Chicago Double-Deck Drawbridge with Elevated Railway

Double-Leaf Trunnion Bascule of 268-Ft. Span—Operating Pinions Engage Racks in Trusses—Massive Truss Members and Supporting Girders

OF THREE double-deck double-leaf bascule bridges built at Chicago within the past six years, forming distinctive structures among the numerous bridges across the Chicago River, the longest is the new Wells St. bridge, shown in Fig. 1, having a span of 268 ft. c. to c. of trunnions and giving a clear channel width of 220 ft. This bridge, put in operation on Dec. 4, 1921, is the second to carry an electric elevated railway on the upper deck. It is of the fixed trunnion type designed some years ago by the city's engineers (but modified by certain patented features, noted later), and is the twenty-third bridge of this type built across the Chicago River. Each leaf is carried by two trunnions and weighs 2,500 tons (1,300 tons of counterweight).

Next in order of span is the 256-ft. Michigan Ave. bridge, opened in 1920, which has an upper roadway for fast or pleasure traffic and a lower deck for commercial vehicles. Its weight is 3,500 tons for each leaf, including counterweight. The third is the 245-ft. Lake St. bridge, opened in 1916, which carries an elevated railway on the upper deck and is in general similar to the Wells St. bridge, with a weight of 2,000 tons per leaf, including the counterweight. Both of these latter structures have two lines of trusses with two trunnions carrying each leaf. The Michigan Ave. bridge is notable in having four trunnions in four lines of trusses, with a spacing of 6 ft. between the middle trusses, but its width is about 90 ft. as compared with 72 ft. for the other two bridges (see *Engineering News-Record*, Sept. 9, 1920, page 508).

Traffic on the old Wells St. swingbridge was maintained during the construction of foundations and superstructure for the new bridge, except that the roadway on the lower deck was closed for some weeks, partly on account of changes in grade on the street approaches. The program of putting the new bascule bridge into service and removing the old swing span with a minimum of interruption to traffic was given in *Engineering News-Record* of Oct. 13, 1921, p. 606. The new bridge was put in service for the elevated railway on Dec. 4. Fig. 6 shows the north leaf completed except for the deck framing in the end panels through which pass the elevated railway and the street.

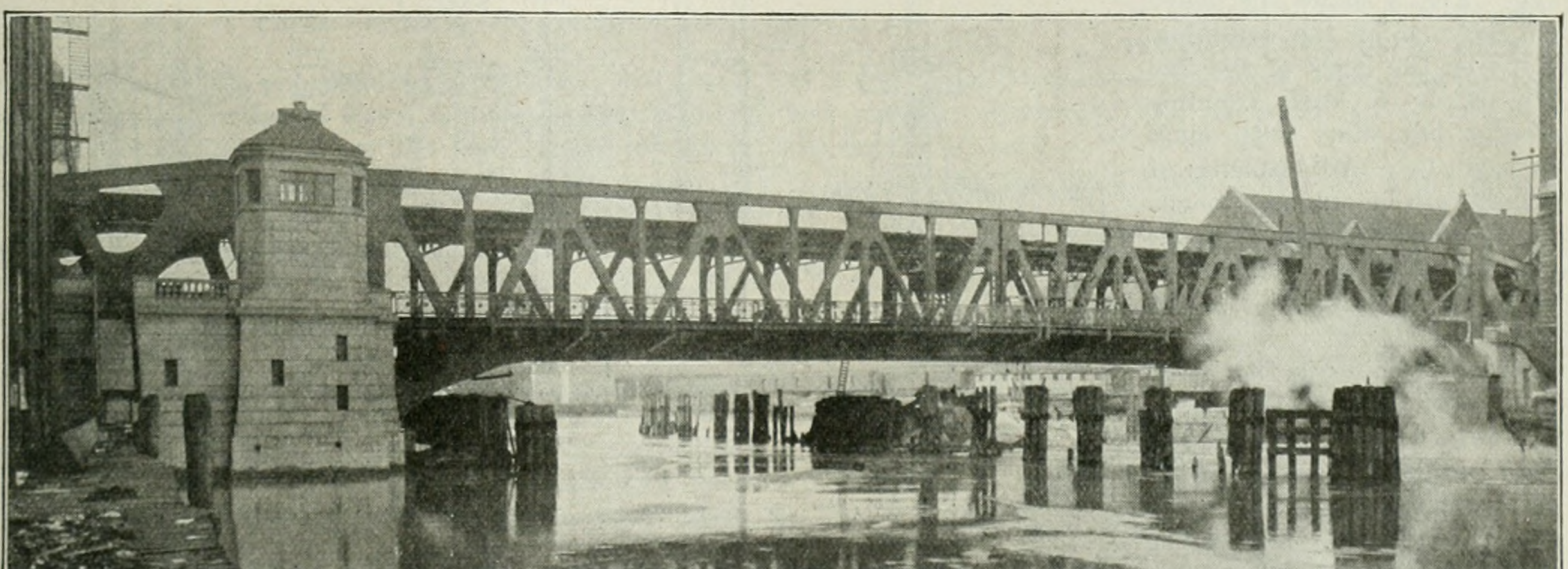


FIG. 1. DOUBLE-DECK 268-FT. BASCULE BRIDGE FOR STREET AND ELEVATED RAILWAY AT WELLS ST., CHICAGO

Deep Concrete Substructure.—For each leaf there is a concrete tailpit or counterweight pit 48 x 48 ft. inside, with its base 31 ft. below water level in the river, supported on six cylindrical concrete sub-piers built in open wells in the Chicago clay, as shown in Fig. 4. It was intended at first to carry the sub-piers to rock, at a depth of about 117 ft., but this design was modified and they were seated in a hardpan stratum at a depth of about 75 ft. These sub-piers were belled out at the base, increasing the area to limit the pressure on hardpan to 8 tons per square foot, which is the unit adopted for other bridge foundations.

Two piers under the side walls of the pit and carrying the trunnion columns are 10 ft. in diameter, belled out to 18 ft. Two under the front wall or river pier are 11 ft. in diameter and two under the rear wall are 8½ ft. in diameter, these last carrying the anchor columns for the transverse girder which restricts the upward movement of the heel of the bridge leaf.

In the cofferdam for the pit, the bottom course of bracing was supported by jacks on upright posts. During the concreting of the 72-in. floor, which is heavily reinforced to resist upward pressure, the jack supports were moved from place to place in order to avoid leaving holes through the floor. To make the pits watertight, 10 lb. of hydrated lime per bag of cement was added to the concrete and a 1:2 mortar course 6 in. thick was applied in the floor and on the outside of the walls, being carried up with the concrete of the walls.

Trusses, Framing and Floors.—Two lines of trusses, 27 ft. deep c. to c. of chords and spaced 41 ft. 9 in. c. to c., carry two sets of plate-girder floorbeams, at the bottom-chord level and 4 ft. below the top chords, giving a headroom of 14½ ft. above the roadway paving (see Fig. 4). The panel length is mainly 14 ft. 10 in. In general design the trusses are of the parallel-chord type, but with the bottom chords curved downward toward the heel in order to increase the depth at the trunnions and to improve the appearance. An inverted trough section with outside flanges is used for the top chords, and a double channel section with flanges inward for the bottom chords. Details of the trusses are given in Figs. 2 and 3. Members radiating from the trunnion are of horizontal H-section with lacing over the open sides. A heavy H-section is used for the first vertical post, which takes a bearing on the pier when the bridge is closed. Connection plates are of large dimensions and have curved outlines to improve the appearance, these curves being finished accurately by grinding. Fig. 3 shows the heavy connections at the trunnion. Between the heels of the two trusses is a steel counterweight box filled with mass concrete. Adjustments of weight will be made by means of cast concrete blocks of about 170 lb. each, secured in recesses in the counterweight box.

