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Bascule Bridges Over the East Chicago Canal.

One of the features of the industrial development in the district at the south end of Lake Michigan is the construction of the East Chicago ship canal from the lake to Indiana Harbor, Ind., in order to provide for the delivery of ore at the steel works and to provide water transportation service for the various manufacturing plants and other industries which are being established in and around that city. Near the lake, the canal will cross four railways, the first named being farthest from the lake: (1) Pennsylvania Lines, 2 tracks; (2) Lake Shore & each other): two for the Lake Shore & Michigan Southern Ry. and one for each of the other two railways. These bridges are described in the present article.*

The substructures were designed by the railway companies and consist of concrete piers supported on wooden piles. As there was no navigation, each road constructed temporary "run-around" tracks on a pile and timber structure so that traffic would not interfere with the work of constructing the substructure and erecting the superstructure. Sheet piling was driven to form cofferdams, and the enclosed material excavated to a depth of about 25 ft. The foundation piles were then driven, with the aid of the water jet, and the bridge revolves around (A) it moves backward due to the movement of translation of the roller (B) along the track girder (C) to the position (D). The two rollers (one to each truss) carry the entire weight of the structure when it is in motion or is standing in the open position. When the bridge is in the closed position it rests directly on the forward pin bearings at (E) on the pivot pier, and on cast steel shoes on the other pier. These bearings take the entire live load and part of the dead load with the bridge in the closed position. With the bridge closed, therefore, the roller is free and can be removed and replaced without difficulty. No pit is required to receive the tail or counterweight.

