the Ohio River at the Ironton plant during August, 1923, averaged 22,000 B. Coli per 100 cc. It has been necessary, then, for each step in the water purification process to be operated at a maximum degree of efficiency and most especially that of filtration. It is the writer's opinion that the most important factor in obtaining a high degree of filtration efficiency is the proper preparation of the water for filtration. A limited amount of well-formed floc in the influent water to the filters is essential. Secondly, the size of the sand must be fine enough and of uniformity enough to intersept and retain suspended flocculated material as well as to furnish the medium for proper film development.

* * *

Author Answers Points in Discussion

By John R. Baylis

It was not intended that the conclusions set forth in the study of filter beds at Baltimore should be applied elsewhere without first checking up on local conditions. The fact that a vast number of filter beds throughout the United States form clogged places forces us to admit that we have a problem. Observations at other places having variable characters of water leads to the belief that alkalinity, turbidity and properly coagulated water are not the controlling factors, though they may have some influence. Evidence seems to prove conclusively that no rate of wash that may be applied under the beds will prevent clogging in many plants. An additional force is necessary to maintain such filter beds in good order, whether it be in the form of air, rakes, water jets or other means. It is believed that water jets will prove the more economical in many instances. Any device that merely corrects a bad condition, only to let the beds become bad again before correcting, is a makeshift that should not be tolerated. Whatever be the force necessary to keep beds in good condition, it should be applied. Attention to a satisfactory washing adjunct is almost as essential as it is to apply the necessary chemicals for proper treatment.

The statement that the top 16 to 18 in. of sand should be of uniform size was not intended to imply that this should be the total depth of sand in the bad; 6 to 10 in. of fairly coarse sand from 1.5 to 2.0 mm. below the filtering sand is very desirable. The coarse sand will aid in breaking up clogged masses that might escape the surface wash. The purpose of surface wash is not to break up clogged masses that have settled to the gravel layer, but to prevent them from forming. It is probably cheaper to break up the clogged places already formed by other means. Later experiments with chlorine tend to confirm the fact that it cannot be relied upon to prevent clogging under our conditions, although it probably offers some aid.

The idea of omitting the underdrains is Mr. Armstrong's, and full credit should go to him. It might be interesting to note that two years' operation of such a filter in our plant has shown that its condition is as good as that of the other filters.

The burden of proof that colloidal adsorption is responsible for shrinkage rests with its advocates. The pulling away of the sand from any vertical surface occurred only when filtering and when there was settlement.

It is not expected that there will be general agreement on sand sizes. Sand having an effective size of 0.6 mm. will filter properly coagulated water to a colloidal turbidity of 0.2 p.p.m., and a floc turbidity of 0.02 p.p.m., which is the desired standard for well operated plants. Unless there is bacterial action taking place in the filter beds, the bacterial removal is largely in proportion to the colloidal turbidity of the filter effluent. If the larger size offers aid in preventing cracks, it is the better size to use.

Bill Restricts Use of Wooden Passenger Cars

Use of wooden passenger cars between or in front of a steel or a steel-underframe car is prohibited in a bill which has been reported favorably by the Senate Committee on Interstate Commerce. Penalties are provided for violations of the proposed law. The legislation is based on an urgent recommendation from the Interstate Commerce Commission.

Towers of First Suspension Bridge Over Hudson River Completed

Erection of 350-Ft. Steel Towers for Highway Bridge Accomplished—Approaches and Anchorage Tunnels Under Way

During February the erection of the towers for the suspension bridge across the Hudson River at the lower edge of the Highlands, which is being built for the Bear Mountain-Hudson River Bridge Corporation, was completed, and riveting is now nearly completed. Work on the cables will begin this spring, and it is hoped that erection may be completed by the end of the year.

Erection of the steel towers was done by methods and equipment much like those used some years ago on the Manhattan bridge across the East River at New York. A creeper traveler carrying a stiffleg derrick of 50 tons capacity was erected on the river side of the tower, and as the successive sections of the main columns were set the creeper was pulled up by a special hoisting engine to a new position from which the next sections of the tower could be set. Each post consisted of three pieces above the bottom section, which consisted of seven pieces. The heaviest erection piece was 55 ft. long and weighed 50 tons. The posts of these towers are battered inward toward the top; the suspension and fastenings of the traveler were therefore designed to suit the different widths between posts at the successive settings.

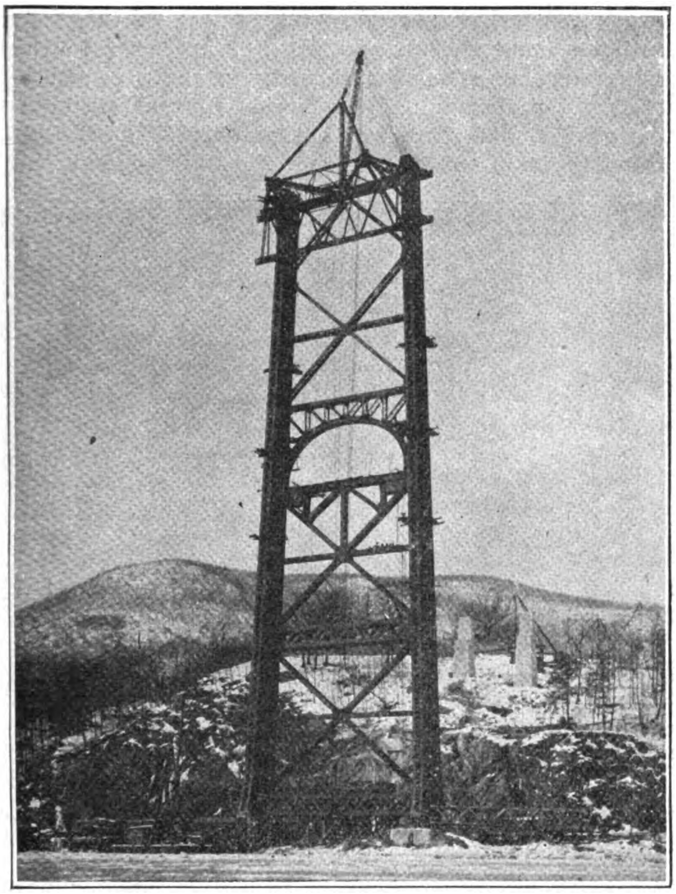
For the cable erection a foot bridge or working platform will be erected just under the two main cables. The girders for anchoring the foot-bridge cables are now being placed in the anchorage pits.

It is only two years since the conception of the project for the bridge, although the first charter for a bridge at this site was obtained in 1868 and many attempts to undertake construction were made subsequently. The present charter was obtained less than two years ago; after securing permits and completing the financial arrangements, a contract for construction was signed on March 24, 1923, and work was immediately begun.

The bridge will be a suspension bridge with straight (unloaded) backstays, of 1,632-ft. main span and with a clearance at high tide of 155 ft. It is to carry a reinforced-concrete roadway 38 ft. wide and two 5-ft. sidewalks. The west approach consists of two 50-ft. spans, one 100-ft. span, and one 220-ft. span, while the east approach consists of a single 220-ft. span. The main towers are 350 ft. high and rest on concrete piers carried on rock near water level. The two main cables will be 18 in. in diameter each. The anchor pits are inclined tunnels, those on the west bank about 110 ft. deep and those on the east bank about 90 ft. deep. The cast-steel bases to which the anchorage eyebars will be fastened are now being set in these tunnels. The cables carrying the suspended structure will be woven in place and will consist each of 7,452 parallel wires of 0.192 in. diameter. The stiffening trusses will be 30 ft. deep and spaced 55 ft. apart; they will be placed below the roadway, so that a clear view up and down the river will be obtained from the floor of the bridge. A horizontal truss under the bottom chord will act as windbracing. The transverse struts of this truss extend outside the chord and the suspender ropes from the cables are connected to them.

A large amount of highway work is required in constructing approaches to the bridge. On the east side a road is being built about 3 miles long from the end of the bridge to a connection with the present main road at a point near the state military camp at Peekskill. This is very difficult work, being side-hill construction through granite and for a long distance being immediately over the main-line tracks of the New York Central R.R. The west approach road will be only about 800 ft. long extending to the Henry Hudson Highway.

E. Roland Harriman is president of the bridge company and Wilson Fitch Smith is chief engineer. Howard C. Baird, consulting engineer, is responsible for the design of the bridge. J. V. W. Reynders is in charge of construction for the contractors, the Terry & Tench Co., Inc., who obtained the charter and have the contract for the whole work.



WEST (BEAR MOUNTAIN) TOWER AND EAST (ANTHONY'S NOSE) TOWER OF HIGHWAY BRIDGE ACROSS THE HUDSON

New Type of Fishway

A possible means of overcoming the objection of the fish industry on the Pacific Coast to the construction of dams on such streams as the Columbia, and the Sacramento and the Klamath Rivers and the rivers on the west coast of Alaska, is expected to be found in a type of fishway recently developed in California. Heretofore the Bureau of Fisheries has taken the position that fish will not cross a dam over 30 ft. in height regardless of what may be provided to facilitate their passage, but the recent experiments with a fishway providing a series of resting pools has demonstrated that fish will climb to this or greater heights.

Defect in Illinois Drainage Law

THE 1923 Illinois legislature amended the Drainage Act to provide that no bonds could be issued without submitting the bond issue to a vote of the District and that the rate of taxation for all purposes, exclusive of bonds and interest, should not exceed 0.66 per cent. Prior to the amendment the rate for all purposes exclusive of bonds and interest was 1.33 per cent, or in other words the rate was reduced 50 per cent. In the extension of 1923 taxes for the East Side Levee and Sanitary District, East St. Louis, the county clerk of St. Clair county felt that he must abide by this amendment and refused to extend a rate more than 0.66 per cent.

Attorneys for the District contended that the amendment was not legally passed in the legislature and in a mandamus proceeding in the Circuit Court to compel the county clerk to extend the taxes on the law prior to its purported amendment in 1923, the Circuit Court held that the act had not legally passed. Taxes were therefore extended by the county clerk based on the law in effect in 1923. The basis of the court's decision was that the Senate, in receding from an amendment in which the House had refused to concur, had voted without a legal majority being present.

While the law in question is general in its terms, the East Side District is the only one now operating under its provisions. The principal differences between this law and the Levee Act are: (1) It contains a provision allowing the organization of districts including territory in more than one county; (2) the manner of taxation is changed from a benefits assessment on property to a general tax on all classes of property.

Edward F. Terry

Edward F. Terry, whose associates termed him one of the most successful construction engineers in America, and whose death was noted in these columns last week, began life on a New England farm. He was born near Concord, New Hampshire, in 1857. Both of his parents died while he was very young, and he was sent to live with an uncle in Wisconsin. As a boy, the railroad and everything that pertained to its building and operation interested him and he spent most of his spare time with the workmen along the tracks.

Michael Riney, an old time bridge builder, took a liking to the young man and offered him a job as a riveter. That was before the days of electric tools and the job of riveting was arduous, but young Terry was a physical giant and thrived on hard work. Later Riney was badly hurt in Rochester, N. Y., while working on a viaduct for the Rochester Bridge Works. Terry was put in charge of the work in his place. He finished the job satisfactorily and his real career as a leader in steel construction then began.

Mr. Terry directed construction work shortly afterwards for the Youngstown Bridge Co., and built the steel arch bridge at St. Paul, Minnesota. Altogether he bridged the Mississippi River five times as well as erecting spans over the Missouri and other rivers in the middle west. Later he did much construction work on the Union Pacific R.R. in Idaho and Oregon under George H. Pegram.