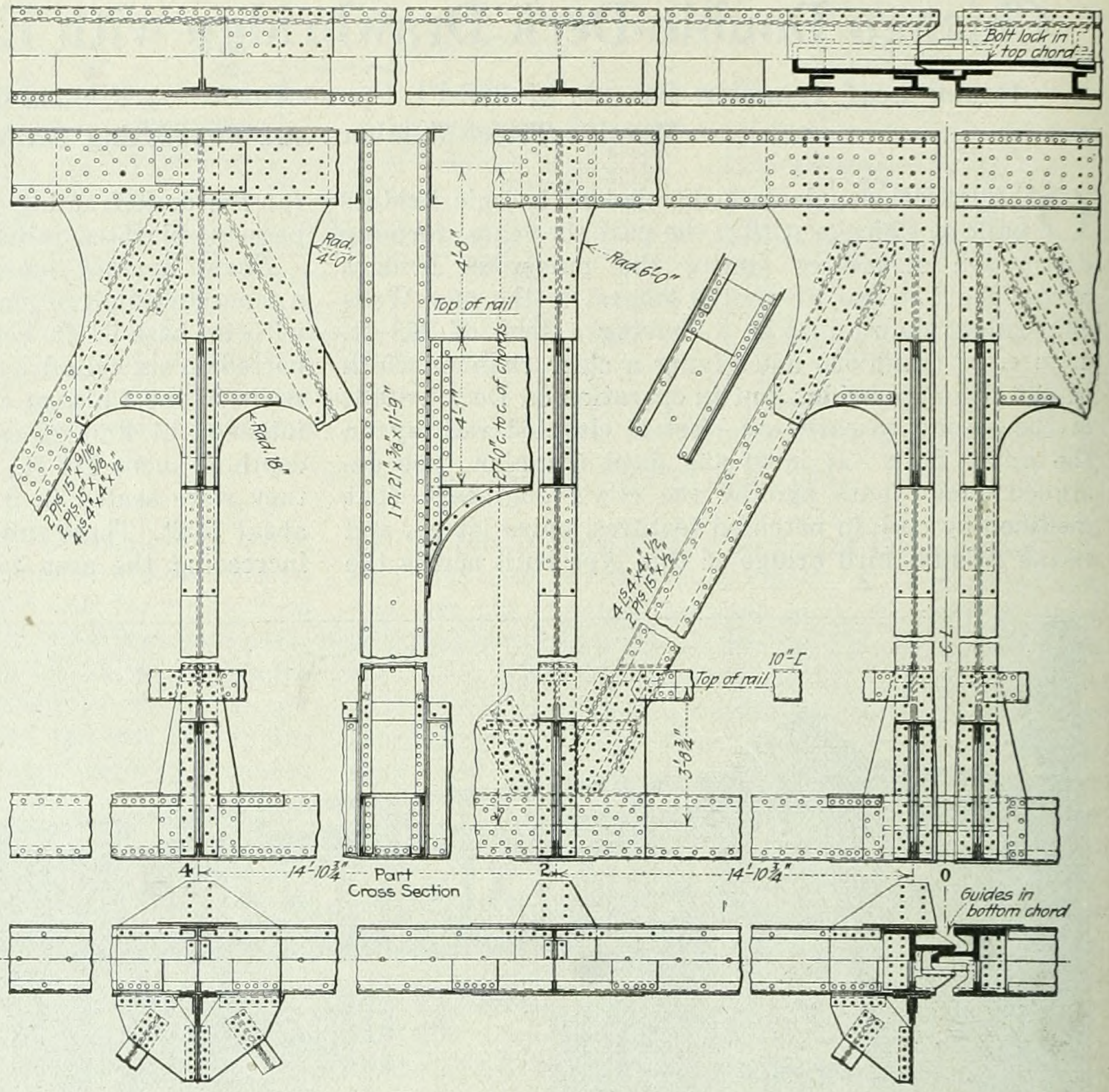


FIG. 2. PART OF MAIN TRUSS, WITH END LOCKS AND GUIDES

Floor framing in the lower deck consists of nineteen lines of 15-in. I-beams between the floor beams, five stringers being grouped under each car track (see Fig. 4.) Cantilever extensions of the floor beams carry timber joists for 15½-ft. sidewalks. For the upper deck there are five 18-in. I-beams, two under each of the elevated-railway tracks. These tracks are spaced 24 ft. c. to c., while the street-car tracks on the lower deck are 10 ft. 2 in. c. to c.

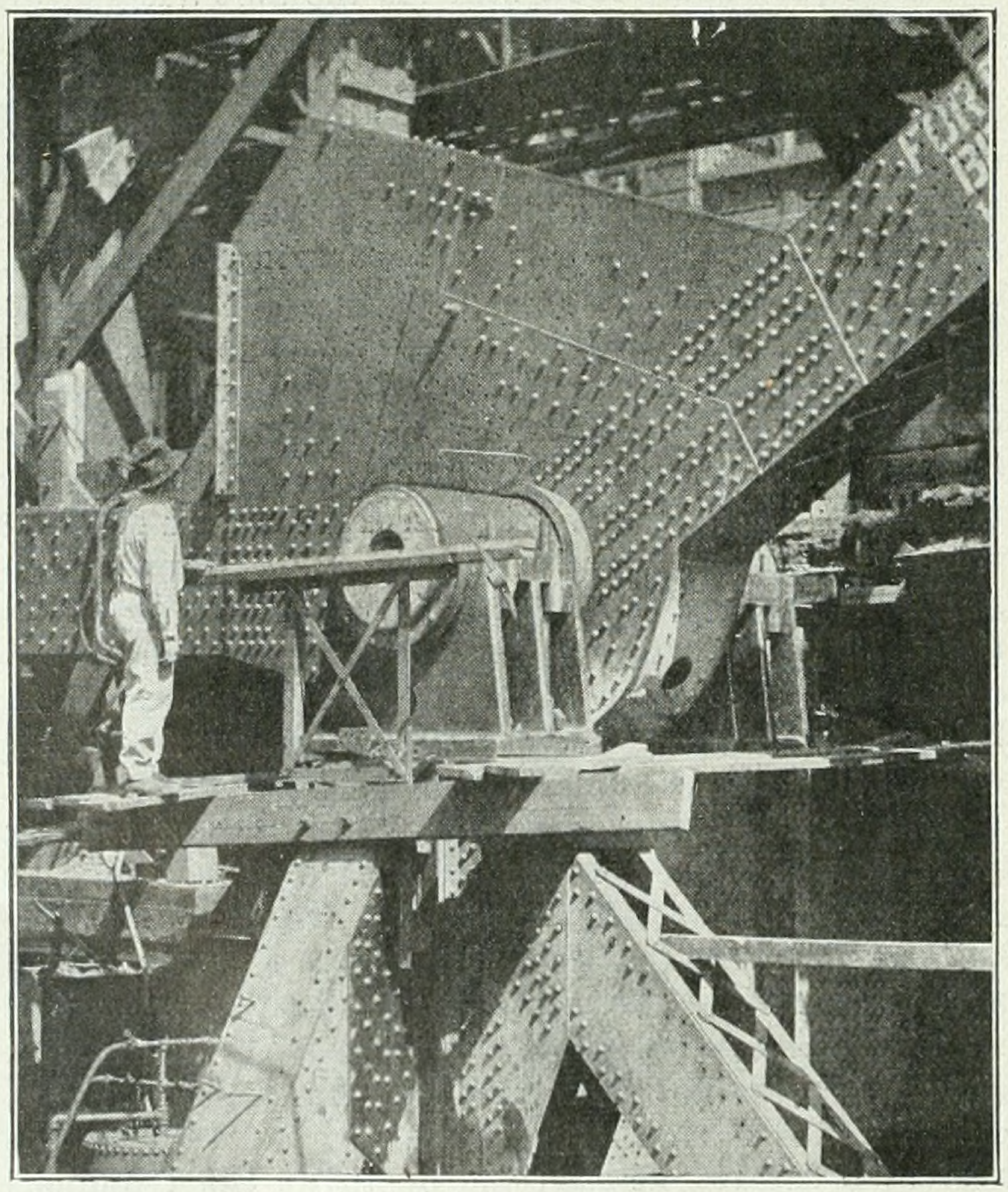


FIG. 3. TRUNNION AND MASSIVE TRUSS MEMBERS

Roadway paving consists of rectangular yellow-pine blocks 3½ in. thick laid on 6 x 12-in. transverse planks, which rest on 4 x 6-in. oak strips on the I-beams and are bolted through the top flanges of these beams. Sidewalks are of transverse planks on wood joists. The upper or railway deck is of the usual open construction, with ties laid across the stringers and carrying track rails with double lines of guard timbers. All timber is creosoted. Grooved girder 129-lb. 9-in. rails for the street-car tracks are bolted to cast-steel saddles riveted between pairs of I-beams, as shown in Fig. 5.

In order to reduce wear, these rails are manganese steel castings for 8 ft. at the end of the leaf and on both sides of the break in the floor at the heel. On the leaf the rails project so as to take a bearing on the end of the opposite leaf. The rail ends are halved so as to give lateral support at the joints in mid span. At the break in the floor at the heel, the 1-in. opening in the roadway is covered by a steel plate set in the recessed face of castings attached to the ends of the approach and leaf. This plate is secured to the approach casting by countersunk rivets. Details of these breaks in the floor are given in Fig. 8.

Live load on the upper deck consists of 50-ton cars of the elevated railway, or 2,000 lb. per lin.ft. for trusses. On the lower deck it includes 50-ton street cars, a 24-ton four-wheel truck and 100 lb. per sq.ft. on the sidewalk and unoccupied space of the roadway.

