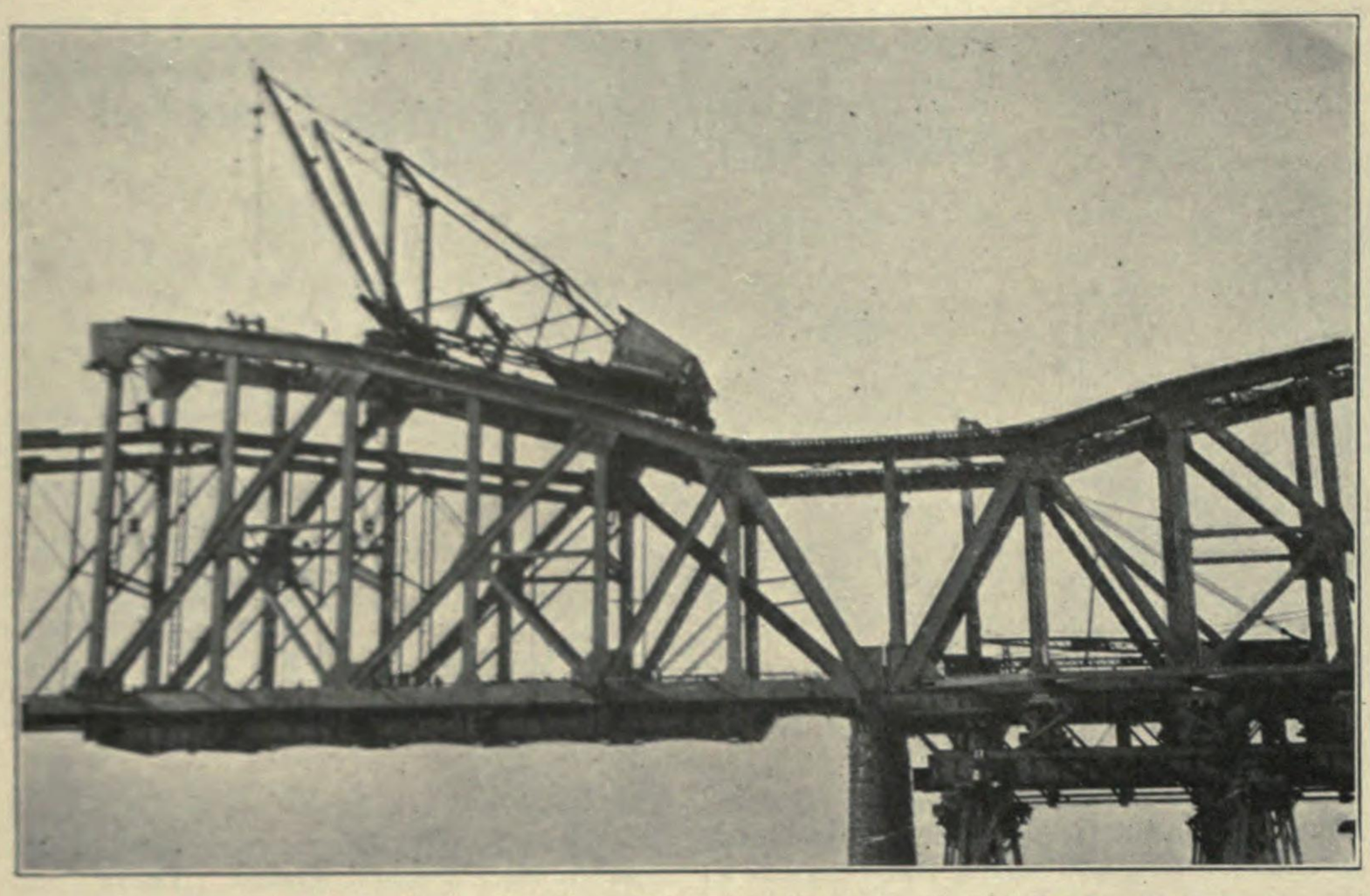


NEW PIER GRILLAGE PLACED—CANTILEVER ERECTION OF 525-FT. SPAN

New stringers used on falsework to support floor and temporary anchor span by blocking.