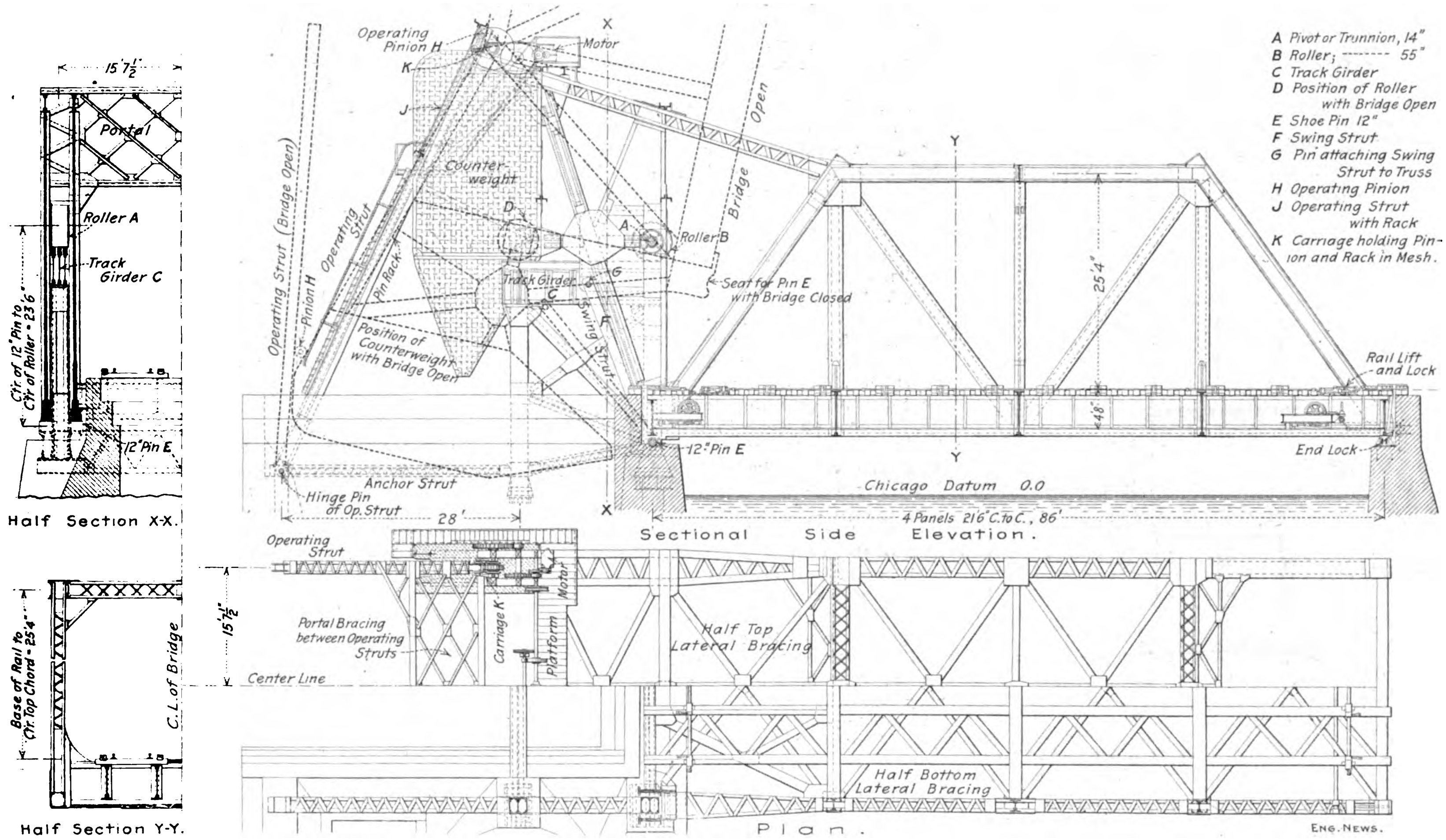

FIG. 1. DOUBLE-TRACK RAILWAY BASCULE BRIDGE OF THE RALL TYPE OVER THE EAST CHICAGO CANAL, NEAR INDIANA HARBOR, IND.
(There are four of these bridges over the canal.)
(Strobel Steel Construction Co., Chicago, Designers and Contractors.)

Michigan Southern Ry., 6 tracks; (3) Baltimore & Ohio Ry., 2 tracks; (4) Chicago, Lake Shore & Eastern Ry., 2 tracks. The canal is being built by the Indiana Harbor Land Co., and the company induced the railways to build drawbridges in advance, so as to avoid interference with the railway traffic and the canal construction in the future. There is, of course, no necessity for operating the bridges at the present time.

The first three railways, after considering the situation, decided to invite tenders jointly. The bascule type of bridge was adopted as the type that would best meet the requirements, and especially the requirement that additional tracks and bridges might be installed at a future time without interfering with the existing tracks and bridges.

Designs and proposals were accordingly invited by Mr. R. Trimble, Chief Engineer of Maintenance of Way of the Pittsburg, Fort Wayne & Chicago Ry. (Pennsylvania Lines; Northwest System). The offers submitted by the various bascule bridge companies and patentees were considered by a committee consisting of the chief engineers and the bridge engineers of the three railway companies, with Mr. Albert Lucius as their Consulting Engineer in this matter. The offer of the Strobel Steel Construction Co., of Chicago, for the Rall patented type of bascule bridge was accepted, as being the most economical and offering certain advantages in efficiency and simplicity of operation. A contract was accordingly awarded to that company for the construction of four double-track bridges (duplicates of

the concrete for the piers was then deposited in timber forms. As the material penetrated was water-bearing sand, some difficulty was experienced on account of the washing away and undercutting of the sand.

Each bridge consists of a double-track, single-leaf, through-truss span, having a length of 86 ft. c. to c. of bearings. The general design of the bridge and its operating mechanism is shown in Fig. 1. The proportioning is in accordance with the specifications of the Pennsylvania Lines, which call for a live load of 60,000 lbs. concentrated weight plus a train load of 5,000 lbs. per lin. ft. of track. The weight of structural material in each bridge is about 313 tons, and that of the operating machinery is about 13 tons. The total rolling load of the bridge is 555 tons.

The special feature is in the swinging arrangement, which is covered by the patents on the Rall system. The bridge is of the movable center bascule type (as distinguished from the fixed trunnion type), and in opening it rolls backward as it swings upward. The pivot (A) is at the center of gravity of the moving structure, and forms the center of rotation. The principle will be understood easily by an examination of Fig. 1. The roller (B) is mounted on the pivot, and as

*The other two bridges are of the Scherzer rolling-lift bascule type. These are (1) the third bridge of the Lake Shore & Michigan Southern Ry. (which road has six tracks), and (2) the bridge of the Chicago, Lake Shore & Eastern Ry. These were built by the Scherzer Rolling-Lift Bridge Co., of Chicago.

The distance of the horizontal travel of the pivot in opening the bridge is just sufficient to keep the tail clear of the masonry when the bridge is in the open position. In these bridges it is about 16 ft. This retractile motion of the bridge permits of the use of a minimum length of span, with a consequent economy in cost.

The counterweight consists of cast iron blocks for its lower third. These are bolted to a steel framework, which is continuous with and an integral part of the main trusses. The upper portion of the counterweight consists of stone-concrete in which pig iron is embedded. The concrete is reinforced with heavy wire meshing and tied together transversely by iron rods. Owing to the concentration of load made possible by the use of cast-iron blocks for a portion of the counterweight, it was found more economical to use them in this instance than to construct the entire counterweight of concrete, though the latter method would be preferable in some cases. Provision is made for attaching additional cast-iron counterweight blocks should changes in the weight of the track rails or other changes in the bridge require such additions. The total weight of the two counterweights of each bridge is about 340 tons.

The tail, or portion of the bridge from which the counterweight is suspended, is 28 ft. long. This is in the form of an irregular polygon, the forward portion of which is a triangular girder in which the trunnion or turning pivot (A) of the truss, is mounted. This pivot is also in the center of gravity and the center of rotation of the movable part of the bridge, as already noted. The motion is controlled by the swing strut (F). This is pivoted on the forward fixed pin support (E), and pin-connected to the triangular girder part of the truss at a point (G) somewhat back of and below the trunnion.