Trunnions and Supports—In each truss is a forged steel trunnion shaft, having its ends carried in cast-steel

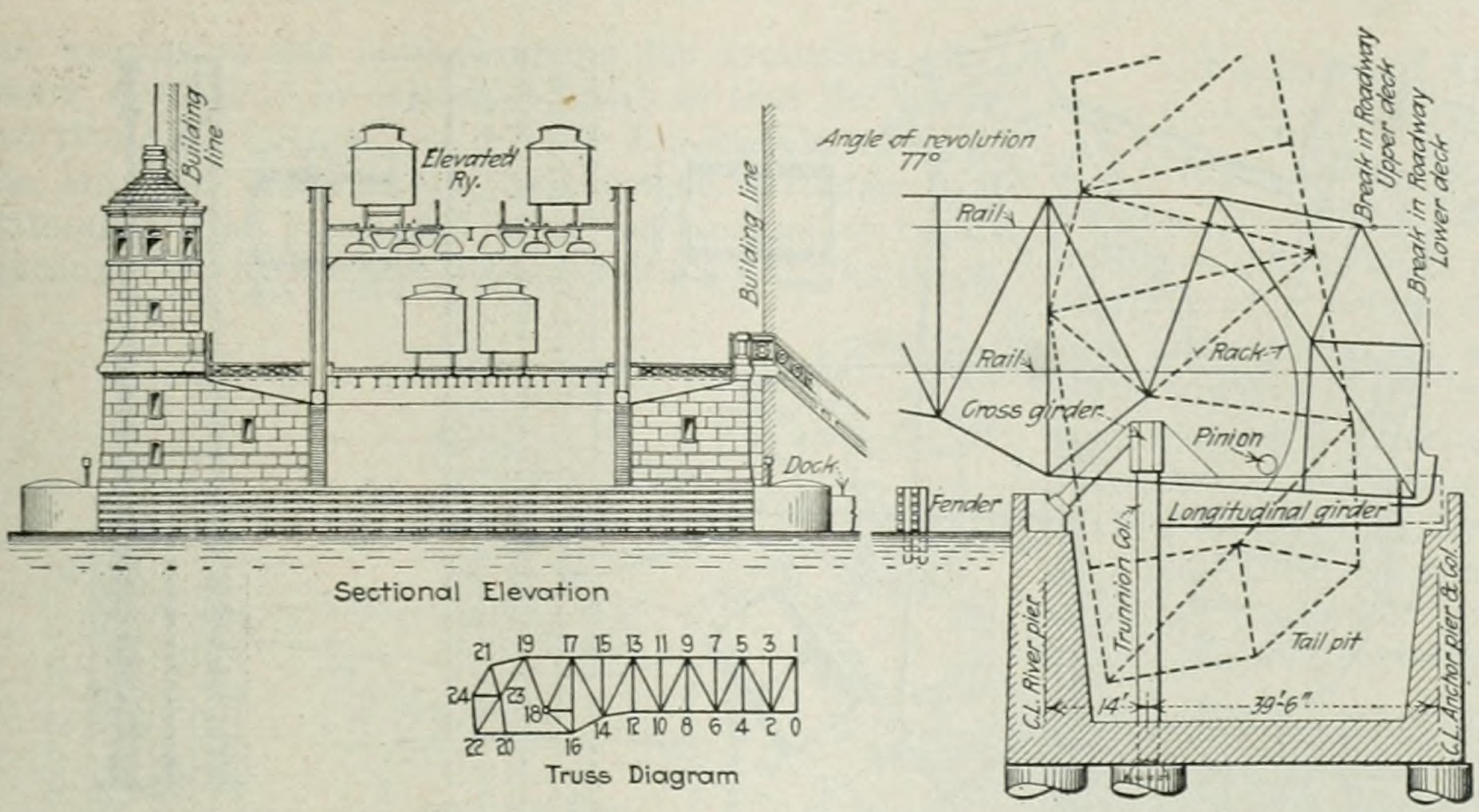


FIG. 4. CROSS-SECTION AND SECTIONAL END ELEVATION

the trusses are held in line by projecting lugs on one leaf which enter slotted lugs on the end of the opposite leaf (see Fig. 2).

Tail locks of the toggle type take the live-load reaction on the heel of the closed leaf and also force the bridge down to its final closed position for engagement of the center locks. These toggles are upright, each composed of a pair of levers hinged together, the lower lever being seated in a foot bearing and the upper one entering a cup-shaped lug on the heel of the truss. To release the bridge in order that it can be opened, the toggle is slacked by the pull of a motor-operated horizontal lever, thus drawing the lock member downward and backward so as to clear the lug.

Upward reaction at the heel of the leaf is taken care of by brackets on the trusses, which engage the bottom of a transverse anchor girder on columns in the rear wall of the tail pit. When the bridge is closed, the bottom chord of each truss takes a bearing on the pier or front wall of the pit, this bearing being directly under the first vertical post or panel point beyond the trunnion. A heavy bearing plate is riveted to the bottom of the lower chord at this point (see Fig. 7).

A pinion and segmental rack for each truss constitute the operating mechanism, the pinion shaft being carried by an inboard bearing on the side wall of the pit and the rack, of 20-ft. pitch radius, being built into

bearing blocks with phosphor-bronze lining. The shaft, bored for the detection of flaws, is 108½ in. long, 29½ in. in diameter in the truss and 27½ in. in bearings. It is made for a light driving fit in the truss and a running fit in the bearings, with allowance for free movement and lubrication. These dimensions are proportioned for a load of 2,500,000 lb. on each trunnion and a unit pressure of 1,250 lb. per sq.in. on the bearings. In setting the trunnions, an accurate base line was established at right angles to the center line of the bridge, and was transferred to a fine piano wire stretched in close proximity to the trunnions, which were then placed parallel to the wire.

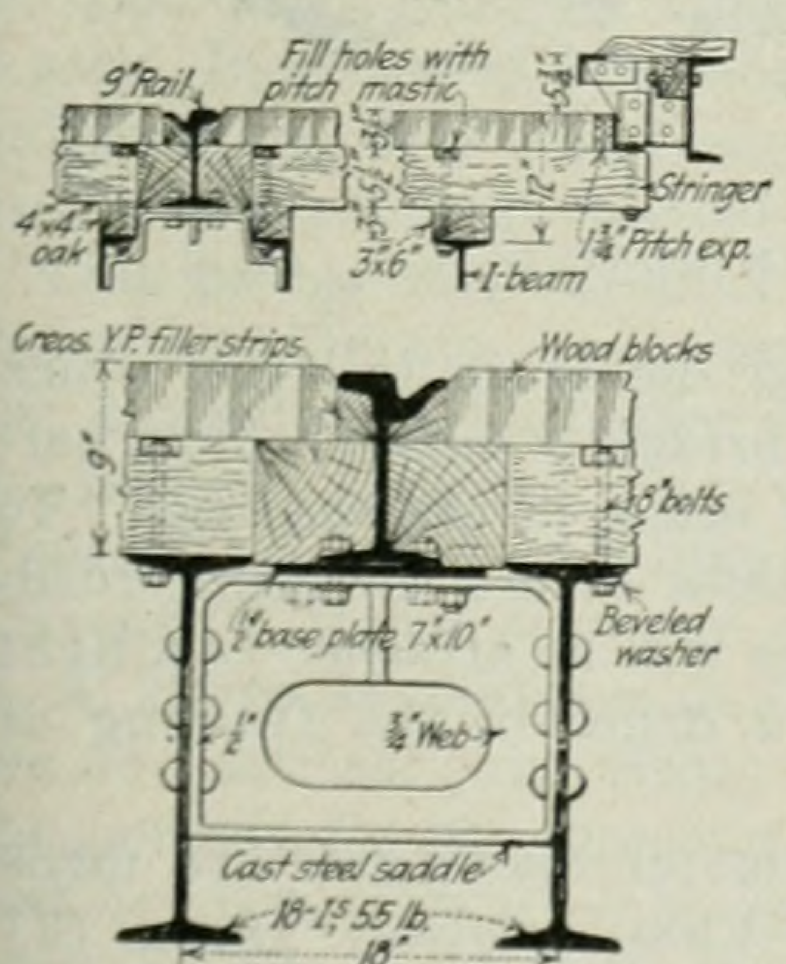


FIG. 5. HIGHWAY DECK AND STREET-CAR TRACK

The four bearings for each leaf are seated on a heavy 79-in. box girder 51½ ft. long, extending across the tail pit and supported on massive columns in the side walls. The ends of this girder pass through the trusses, the members of which are so arranged as to clear the girder in all positions of the leaf. Against the trunnion columns are framed the ends of similar 72½-in. longitudinal girders 39½ ft. long, which are anchored to shoes on the side walls. Brackets or gussets on these girders are riveted to the rear of the cross girder, the forward side of which is braced against the front wall or pier of the pit by a pair of inclined struts. Fig. 4 shows the general arrangement and Fig. 9 gives the details of these heavy girders.

As the longitudinal girders were placed at an early stage of the work to support temporary trusses during the erection of the span, they were built with temporary extension panels 4 ft. 10 in. long to frame against the anchor columns in the rear wall until such time as the side walls of the pit were carried up to the elevation for the shoe bearings. After completion, these extensions were cut off at splices which were provided for the purpose.