Longest Riveted Simple Trusses Erected Around Old Bridge by Cantilever Method

Half Spans from Back Channel Used as Anchors for 525-Foot Main Channel Spans During Reconstruction of Ohio Connecting Bridge

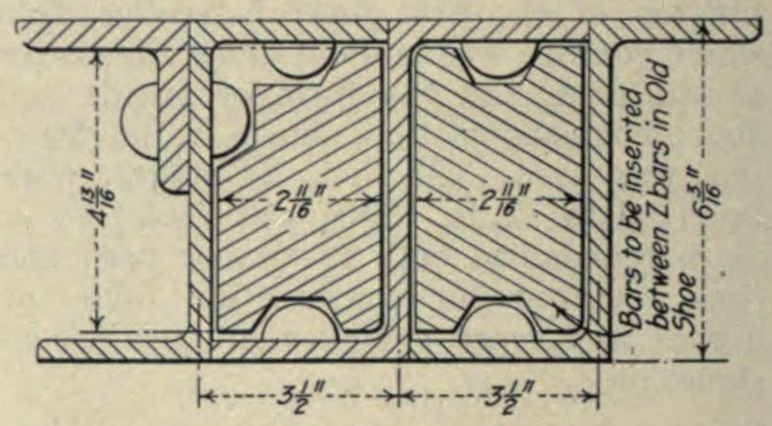
THE ERECTION of the longest riveted simple truss span in the country has recently been completed at Pittsburgh by a unique cantilever method involving the use of anchor arms temporarily adapted from another span used in the same crossing. The Ohio connecting bridge of the Pennsylvania Lines West of Pittsburgh over the Ohio River, an old single-track structure about 4545 ft. long, built in 1890, is being replaced by a modern double-track bridge supported on the same piers, which were originally built wide enough for this purpose. The original single-track crossing consisted of one span 525 ft. long over the main channel and a series of eleven deck truss spans, each about 175 ft. long, across Brunot's Island, and a 416-ft. span over the back channel. The long steel single-track viaduct approaches consist of about 636 ft. on a curve and 660 ft. on tangent and one 140-ft. deck truss span at one end and two deck truss spans at the other end.

The reconstruction work included the replacement, practically without interruption of traffic, of the old 525-ft. single-track span, which was about 65 ft. deep at the center, by the double-track riveted truss span shown in the accompanying elevation, about 91 ft. deep at the center and 50 ft. at the ends. The cantilever erection of this span was accomplished by using half trusses from the 416-ft. back-channel span. The approach viaduct was also changed to a double-track structure, and the grade decreased from 0.56 per cent to 0.3 per cent. The 140-ft. span shown by dash lines on the elevation was originally designed to support two tracks, one track to Pittsburgh branching off from the main line. It was first shifted to one side while the falsework and anchor span were used for erecting the 525-ft. span, and then replaced in its new position on the piers.

The deck trusses across Brunot's Island are replaced on the same piers by double-track triangular trusses of the type shown on the drawing. The old 416-ft. pin-connected Pettit trusses, which were 60 ft. deep, are being replaced by the riveted trusses shown in the diagram, 75 ft. deep at the center, after they have served as temporary anchor spans as above mentioned. The deck truss spans at the end, shown by dash lines, have been retained in the new structure, as they originally supported two tracks.