The bridge is operated by means of a pinion (H), mounted on the bridge and meshing into a

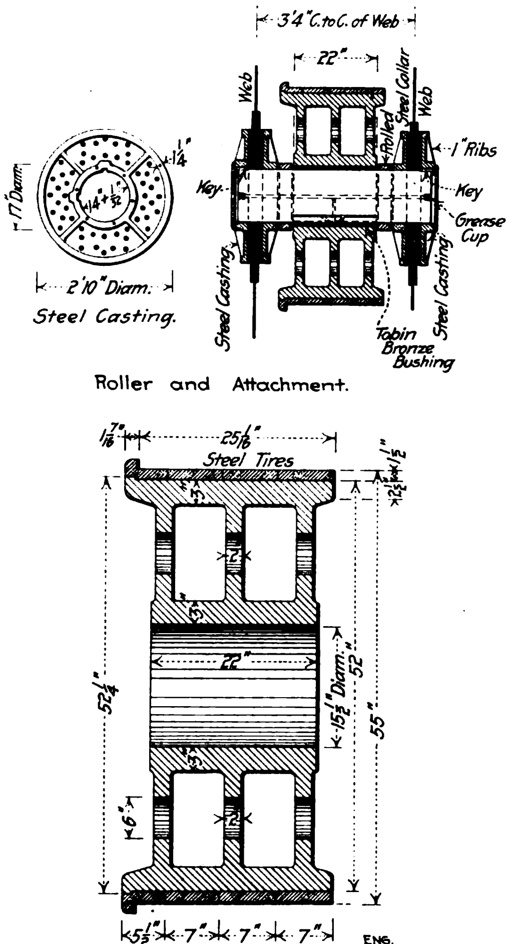

Fig. 2. Roller at Rall Bascule Bridges over the East Chicago Canal.

straight rack on the face of the operating strut (J). The latter is located at the extreme end of the bridge, back of the counterweight. It is hinged at the bottom to the foundation, and is free to move to accommodate itself automatically to the irregular curve described by the pinion in the tail of the bridge while in motion.

This method of applying the power is one of the special features of this design, and is claimed to result in considerable economy, as it avoids all irregular and expensive racks or tracks foı the bridge operation, thus simplifying the work in the office, shop and field. The operating gear is held in mesh by means of a steel carriage (K) which travels along a track on the other side of the operating strut; it is connected with the axle of the main pinion and moves with it.

ROLLERS AND TRACK GIRDERS.—The trunnion (A), about which the bridge rotates, is carried by a roller or wheel (B) which turns around the trunnion. This roller is shown in detail in Fig. 2. It has a cast-iron center, on which are shrunk steel tires 1½ ins. thick. The journal bearing between the trunnion pin and the roller has a ¾-in. bronze bushing (with an easy fit on the pin), and is designed for a maximum pressure of 1,600 lbs. per sq. in. The trunnions are 14 ins. diameter and 4 ft. long. The rollers are 55 ins. diameter. Each roller has a smooth face 25 ins. wide, with a 1¼-in. flange at the outer edge to maintain the alinement of the bridge. The pressure on the roller is 22,000 lbs. per lin. in.

The track on which the roller travels is straight and short. As the operation is controlled by the swing strut (F), previously mentioned, there is no necessity for projecting lugs or cogs to keep the bridge from getting out of position. The track plate (1¼ x 25 ins.) is made continuous and without joints, as shown in Fig. 4. The track girder (which carries the bridge while in motion) has three webs with side plates and six 12-in. channels in the top chord in order to provide proper rivet areas for the large concentrated loads. The girder is filled with concrete. When the bridge is closed, the roller bears but lightly on the track. Consequently the live and dead loads are not carried by the trunnion and track girders, but are carried by the forward pin support (E) and by the bearings at the opposite end of the bridge.

LOCKS.—When the bridge is closed, each truss is secured at the farther end by an end lock. This is a bolt of rectangular shape operated by a transverse shaft which connects both locks and is operated by gearing and a worm-wheel from an independent motor which is controlled by the operator on shore. This apparatus is so designed and interlocked with indicator signals that the operator knows when the locks are either shot or drawn. Should he overlook the signal and fail to stop the operation, the bolts will continue to move in and out without breaking any of the parts.

Each bridge is provided at both ends with rail locks for each track. These are of the standard design of the L. S. & M. S. Ry. for that company's bridges, and of the standard design of the Pennsylvania Lines for the other two bridges. The rail locks for each bridge are so connected by means of levers that they are operated simultaneously. They are moved by an independent motor controlled from the operator's house on shore in the same manner as the bridge locks. Means are provided for operating both the rail locks and bridge end locks by hand if necessary.

MACHINERY EQUIPMENT.—The machinery for operating the bridge is very simple. It consists of three sets of gear wheels connecting with each motor and meshing into the straight rack of the operating strut. All of these gears are of cast steel and are in the rough, except that cut gears are used for the first gear engaging the armature shaft pinion and for the main operating pinion. The motion of the bridges is said to be very smooth, and is practically noiseless, the latter being an important point for city bridges.