In the meeting ends of the top chords are center locks of the bolt type, each operated by a 3-hp. motor on the leaf. In the bottom chords no locks are provided, but

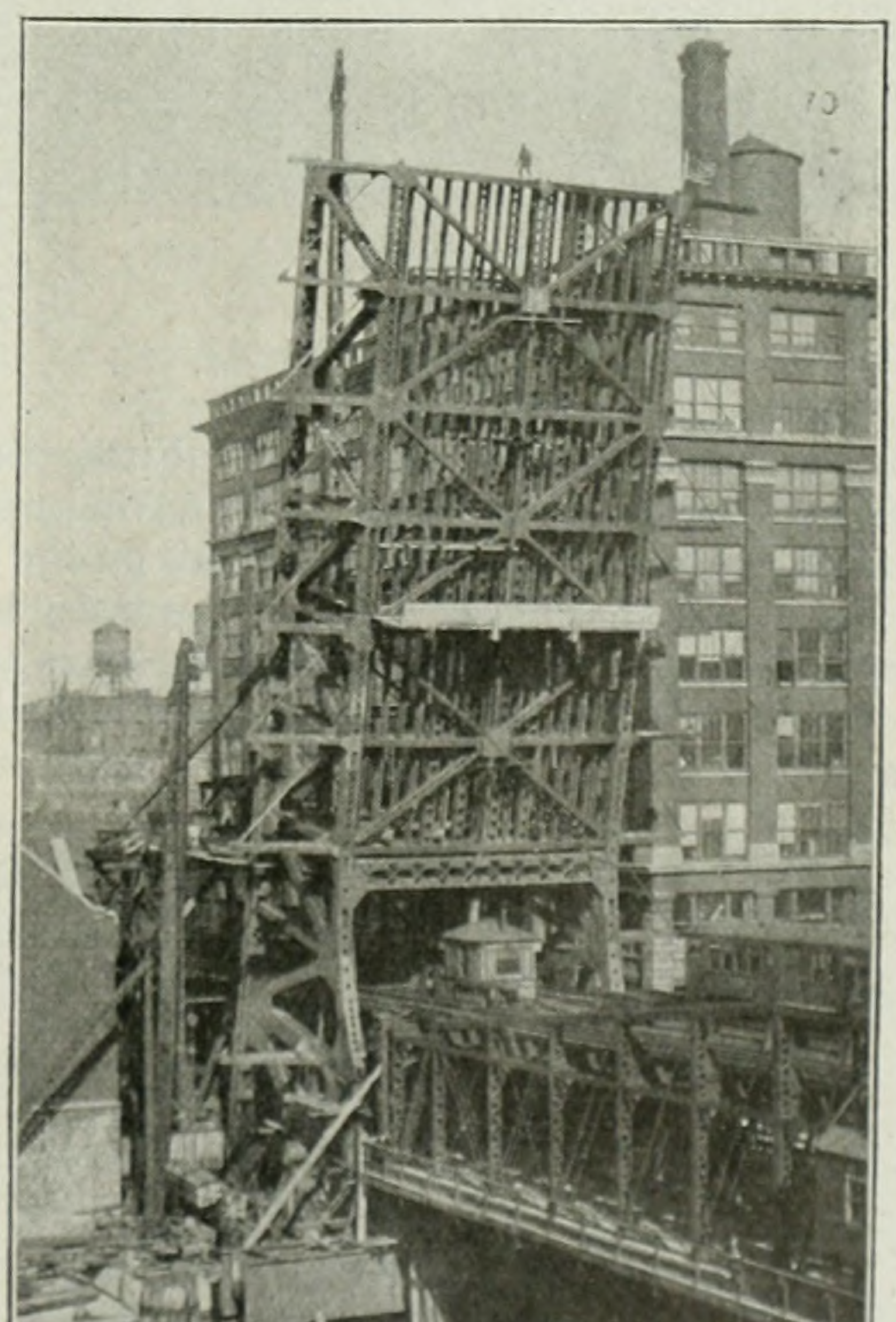


FIG. 6. NORTH LEAF ERECTED WHILE STREET AND RAILWAY TRAFFIC PASS THROUGH LOWER PORTION

the heel of the truss, as indicated in Fig. 4. The pinion is 17 in. wide, with a pitch of 7 in. and a pitch diameter of 31.2 in. It is driven by a 100-hp. motor through a train of gearing shown in Fig. 9. This arrangement was devised and patented by the late Alexander Von Babo, while assistant engineer of bridges for the city, and it has been used on a number of the river bridges.

Each leaf is operated by two motors and two gear trains. Torsion between the two opposite trusses is resisted by the transverse girders which carry the counterweight box and by similar trusses in vertical and horizontal planes in front of the trunnion. These girders provide sufficient rigidity to enable the leaf to be operated by one motor and pinion if necessary. The machinery is designed to raise or lower the leaves in 45 seconds.

To hold the bridge in any position there is an electrically-operated band brake on the motor shaft, with a similar hand-operated emergency brake on the first countershaft from the motor. Either brake is designed to hold the leaf against a 20-lb. wind pressure. It was at first intended to use grip brakes on the heel of each truss, engaging curved rails on the tail pit, as at the Michigan Ave. bridge. In view of the extra expense it was decided to rely on braking through the machinery, as in most of the other Chicago River bridges.

In addition to signal lamps, gongs and the usual roadway gates of the railroad type, with swinging arms, there will be yielding cable barriers of the Strauss type

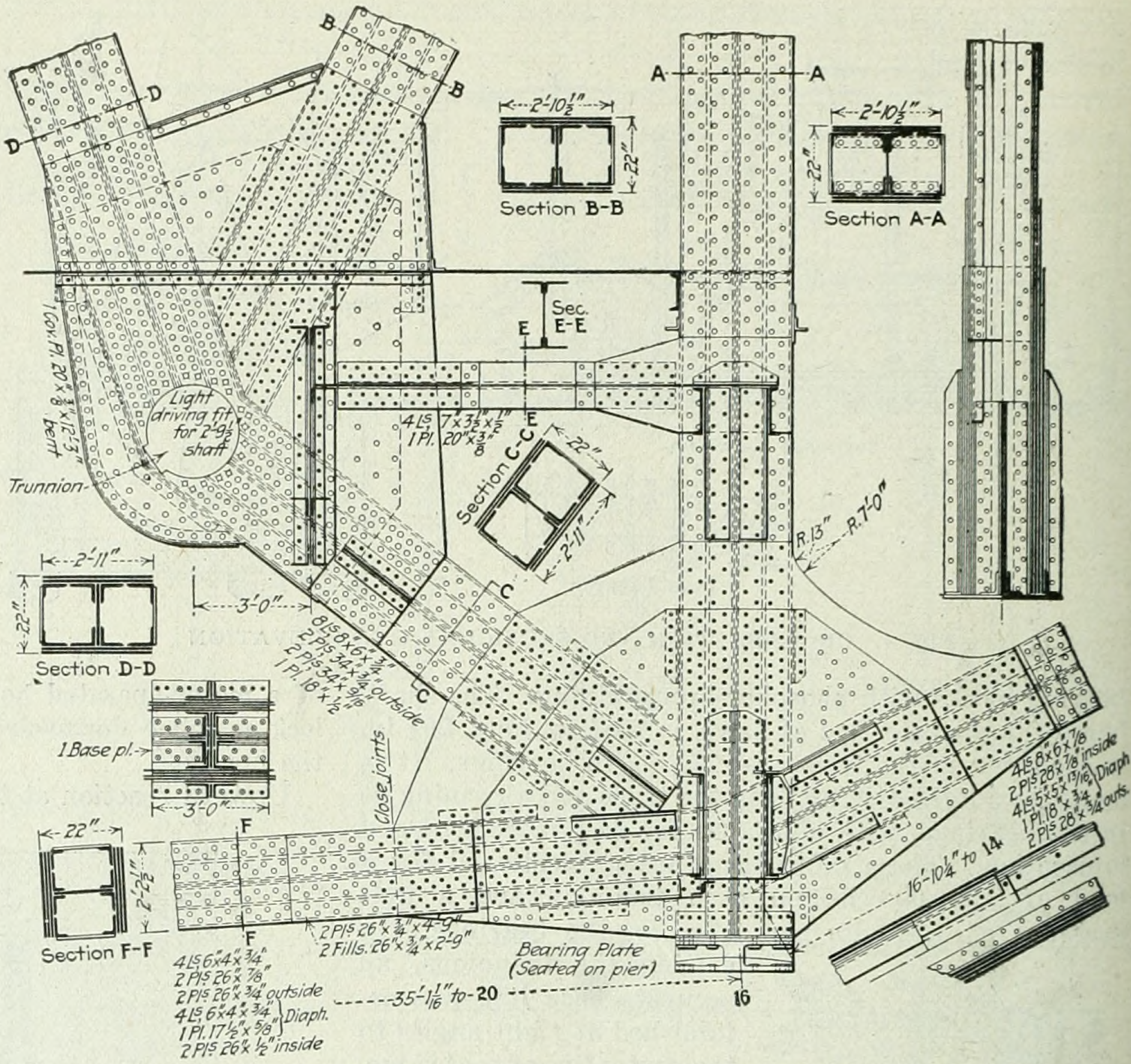


FIG. 7. TRUSS MEMBERS AT TRUNNION BEARING

to close the roadway beyond the large tail pit, which is open when a double-deck bridge is raised. This barrier will be 21½ ft. from the break in the roadway. To prevent undue sag in the cables across the 38-ft. roadway, the center of the barrier will be attached to a light vertical cable wound upon a drum in the framing of the upper deck.

To open the bridge, five motor operations are made in series, as follows: (1) Close roadway gates, (2) lower roadway barriers, (3) release center lock, (4) release heel locks, (5) raise bridge. The electrical mechanism is so interlocked that each operation must be completed before the next one can be made. The bridge is so interlocked with the signal system of the elevated railway as to prevent the center lock being released until the railway signals are set at the "stop" position. Trains on the elevated railway are equipped with devices for automatically applying the brakes and shutting off current if a motorman should pass a "stop" signal.