CUTTING DOWN OLD PIERS UNDER TRAFFIC

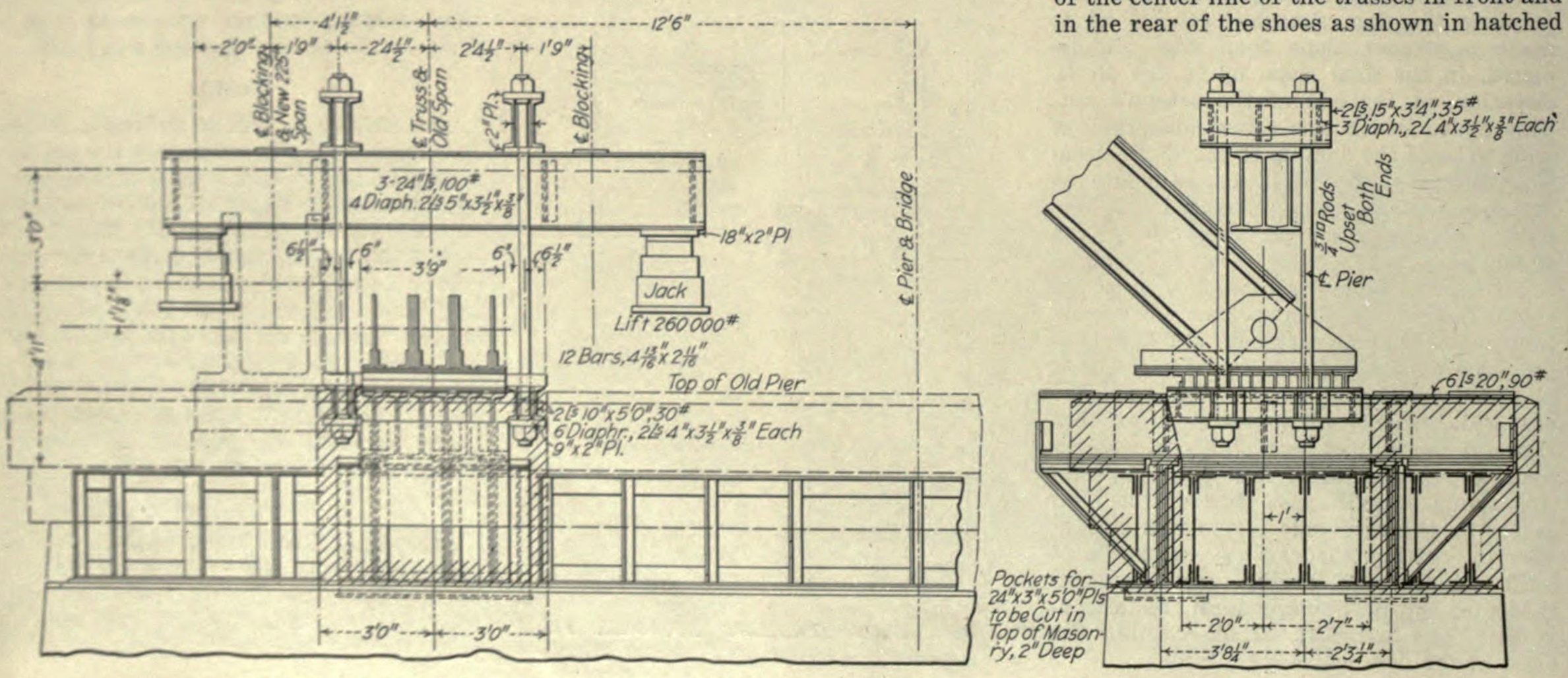
One of the most difficult problems was the removal of several courses of the masonry from the tops of the old piers to allow the placing of seven heavy plate girders acting as pier grillages for the purpose of distributing the heavy loads over the piers and making room for much deeper and heavier shoes than were used in the old structure.



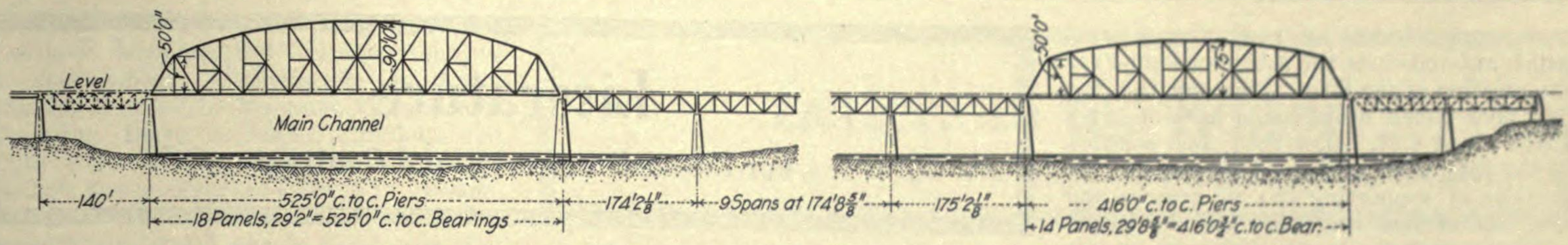
SPECIAL BARS TO SUPPORT OLD SHOES

One of the accompanying drawings shows the details of the scheme adopted. Since traffic had to be maintained, it was necessary to use a method which would insure a minimum interruption of trains while the old trusses were suspended. This was accomplished by the use of outside temporary girder supports resting on the piers and carrying six 20-in. I-beams as shown.