Mr. Terry formed a partnership with Frederick Tench, under the firm name of Terry and Tench Construction Co., in 1895, their first contract being the erection of the New York Central four-track drawbridge over the Harlem river, the first of its kind. Since then they have built many bridges and elevated railroads. Mr. Terry had personal charge of the third tracking of the 2nd, 3rd, and 9th Avenue Elevated roads in New York. He also directed the erection of the Manhattan Bridge. The Boston Elevated R.R., Grand Central Terminal, Biltmore Hotel and other big steel construction contracts were handled by his firm. Three of the city of New York's piers at Stapleton, S. I., were built under his firm's direction.

During the war Mr. Terry formed the Terry Shipbuilding Corporation at Savannah, Ga.

Engineers Address New England Health Institute

A half dozen engineers and chemists were included on the "faculty" of more than eighty members that addressed the New England Health Institute at Boston during the week of May 5 to 10. The institute was held under the joint auspices of the U. S. Public Health Service, the various state health departments of New England, the Yale and Harvard schools of public health, the departments of biology and public health of the Massachusetts Institute of Technology and Simmons College, with Dr. Eugene R. Kelly, State Commissioner of Health of Massachusetts, as director. Thirteen "courses" were offered, including public health administration, sanitation and engineering, and industrial hygiene. The chairman of the section on sanitation and engineering was I. V. Hitchcock, assistant professor of public health at Yale University.

Papers on engineering and related subjects included: "Sanitation of Swimming Pools and Other Bathing Places," Stephen DeM. Gage, Providence; "Private Water Supplies and Their Dangers," C. P. Moat, Burlington, Vt.; "Sewage Disposal and Drainage," Prof. George C. Whipple of Harvard University; "Garbage Collection and Disposal," M. N. Baker, New York City; "Some Unsolved Problems of Public Health," Prof. C-E. A. Winslow, Yale University; "Stream Pollution by Industrial Waste and Its Control," J. Frederick Jackson, Hartford; "Water Supplies and Their Protection," X. H. Goodnough, Boston.

Engineering Societies

Calendar

Annual Meetings

AMERICAN WATER WORKS ASSOCIATION, New York City; Annual Convention, New York City, May 19-24, 1924.

AMERICAN ASSOCIATION OF ENGINEERS, Chicago, Ill.; Annual Meeting, San Francisco, Calif., June 11-13, 1924.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Convention, June 18-20, Pasadena, Calif.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J., June 23-28, 1924.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, University of Pittsburgh; Annual Meeting, Boulder, Colo., June 25-28.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburg, Fla.; Annual Convention, Boston, Mass., Sept. 29-Oct. 3, 1924.

The New England Water-Works Association will hold its annual convention Sept. 23 to 26 inclusive at Rochester, N. Y. Headquarters will be at the Powers Hotel.

Personal Notes

MUSSON & GALE, engineers and accountants, Oklahoma City, Okla., announce that by reason of increase in their business they have separated their civil work into a department at the head of which is Colonel Frank B. King, consulting engineer, who has been president of the Oklahoma City chapter of the American Association of Engineers and of the Oklahoma Society of Engineers, who served as lieutenant-colonel and colonel of engineers in France, and who has practiced civil engineering in Oklahoma for twenty years.

RAY E. BEHRENS, formerly county engineer of Waukesha County, Wis., has been appointed assistant civil engineer in Milwaukee County, for service in the department of regional planning and zoning.

WALTER C. BENEDICT has resigned as district engineer of the Buffalo district of the Empire Engineering Co., Inc., to become president of the Twin City Construction Corp. of North Tonawanda, N. Y. Associated with Mr. Benedict in the company are Fred. W. Ives, former president of the New York State Builders Supply Association, and William E. O'Reilly, formerly of the firm of Bewley & O'Rielly, Inc., contractors of Lockport, N. Y.

GEORGE F. WIEGHARDT, formerly highway engineer for the city of Baltimore and for some time engaged in engineering work in Reading, Pa., has been appointed business manager for the Baltimore public schools. Before he was made highway engineer Mr. Wieghardt was assistant engineer in the water department of Baltimore.

WILLIAM C. RUDD has established an office as consulting engineer at 307 Hazen Bldg., Main and 9th Sts., Cincinnati, Ohio, for special practice in steam engineering and combustion for water-works, power plants, heating plants and for industries. Mr. Rudd has been in similar work for twelve years, for the past year associated with George W. Hubley, consulting engineer of Louisville, Ky., and for the six preceding years engineer of water service for the Louisville & Nashville Railroad Co.

THE DOCK & TERMINAL ENGINEERING CO. has acquired the engineering business formerly conducted by the Cleveland Dock Engineering Co. and will continue with Cleveland office at 4614 Prospect Ave. and New York City office at 15 Park Row, and with the following personnel: Gaylord W. Feaga, president; Joseph S. Ruble, vice-president; James D. Carey, secretary; Edgar B. Thomas, chief engineer; and Wilbur J. Watson, consulting engineer.

THOMAS W. SASSCER has been promoted to be assistant construction engineer in the highways department of the city of Baltimore, Md. Frank A. Lucas, Ferdinand S. Schmiedeke, Edward W. Boyce, Harry J. Lummis, Jr., and Rudolph F. Zerner have been appointed assistant topographical engineers in the city surveyor's department, and John B. McCrone, Jr., an engineering aid in the same department. Leon Small, for several years assistant engineer in the water department, has been appointed mechanical engineer in that department.

M. J. STINCHFIELD, JR., assistant state engineer for the Indiana Conservation Department for the past three years, has resigned to take charge of the engineering staff of the Walb Construction Co., LaGrange, Ind., and will also be advantageous since it would obviate the necessity of storing the clinker and so permit it to pass directly to the grinders. The exposure of the product to the action of carbon dioxide can, as a practical matter, be accomplished during any one or all of the several stages of grinding and pulverizing by feeding carbon dioxide with or without moisture into suitably arranged pulverizing machinery. The same object may also be attained by delivering the ground cement into storage bins filled with an atmosphere containing carbon dioxide, by causing the cement on its way from the pulverizing mills to pass through such an atmosphere or by separately aerating it with moist carbon dioxide at any stage after grinding and before use. Temperature at the time of exposure is an important factor. The best results are probably to be obtained at and above 180 deg. Fahrenheit.

From the standpoint of the manufacturer it is also to be noted that the process suggested would involve no appreciable increase in cost, since the carbon dioxide necessary can probably be readily obtained from the waste kiln gases after they have been sufficiently cooled and conditioned. It may also be concluded that a cement so treated will be less liable to deterioration during storage.

This suggested process and the inferences on which it is based are the direct result of the investigations which had for their purpose the study of the solubility of cements in general. It is presented as a definite and practical suggestion looking toward the attainment of a more uniform and a more stable cement which, when used in concrete, will result in a product possessed of both greater permanence and lesser solubility. Any process or procedure which will render possible a reduction in the quantity of the easily soluble calcium sulphate which is at present added to portland cements after calcination will be most desirable.

It is not possible within the compass of this article to present the more detailed results which have been obtained, not only with sugar solutions but also with solutions of glycerine and of sodium carbonate. The indications of these researches in connection with those on the tensile strengths of portland cements, when mixed with quantities of water which approximate those used in actual work, all agree with observations which have been made on the rise of temperature during the setting period and tend to confirm the substantial correctness of the suggestions presented.

Further data in regard to all of these investigations will be forthcoming in future articles of this series and, in concluding the present writing, acknowledgment is made of the invaluable help and assistance rendered by L. B. Stebbins, assistant engineer in charge of the laboratory of the Board of Water Supply.

Subway Surveys Being Made at Brussels

Surveys have been started in Brussels, Belgium, toward the construction of a subway. According to an announcement by M. Max, bourgemaster, it is planned to run the subway from the Gare du Midi to the Putterie quarter, where the central station will occupy a site originally intended for a union railway station, thus making use of some work already completed. From this central point lines will radiate to the other two principal railway stations of the city, the Gare du Nord and the Gare du Luxembourg.

Construction Progress on Bear Mountain Bridge

Bottom Chords of Stiffening Trusses Were Joined on October 6—Physical Features Described

PROGRESS on the suspension bridge now in course of construction across the Hudson River at Anthony's Nose, about 40 miles above New York City, and known as the Bear Mountain bridge, has so far advanced that the bottom chords of the stiffening trusses met on Oct. 6. This bridge has the longest suspension span in existence, and will be exceeded only by the Philadelphia bridge, the main span being 1,632 ft. c. to c. of towers, exceeding by a few feet the Williamsburg bridge, which is the longest of the East River bridges of this type. Its location is peculiarly adapted to a suspension structure as the river narrows at this point and the rock formation furnishes a natural foundation for the piers and also furnishes the necessary anchorage for the cables. On the west bank and close to the bridge approach is historic Fort Clinton, and it was at this narrow point in the river that the celebrated chain was placed to prevent passage of the British vessels in the Revolutionary War.

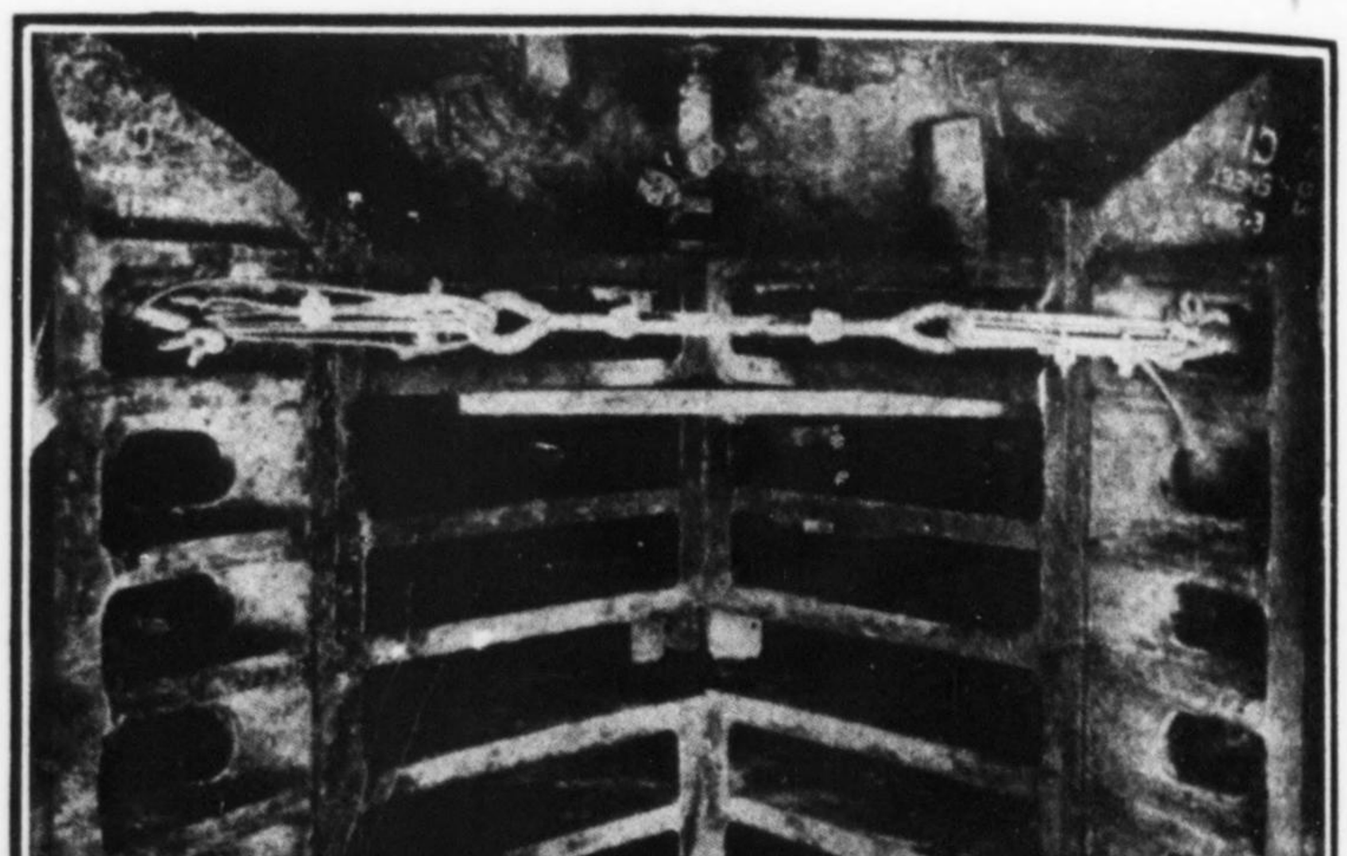


FIG. 1—ANCHORAGE CASTINGS IN PLACE IN PIT
Looking into inclined rock tunnel of north anchor chain on the west bank.