Each bridge is operated by two 35-HP., 220-volt, direct-current motors, geared to the main cross shaft. The actual power required to open or close the bridge in one minute under ordinary wind conditions is 25 HP. Thus one motor is sufficient to operate the bridge safely, and the second motor is provided only for emergency purposes. Each motor is equipped with an electric solenoid brake which is normally set by means of a spring, and released by the controller. There is a hydraulic emergency brake on the driving shaft, operated by a hand pump in the operator's house. The rail locks at each end of the bridge are operated by means of a 2½-HP. direct-current motor, and the end lock is operated by a motor of the same size.

A reinforced-concrete platform at the top of the bridge connects the trusses for the convenience of the bridge tender in oiling and caring for the machinery. Access to this is provided by means of a stairway attached to the operating strut and to the side of the counterweight. The main trunnions are lubricated from this platform through gas pipe conduits and pressure grease cups.

OPERATION AND SIGNALS.—The bridge carrying the tracks of the Pennsylvania Lines, being remote from the others, is operated from the railway signal tower adjacent to the bridge. Power is generated in the same building by means of two small dynamos, each driven by a kerosene engine. These units are used to charge the storage battery, from which 250-volt current is taken for the operation of the bridge. The generating and storage battery plants furnish current for the railway company's electric interlocking plant as well as for the operation of the bridge.

The three bridges for the Lake Shore & Michigan Southern Ry. and the Baltimore & Ohio Ry. are operated from one signal tower controlling the tracks of the several railways using the bridges.* The power plant for the operation of the bridges is contained in the same building. This installation is of interest, as provision is made for operating a greater number of drawbridges from one point than has ever been attempted elsewhere. Three-phase alternating current at 440 volts is delivered at the plant by

*This tower provides also for the operation of the third adjacent bridge of the Lake Shore & Michigan Southern Ry. and the bridge of the Chicago, Lake Shore & Eastern Ry. Both of these are of the Scherzer type, as already explained, but will be operated in connection with the Rall type bridges described in this article. The interlocking for the protection of the five bridges as well as the operation of the bridges will be handled from this one tower. The electric interlocking plant is being installed by the General Railway Signal Co.

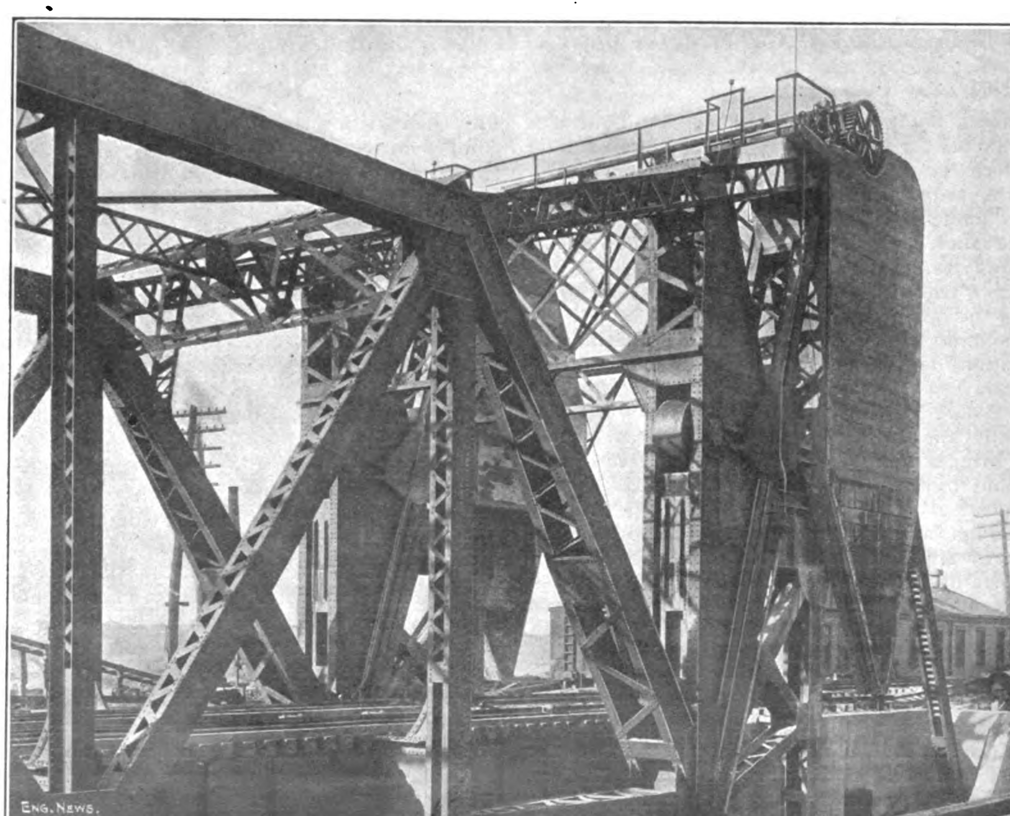

FIG. 3. DOUBLE-TRACK BASCULE BRIDGE (RALL TYPE); PENNSYLVANIA LINES.