The order of operations for both the piers was the same. First, the old shoe plates, grillage and rollers were burned through with a flame, to reduce the width of the old shoes to 3 ft. 9 in. The masonry of the pier was then removed for 3 ft. on each side of the center line of the trusses in front and in the rear of the shoes as shown in hatched



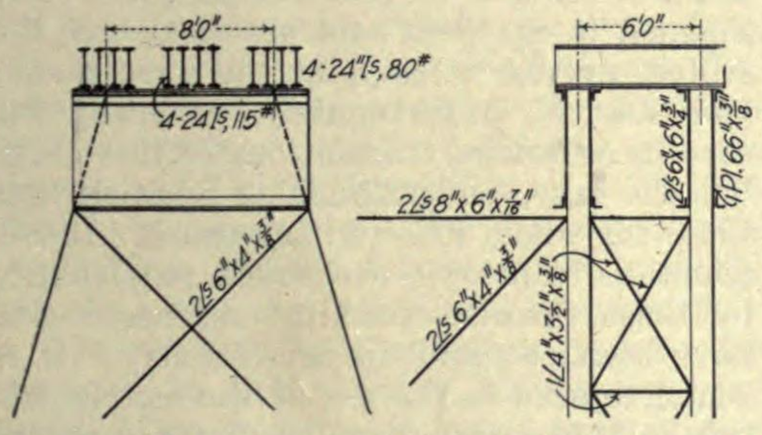
DETAILS OF SCHEME USED TO CUT DOWN TOP OF MASONRY PIER AND PLACE GIRDER GRILLAGE



OHIO CONNECTING BRIDGE OF THE PENNSYLVANIA LINES WEST OF PITTSBURGH—BRUNOT'S ISLAND IN CENTER

outline to allow the two above-mentioned supporting girders to be placed. These girders rest on the 24 x 3-in. bearing plates grouted into the pier as noted. Enough of the top course of masonry was taken out to permit the double-channel beam to be inserted. These 10-in. channel beams support twelve special bars, 4 13/16 by 2 11/16 in. in size, inserted in the old Z-bar grillage. The details of these bars, which are shaped to clear the rivet heads, are given on the accompanying large-scale drawing.

Jacking girders of three 24-in. I-beams 14 ft. long were then placed and the 3¼-in. square rods erected. Traffic was stopped and the span load lifted from the shoe by the two jacks. The top course of masonry



MATERIAL AT TOP OF TEMPORARY BENTS

immediately under the shoe was removed and six 20-in. I-beams were placed under it and on top of the supporting girders, and connected to the brackets as shown. The span was then jacked down until the shoes rested on these beams and girders, when traffic was allowed to pass.

The jacks and jacking girders were then removed, and the masonry was cut down to the final level below the bottom of the new pier girders. A concrete fill was poured on top of the old course of masonry to give the proper level for the plates under the pier girders. The four inside pier girders were placed in position, one at a time, and the I-beams supporting the shoes were wedged up from the pier girders until the load was released from the outside girders and brackets, which were then removed. The remainder of the pier girders were then set. During the removal of the masonry courses, the end stringers and the temporary girders for the adjacent span were followed up with blocking to take care of the traffic.

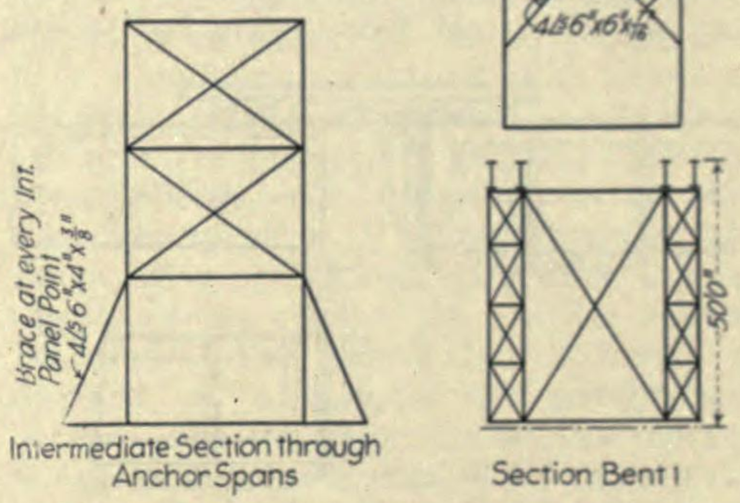
The general scheme used in the erection of the heavy main channel span is illustrated. Partly owing to the necessity for preserving a clear channel during erection and hence for adopting the cantilever method, and partly owing to the desire for rigidity and stiffness in the new structure, these trusses were designed of stiff members with riveted joints, making them the longest of this type yet constructed. The novel method of providing anchor spans by the use of the new material for the 416-ft. back-channel span with the addition of a few members to support platforms weighted down by stringers, floorbeams and steel rails to develop the desired resistance to uplift is indicated by the drawing.

