The Schell Memorial Bridge.—I.

This is a highway bridge crossing the Connecticut River at Northfield, Mass. About a half mile below, in this river, was an old covered timber bridge, carrying a track of the Central Vermont R. R. on its upper deck and a town highway below. This bridge had become unsafe from age and increase in the railroad traffic, and the new bridge was originally projected simply to take the place of the highway portion of the old bridge and to shorten the distance between the Northfield Seminary and the Moody Auditorium, where large numbers of people assemble at the summer conferences, and the station of the Boston & Maine R. R. and Central Vermont Ry., at South Vernon Junction.

The bridge was first designed for utilitarian purposes only, with three simple and independent spans, but the project for a new structure having been made known to Mr. Robert Francis Schell, of New York and Northfield, he offered to bear the expense of the new bridge, the abutments of which were to bear bronze tablets in memory of his father and mother. It was then decided to alter the design in order to make it more appropriate for its purpose as a memorial bridge, and with this object in view, the relative lengths of spans and the general outline of the bridge in elevation were modified; the three spans were covered by continuous trusses with curved upper and lower chords, and more elaborate and expensive portals, railings and abutments were built. Owing to the original conditions and the fact that certain details of alterations were not decided upon until after contracts had been let and work was well under way, the results are not so satisfactory to the designer as they might have been with a more complete knowledge of the purpose and ultimate cost at the outset.

At the location selected for the site of this bridge as being most satisfactory for the approaches, the river is much narrower than at any other available crossing, but just above the bridge the stream widens and trends to the west at a large angle, making the current irregular and oblique to the banks, which are here curved and irregular.

The maximum depth of water is about 25 ft. (at mean low water), with an ordinary or not infrequent spring flood rise of 28 ft., and an estimated maximum rise of 33 ft.

The easterly bank of the river is evidently

The Schell Memorial Bridge across the Connecticut River.

upon until after contracts had been let and work was well under way, the results are not so satisfactory to the designer as they might have been with a more complete knowledge of the purpose and ultimate cost at the outset.

The granite facing of the piers was cut at the Lebanon (N. H.) quarries from course plans giving the exact dimensions of each stone, with joints, which were specified to be cut to lay from 3/8 in. to 3/4 in. for 8 in. back from the face on bed and build. The courses have a uniform rise of 2 ft. and a thickness varying from 20 in. for the upper courses, to 24 in. for the lower courses. The principal pier dimensions are: 26x8 ft. at the top, 36x8 ft. at the base, and 28 ft. high above top of foundation, or 32 ft. above mean low water.

The granite facing is bonded generally with one header to every two stretchers, and is provided with a base or plinth course projecting 3 in., and a flush coping, the upper corners of plinth and coping being rounded. The face stones are laid in 1:2 Portland cement mortar, and backed or filled with rubble concrete made by embedding field stones in rather wet concrete.

The foundation of the east pier is upon the boulder clay at a depth of 3 ft. below mean low water, and is 13x14 ft. at base and 10x27 ft. on top, built in four courses, the two lower of 18-in. rise and the two upper of 24-in. rise. This foundation was built in a cofferdam made from the excavated material, with some sand bags, the river being not much above its mean low water level when the foundation was laid.

The foundation of the west pier is of nearly the same horizontal dimensions as the east pier, but is one 18-in. course less in height, and rests upon 56 oak piles in staggered rows 2½ ft. center to center. The piles average 7 in. diameter at top, 10¼ in. diameter at the level where cut off, 1 ft. below mean low water, and

22 to 29½ ft. in net length, the shorter piles being generally in the inner rows.

The cofferdam for the west pier consisted of a double row of 3-in. spruce sheet piling on river side and ends of pier, and a single row of the same on the bank side, with earth filling. The sheet piling was driven after the main piles and the enclosure was pumped dry previous to cutting off the butts of the piles and laying the concrete. In this foundation 6 in. of dry broken stone was spread over the sand bottom to dry it before laying the concrete. The 1:2:4 concrete in both foundations was mixed with Alsen's imported Portland cement, good clean and coarse, sharp sand found at and near the site of the west pier, and with broken stone, averaging 2 in., and not exceeding 2½ in. The suction hose of the pumps terminated in well formed by lengths of 18-in. sewer pipe, which were eventually filled with concrete.