The structure is intended to provide for the traffic of the existing state road on the west side of the river and traffic which will be developed by a possible future road in addition to the road now nearing completion which forms the east approach to the bridge. A roadway of 38 ft. in width, providing for four lines of vehicles, together with two 5-ft. sidewalks, occupies almost the entire space between the stiffening trusses, which are required to be 55 ft. apart for lateral stability.

Several unusual features are embodied in the design, particularly in the anchorages and the main span trusses. The landward portion of the main cables form straight backstays, as the shore spans are so short that they are better carried on their own piers than suspended from the cables. These backstays are carried into rock tunnels at an angle of 26 deg. with the horizontal, the ends of the cable strands being anchored in the usual way to a group of eyebars. These bars are anchored to castings, which take a bearing on the rock face of the chambers provided at the lower ends of the pits. The eyebars are laid flat and are in line with the backstays and the bearing faces of the castings make an angle of 45 deg. transversely with this line, so that a wide distribution of reaction on the rock is obtained.

vertical members, which pass through and are supported on a very wide truss on the main towers, so that the reactions are perfectly central.

The towers, which are 351 ft. high, rest on cast steel bases 10 ft. x 35 ft. x 5 ft. high, which in turn rest on concrete piers 20 ft. x 40 ft. on top. Each base is made up of three sections as is shown in Fig. 3. The columns are slightly battered transversely, so that the main trusses and the approach span trusses may come entirely inside, the width at the bottom being 89 ft. 10 in., and at the top 61 ft. 4 in., or the distance c. to c. of cables.

FIG. 2—BOTTOM CHORDS OF STIFFENING TRUSS ABOUT TO BE JOINED

Fig. 1 shows castings in position; the height is 11 ft. and the width shown 9 ft., flaring to 22 ft. behind the rock.

The eyebars are of structural steel and the bearings of cast steel. The main truss members are of silicon steel, furnished under special specifications, and the floor system, bracing, towers, and approach spans are of structural steel according to A. R. E. A. specifications. The main trusses are attached to the towers by swinging

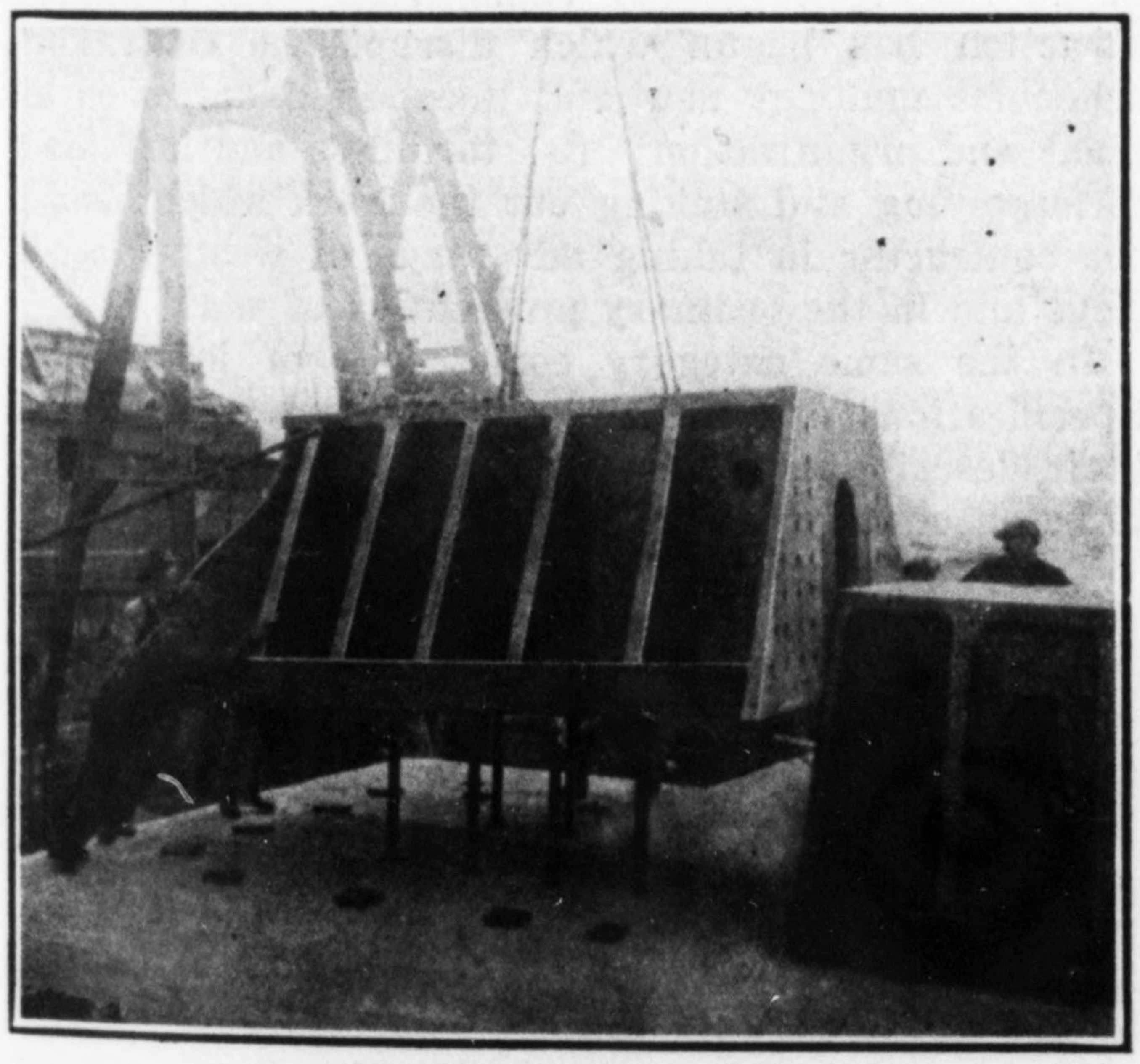


FIG. 3—SETTING CASTINGS ON PIER

The main cables are of drawn steel wire and are 18¼ in. in diameter, each cable being made up of 7,252 galvanized wires which are of 0.192 in. diameter; the total length of single wire in the two cables being 7,377 miles.

The work on this structure was taken up early in 1923, the excavation for the anchorages and main piers being begun in May, and concreting for the latter starting early in August. The erection of the east tower started Oct. 22, 1923, both east and west towers being completed about the middle of April, 1924. The first castings were placed in the anchorage pits the latter part of January, 1924, and the anchor bars completely placed about June 1. Meanwhile, the wire rope cables for the temporary footbridge or working platform were put in place during April, and the platform completed early in June, thus enabling the spinning of the main cable strands to start on June 14. The cables were completed on Aug. 23 and immediately thereafter the weight of the footbridge was transferred to them and the wire rope cables removed, to be used for the main span suspenders.

Erection of the stiffening trusses started Sept. 13, the lower chords, web members, bracing, and the greater part of floor being placed by a traveler on each half of span advancing from the towers to the center of span and picking up the steel from barges towed to position. The travelers are now retreating shoreward and placing top chords and remaining floor members required to complete the span.

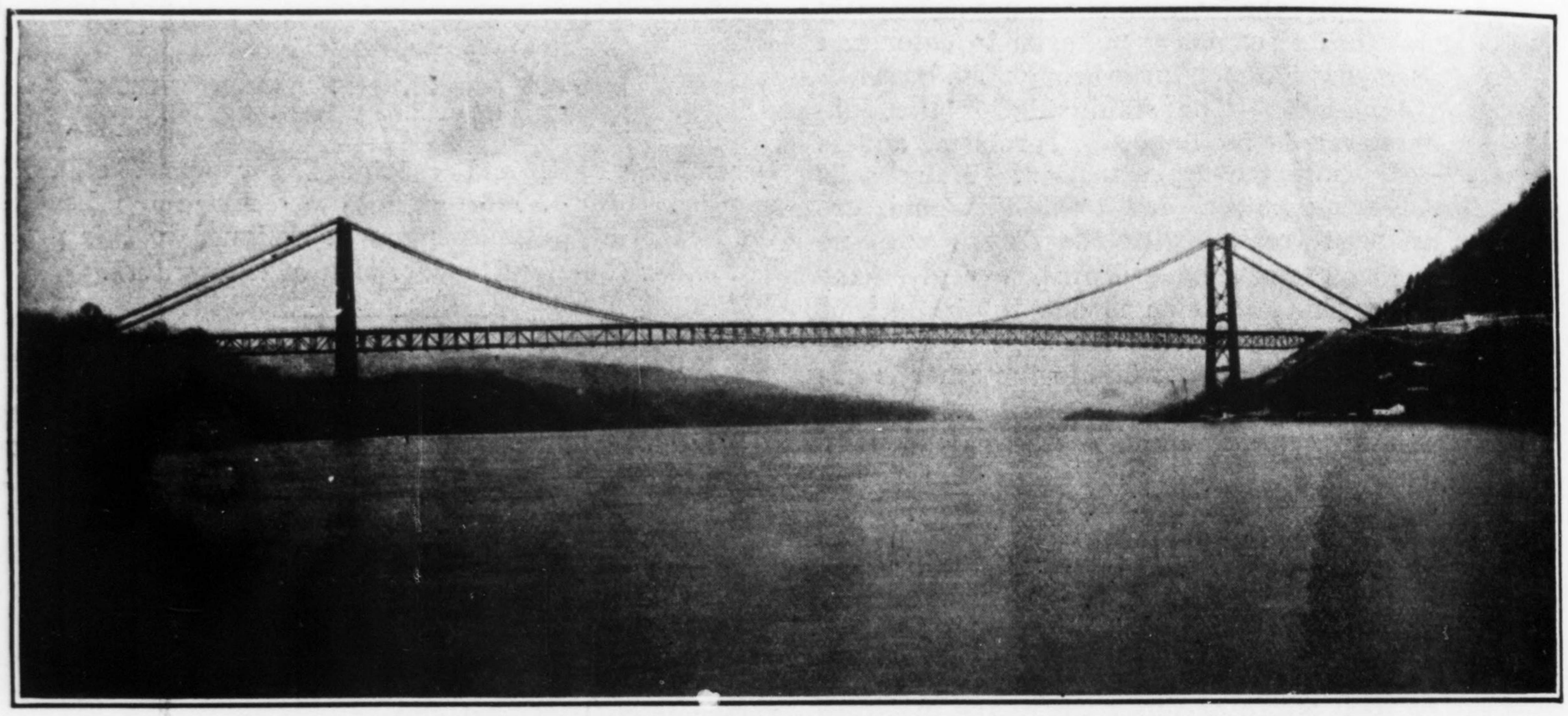
The structure was designed and is being supervised by Howard C. Baird, consulting engineer, 95 Liberty St., New York City.