Operating equipment includes four bridge motors of 100 hp., two heel lock motors of 7½ hp., a 3-hp. motor for center locks, twelve motors for operating gates and barriers and two 15-hp. motors for the tail-pit pumps. Two sources of current are provided for each leaf, from the power systems of the elevated and surface railways respectively.

In putting the new bridge into service, the program differed slightly from that outlined in *Engineering News-Record* of Oct. 13, 1921, p. 606. The elevated-railway traffic was stopped at 8 p.m., Friday, Dec. 2, and the railway forces then began to remove the tracks from the upper deck of the old span and old approaches. The old swing span was swung open at midnight, and

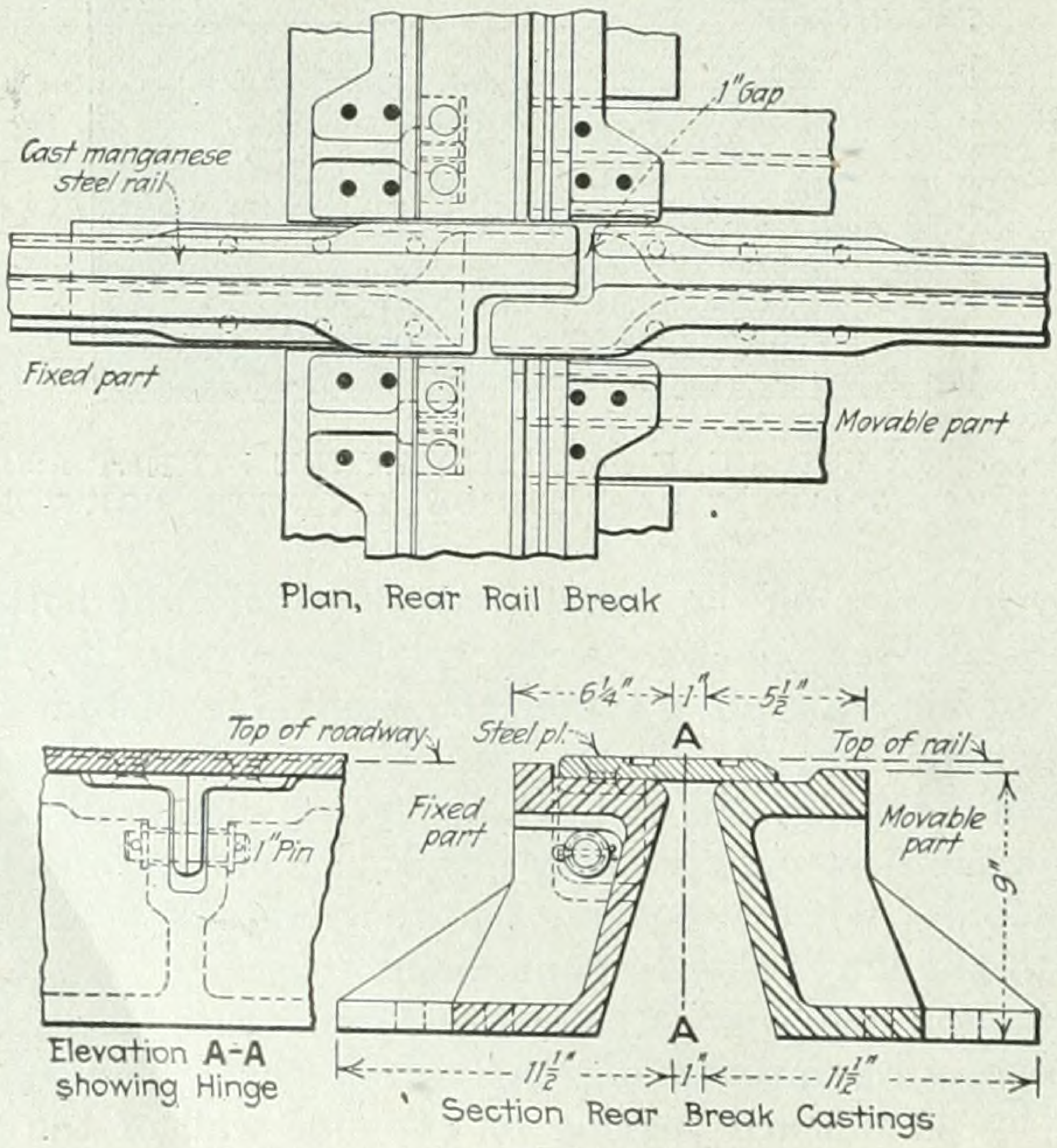


FIG. 8. BREAKS IN CAR TRACK RAILS AND ROADWAY

as soon as it was blocked up on the protection pier, work was begun in cutting it apart so that the center portion could be removed to allow the bascule leaves to be lowered. Placing the floor beams, stringers and laterals in the panels left open for passage of trains through the leaves was begun at 9:15 a.m. Saturday.

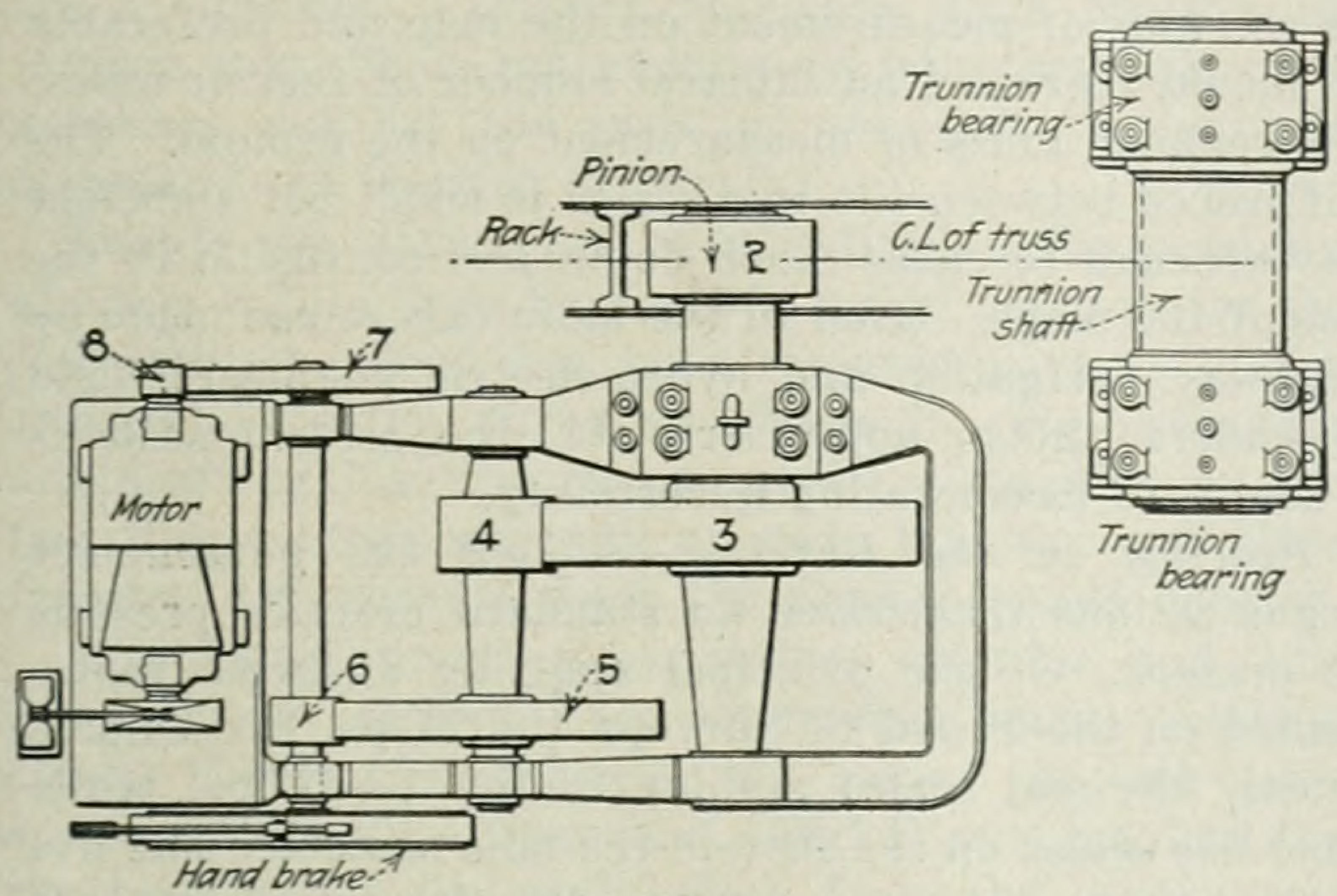


FIG. 9. PLAN OF MACHINERY LAYOUT

This work was discontinued at 5 p.m., for although lights were provided the shadows made it dangerous for the men to work at night. The work was resumed at 6:30 a.m., Sunday, Dec. 4, and was completed by 4 p.m. Both leaves were lowered at 5 p.m.; tracklaying on the upper deck was begun at once. Elevated traffic over the new bridge started at 7 a.m., Monday, Dec. 5.