The abutments are of concrete, faced above the grade lines with small ashlar (granite from the same quarries as that for the piers) and reinforced with steel I-beams. The abutments are wider than the superstructure of the bridge, and their side walls, which are parallel with the line of the bridge, are carried up above 4 ft. above the surface of the roadway, forming parapet walls, coped with granite. These parapets are terminated at both ends by substantial stone posts wider than the parapets, rising above them, and covered with caps of cut stone. Two of the larger stone posts are placed at the ends of the bridge seats and outside of the bearings, concealing the bearings from a side or approach view.

The west abutment, here illustrated, is in the form of a rectangular box, open on top and bottom, and supported at its four corners upon concrete piers, which extend nearly to low-water level and rest upon oak piles. Steel I-beams 8 in. deep are embedded in the concrete about 3 ft. above the tops of the piers which support the abutments, on all four sides.
The Power Plant of the Oliver Building, Boston.  
By Howard S. Knowlton.

An interesting isolated plant has recently been completed in the new 11-story Oliver Building in Boston. In general design the structure resembles the Board of Trade Building in Boston, owned by the same interests. The general contractors were the Thompson-Starrett Co., of New York and Boston, and the architect was Goldwin Starrett, of New York. Messrs. Winslow and Bigelow, of Boston, were retained as consulting and supervising architects.

The power plant is located centrally in the basement, and it supplies all the heat, light and power used in the building. The four 150-h.p. boilers are set up in a room adjoining a pump room and an engine room. They are of the Scotch marine type with Morison internal corrugated furnaces, and were built by the Hodge Boiler Works, of East Boston. They are 15½ ft. long and 8 ft. in diameter. The total heating surface of each boiler is 1,071 sq. ft., and each contains eighty 3½-in. tubes 13 ft. long. Feed water is supplied by two 8x5x19-in. single-acting Davidson pumps. There is also an 8x6x16-in. Davidson pump for house supply and fire purposes. The feed pumps also return the water of condensation from the heating system to the boilers. The pump room also contains two Monitor injectors for boiler feeding, and a bricklined sump, 3 ft. by 5 ft. in area and 3 ft. deep, lined with brick.

Coal is brought from the bins to the boilers by a 500-h.p. car running on a narrow gauge track to a platform scale. After the fuel is weighed, the car is turned by a turntable arrangement and run in front of the furnaces, the boiler track being at right angles to that leading from the bins to the scales.

The feed water is heated by a 600-h.p. "American" heater, with by-passes on both the steam and water connections. The building is supplied with cold drinking water through a system installed by Steele & Condict, of Jersey City. Two Knowles pumps drive the apparatus of this system. The plant includes a blow-off tank 3 ft. 6 in. in diameter by 6 ft. long; a hot water tank 3 ft. in diameter and 6 ft. long; a 1,500 gal. suction tank, and a 3,000-gal. house tank.

The building is served by five 5½x8½-ft. passenger elevators, made by the Plunger Elevator Co., of Worchester, Mass. Each elevator has a 6½-in. steel plunger. Three of the elevators have an average lifting capacity of 1,500 lb. at a speed of 400 ft. per minute, and a maximum lifting capacity of 2,500 lb. at a somewhat slower rate. Two elevators run from the basement to the 5th floor of the building.

The other three run from the street floor to the eleventh, a rise of 112 ft. One of these elevators is direct-connected to a jack pump, and with this pump carries a load of 8,000 lb. at slow speed.

The gear of three of the Davidson elevators is arranged to give a uniform performance on both sides of a duplex cylinder combination; these pumps are 14 and 26x12x24-in. compounds. There are also two simple Davidson elevator pumps, one 16x9½x16½ in. and the other 16x12x12½ in.

There are two high pressure tanks for the elevator system, each 24 in. in diameter and 12 ft. long, installed in the engine room, and also a 15½x12x8½ discharge tank. Armstrong flash signals are provided for the cars.

The engine room at present contains two 75 k.w. General Electric 115-volt generators, one 100 k.w. machine, and a 25 k.w. unit for light loads. The 75 k.w. machines are direct-connected to two simple 14x14-in. 120-h.p. non-condensing automatic engines, built by the Harrisburg Foun dry & Machine Works. The 50-k.w. generator is connected directly to a 50-h.p. 12x12-in. Harrisburg engine. The 25 k.w. dynamo is driven by a 40-h.p. 9x19-in. Harrisburg engine, to which it is direct-connected.

The piping system possesses various features of interest. Branch boiler headers are connected to a 10-in. main header, and connections taken from this lead to the feed pumps, electric light engines, elevator pumps and a reducing valve on the heating system. The auxiliary main first takes off supplies steam to the small pumps, hot water generator and the injectors. All the high pressure piping is delivered through Kieley steam traps, each provided with a three-valve by-pass.