Bear Mountain Suspension Bridge Over Hudson River

Design of Longest Suspension Span Yet Built—Private Enterprise Builds First Highway Crossing of Hudson in 150-Mile Stretch From Albany to Mouth of River

By Howard C. Baird
Consulting Engineer, New York City

The Bear Mountain Bridge, crossing the Hudson River from Anthony's Nose on the east bank to Bear Mountain on the west, a few miles above Peekskill, N. Y., was completed ready for traffic Nov. 26. Wrapping of the cables, final adjustment for elevation, and covering of the anchorage pits, remains to be done, but this work will not interfere with the use of the structure. The main span, 1,632 ft. c. to c. of towers, the longest suspension bridge in the world, was completed in an extraordinarily short space of time, both the cable spinning and the erection of the suspended structure, including the concrete floor slabs. The construction of the piers and anchorages and the erection of the approaches and the towers, the latter in the winter season, while not so rapid in progress as the main span, contributed to the remarkable record of a bridge structure over the Hudson River being ready for traffic 18 months after breaking ground.

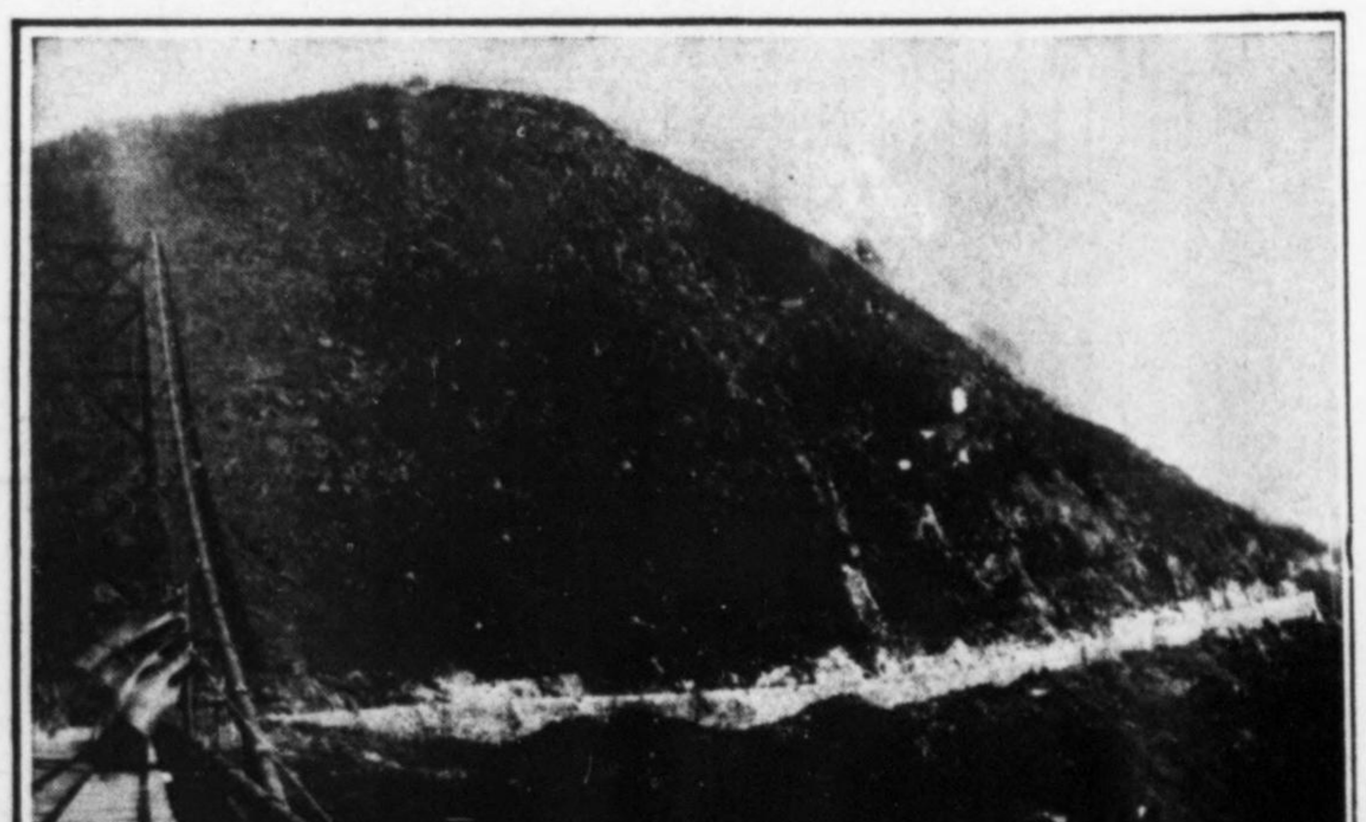


LOOKING UPSTREAM AT THE BEAR MOUNTAIN BRIDGE
Bear Mountain at left. Anthony's Nose at right. Footbridges under cables still in place on a large part of the span.

Location—The location was fixed by the available clear space at the river bank between the water and the railroad property on both sides of the river, and the topography of the high ground, into which the anchorage tunnels were driven through solid rock. The span length was fixed by triangulation and checked very closely with the joining of the two halves of the stiffening trusses at the center.

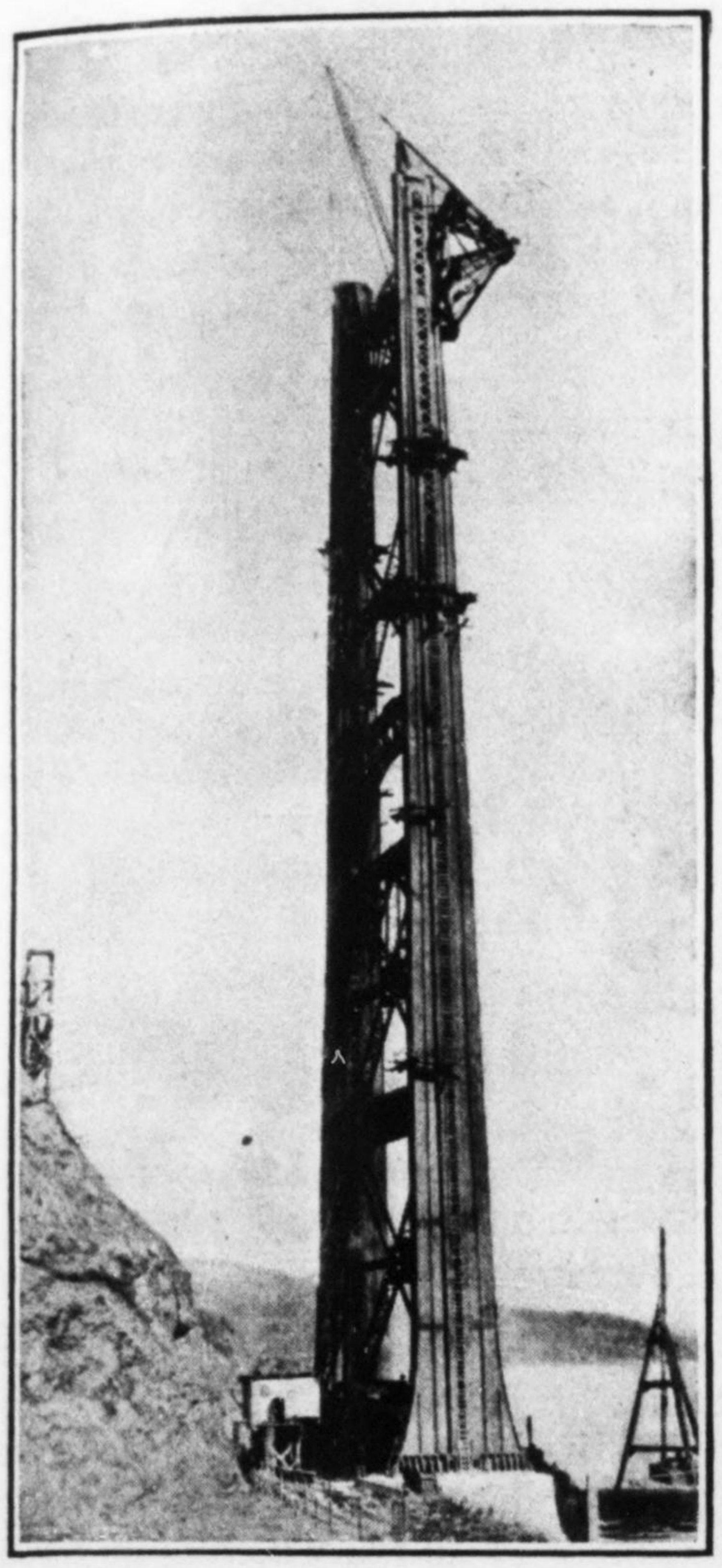
Capacity—The loading of the bridge was fixed by the charter granted the company by the State of New York, but in addition it was deemed advisable to provide a floor system capable of carrying 15-ton and 20-ton trucks so as to meet fully the requirements of modern highway traffic. The specified load of 70 lb. per square foot for the general live-load on the main-span roadway is equivalent to a total of 217 10-ton trucks, or four lines of 54 trucks each, the roadway being 38 ft. wide although a width of 20 ft. only is required by the charter. There is a 5-ft. sidewalk on each side of the roadway.