The anchor spans were erected on timber falsework, using the special supporting girders for the end shoes as shown in one of the accompanying photographs, which also indicates the method of blocking up under the panel points and under the floor on the new steel stringers, temporarily used below the trusses. The new main trusses were erected by the large two-boom travelers shown, the material being delivered on barges in the river below and hoisted into place. The heavy built-up erection ties of twelve plates and two angles carried the traveler loads on the blocking seen in the photograph, being supported by temporary posts above the piers. The erection and wind stresses in some of the members of the anchor spans are very high; in the end post the total is 3,000,000 lb., which is about the same as its total normal design stress.

BRACING AND STEEL BENTS

The lower chords of the anchor trusses could not be braced laterally on the inside without interference with the floor and traffic. The outside horizontal triangular trusses shown in the plan view were therefore designed to keep these chords in line. Diagonal braces to the vertical posts, as shown in the cross-section, were used outside of the anchor trusses to support the horizontal trusses. As the new 416-ft. trusses used in these anchor spans are spaced 32 ft. apart, and the main 525-ft. trusses are 33 ft. 3 in. apart, the upper diagonal bracing and the swaybracing had to be lengthened for this erection condition by the addition of ½-in. lateral plates.

The cross-sections at the steel erection bents 1 and 2 given on the drawing indicate the erection material which had to be supplied for bracing at these points, all members being of the stiff latticed type. It is seen that one bent was placed six panels from the left main pier, while the other is seven panels from the right main pier to avoid interference with the existing piers shown. The only added truss members required were the right end diagonal and half vertical whose sections are given on the drawing. The steel I-beam grillage and supporting cross girders for the jacks and blocking, and the material used in these bents, are

