placed diagonally over the river and is 150 ft. span, giving a clear 100 ft. channel below. The line of clearance through the bridge is 24 ft. above rail level.

The operation of opening and closing the bridge is effected in a very ingenious way. Placed diagonally between the top and bottom chords of the bridge on each side is a heavy girder, the top of which is a wavy line upon which a rack is carried. This they call the rack girder. Upon this rack a gear wheel runs, operated by the motors on the heavy counterweight girders pivoted under the operator's tower. The lowering of the outer end of the counterweight girder causes the diagonal wavy-top or rack girder of the bridge to swing down at its free end and so move the bridge about the pivot on the abutment, just as you can raise the long end of a crowbar by standing on its sharp upturned point.

The form of curve employed in making the wavy line on the rack or diagonal connecting girder at what we have called the base of the bridge when it stands on end, is designed with a particular purpose in view. Mr. W. M. Hughes of Chicago, the consulting bridge engineer



BRIDGE IN POSITION FOR THE PASSAGE OF TRAINS.



BRIDGE RISES AS THE COUNTERWEIGHT GOES DOWN JUST AS THE CROWBAR COMES UP WHEN THE TOE OF THE BOOT IS PRESSED DOWN WITH THE HEEL AS FULCRUM.

from whose designs the bridge was made, writes us as follows concerning this curved or wavy line. He says:

"The curve of the rack girder is so formed as to keep the movable leaf or movable part of the bridge in equilibrium in any position so that the only power required to operate is that necessary tc start the bridge in motion and to overcome wind and friction. In the case of the C. & A. bridge, the center of gravity of the movable leaf is 42 ft. 9 ins. horizontal distance and 18 ft. 2 ins. vertical distance from the center of the trunnion. The total weight of the movable leaf, multiplied by the rise of the center of gravity, divided by the drop of the counterweight, equals the amount of the counterweight required to keep the bridge in balance, and in this case the rise and fall are equal. The curve reverses near the lower end; this is at a point where the center of gravity passes a vertical line through the center of the trunnion. Here the counterweight comes into action to prevent the bridge from dropping back, and on the reverse assists in lowering it to a horizontal position."

When it is desired to raise the bridge the driving gear is put in motion and the two gears which engage with the racks begin to move. This causes the weighted girder carrying the motors, etc., to go down as the gears traverse the rack and the bridge is raised by the pull of the gear wheels as they move along the rack girder. The fact that the heavy girder carrying the cast iron weights also carries the motor, gears, shafts, etc., adds their weight to the others and so an effective counterweight for the bridge is economically secured.

The bridge is locked by means of two wedges moving horizontally at the end and in the center of the bottom chords. These wedges slide under rollers mounted on uprights which are anchored to the abutment, so that locking the bridge tends to gradually draw the bridge down during the operation. The end lock is worked by a 3 h. p. motor carried on a platform under the track.

Welding a Mud Ring.