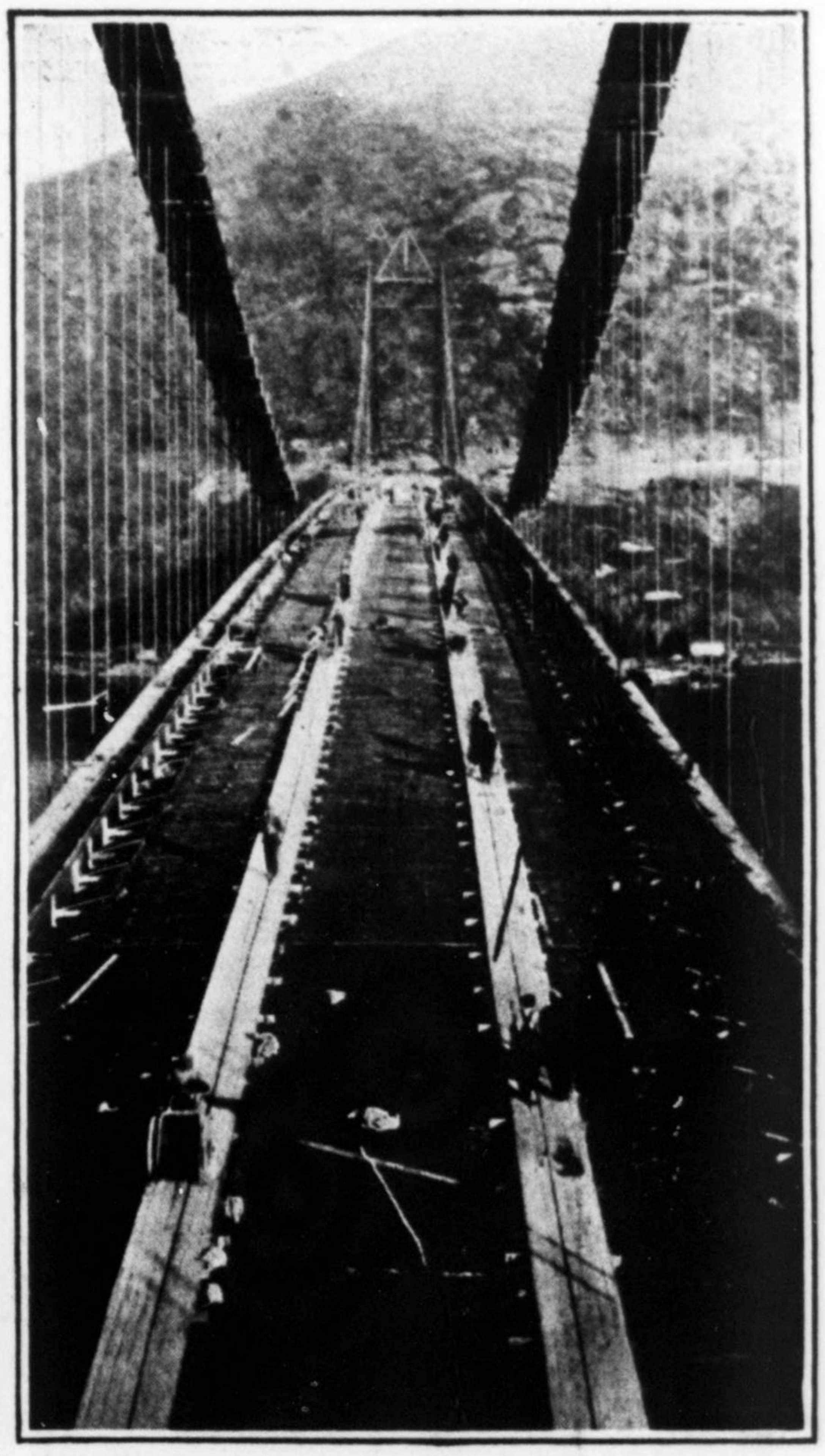
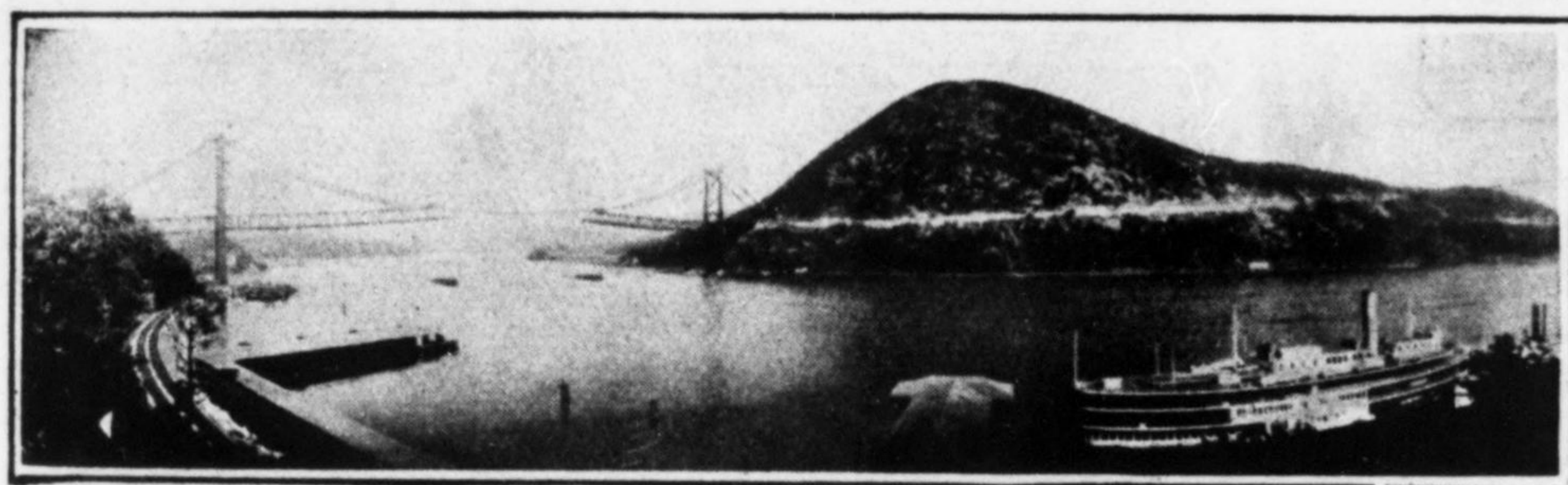
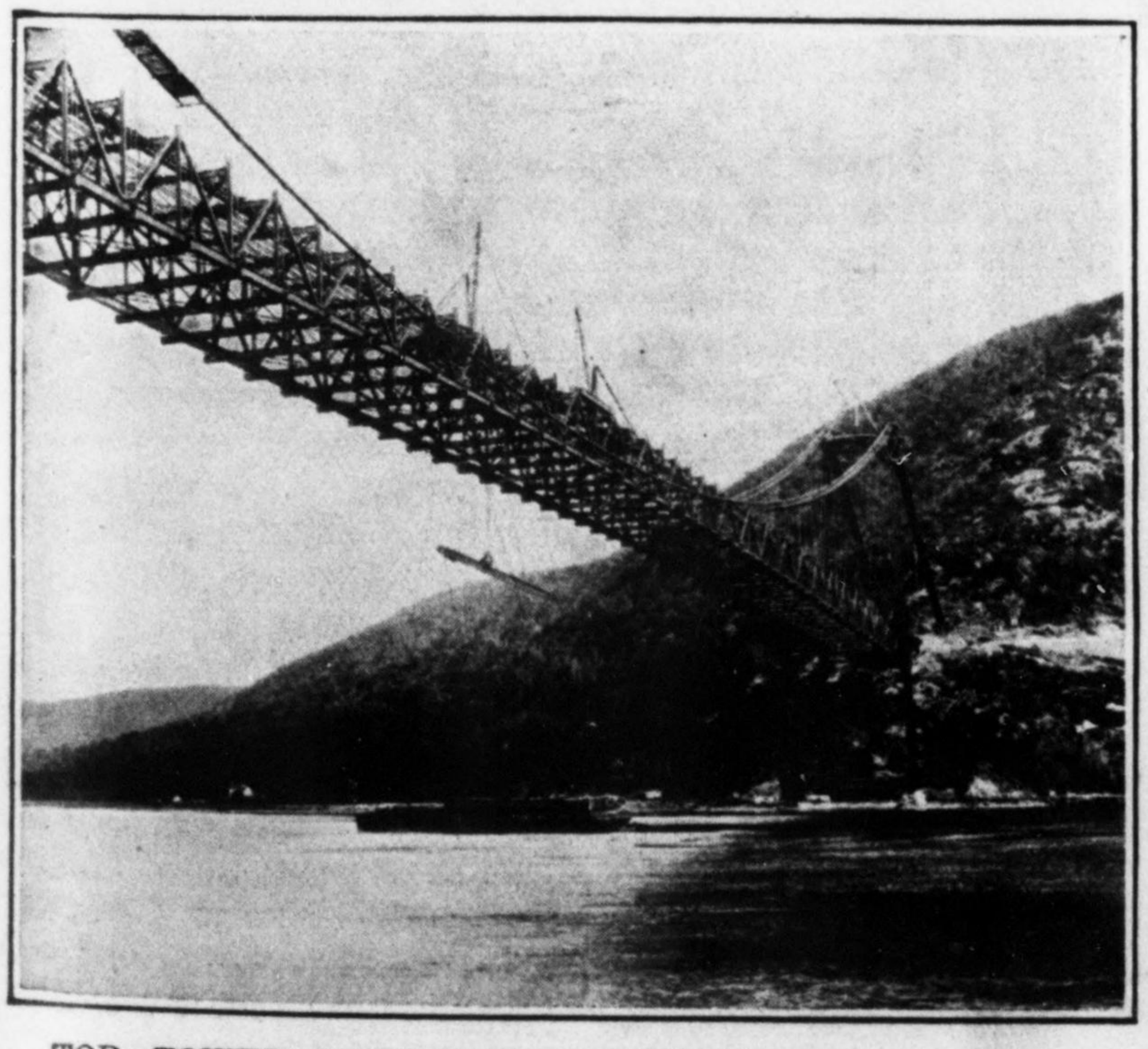
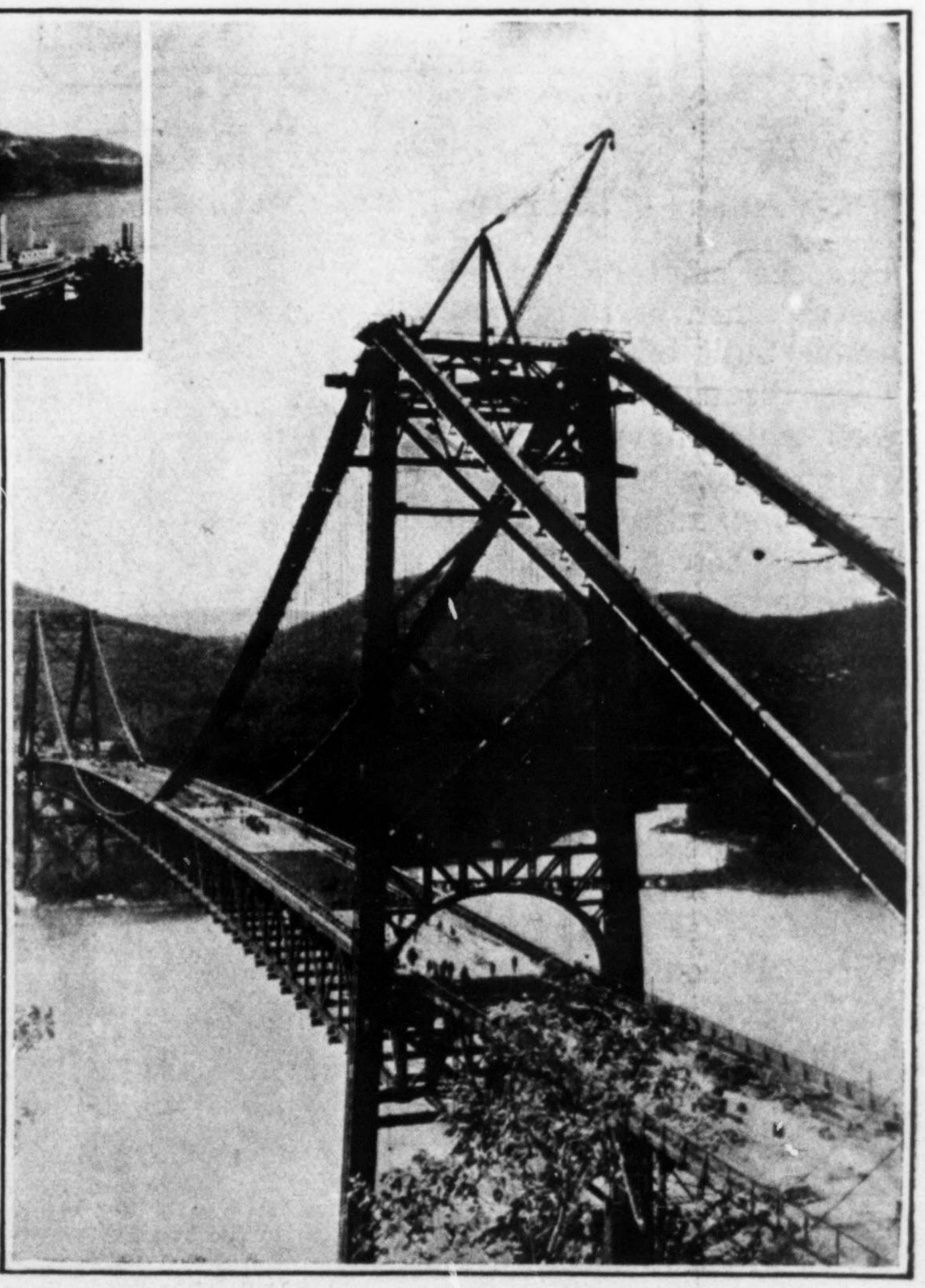
Cables and Stiffening Trusses—The suspended structure, which is of deck type, is carried by two cables with a versed sine of 200 ft. under live-load; the backstays are straight except for the sag due to their own weight. Each cable is made up of 7,252 wires of 0.192 in. diameter, drawn from openhearth steel billets and having an ultimate strength of 215,000 to 220,000 lb. per square inch after galvanizing. Cast-steel saddles carry the load from the cables to the towers and are fixed to the top of the columns, the latter being required to bend as the temperature and loading conditions change. The wire-rope suspenders are supported by cast-steel bands on the cables and at the bottom end