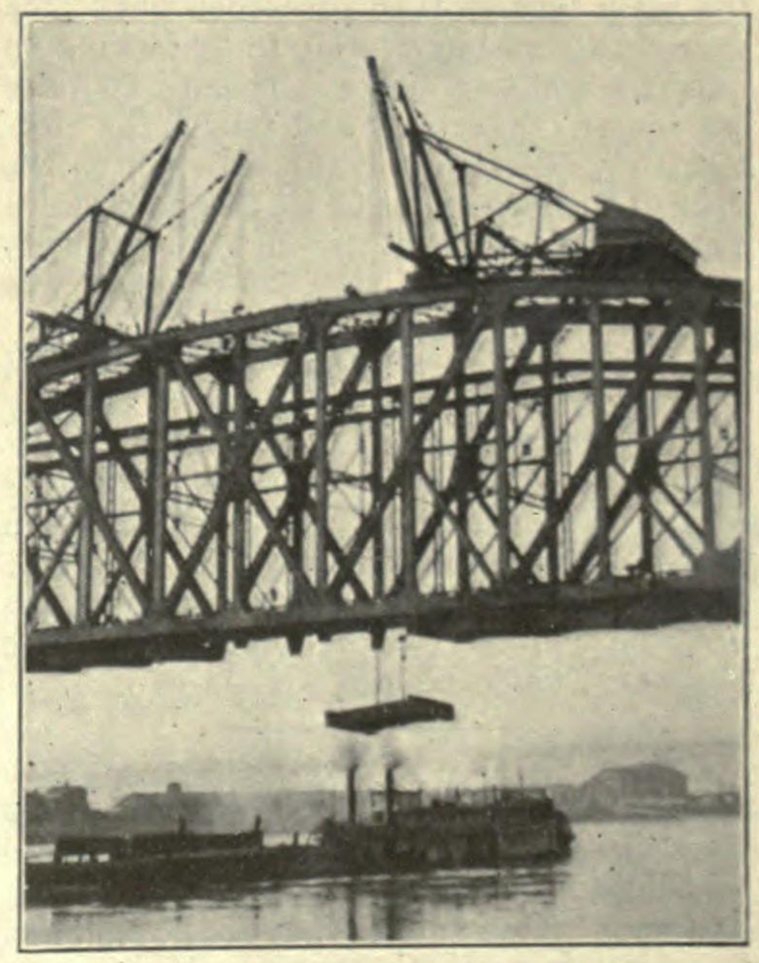


SECTIONS SHOWING BRACING OF TEMPORARY ANCHOR SPAN AND BENT 1

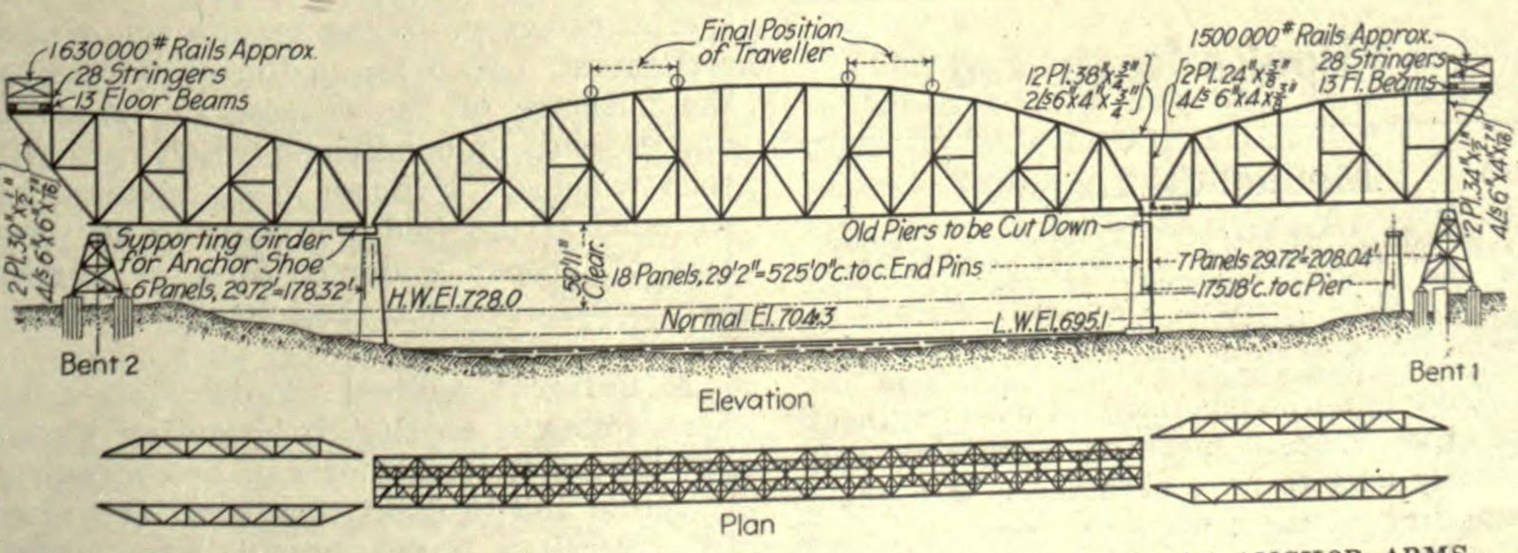
shown on the details. The bents were supported on piles capped by steel I-beam grillages.

RAPID PLACING OF NEW FLOOR

The new floor system was riveted up on barges and raised into a position below the old floor and temporarily supported by long hanger plates below the main panel points. One of the photographs shows a panel being raised from the barge into position below the truss. The drawing on page 84 shows



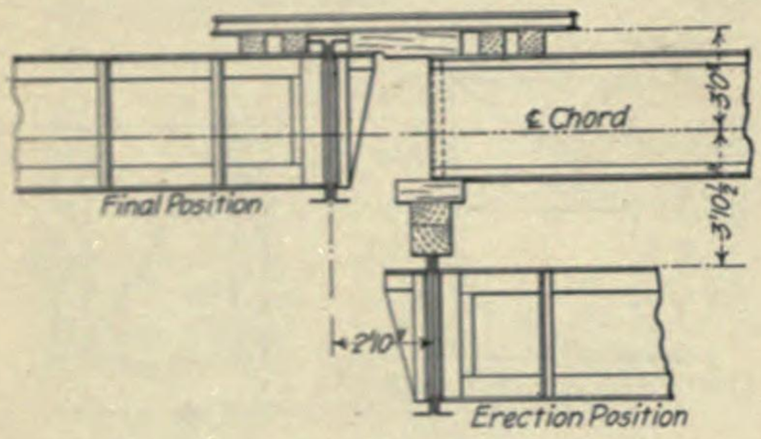
RAISING PANEL OF FLOOR FROM BARGE



CANTILEVER ERECTION OF 525-FT. SPAN, USING 416-FT. TRUSSES AS ANCHOR ARMS

that two floorbeams are used at each panel point, and indicates the scheme adopted for the erection of the floor. It is seen that the new floor panels were first erected in a position about 6 ft. below their final position in the completed bridge. This was for the purpose of supporting the old trusses and floor before their removal. The old trusses were spaced 25 ft. apart and the new trusses 33 ft. 3 in. apart, the two interior lines of new stringers being the same distance apart as the two lines of old stringers. It was therefore possible to block up the old stringers on the new. Since the old trusses consisted of twenty panels at 26 ft. 1¾ in. each the panel points did not match, and it was necessary to cut the old stringers to permit raising the new panels one at a time.