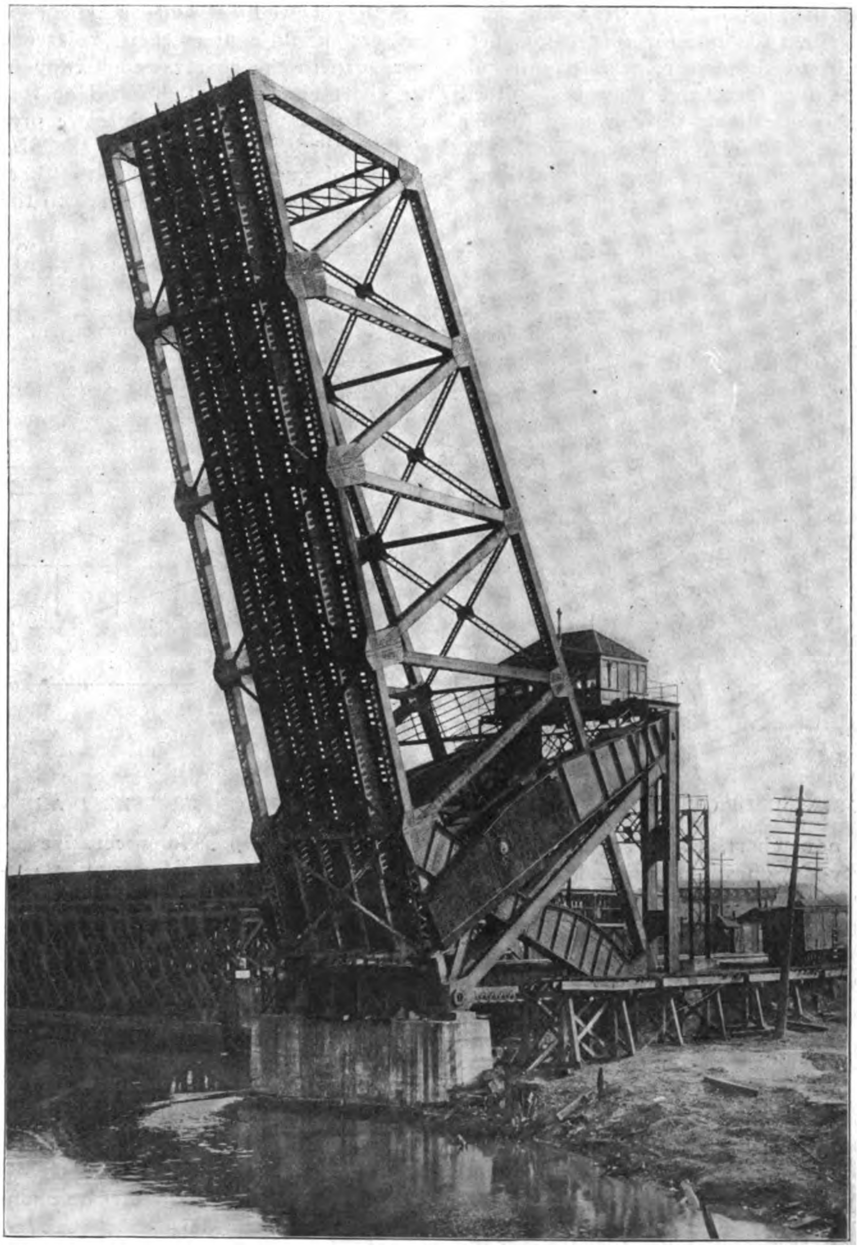
Not long ago an interesting piece of work was done at the St. Augustine shops of the Florida East Coast Railway. It was the welding of a broken mud ring without removing it from the boiler, and without any serious dismantling of the engine.

When the work came to be done it was necessary to cut a piece out of the throat sheet 10 x 14 in.; also a piece out of the flue sheet 8 in. wide and running up to the top of the grate bars. This did not necessitate bringing the patch into the fire. When this was done a line of 1-in. holes was drilled along the fracture in the mud ring, so as to allow for a free flow of Thermit steel, by which the welding was effected. The ends were then cleaned to a distance of 2 in. from the fracture, after which the ring was expanded 3-16 in. to allow for shrinkage.

A sort of cup of beeswax was shaped up about the fracture in the form of a collar 4 in. wide and 1 in. thick at the middle part.

The operation of welding the mud ring was in accordance with standard Thermit practice. The method adopted for suspending the crucible was cleverly accomplished. This was done by what is commonly known in the shops as an "old man" clamped to the running board bracket of the locomotive, with its arm down. Then a shank was taken from an automatic coupler, drilled, and slipped on to the arm, while another arm with the crucible ring welded to it was placed in the hole drilled in the shank. This arrangement held the crucible in position, and it was possible to adjust it in any position desired.

The ring was heated by means of a gasoline torch for about 50 minutes until it was brought to a white heat, after which the Thermit was ignited and the Thermit steel poured into the mold. The weld was a most successful one in every respect, and it is estimated that the cost of the entire job with sheets replaced did not exceed $75.



PAGE BASCULE BRIDGE ON THE CHICAGO & ALTON.

It is not what people eat but what they digest that makes them strong. It is not what they read but what they remember that makes them learned. It is not what they profess but what they practice that makes them righteous.—*Watchman.*

It's no use calling people to happiness in a sepulchral tone.