(At the right is shown one of the rollers, with the massive girder in which it is carried.)

a power company. Two 40-ampere mercury arc rectifiers transform the alternating current into direct current, and are used for charging a storage battery of 128 chloride accumulator cells. This battery is used for operating the several bridges and for the electric interlocking and signal system governing the tracks crossing the bridges. In addition, a direct-connected motor generator set of 35 KW. capacity is installed. This may be used to operate the bridges or charge the storage battery under emergency conditions, or may be used in conjunction with the storage battery in operating the bridges.

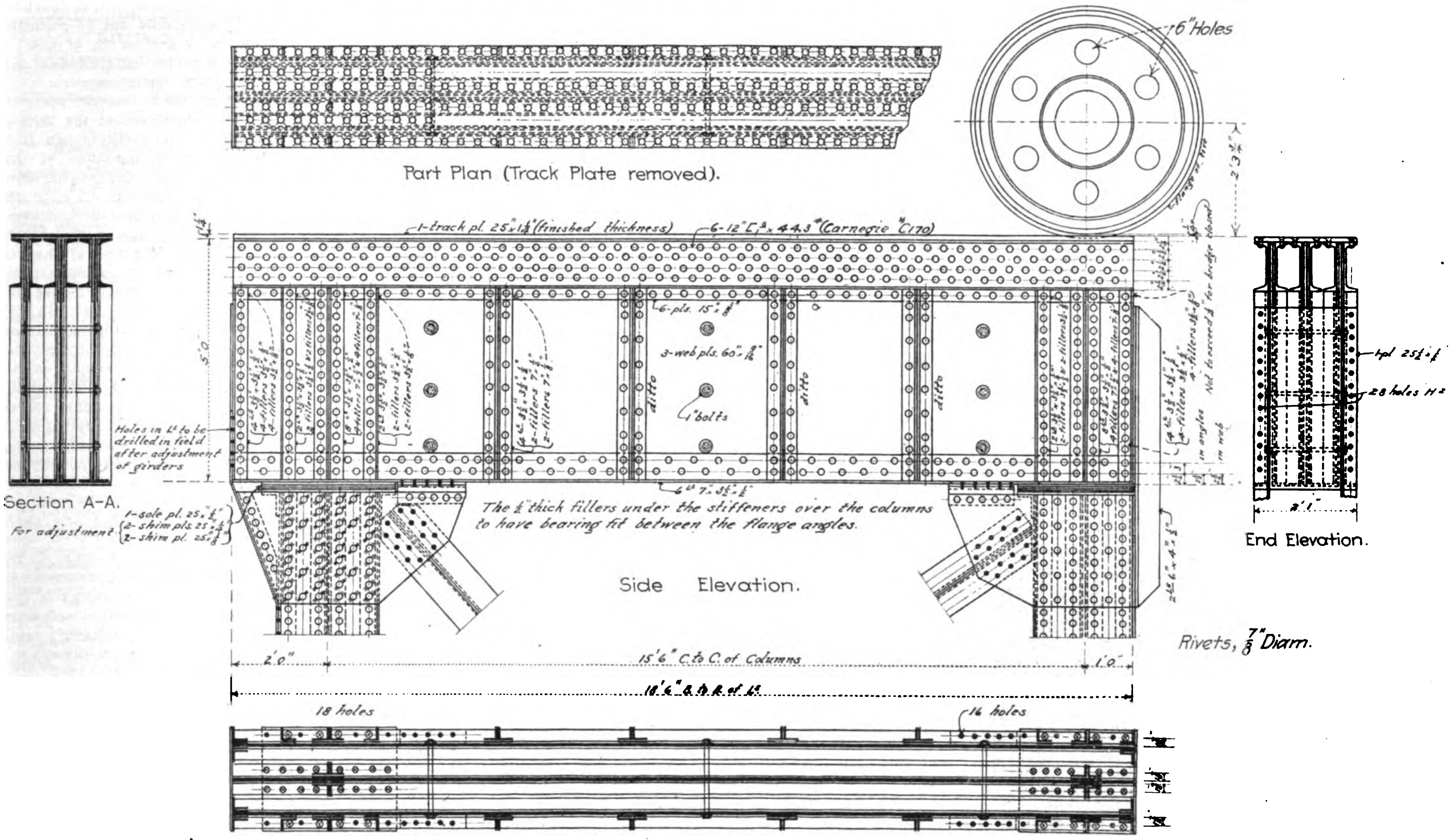

FIG. 4. TRACK GIRDER OF BASCULE BRIDGE.

The storage batteries are installed in the basement of the power-house. The generating plant and a complete switchboard for its control are on the ground floor. The electric signal machines and the controlling appliances for the bridges are on the second floor, from which all tracks and bridges are in clear view. Each bridge has its own switchboard and controllers, and each board has electric indicators showing the operator the position of all devices on the corresponding bridge.