After the new floor system was placed in its temporary position, the old trusses and floor were blocked up and the trusses razed. The old stringers were cut through with a flame above one of the new floorbeams in each panel and four stiffener angles and temporary cross frames riveted to them. This was done throughout the span before any of the panels of the new floor system were raised to their final position. The taking out of the old floor system and raising



TWO FLOORBEAMS AT EACH PANEL POINT

The new floor was first erected about 6 ft. below the final location.

the new to its final position was accomplished without holding up trains more than an average of 40 min. per panel. The record time for one panel was 28 min., and the two center panels, which were changed in one operation, required one hour.

The placing of the pier girders on the piers at the ends of the main 525-ft. span was started Aug. 31, 1914, and finished on Sept. 18. Erection of steelwork of the anchor spans was begun Sept. 23 and completed by Jan. 11, 1915. The erection of the main trusses then proceeded until they were finally swung on Feb. 18 by jacking up from the end steel bents sufficiently to make the center connections and relieve the erection ties. Blocking up the old span on the floor of the new started Feb. 20 and between Feb. 26 and March 18 the old span was completely razed. The new 525-ft. span was practically completed by March 19, 1915.

These truss spans were fabricated and erected by the American Bridge Company for the Pennsylvania Lines West of Pittsburgh. J. C. Bland is engineer of bridges of the railroad. Richard Khuen, Jr., and later L. H. Shoemaker, were in charge of the construction, and H. A. Green, division erection manager of the American Bridge Company, was in charge of erection.

STREET TRAFFIC ACCIDENTS in San Francisco have been reduced, it is stated, since the adoption of "safety crossings" indicated by white bands painted on the pavement, and upon which automobiles are not allowed to encroach until the traffic policeman signals by whistle.

Literature

For the Civil Engineer and Contractor

New Publications

REPORT OF THE BUREAU OF BUILDINGS OF THE BOROUGH OF MANHATTAN, NEW YORK. 1914. Cloth; 7 x 10 in.; 99 pages, illustrated.

EXPERIENCES IN EFFICIENCY. By Benjamin A. Franklin. Cloth, 5¼ x 7½ in.; 167 pages. New York, the Engineering Magazine Company. $1 net.

ONE YEAR OF CITY MANAGEMENT IN DAYTON, OHIO. By Lent D. Upson, director. Paper; 6 x 9 in.; 7 pages. Dayton, Ohio, Bureau of Municipal Research.

THE BUDGET OF THE CITY OF DAYTON, 1915. As Enacted by the City Commission. Paper; 6 x 9 in.; 52 pages. Dayton, Ohio, Bureau of Municipal Research.

SANITATION IN PANAMA. By William Crawford Gorgas, surgeon general, U. S. Army. Cloth; 6 x 9 in.; 298 pages, illustrated. New York, D. Appleton & Company. $2 net.

STANDARD CLASSIFICATION OF ACCOUNTS for the use of the city and county of Denver. By Thomas R. Lill. Paper; 6 x 9 in.; 57 pages. Denver, the Colorado Taxpayers' Protective League.

SOME TYPES OF CITY GOVERNMENT. By Lent D. Upson, director, Bureau of Municipal Research of Dayton. Paper; 6 x 9 in.; 8 pages, diagrams. Dayton, Ohio, Bureau of Municipal Research.

YEAR BOOK OF THE DEPARTMENT OF AGRICULTURE FOR 1914. Cloth, 6 x 9 in., 715 pages, illustrated. Of principal interest to the engineer are the chapters on "State Management of Public Roads," by J. E. Pennybacker, and "The Preparation of Fertilizer from Municipal Waste," by J. W. Turrentine.

U. S. GEOLOGICAL SURVEY—Washington, D. C. Superintendent of Documents. Paper; 6 x 9 in.
WATER SUPPLY PAPER 340K—Stream Gaging Stations and Publication Relating to Water Resources, 1885-1913. Part XI, Pacific Coast Basins in California. Compiled by R. D. Wood. 15 pages, with list of other reports.
WATER SUPPLY PAPER 358—Water Resources of the Rio Grande Basin, 1888-1913. By Robert Fallansbee and H. J. Dean. 725 pages, illustrated.