The exhaust from all the pumps, engines and air compressors is connected to a main running under the floor to the feed water heater. The main then rises to the engine room ceiling, where it has a Cochran grease extractor. After the exhaust main leaves the grease extractor a tee is provided for connection with the heating system, and the main then rises to the roof. It has a Kieley back pressure valve. A vapor pipe runs from the boiler blow-off tank alongside the exhaust pipe to the roof drain the exhaust head. A system of drain pipes connect all the pumps in the building with the pump pit. The hot water tank is controlled by a Davis & Roech valve on the main steam supply.

The boilers and steam heating system of the building were installed by the Cleghorn Company of Boston. The building can be heated either by exhaust or live steam through a reverse process. Air is taken from the main exhaust piping just inside the back pressure valve. From this point the main steam rises to the roof to horizontal mains, from which risers extend down through the building to the second floor. Each riser throughout the building is anchored to the steel work at one-quarter the height from the top and one-quarter the height from the bottom, and provided in the center with an expansion joint.
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The Schell Memorial Bridge.—II.

The main trusses are continuous from abutment to abutment, with all of the dead weight borne on the two piers, and without any weight or reaction at the abutments except when a live load is on the bridge. The shore arms are designed to act as cantilevers, extending in a reverse direction, from the piers toward the abutments, when the bridge is unloaded. This purpose is accomplished by means of adjustable bearings placed under the ends of the trusses on the abutments, each bearing being raised or lowered by drawing together or slackening off two cast-iron wedges held together and adjusted by screw bolts and nuts.

The upper ends of the anchor rods, already referred to, pass through the abutment bearings and ends of the trusses, on which they bear, and are fixed to the cast-iron washers and spiral steel freight-car springs, through which the anchor rods pass. The bearings were adjusted so as to leave a play of 1/32 to 1/16 in. between the ends of the trusses and the bearings below, and also between the washers on top of the springs and the nuts on the anchor rods. Although the abutment ends of the bridge are thus left free to expand and contract under temperature changes, their upward and downward motion is checked by the anchor rods and springs, together with the adjustable bearings, so that the deflection of the trusses under moving loads is reduced and the vibration kept down to about the usual amount in a bridge of simple span of the same length.

The trusses rest on cast-iron bearings having a total depth of about 2 ft., on both piers. The bearings on the east pier are fixed or bolted to it, and those on the west pier are provided with sets of five cast-iron rockers or segmental rollers, 12 in. deep, toothed into the top and bottom castings so as to move with them.

The outline of the upper chords of the main trusses is a polygonal curve, convex upwardly on the central span and reversed on the piers so as to be concave upwardly in the side spans. The roadway is on a straight grade of 9 in. in 16 ft., or 6/9 per cent. for 144 ft. from each abutment, these grades being connected over the central portion of the bridge by a vertical curve tangent to the grades. The lower chords of the trusses are parallel to this vertical curve throughout its length, but at the ends of the central span and in the side spans they have a greater curvature, and in the latter portions the softits, or under surfaces of the lower same height above the lower chords, transverse struts, formed of four angles, latticed, connect the chords below the floorbeams. The lower lateral diagonals are all angles, crossing each panel in two directions, each diagonal consisting of two angles in the panels of the middle span toward the piers, and single angles in the central panels of the middle span and in the side spans. The upper lateral bracing consists of vertical transverse braced frames at every pair of main posts in the middle span, transverse struts each consisting of four angles latticed, in the plane of the top chord at intermediate points and at all points in the side spans, arched portal bracing consisting of the posts over the piers, arched portals in vertical planes at the first panel point from each abutment, and single diagonal angles in the plane of the upper chords, extending over two panels, except in the portion of the middle span toward the piers, where there are two angles in each diagonal. All of the principal truss and lateral connections are formed of gusset plates, wider than the chords.

The upper chord is of the ordinary section, consisting of two side plates 16 in. deep, a top plate 20 in. wide, and four 3x3-in. angles, double...
latticed underneath, throughout the portion of the middle span from U₁ to U₇; elsewhere and in the inclined end posts at the abutments the top plate is omitted, latticed bars being substituted. The depth of the side plates is reduced in the side spans to 11 and 12 in., and single lattice substituted.

The lower chord consists of two side plates and four angles throughout, latticed top and bottom in the side spans and panels of the middle span nearest to the piers, connected by tie-plates elsewhere.