The several motors on each bridge are electrically interlocked with each other and with the signals governing the approaching tracks. Nothing can be done toward opening any bridge until all signals governing the approach tracks are set at the "stop" position. In closing, the signals cannot be set for a clear track until the bridge is closed and locked and the rail locks are set for the passage of trains.

For the guidance of vessels approaching the bridge, there are two river signal lights (one green and one red) at the extreme end of each bridge on either side. These signals have incandescent electric bulbs installed in independent lanterns, and are so arranged that the red light will show while the bridge is in the closed position and throughout its motion. When it reaches its open (or nearly open) position, the lamp in the red lantern is extinguished and that of the green lantern is lighted by the operation of a gravity mercury switch.

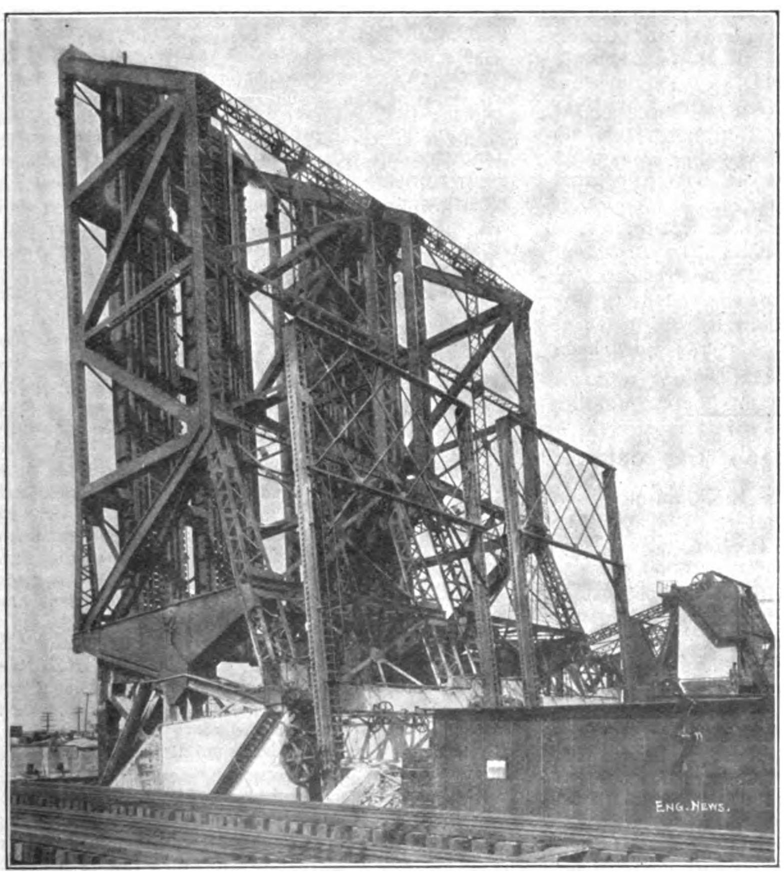

FIG. 5. TWO DOUBLE-TRACK BASCULE BRIDGES (RALL TYPE); LAKE SHORE & MICHIGAN SOUTHERN RY.

(The top of the roller of the left-hand truss may be seen at the middle of the horizontal line of the triangular plate girder.)

The Strobel Steel Construction Co., of Chicago (as contractor for the superstructures), designed the four Rall bridges, prepared all general and detail plans, and erected the superstructures, including the installation of the machinery. The structural steel was fabricated by the Pennsylvania Steel Co., of Steelton, Pa. The machinery was furnished by Geo. P. Nichols & Bro., of Chicago, who also furnished and installed the electric equipment. The railway companies were represented by the following engineers: Mr. Albert Lucius, M. Am. Soc. C. E. (of New York), as their joint consulting engineer; Mr. J. C. Bland, Engineer of Bridges, Pennsylvania Lines; Mr. B. R. Leffler, Engineer of Bridges, Lake Shore & Michigan Southern Ry., and Mr. J. E. Greiner (and later Mr. W. S. Bouton), Engineer of Bridges, Baltimore & Ohio Ry.

Fig. 3 is a view of the pivoted end of the Pennsylvania Lines bridge, showing one of the rollers and the massive girder in which it is mounted. Fig. 5 shows the two Lake Shore & Michigan Southern Ry. bridges in the open position; in this view the top of the roller may be seen above the middle of the horizontal line of the triangular girder in the left-hand truss.

TYPHOID FEVER DEATHS IN CHICAGO for 1908 totaled 338, or at the rate of 15.6 per 100,000. This was 12% below the rate for 1907, about 33% lower than the average for the last ten years, and 91% below the record-breaking figure of 1891, when the appalling rate of 173.8 per 100,000 was recorded. For the nine years since the opening of the drainage canal, the average rate per 100,000 was 21.1, as against 57.7 for the nine years before the canal was opened. According to the bulletin of the Chicago Department of Health for Feb. 20, 1909,

If the pre-channel typhoid rate had prevailed during the last nine years there would have been 10,035 deaths from typhoid fever in that period, or 6,014 more than actually occurred. Figuring on the basis of the legislative value of a human life, this saving represents the sum of $64,140,000 or more than the entire cost of the drainage channel to date.