ROAD MODELS—Bulletin 220, U. S. Department of Agriculture. Prepared by the Office of Public Roads, Logan Waller Page, director. Paper, 6 x 8 in.; 24 pages; illustrated. Washington, Government Printing Office.
This bulletin contains illustrations and descriptions of the models in miniature of roads, bridges and culverts and of road machinery exhibited by the Office of Public Roads at expositions and fairs and on railroads. Methods of construction are discussed.

LIMESTONE ROAD MATERIALS OF WISCONSIN. By W. O. Hotchkiss and Edward Steidtmann. Bulletin 34, Economic Series 16. Cloth; 7 x 10 in.; 136 pages; illustrated; tables and diagrams. Madison, Wis., State Printing Office.
A publication intended to aid in conserving highway expenditures for stone, which, delivered on the road, usually represents two-thirds or more of the total cost of the road. The report contains chapters on the general characteristics of Wisconsin road materials and descriptions of tests on hardness, toughness, per cent of wear, specific gravity and weight per cubic foot, and absorption.

BULLETIN OF THE PACIFIC HIGHWAY ASSOCIATION issued June 8, 1915. Paper; 6 x 9 in.; 20 pages. H. L. Bowlby, executive offices, Chamber of Commerce Building, Portland, Ore.
Official announcement of the incorporation of the Pacific Highway Association on April 19, 1915, the objects of the organization and its rules and by-laws. Ten pages are devoted to a report on the conditions of the Pacific Highway between Seattle, Wash., and San Francisco, Cal., the report having been written by Mr. Bowlby, ex-State highway engineer of Oregon, as a record of a round trip made by automobile over this highway during the month of May. The report notes distances and running time between all stops and comments in detail on the conditions of the road along the entire route.

Books Reviewed

Manual del Ingeniero

Spanish translation of Trautwine's Engineer's Pocket Book. Translator; Alberto Smith, professor of the Central University of Caracas. Cloth, 4½ x 7 in.; 1273 pages; illustrated; diagrams and tables. Paris, France, Garnier Brothers. On sale by A. Smith, 45 Broadway, New York. $5 net.

Only one who has mingled with engineers of the Spanish-speaking countries sufficiently long to have obtained a fair understanding of their ways of thinking and of the language they speak can thoroughly appreciate the value and the difficulties of the translation this author has made. Of recent years a great many of these Spanish-speaking engineers have obtained their education in the United States and have done most of their important work either under the supervision of or in association with Americans, yet the American engineer does not occupy the pre-eminent position he should in the southern countries nor are his standards of practice generally adopted there. The reason is simple—the Spanish-speaking engineer has had to look to others, particularly to the French, to obtain his technical information in a form that is understandable to him and, naturally, with this information he has adopted their methods of procedure. This work will do much to combat this tendency and will serve a very useful purpose. The Spanish is excellent and practical, not the stilted, precise attempt at the pure *castellano* that is, unfortunately, generally the case in American translations of this class, but the easy, understandable Spanish that those for whom it is written speak. It will doubtless be heartily welcomed, particularly by those Spanish-speaking engineers who have been educated in this country. It is complete even to the use of the metric system in tables and formulas, instead of the English system of feet and inches or decimals. In contents the work is identical with the original, so that a reader who understands either of the languages may lay the original and the translation side by side and easily acquaint himself with the terminology of the other.

Irrigation in America

Author, A. D. Lewis, M.A., circle engineer, Irrigation Department, Union of South Africa. Cloth; 8½ x 11 in.; 258 pages, illustrated. Pretoria, South Africa, Government Printing and Stationery Office.

The object of the author in writing this book is avowedly to spread information of the rapid strides made in America in recent years in the irrigation of arid lands and methods of inducing settlement thereon. Many valuable examples of engineering methods in constructing high masonry and earthen dams are given, and even more valuable lessons are derived from the results of settlement. Seventeen of the more modern irrigation schemes which the author inspected during a trip in the United States in 1913 are described and well illustrated. Each scheme is described separately in all of its aspects and with special reference to the results achieved in settlement, which is, as the author states, the measure of the success of irrigation and depends on conditions which vary with each scheme. Failures have resulted not so much from bad engineering as from lack of proper understanding of agricultural conditions and the human element involved.

A uniform method of description has been followed so that information on any one aspect of irrigation can be conveniently found and brought together. One chapter describes some useful crop experiments in Utah and two chapters are de-