This bridge was designed in the bureau of engineering of the Chicago Department of Public Works, under the direction of Alexander Murdoch, city engineer; C. F. Healey, assistant city engineer, and Thomas G. Pihlfeldt, engineer of bridges. Its construction is under Clarence S. Rowe, engineer of bridge construction, with F. A. Berry as engineer in local charge; C. F. Harrington, is electrical supervisor. The Ketler-Elliott Co. had the contract for the superstructure, including machinery and erection, the steel being fabricated under subcontract by the Fort Pitt Bridge Co. The FitzSimons & Connell Dredge & Dock Co. had the contract for the substructure, and the Norwood-Noonan Co. had that for the electrical equipment. Since patents of the Strauss Bascule Bridge Co. cover the cross-girder support of the trunnion bearings and the arrangement of members in the heels of the trusses so as to clear the cross girder during the movement of the leaf, the bridge is operated under license from that company.

Lincoln Highway Construction in 1921

Nearly 400 miles of Lincoln Highway were improved in 1921. For new construction $7,700,000 was expended and for maintenance $1,700,000. The additional mileage improved last year represents 12 per cent of the total

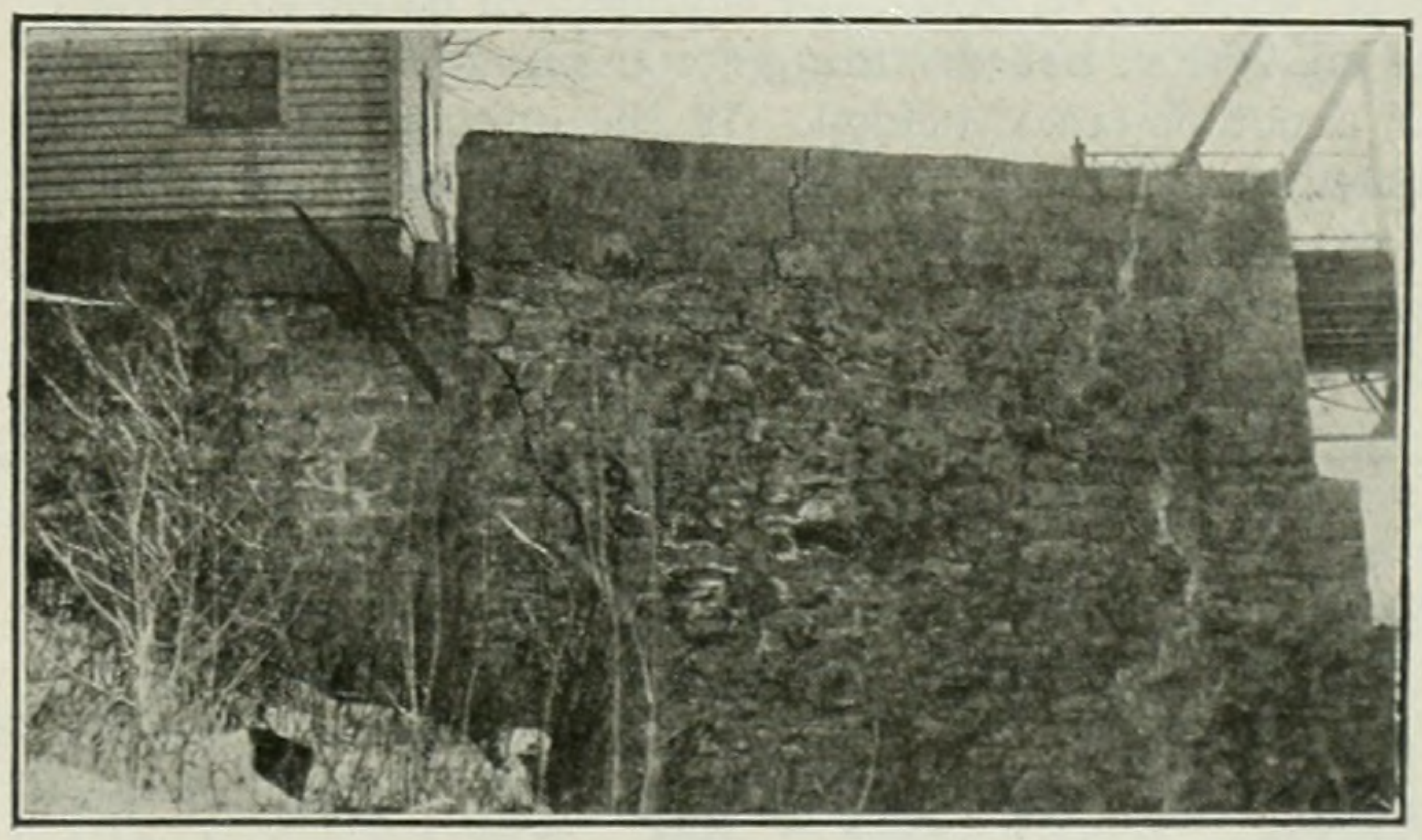
	Miles		Miles
Concrete	521.75	Granite Block	7.10
Brick	241.03	Graded Gravel	1,052.45
Bituminous Macadam	383.28	Natural Gravel	62.10
Macadam	287.10	Graded Earth	526.99
Asphalt	78.00	Natural Earth	136.00
Creosote Block	5.90	Sand	3.30

mileage. Since 1913 when the route was dedicated more than $40,000,000 has been expended on this transcontinental line of 3,305 miles. The surfacing types are no'ed in the above table.

Failure of Old Bridge Masonry

An INTERESTING case of progressive failure of old bridge masonry exists at Belvidere, N. J. The east or New Jersey abutment of the Delaware River bridge at that point is cracked, and the outer portion is slowly moving toward the stream. The two views herewith show the north and south face respectively, the latter being stiffened by a heavy buttress, out of which a young tree is growing.

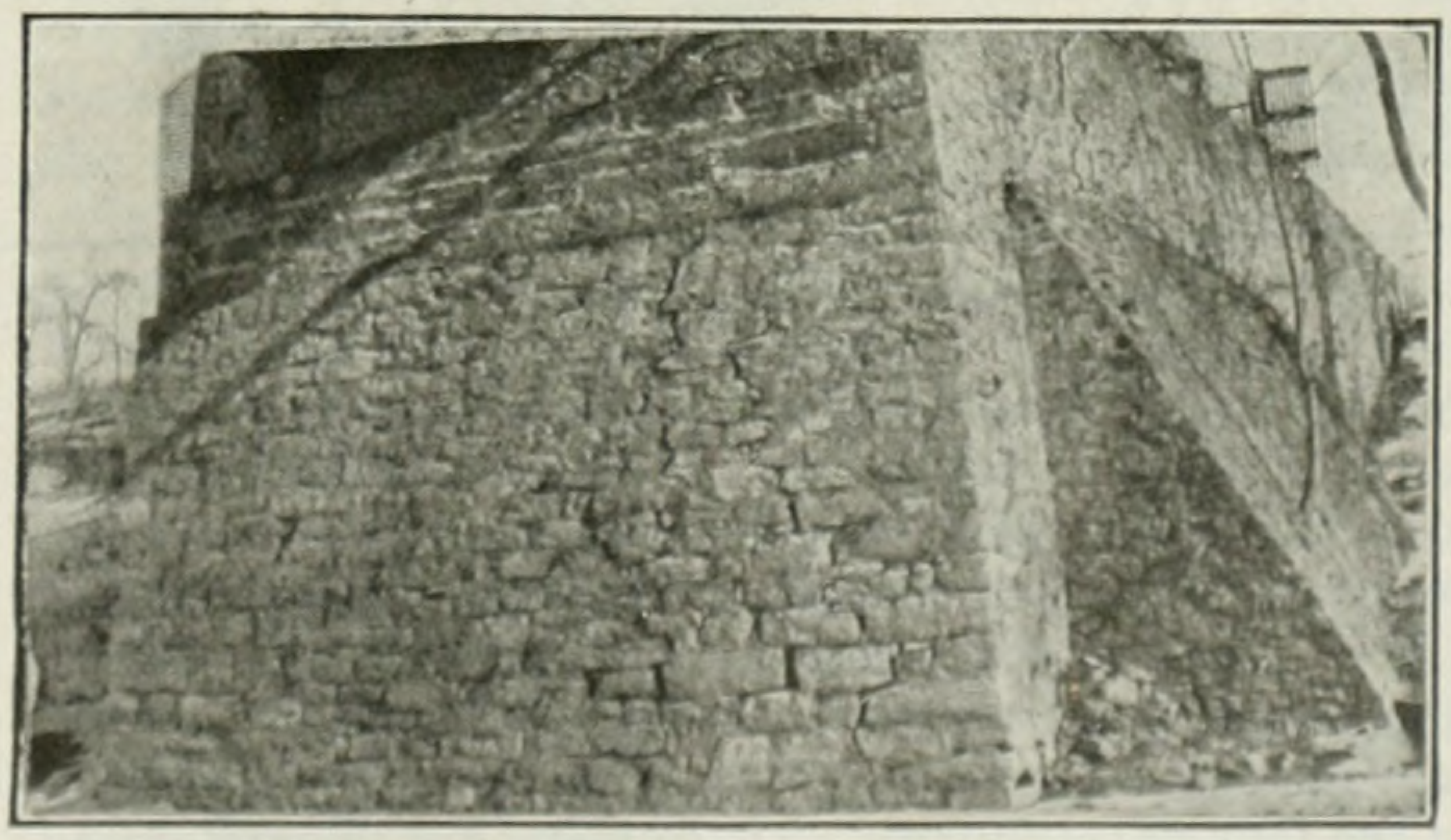
According to Charles A. Mead, chief engineer, Division of Bridges and Grade Crossings of the State Board of Public Utility Commissioners, there is no accurate record of the age of the masonry or of the material on which the abutment is founded. He states that the



CRACKS IN NORTH FACE

abutment is probably about 80 years old, and that the buttress on the south side appears to have been built soon after the construction of the abutment, to counteract bulging of the wall. It is believed that the abutment rests on a layer of slippery material overlying rock, dipping toward the river, and it is not heavy enough to resist the pressure of the fill and the live-load surcharge.