The main vertical posts over the piers are of special section as shown, the other posts are either two plates and four angles double latticed on two sides or four angles single latticed. Main diagonals, hangers and sub-struts are generally of four angles, but the heavier diagonals are of two plates and four angles. The sub and counter diagonals are of two angles.

The majority of the members of the trusses are of symmetrical cross-section, with the centers of gravity of the sections placed on the stress sheet and layout diagram lines, and with rivets in connections symmetrically disposed about the layout lines. In the unsymmetrical...
portions of the upper chord, and in the curved portions of the lower chord (which were in compression during erection), the stress is either at or below the center of gravity of chord section at the middle of a panel length. The layout lines of upper and lower laterals are intersected upon the center lines of the chords in plan.

The steel floorbeams carry eight lines of 5 x 12-in. longleaf hard pine stringers, spaced 2 3/4 ft. apart on centers, and butted on the top flanges of the floorbeams, on which they are galled to varying depths to give a crown to the roadway. The floor planking is a single course of 3-in. chestnut, spiked to each stringer with 5 1/2-in. steel spikes. The curbs or wheel guards, which also serve as bases for the railings, are 6 x 12-in. hard pine, secured to the outer stringers, through the floor planking, by means of 5/8-in. lag screws. The railings are formed of four lines of wrought-iron pipe passing through cast-iron posts of special design, spaced 5 ft. 4 in. on centers and secured to the broad wheel guards on which they rest by lag screws. Every third railing post is also fastened to the adjacent post of the truss by means of a 3/8-in. bolt in slotted connection.

The steel work was primed with a coat of boiled linseed oil in the shops, and in the field was painted with one coat of No. 31 special and one of No. 16 special paint manufactured by the National Paint Works of Williamsport, Pa.

The quality of steel specified was very nearly that of the present grade of “railway bridge steel” of the manufacturers' standard specifications.

The bridge was designed to carry, in addition to its own weight (determined by detail esti-
mates), a live load w = 60 + (2400 - L) in which formula w = live load per square foot of floor surface and L = length of bridge covered by the load to produce the maximum stress in any member. This formula gives a load of 67 lb. per square foot for the condition of load covering the whole of the middle span, 90 lb. per square foot for load covering the side spans, and for load covering 32 ft. of length, giving the maximum load on floor and sub-panel systems 125 lb. per square foot. With stresses produced by the above loads the unit stresses in tension will not exceed those given by the formulae

\[ s = \frac{10,000}{100 + 4p} \text{ for general truss members,} \]
\[ s = \frac{8,033}{100 + 2p} \text{ for floorbeams, hangers and counters,} \]

in which \( s \) = stress in pounds per square inch and \( p = 100 \) (minimum stress) or maximum stress, or the percentage of minimum to maximum stress. For the chords of the middle span the dead load stress was taken as the mini-

pose. In determining the live load stresses, the live load was assumed to cover the middle span, without resting on the end spans, and also to cover both end spans without resting on the middle span, and in both cases without weight or reaction at the abutments, although, under the maximum live loads, there will doubtless be some positive or negative reaction at the abutments, yet it is believed that the stresses found by allowing for such reactions would be less than the maximum assumed.

The estimated weight of steel in the superstructure, exclusive of railings, is 365 net tons. The cost of the bridge was $42,000.

In the first installment of this description, printed last week, Mr. Schell's full name was incorrectly given, as it is Francis Robert Schell.

(To be continued.)

The New 5,000,000-Gal. Reinforced Concrete Reservoir at East Orange, N. J., has been found to be watertight on testing.
The Schell Memorial Bridge—III.

Cantilever Erection by Cableway.—Although when completed the Schell Memorial Bridge is a continuous bridge, with a central span of 352 ft. and two shore spans of 80 ft. each, it was treated for the purpose of erection as a cantilever bridge, with the shore arms of the cantilevers counterweighted by temporary earth loads, suspended in wooden cribs from the two panels adjacent to each abutment. All material for the bridge was delivered and stored on the west bank, and was put in place in the bridge by means of a wire rope cableway, supported on two wooden towers, the west tower being about 100 ft. high and the distance between towers 200 ft. This method and the plant used involve a number of interesting features and details, of which there is no published description of previous use.