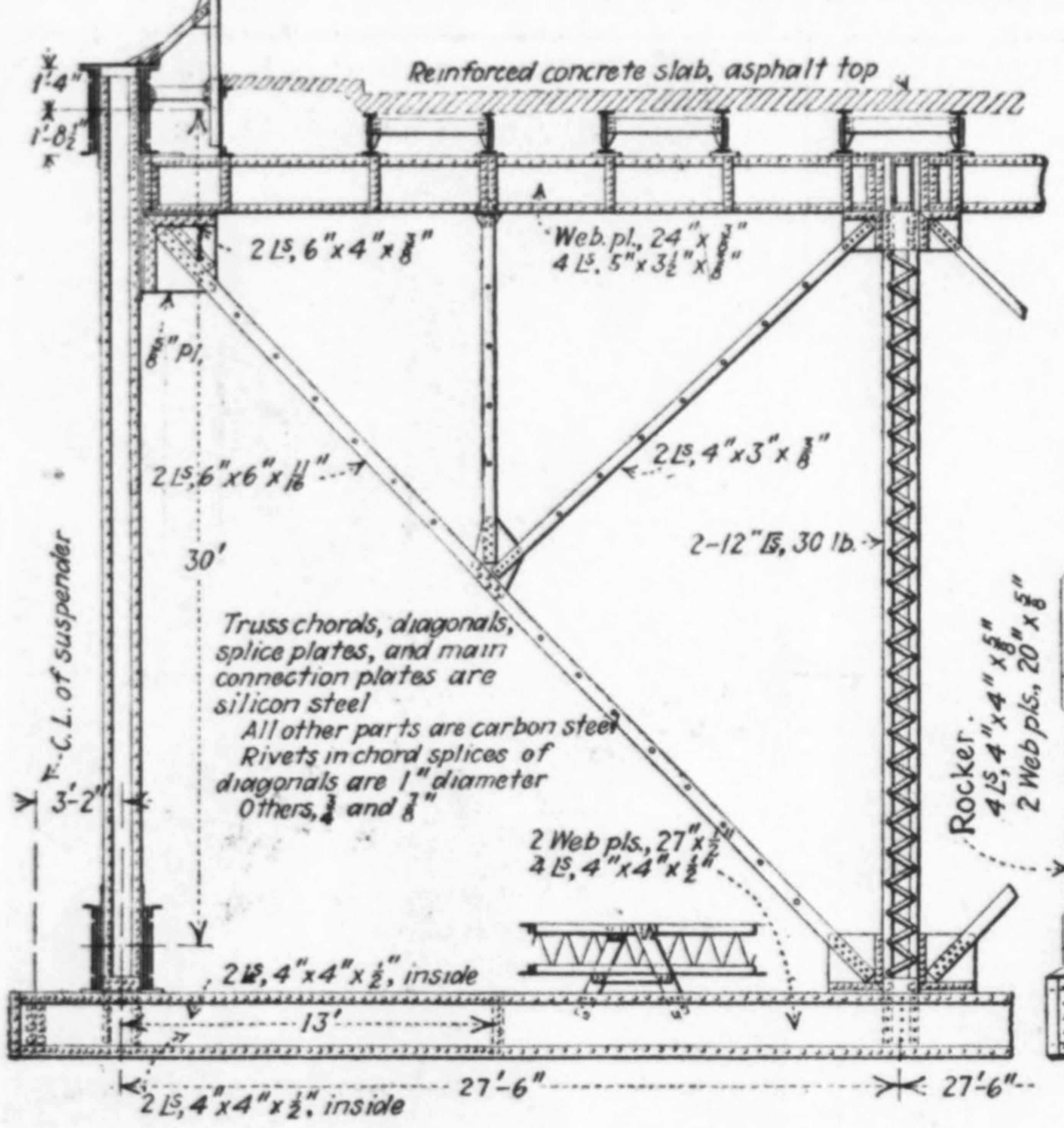
DIFFICULT EAST APPROACH ROAD CONSTRUCTED AS PART OF THE BRIDGE ENTERPRISE

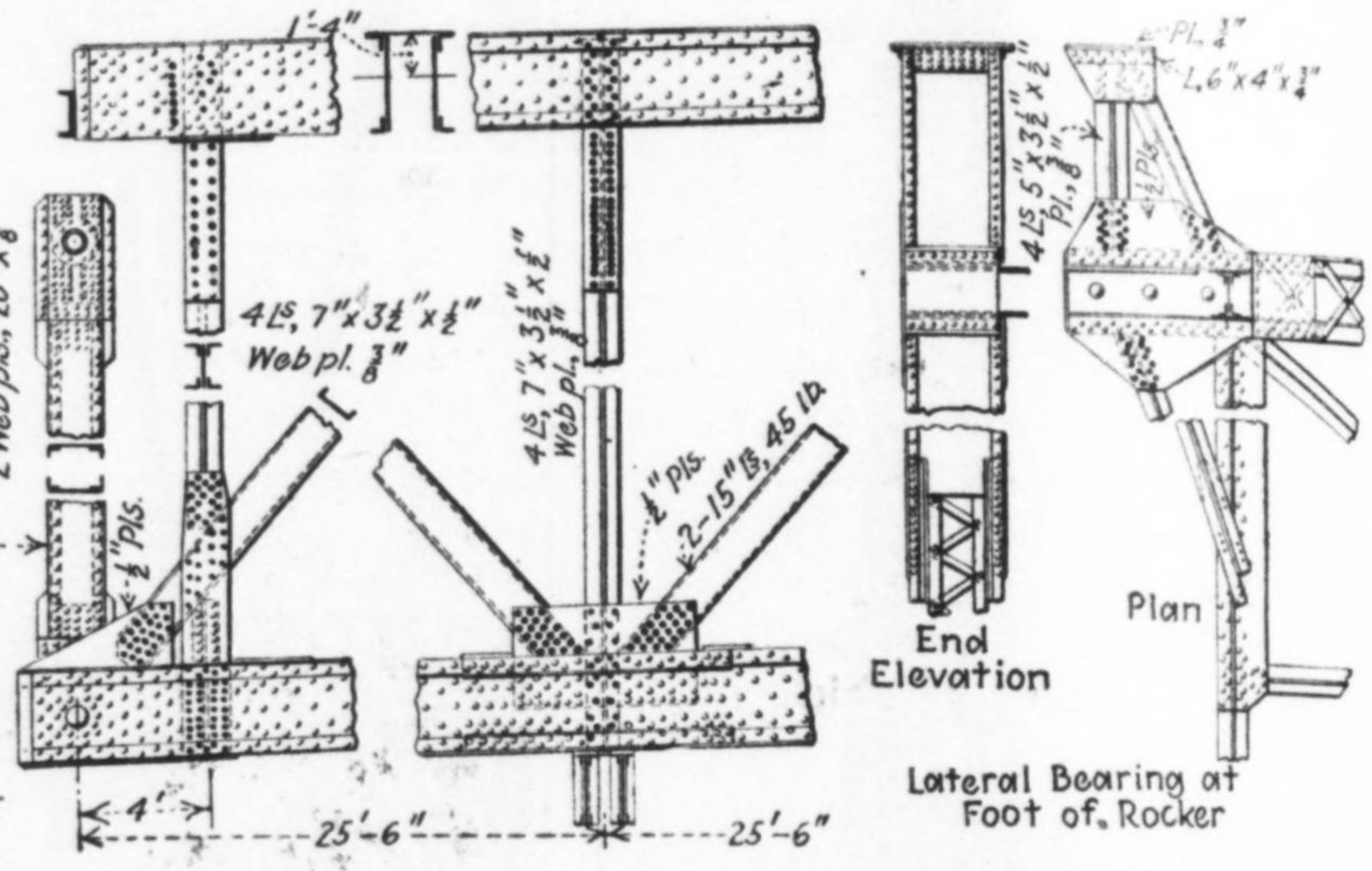
Views of Bear Mountain Bridge Construction Work During 1924 Season



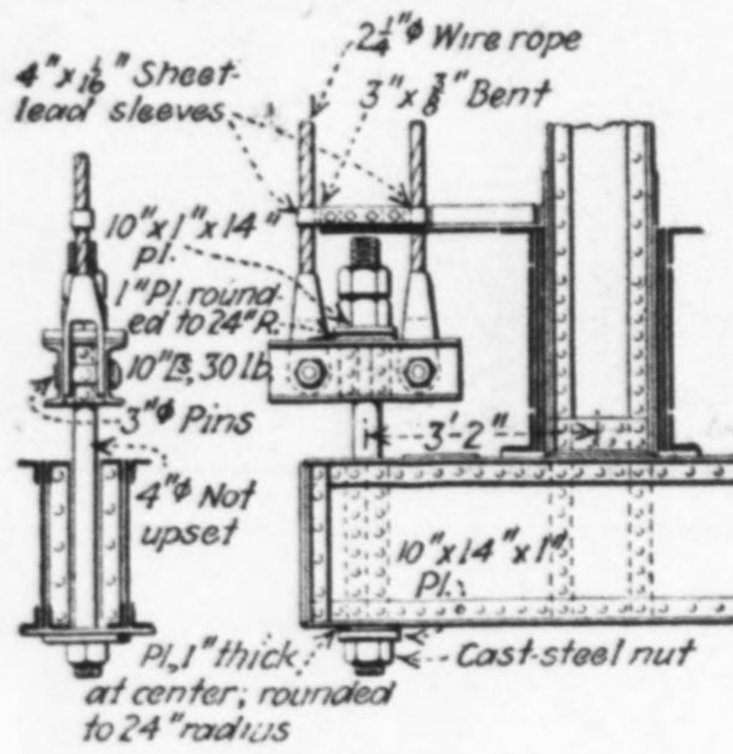





TOP—TOWER CONSTRUCTION, COMPLETED IN EARLY SPRING; CABLE SPINNING IN MIDSUMMER; CONCRETING THE FLOOR SLAB IN NOVEMBER. MIDDLE—STIFFENING TRUSSES APPROACHING JUNCTION. BOTTOM—WORK ON STIFFENING TRUSSES NEARLY COMPLETED; ROADWAY FINISHING (VIEW TOWARD POPOLOPEN CREEK ON WEST BANK)