Measurements of the cracks in the two wings of the abutment have been made during the last two years,



SOUTH FACE SHOWING CRACKS AND HEAVY BUTTRESS

after these cracks had been pointed. The cracks increased in width during this period from $\frac{1}{16}$ in. to nearly 3 in.; on Dec. 14, 1921, the main crack in the north wing wall was 2 in. wide, that in the south wing $2\frac{3}{4}$ in.

The bridge comprises four spans of lengths ranging from 153 to 169 ft., with trusses 26 ft. deep center to center of chords and 19 ft. apart center to center of trusses. The superstructure, built about 1905, is very light for present-day traffic loads. The bridge is privately owned and operated as a toll bridge. Investigation of its safety for public travel is in progress.

street traffic a program was laid out covering the different steps. The first step was to close the lower deck to traffic, on Sept. 28, and it is planned to have the lower deck approaches completed by Nov. 9. Alterations to the elevated structure on the approaches will necessitate discontinuing the railway traffic temporarily, but this work can be performed on three successive Sundays, Nov. 6, 13, and 20. The leaves of the new bridge should be ready to lower to a horizontal position six days later, or on Saturday, Nov. 26. During the lowering and adjusting of the leaves, elevated traffic over the bridge will be discontinued for a period of only about 48 hours, and the new bridge should be available for use by trains on Monday morning, Nov. 28. When the leaves have been lowered, work on the lower-deck roadway of the bridge proper can be started. Final completion of the bridge and approaches should be effected by Dec. 27. Pedestrian traffic will be maintained with the least possible interruption during the period that the bridge and approaches are closed to vehicle traffic. Dredging and clearing of the channel will be done between Dec. 5 and Feb. 4.

Specifications of New Bascule

The new bridge is of the trunnion bascule type, with a span of 268 ft. c. to c. of trunnions, giving a clear channel 200 ft. wide. It has two lines of trusses spaced 41 ft. c. to c., the lower deck having a 38-ft. roadway and two 13-ft. walks (outside). On the upper deck are two tracks for the elevated railway. The total weight of each leaf complete will be about 2,460 tons, including 1,300 tons of counterweight. The deck arrangements are similar to those of the Lake St. bridge. In the Michigan Ave. bridge (*Engineering News-Record*, Sept. 9, 1920, p. 508) there are four trusses with two roadways and inside walks on the lower deck, and two wider roadways and outside walks on the upper deck. The old Wells St. swing bridge, with a length of 220 ft., was built in 1888 as a street bridge, being reinforced in 1896 to permit of carrying the elevated railway.

This important bridge was designed in the bureau of engineering of the Chicago department of public works, under the direction of Alex. Murdoch, city engineer; Charles F. Healey, assistant city engineer; Thos. G. Pihlfeldt, engineer of bridges. The construction work is under Clarence S. Rowe, engineer of bridge construction, and F. A. Berry, engineer in local charge. The principal contractors were the FitzSimons & Connell Dredge & Dock Co., substructure; Ketler-Elliot Co., superstructure and operators' houses, the steel being fabricated by the Fort Pitt Bridge Co. under sub-contract; Norwood-Noonan Co., electrical equipment. The bridge is built under license from the Strauss Bascule Bridge Co. as it embodies features patented by that concern.

House Fly Journeys Five to Six Miles a Day

Experiments conducted by the Bureau of Entomology, U. S. Department of Agriculture, show that the house fly journeys 5 to 6 miles in 24 hours and in one observed instance traveled 13.14 miles in that time. This and other species of flies, totaling 234,000 of all kinds, were dusted with red chalk in Texas, liberated, and recaptured in traps placed at various distances.

Texas County Tries Lump-Sum-Fee Road Contract

Straight Contract Prices Cut 40 per Cent—Actual Cost Runs Under Price Bid—Excellent Average Speed Maintained

HIGH prices bid in 1920 on 45 miles of concrete road, a portion of a 110-mile system planned for Wichita County, Texas, resulted in a contract being made by which the contractor receives a lump-sum fee based on a cost estimate prepared by himself. The county purchases the materials and assumes all risks, but the equipment is purchased and paid for by the contractor. With 7 miles of road completed in 1920 and 27 miles more under construction this year, the special contract is considered a success. The plant is high class, the cost is materially less than the original prices bid, and the speed of construction has been greater than the average for similar operations.

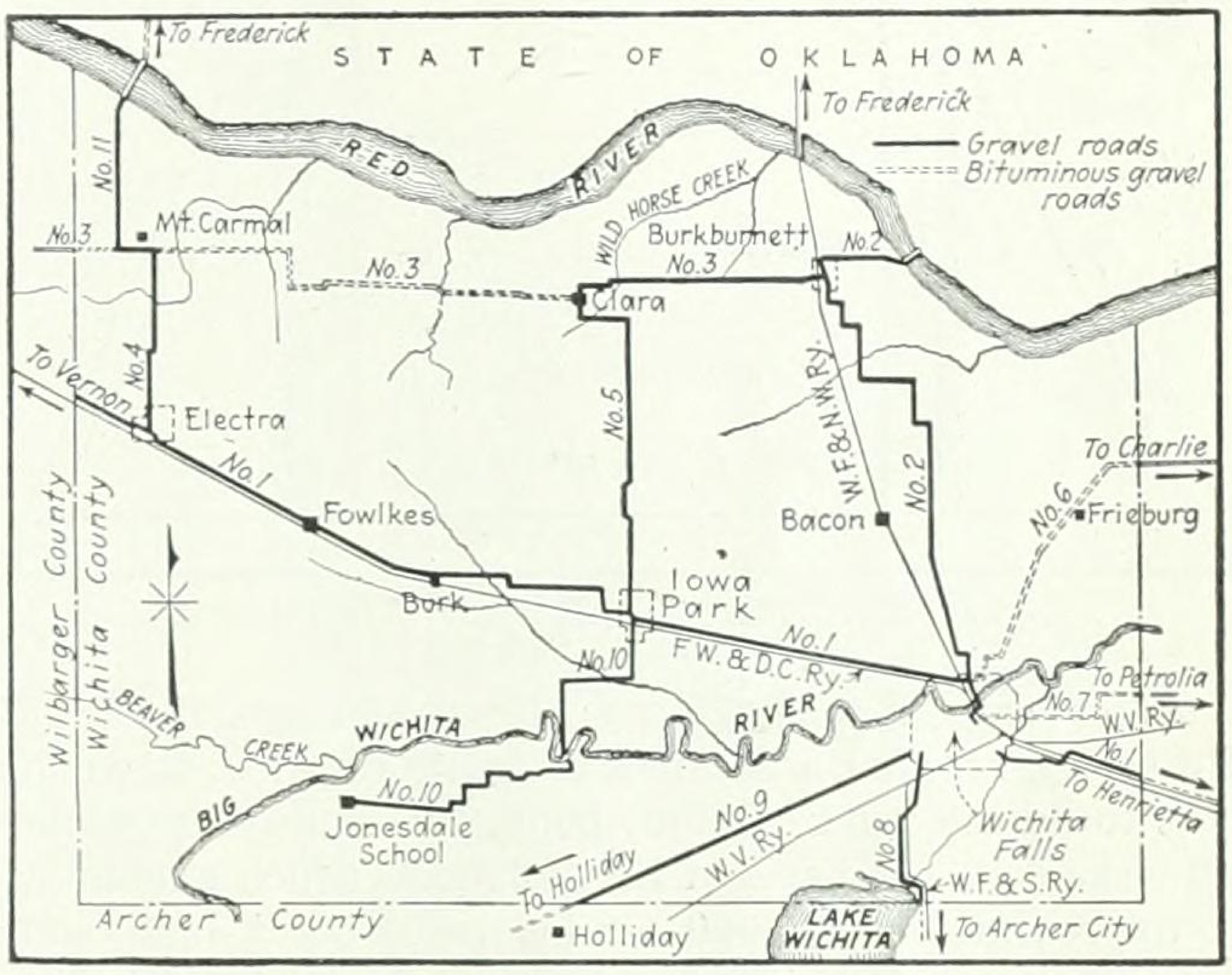


FIG. 1. MAP OF IMPROVED ROAD SYSTEM FOR WICHITA COUNTY, TEXAS

Paved roads were required by the oil-field development. A bond issue of $2,250,000 was voted and 45 miles of concrete road were planned for immediate construction. Commercial production of concrete aggregates had not been developed, so the first act of the county was to assist financially in establishing a stone-crushing plant costing $300,000. The county advanced $100,000 on a stone contract.