As the bridge was designed with riveted connections throughout, special care was taken in making the templates, in order that the several parts when brought together in the field without the support of falseworks might be connected with satisfactory results. The skeleton center lines of members of one of the shore spans and one-half of the middle span were laid out with care on the floor of a large tempel room, and all of the templates for a truss were assembled upon the lay-out lines and the markings, the increase at the center of the bridge being about the amount of the computed deflection at this point during erection. Erection stresses were computed not to exceed 16,000 lb. in tension and 14,500 lb. in compression, both per square inch of section, and allowing for the weights of travelers.

Upon the completion of the substructure the distance between the upstream bearings of the piers was ascertained by measuring across the river on the ice at the level of the bases of piers and placing up the centers of ice breakers with a transit, and was found to be about 1 in. less than the correct distance, at the assumed mean temperature of 40° Fahr. Before the bearings of the trusses each 1 1/2 in. inshore from the centers of bearings on piers. Moreover, in order to insure plenty of room for inserting the closing lengths of the trusses on a very hot day, the expansion bearings (segmental rollers) on the west pier were inclined at an angle toward the west bank and temporarily locked in that position.

The shore spans were erected as simple trusses upon single bents of falsework placed under the points L1, and additional shores under the points L2. The abutment ends at L1 were set below their final level and held there by the earth counterweights until some of this earth was removed in order to lower the outer
ends of the cantilevers and make the center connections. The springs at the upper ends of the anchor rods were removed during the erection and sleeves of hardwood substituted.

The steel was picked up from its storage position on the west bank by the falls from the cableway. As the west cableway tower is about 100 ft. high, this did not require a very great inclination of the falls, considering that any scattering pieces could be run in under the cable, by hand, upon timber rollers. Only one heavy member could be handled at one time by the cableway, and as it was necessary to shift the cable frequently from one side of the towers to the other (an operation which consumed a good deal of time in the early part of the work, but which was later much expedited), the progress of the erection was not rapid, but was sufficient for the time capacity of the small gang of erectors employed and of the four gangs of riveters following, who were rather late in getting their start.

The cantilevers were erected one panel at a time from each side, the erecting gang shifting
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from one side to the other to put in place the corresponding panels.

While all three of the middle panels had been erected, the gap at the center was partly closed on the afternoon of Aug. 28, 1904, by swinging in three lengths of lower chord on the south side, and suspending two of these lengths by iron rope guys from the ends of the upper chord. Measurements and levels were then taken at the result that was revealed as a gap in the lower chord at L13 of 14½ in., and that the top of the floor beam at L13 west was ¼ in. higher than the corresponding floorbeam at L13 east.

Between this date and Sept. 3 the remaining parts of the trusses were erected and levels were taken, showing an elevation at L14 west ½ in. higher than at L14 east. On the afternoon of Sept. 3 the lower chords were drawn together, closing the gaps in these members, but leaving a gap in the upper chord of 2 ½ in. The part of the earth counterweight was then removed, bringing a slight stress on the anchor bolts, which were then slackened off so as to raise the shore ends and lower the outer ends of the cantilevers, thus closing the gap in the upper chord. Levels taken on Sept. 8, after the closure had been made (and when there was probably a slight compression in the upper chord and tension in the lower chord), show a fair correspondence in level of the two sides of the bridge.

A further deflection of 2½ in. at the center of the bridge was measured on Sept. 13, after the counterweights had been entirely removed and the flooring, except two panels of 16 ft. at each end, was in place. All of the above results are shown on the diagram. The counterweights consisted of sand and earth ballast in wooden bins supported upon steel beams suspended from the floorbeams at L13, L14, and L15, by temporary steel hangers, as shown by the detail, the total weight of each being about 108 net tons.

The cantilevers were erected (not including riveting) at a maximum speed of one double panel of 32 ft. in 18 hours, by a gang of six excavators, two men on shore to select and deliver material, and one man to operate the hoisting engine.

The riveting was done by four gangs of four men each, including heaters. Three of these gangs used air hammers, the fourth gang driving by hand hammers throughout.

The compressed air for riveting hammers was carried across the river in a pipe suspended from the trusses, ineffectual attempts having been made to float this pipe.

The cableway was arranged in a special manner, and the towers, saddles and anchorages were designed and constructed by the contractors to provide for the special requirements of the work. The cable was a 3½-in. crucible steel rope with a rated strength of 96 tons. It had a total length of 1,200 ft. and a clear span of 700 ft. The anchorages were about 1,100 ft. apart and were both fixed points, but the cable was supported on the tops of the towers on saddles having a transverse movement of 20 ft. The height of the cable was approximately 14 ft. clear for the bolting tackle above the highest portion of the upper chord, and the transverse adjustment on the towers enabled it, when shifted, to command all portions of the superstructure. It was designed to have a maximum working stress, including that from its own weight, of 64,000 lb.