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ELECTRICALLY OPERATED BASCULE BRIDGES.

By Frank C. Perkins.

The bascule bridges recently constructed at Indiana Harbor, Indiana, by the Strobel Steel Construction Company, of Chicago, may be noted in the accompanying illustration, Fig. 1 and drawing Fig. 2. There were two bridges constructed for the Lake Shore & Michigan Southern Railway, and one bascule bridge of similar type for the Baltimore & Ohio Railway Company, and another for the Pennsylvania Lines West of Pittsburg. They were all built after the Ball design, the double-track railway bascule bridge over the East Chicago canal being built according to the detailed drawing noted in Fig. 2.

Concrete piers supported on wooden piles are used as substructures, and each bridge consists of a double-track single-leaf through-truss span, having a length of 86 feet from center to center of bearing. It is stated that the weight of the structural material in each bridge is more than half a million pounds, while the total rolling load of the bridge is more than a million pounds. The operating machinery of the East Chicago canal bascule bridge weighs about 13 tons, and the total weight of the two counterweights of each bridge is about 340 tons, the tail from which the counterweight is suspended being 28 feet long.

It will be noted from the illustration and drawing that the counterweight is in the form of an irregular polygon, the forward part of which is a triangular girder in which the turning pivot of the truss is mounted, the pivot being the center of gravity as well as the center of rotation of the movable part of the bridge.

The operating machinery of the bridge is very simple, each electric motor being connected with three sets of gear-wheels meshing into the straight rack of the operating strut. There are two 35-horsepower motors utilized for operating each bridge, direct current motors being employed, geared to the main cross shaft and supplied with current from a 220-volt power circuit.

It is stated that one motor is sufficient to operate the bridge safely, as it requires only 25 horsepower to open or close the bridge in one minute. Although this is the actual power required under ordinary wind conditions, as a reserve and for use in an emergency the second motor is provided.

There is an electric solenoid brake provided for each motor which is normally set by means of a spring, while the controller releases the same when the bridge is to be operated.

An emergency hydraulic brake has also been provided on the driving shaft, operated from the driver's house by a hand pump. There is a 2½-horsepower direct current motor utilized for operating the rail lock at each end of the bridge, a similar motor being employed for operating the end lock.

The Pennsylvania Lines bascule bridge is operated by electric power which is generated in the railway signal tower near the bridge. There are two small dynamos installed, each driven by a kerosene engine and supplying current for charging a storage battery consisting of 100 cells or more and supplying a current of 250 volts for the operation of the bridge, as well as for handling the railway company's electric interlocking system.

A signal tower is also utilized for controlling the three bridges of the Baltimore & Ohio Railroad and the Lake Shore & Michigan Southern Railway at Indiana Harbor, the power plant for operating the bridges being installed in the same building. This plant is so arranged that a number of drawbridges may be operated from the same point. An electric power distributing company supplies current for the motors at a pressure of 440 volts, the motors of these bridges being of the direct current type, while the power supplied being of the three-phase alternating current system, the current must be changed in character. There are two 40-ampere mercury arc rectifiers provided to transform the alternating current into a direct current and for charging the storage battery plant, which consists of 128 cells.

At this installation, as well as that previously described, the storage battery plant