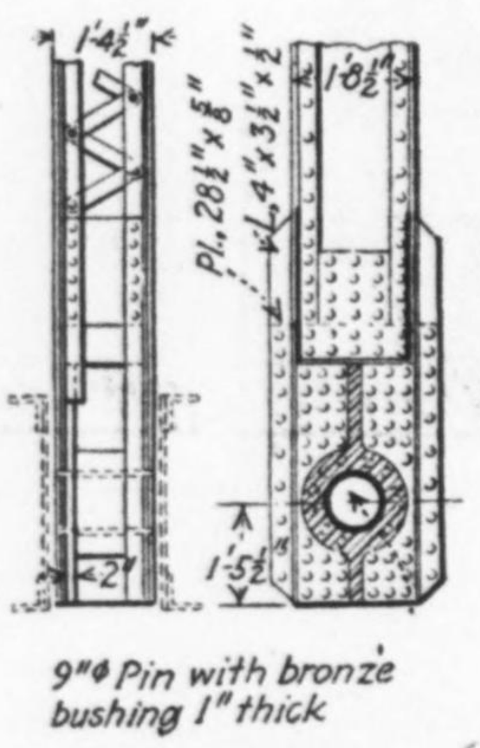




DETAILS OF STIFFENING TRUSSES AND SUSPENDER ATTACHMENT



Attachment of Suspenders



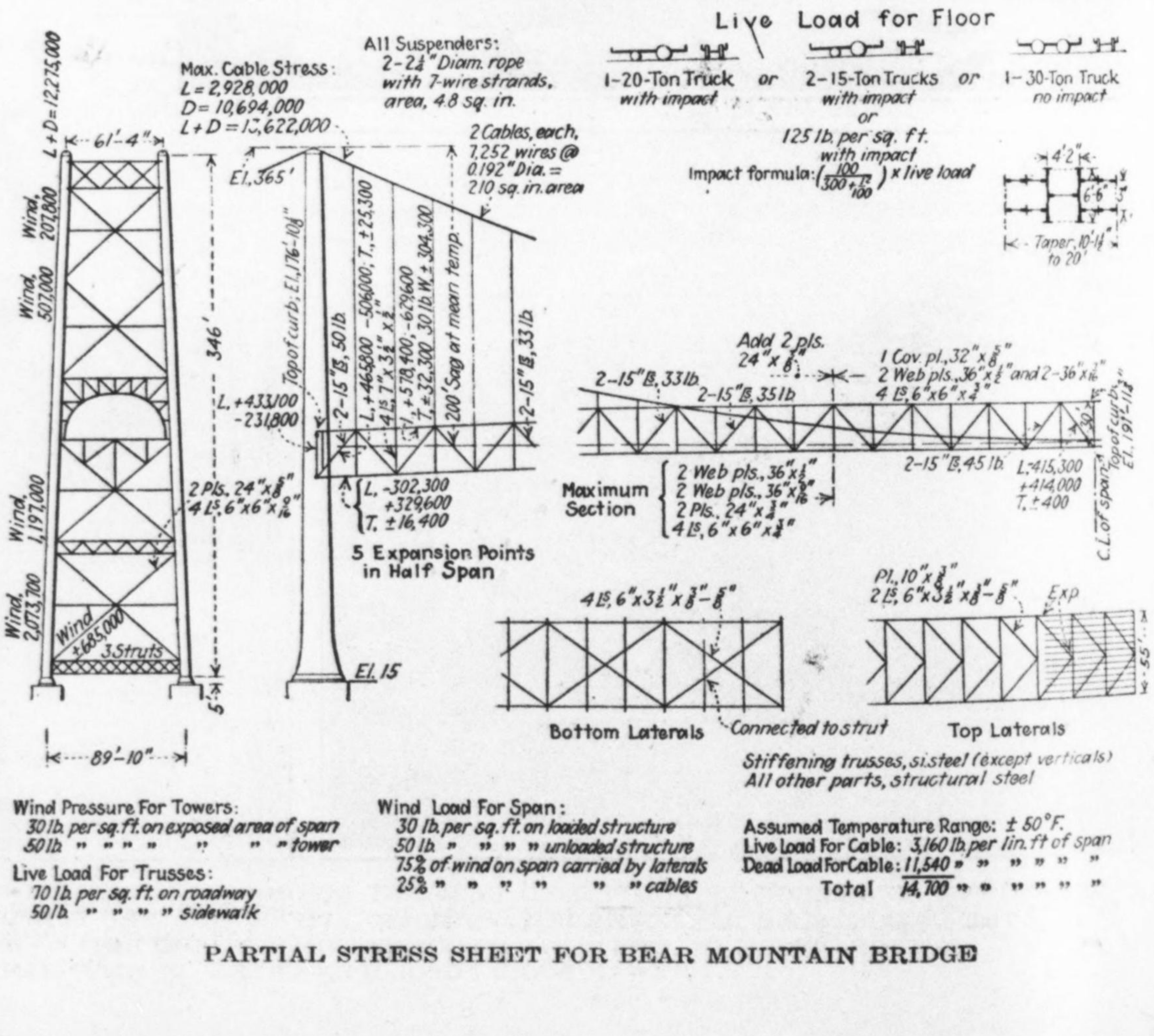
Foot of Rocker

are socketed into clevises which are attached by pins to small beams built of two channels. These beams support hanger rods which have screw ends, giving a possible allowance of 5 in. for adjustment up or down. These hangers support transverse girders which carry the trusses and which were placed in position in advance of the bottom chords which rest on them.

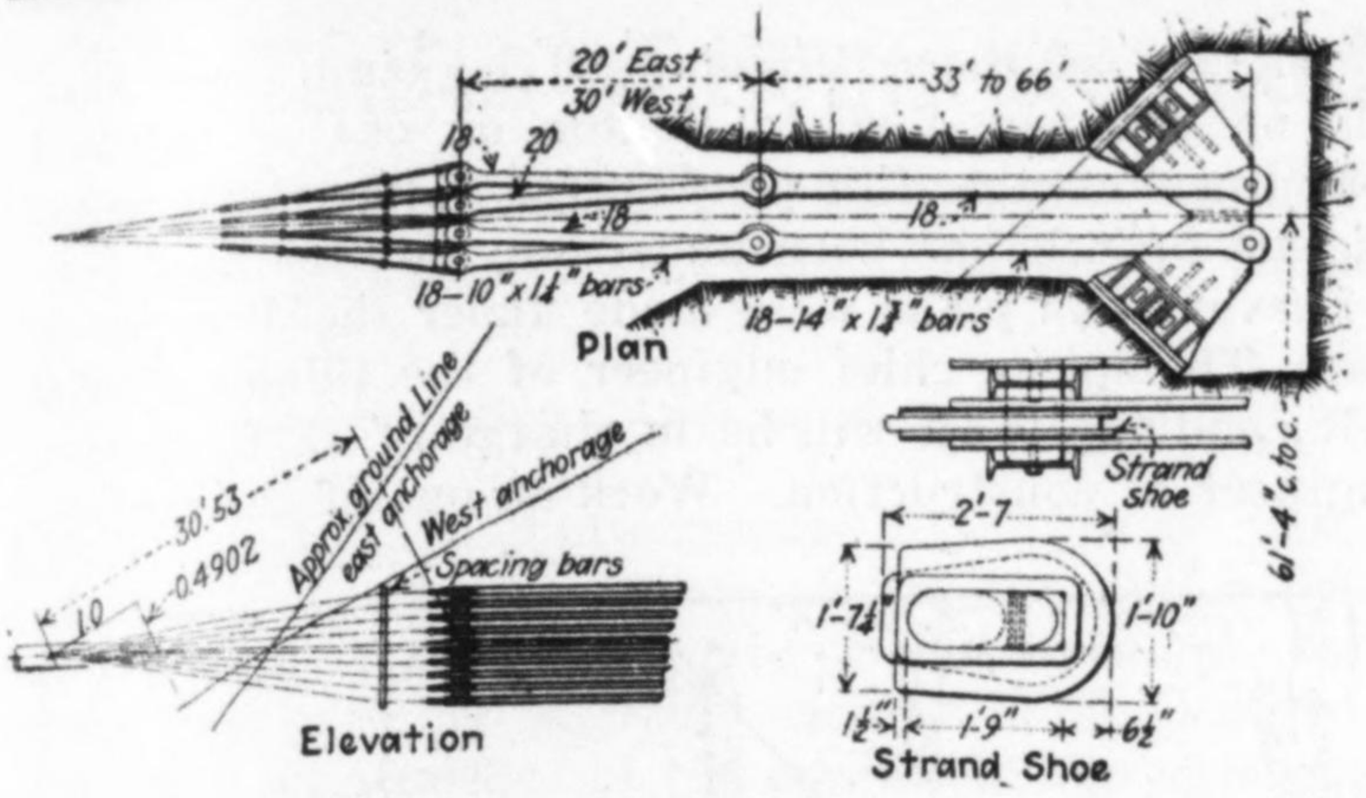
The stiffening trusses are of silicon steel with a specified ultimate strength of 80,000 to 95,000 lb. per square inch and a silicon content of 0.20 to 0.35 per cent, and are calculated for the required live-load, which is 3,160 lb. per linear foot of span, the computations being made by the exact method for composite structures, which is based on static deformations of all the members involved. The connection of the trusses to the towers is through swinging vertical members with phosphor-bronze bearings on pins, the upper ones being placed in transverse trusses on the center line of the tower, which trusses form part of the tower bracing. The swinging members allow the necessary movement for temperature changes and stress distortion. The reactions from the wind forces acting upon the main span are taken up by bearing blocks attached to the sides of the tower columns in the planes of the top and bottom lateral systems.

As the clearance required by the U. S. Government is 135 ft. at the shores and 153 ft. at the center, the trusses are given a camber of 15 ft., which is an advantage in general appearance and gives a grade at the tower which is tangent to the grade of the west approach.

Floor—Owing to the width between trusses, the floor stringers are supported on top of transverse trusses which form, with the bottom transverse girders re-



PARTIAL STRESS SHEET FOR BEAR MOUNTAIN BRIDGE



CABLE ANCHORAGE IN INCLINED TUNNELS IN ROCK

ferred to above, a complete system of sway bracing. To allow for distortion of the trusses due to stress, the floor structure and the top laterals are made with ten expansion joints in the main span, the sections being 153½ ft. long except at the ends.

The roadway is paved with asphalt carried on a floor slab of concrete 6¼ in. thick, reinforced top and bottom with ⅝-in. square rods spaced 4 in. and supported by steel stringers. The reinforcing rods run the entire width of the roadway without splicing, and are bent up into the curb. The sidewalks are of concrete, 5 in. thick, reinforced, and are carried on the concrete curb at their inner edge, the outer edge being supported on steel fascia stringers.