Bids for construction were received in January, 1920. There was one bid and it averaged $80,000 a mile. It was rejected and new bids were asked. This time the county itself put in a bid of $50,000 a mile and another bid was received from the contractor who had previously bid, but his price had been cut to $60,000 a mile. The county commissioners' court awarded the contract to the county.

In explanation of the high prices it is to be noted that the time was early in 1920 during the peak of the oil boom in Wichita County. There was a serious railroad congestion, an acute labor shortage and a heavy constant traffic to be handled by diversion from the roads under construction.

Being without equipment or organization for construction, the county engineer decided to sublet the contract. General contractors were asked to submit

50 per cent of the 100,000 cu. yd. excavation in the approach-cut on Pit River No. 1 tunnel had been completed. About 25 per cent of the 100,000 cu.yd. excavation in Pit River No. 1 power house and tailrace also had been finished. The tunnel for the Pit River No. 1 plant is to be 10,111 ft. long and is being driven by the heading-bench method working from two headings. On this tunnel 5,911 ft. had been completed on Aug. 10 and the remainder was scheduled for completion by Feb. 1, 1922. The diameter of this tunnel is 14 ft. and it will be entirely lined with concrete. Where the formation traversed is poor, the section will be circular and reinforcing will be used. Otherwise, an unreinforced horseshoe section is specified.

Power for construction purposes was developed in a temporary plan near the junction of Fall and Pit Rivers, about 10 miles from Hat Creek No. 1 and 3 miles from Pit River No. 1. Here the head and flow available were suited to an old 1,000-hp. unit which the company had in a generating station at Folsom. This unit was accordingly "loaned" to the Pit River project until the first plants there should be in service.

The Pit River project is being carried out by the Pacific Gas & Electric Co., of San Francisco. O. W Peterson construction engineer for the company is in charge of work on the Pit River projects. E. H. Steele is engineer in charge of line construction.

Putting Large Bascule in Service

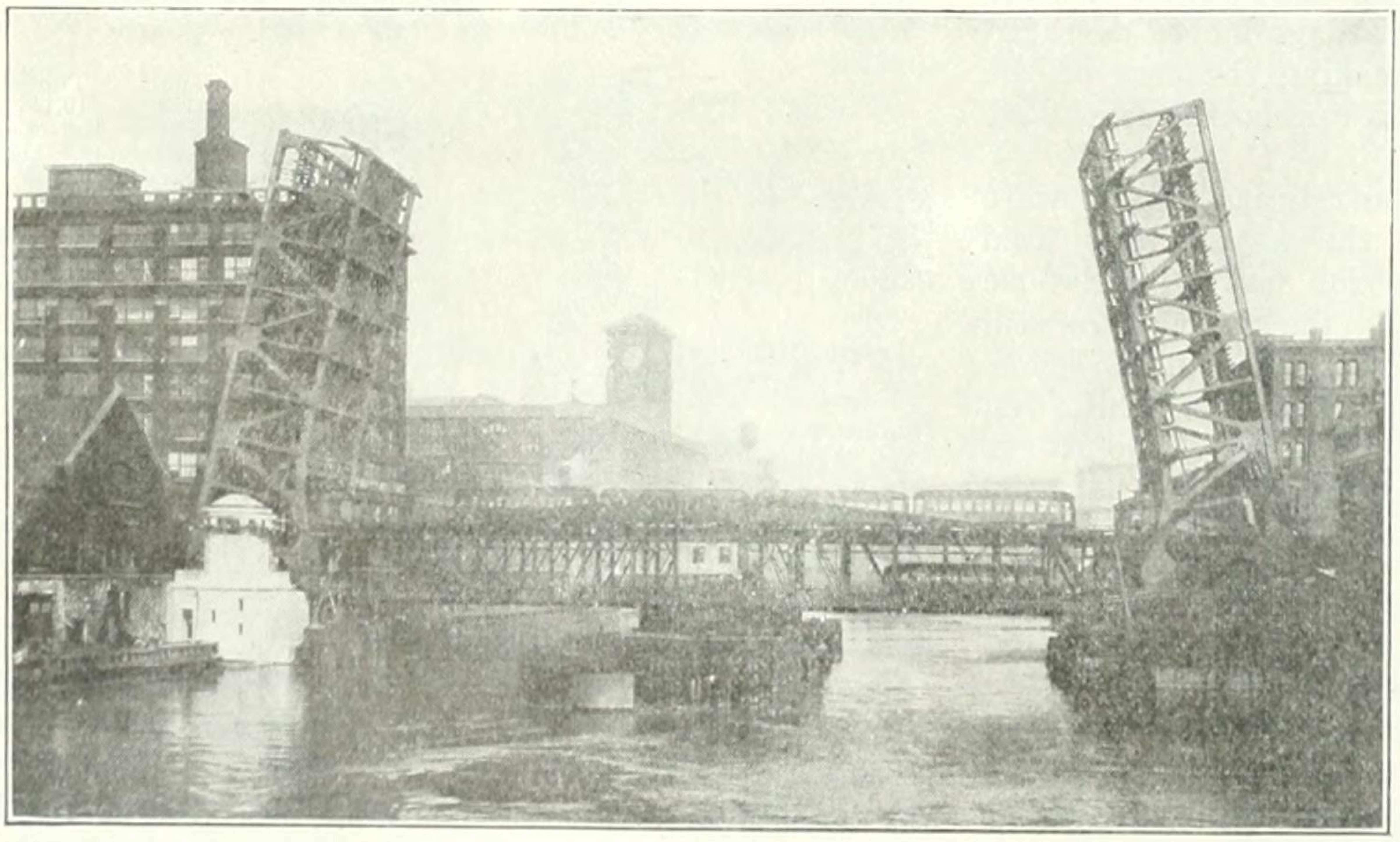
Program for Change to New Structure Involves Minimum Stoppage of Street and Elevated Railway Traffic

RAPID replacement of an old 220-ft. double-deck swing span by a double-leaf double-deck bascule span, 268 ft. c. to c. of trunnions, is planned for the Wells St. crossing of the Chicago River. The new structure, now nearly completed, will be the third double-deck bascule bridge built across the river by the city of Chicago, and will be the second carrying an elevated railway on the upper deck. For similar replacement at the Lake St. bridge in 1916, traffic on the street deck was diverted during the construction period, and that of the elevated railway was interrupted for six days (see *Engineering News*, April 20, 1916, p. 756). In view of the inconvenience to the public during the Lake St. work and in view also of the greater importance of Wells St. as a traffic thoroughfare, the work was so planned by T. G. Pihlfeldt, engineer of bridges, that both decks of the bridge have been kept open throughout the entire construction period and it is proposed to interrupt the elevated railway traffic for only 48 hours while putting the new span into service. The present condition of the work is shown in the accompanying view.

In order to maintain traffic on the street or lower deck during construction, it was necessary to provide temporary supports for the roadway and sidewalks on the approaches to the old bridge to permit of building the new substructure. For this purpose steel girders and trusses were provided and the floor loads were carried by them to pile clusters outside of the limits of the new work. The construction of the greater part of the cofferdams could then be accomplished without disturbing the old bridge. During the remodeling of the lower deck on the fixed part, the street was closed to vehicular traffic only, one roadway at a time, with but slight inconvenience to the public.

For driving those portions of the cofferdams directly under the swing bridge, traffic was stopped between 1 and 4:45 a.m. for about two weeks for each cofferdam, the span being swung to the open position during that time. The completion of the cofferdam was followed by the excavation and concreting of the counterweight pits and sub-piers. In this work the north pier was begun first and its sub-piers were completed in 1918. The main piers and counterweight pit were finished in April, 1919, and the north abutment in May, 1919. The permanent longitudinal and cross-girders for supporting the new bridge superstructure were then placed and the entire north substructure work was completed in July, 1919. Excavation for the south substructure was begun in December, 1919, and the permanent new steel girders were placed in October, 1920.

To avoid interference with traffic during erection of the bridge superstructure, with the leaves in the open or upright position, it was necessary to omit a part of the upper and lower deck floor beams, stringers and bracing, so that vehicles and elevated-railway trains could pass through the structure. When the work on the superstructure has progressed as far as possible in the raised position, it will be necessary to stop all traffic long enough to swing the old bridge to its open position, block it up on the pier protection and remove the portion over the center pier by burning or cutting the members, to afford clearance for lowering the new bridge. While this is being done, the steel floor system and bracing of the new bridge can be completed and tracks installed on the upper deck.



NEW AND OLD DOUBLE-DECK BRIDGES OVER CHICAGO RIVER AT WELLS ST.

To minimize the interruption to elevated railway and