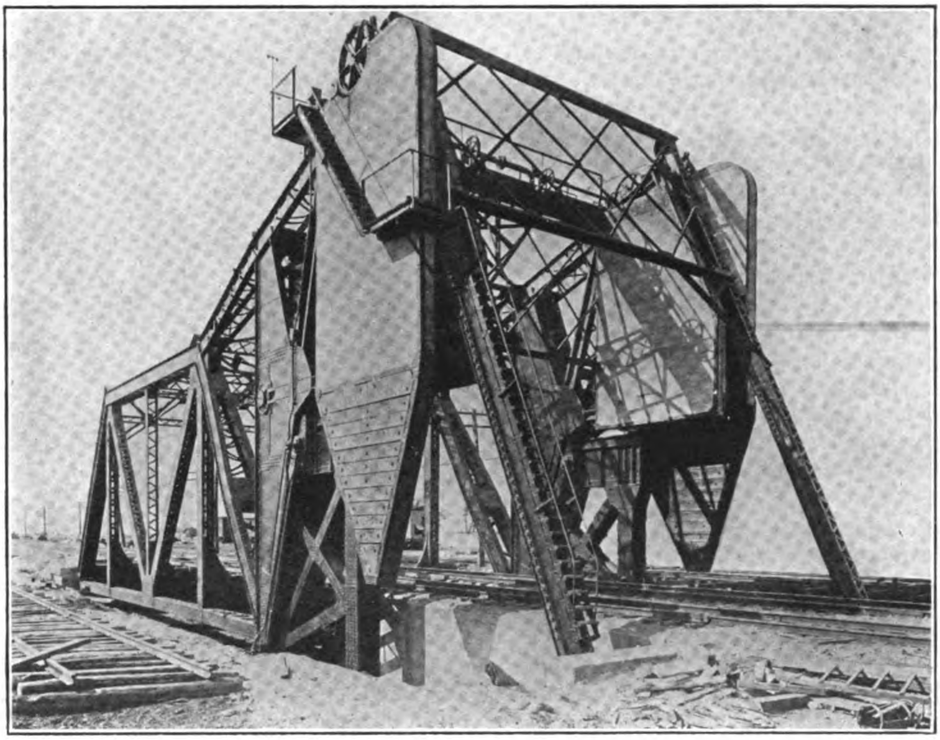

Fig. 1. Bascule Bridge at Indiana Harbor, Ind., designed and built for the B. & O. Railroad Company by Strobel Steel Construction Company. Members of No. 1, Chicago, Ill., were employed.

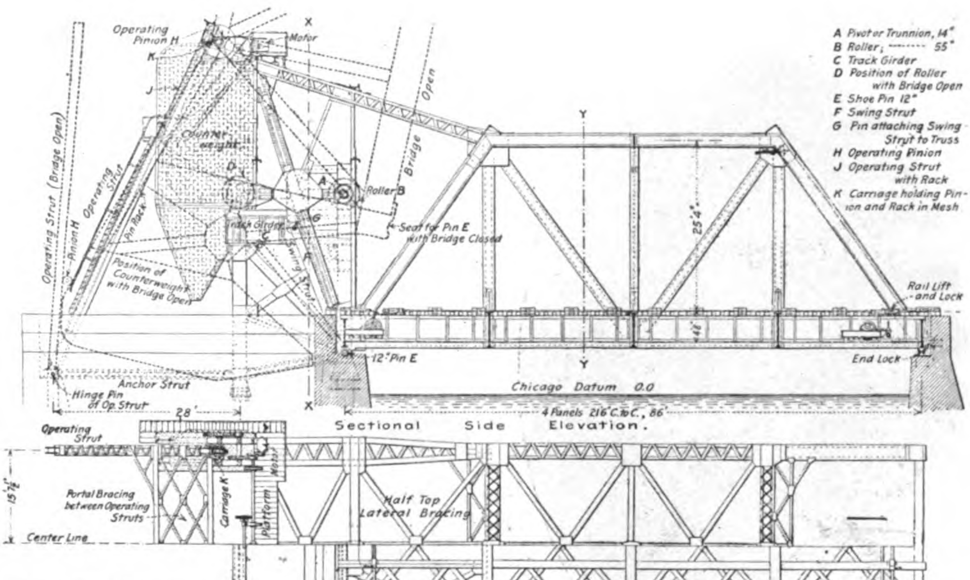

Fig. 2. Plan of double track railroad bascule bridge over East Chicago River.

supplies current for the electric interlocking and signal system controlling the tracks crossing the bridges as well as the electric operation of the bascule bridges.

In case of an emergency, a direct connected motor generator set may be used for supplying the necessary current instead of the storage battery. A 35-kilowatt motor generator set has been installed as a reserve, the whole generating equipment with batteries being placed in the basement of the power house, with the controlling switchboard for the generator and battery. On the second floor are located the controlling apparatus for the electrically operated bridges as well as the electric signal machine, the tracks and bridges being clearly seen from this point.

GETTING UPWARD VIA RAPID PROMOTION.

By H. B. Moyer.

If the average nonunion workman could turn into cash at, say, $100 apiece, all of the gilt-edged, glittering promises made him by his various employers, he would in all probability have to knock off work for a half a day or so and hire a dray to cart his money to the bank. Promises of "promotion, rapid advance in wages, etc.," are some of the good things which he has been handed, and needless to say he has found them all to be gold bricks.

A few years ago the employer found the "promotion" gag a very profitable one. All he had to do was to advertise for workmen, work them on short pay and long-hour schedules until the time came when he could no longer either decently or indecently refuse to fulfill his promise of "promotion," and then turn the flock loose and advertise again. In a nutshell, it was simply the "cheaper-to-move-than-pay-rent" scheme applied in another way.

William E. Quinn, Local No. 40.

With the rapid advance of the labor movement, a new order of things sprang into existence. Experienced mechanics—or at least the sane portion of them—allied themselves with unions, which demanded fair treatment for both mechanics and apprentices, and saw that they received it. Today there is scarcely a trade in existence that is not at least partially organized. Here and there, though, we run across trades which are unprotected by the union card, and as a rule it is in these spots that we find the employer taking most unfair advantage of those working under him or seeking employment at his hands.

In a recent issue of a daily newspaper I noticed the following ads.:

EXPERIENCED ledger keeper, immediately; state age, references and salary. Box 1452.

LINOTYPE operator wanted immediately. $18.00 for first-class man; steady position. Daily News, Chatham, Ont.

Printers and linotype operators are strongly organized; ledger keepers are not identified with organized labor. In the one instance the wages (printers set a minimum scale, but many receive more than that)