Each anchorage consisted of a timber platform buried about 7 ft. underground and connected with the end of the cable by vertical steel bars and a strut in the direction of the resultant of the stresses in the cable and the vertical anchor bars, the strut being composed of three pieces of timber arranged in fan shape with the spread ends down and bearing on the earth through an inclined timber platform. At the east end the cable was converted into a cylindrical cast-iron block which bore upon a riveted steel angle block upon the upper end of the inclined strut. The vertical anchor bars were a pair of 8½x¼-in. bars with reinforced ends, pin-connected between the webs of pairs of short horizontal channels at top and bottom. The bottom channels supported the centers of a pair of 12x16-in. horizontal timbers, 12 ft. long, which were bolted together and carried the anchorage platform, buried in the ground. The west cable was fitted with a cleviss eye, which engaged a pin through the bent and reinforced end of a single 12x½-in. vertical suspension plate 14 ft. long, with top and bottom connections to the inclined strut and anchorage platform, as shown in the detail. The inclined strut was the same as at the east end, except that the cap differed in shape. The vertical anchor at the west end was connected to the short channels below the anchorage platform by a single 4-in. pin.

The timber towers for the cableway were of different heights, owing to the profile of the ground. The west tower was about 100 ft. high and had its base on nearly level ground, but at the site of the east tower the bank had a considerable slope both longitudinally and transversely, and at a pit, having an average depth of about 12 ft., was dug in order to level the base of this tower, which was then about 75 ft. high from its base.

Each tower consisted of two transverse bents 20 ft. wide on centers and about 15 ft. apart longitudinally at the foot, and 2 ft. apart at the top. Each bent was made with two 8½x4-in. posts connected by horizontal struts averaging about 12 ft. apart with X-bracing in double panels. The 12x12-in. sills were seated on four 12x12-in. sleepers 23 ft. long. The caps of the towers overhung the main posts and were girted by lateral and back guys of wire rope attached to eyebolts passing through them near the ends. These caps carried a pair of rails about 18 in. apart, on which the cable saddle was seated. This saddle consisted of a solid timber block with a wide steel base-plate projecting on both sides and on one end to furnish connections for the traversing rope and for a backstay rope. The sides of the block were provided by channels bolted to them, and a longitudinal groove was cut in each block to receive the cable, which was locked in position by a cap piece fastened over it by V-bolts. The saddle was moved along the caps, when it became necessary to shift the cable, by wire ropes, attached to each side and led over sheaves at the ends, and thence down to hand tackles.

Close to the west anchorage an adjustment for the cable was provided by interposing a sheave frame made of a pair of transverse steel beams, one of which was connected to the cable and the other to the top of the vertical anchor bar, each beam consisting of a pair of 15-in. channels, back to back, with a space sufficient for four sheaves between each pair. These sheaves were rove with two ½-in. steel wire ropes, so as to correspond to a ten-part tackle. One end of each rope was fastened to the beam at the anchor end, and the other end, after engaging four sheaves, was clamped to a short rope connected to the opposite beam. Beyond the clamp the main rope passed down to a hand tackle by which it could be adjusted.

In operation, if it was necessary to shorten or lengthen the main cable while in service, a strain was put on the two tackles connected to

Cableway Tower with Traveling Saddle

the adjustment device and the clamps between the short ropes and the tackle ropes were loosened. The tackles were then slack off or set up, as the case might be, and when the distance between the beams had been sufficiently changed the clamps were then screwed up and the tackles released, leaving the adjustment device fixed with the required dimensions.

Mr. Edward S. Shaw, of Boston, was the designer and supervising engineer of this bridge. The New England Structural Co., of Boston and Everett, Mass., was the contractor for the superstructure; Mr. W. B. Douglass was chief engineer, and Mr. E. N. Pike chief draughtsman of this company. Messrs. Ellis & Buswell, of Woburn, Mass., were the contractors for the substructure.

AIR LEAKAGE THROUGH BOILER SETTINGS of brick can be lessened by giving the walls two coats of Portland cement wash and then one coat of cold-water paint to brighten them up, according to Mr. Wm. C. McCracken, in a recent paper on boilers and furnaces before the Ohio Society of Mechanical, Electrical and Steam Engineers.
Cantilever Erection with Cableway, Schell Memorial Bridge.