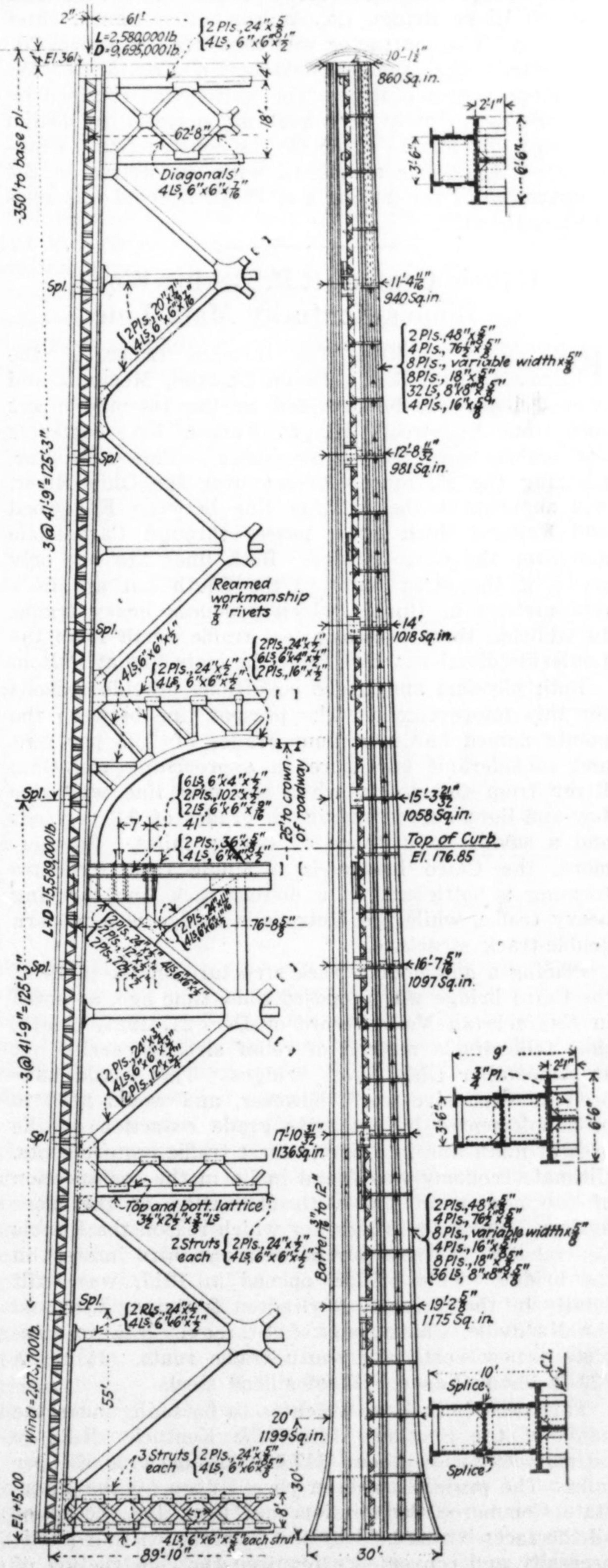
Towers—The towers are 350 ft. high and have a base width of 89 ft. 10 in. and a width of 61 ft. 4 in. at the saddles. The batter allows the connections of the main-span and approach-span trusses to be made between the columns, and on the center line of the tower. The material of the towers is structural steel, A. R. E. A. specifications, except for the saddles and bases, which are of cast steel. The tower piers are of concrete built on solid rock.

As the towers were erected complete before the approach spans were placed and before the footbridge cables were strung, the overturning effect of a broadside wind had to be provided for in the anchors and the splices, in addition to the effect of the eccentric load of the creepers, which overhung the river side of each tower.

Wind Pressure—In computing wind pressure on the finished bridge, a force of 50 lb. per square foot was taken on the exposed surfaces of the towers to provide for a local concentration of pressure, and in addition 30 lb. per square foot on the exposed surfaces of the cables and main span and approaches, including an allowance for exposed surfaces of the live-load.

Anchorages—The anchorages are made up of 74 eyebars for each cable, or two for each of the 37 strands into which the cable divides at the ends, the wires being carried around cast-steel shoes with adjustable pin bearings; these bars are pin-connected to other bars of various lengths to suit the length of the tunnels, and the last set of bars is pin-connected to steel castings which act as shoes to distribute the pressure on the rock. The anchor bars do not change direction, but are in line with the backstays and are laid flat, this being necessary to suit the arrangement of the shoe castings. The pits are filled with concrete up to a few feet back of the cable connections.

The approach spans are unusual only in the spacing of the trusses to suit the wide roadway. Except in the case of the plate girders, transverse trusses are used instead of floorbeams, these trusses forming sway bracing as on the main span. The live-loads for the girders and the trusses, varying from 50 ft. to 210 ft.,



CABLE-SUPPORT TOWERS—BATTERED POSTS CLEAR THE STIFFENING TRUSSES AND PERMIT CENTRAL ROCKER ARRANGEMENT were increased over those required for the main span in order to meet usual requirements for such lengths of highway spans.

The bridge was constructed for the Bear Mountain Hudson River Bridge Co., Wilson Fitch Smith, chief engineer. The contractor was the Terry & Tench Co., afterwards the Tench Construction Co., J. V. W. Reynders, representative. The writer was retained by the bridge company as consulting engineer to design the structure and to supervise the construction. Francis P. Witmer was associated with the writer on the preparation of the design, and H. D. Leopold was resident engineer.

Illinois Central R.R. Begins Work on Illinois-Kentucky Main Line

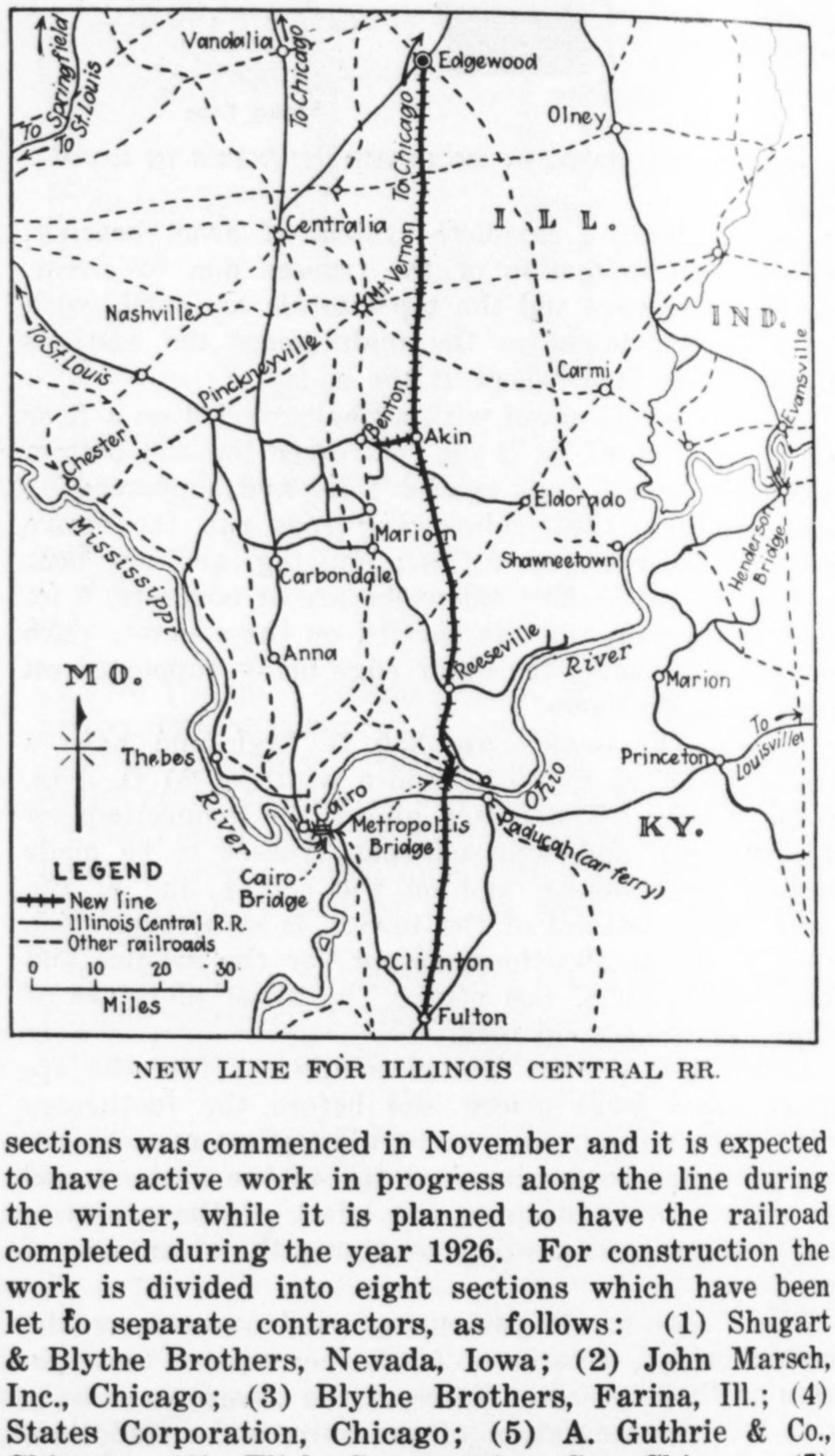
IMPROVED facilities for through traffic of the Illinois Central R.R. between Chicago, Memphis and New Orleans will be provided by the 166-mile direct line from Edgewood, Ill., to Fulton, Ky., contracts for which were let in November. This new line, utilizing the Metropolis bridge over the Ohio River, will supplement the existing line between Edgewood and Fulton, which latter passes through Carbondale and over the Cairo bridge. Both lines are not only parts of the main route to the South but are in a coal district in Illinois which produces heavy traffic. In addition there is heavy coal traffic north from the Louisville division, which joins the main line at Fulton.

Both physical and traffic conditions provide reasons for this improvement. The present line between the points named has maximum grades of 1.25 per cent and considerable curvature in approaching the Ohio River from the north, while the new line will give few and light curves, maximum grades of 0.3 per cent and a saving in distance of twenty miles. Furthermore, the Cairo bridge is a single-track structure forming a bottleneck in a double-track line carrying heavy traffic, while the Metropolis bridge is a modern double-track structure.

Placing a new double-track structure on the piers of the Cairo bridge was proposed some time ago, as noted in *Engineering News-Record* of Dec. 21, 1921, p. 912, thus following a method of relief already carried out at some other Ohio River bridges. This would have been an expensive work, however, and would need to be supplemented by extensive grade reduction on the present main line in order to meet traffic requirements. Ultimate economy was found to lie in the construction of the new main line with utilization of the more modern Metropolis bridge, for which reason the Illinois Central R.R. has now purchased a one-third interest in the bridge. This bridge, opened in 1917, was built jointly by the Chicago, Burlington & Quincy R.R. and the Nashville, Chattanooga & St. Louis R.R. to complete a new north and south traffic route. It has a 720-ft. channel span built of silicon steel.

This new main line, which is to be built under the name of the Southern Illinois & Kentucky R.R., is estimated to cost about $17,000,000 or $100,000 per mile. The project has been passed upon by the Interstate Commerce Commission and upon the record of all the facts it was held by the Commission that public necessity and convenience required the construction of the line and that it was in the public interest that it should be built. A ten-mile branch to tap a coal district in southern Illinois will be built from Akin, Ill., on the new line, to Benton on one of the local coal lines of the Illinois Central R.R. Construction on this branch has been under way for the past year.

Surveys and plans were made under the direction of F. L. Thompson, chief engineer of the Illinois Central R.R., and the work will be in charge of E. L. Crugar, engineer of construction. Work on one of the contract



NEW LINE FOR ILLINOIS CENTRAL RR.

sections was commenced in November and it is expected to have active work in progress along the line during the winter, while it is planned to have the railroad completed during the year 1926. For construction the work is divided into eight sections which have been let to separate contractors, as follows: (1) Shugart & Blythe Brothers, Nevada, Iowa; (2) John Marsch, Inc., Chicago; (3) Blythe Brothers, Farina, Ill.; (4) States Corporation, Chicago; (5) A. Guthrie & Co., Chicago; (6) Flick Construction Co., Chicago; (7) Dominion Construction Co., Niles, Mich.; (8) H. W. Nelson Co., Fulton, Ky.

Year's Income from Forests Is $5,000,000

Receipts from national forest resources during the fiscal year ending June 30, 1924, totaled $5,251,903, according to the final tabulation made by the Forest Service. This amount is $84,000 less than the receipts for the previous fiscal year but is $840,000 larger than the average annual receipts of the preceding five years. Sales of timber and livestock grazing permits were responsible for most of the money received, $3,036,395 having been paid for timber and $1,915,561 for grazing permits. Permits for the use of national forest lands for summer homes and other forms of special use, including water power, brought in $299,946.