tions; thus a constant current of air can flow through the section, entering the bottom and passing out through the grill work at the top.

The exterior of the car has very much the appearance of the standard railroad coach, except that it is much shorter. It has deck lights, broad double windows and extended vestibules. The dimensions of the car are as follows: Length of car over all, 56 feet 4 inches; height from rail, 13 feet 4⅞ inches; clear head-room inside, 6 feet 5¾ inches. There are six longitudinal wood sills, 7 x 7 inches in section, in the floor made in two pieces with a half-inch steel plate sandwiched between.

The construction of the trucks is much the same as that for regular railroad service. They have four wheels each, and each axle is supplied with a 150-horsepower motor built for a speed of 60 to 70 miles an hour. The details of the construction of the electric sleeping car were worked out by M. F. Holland, and the cars built by the Harlan & Hollingsworth Company, of Wilmington, Del.

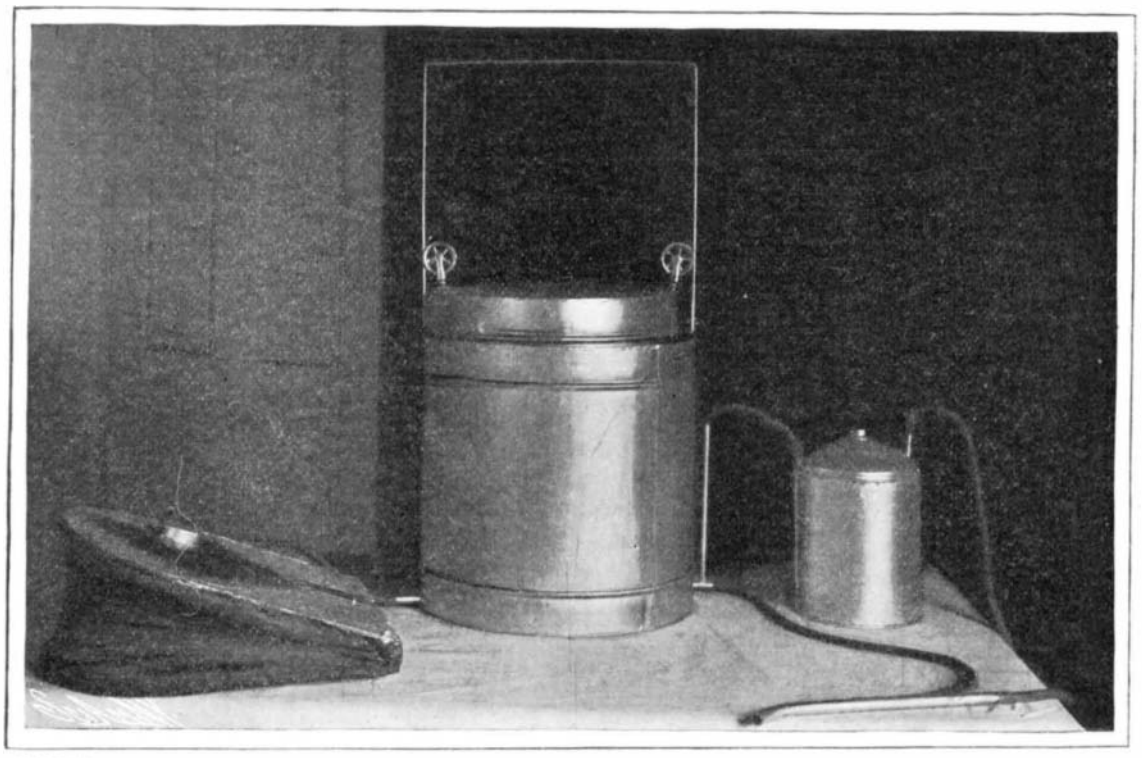
A SIMPLE LABORATORY BLOWPIPE APPARATUS.

The following article is a description of a simple and inexpensive vaporizer for laboratories without the convenience of a gas supply; its chief advantages being its even operation and the ease with which the pressure can be varied. One of the size given is suitable for almost all laboratory work.

The foot bellows is 15 inches long by 11 inches wide, and is expanded by a coiled spring within. The inlet valve is of the clapper type, and takes air from the underside. The outlet valve is of the same class, and exhausts the air into a small tin dome, from where it is conducted by tubing to the gasometer or holder.

The entire gasometer is built of galvanized iron. The outer cylinder or water tank is 12 inches high by 14 inches in diameter. The inlet pipe extends from the outside half way toward the center of the tank upon the bottom, where it is bent at a right angle and reaches perpendicularly to a level with the top of the tank. The outlet pipe is a counterpart of the inlet, with the exception that it has an upright branch outside of the tank which leads to the vaporizer, the other branch leading to the air blast of the blowpipe. The inner inverted cylinder or gasometer is 12 inches in diameter by 14 inches high. At diametrically opposite points at both top and bottom are affixed guide wheels with concave faces. The wheels upon each side, being perpendicularly in line, run upon guide rods extending along the sides from the base of the outer cylinder or tank to a height of 14 inches above it. The guide rods are made separable from the tank to facilitate removal of the gasometer. The latter must rise and fall freely without hitching, otherwise the supply of gas and air to the blowpipe will be jerky. When in use, the outer cylinder is filled with water to within an inch of the top.

The vaporizer is a galvanized iron vessel 6 inches in diameter by 10 inches high, which is half filled with gasoline when in use. The inlet pipe extends from the outside through the top to within a quarter of an inch of the bottom. The outlet pipe extends just within the dome. The inlet should be marked to prevent mistake in coupling up.



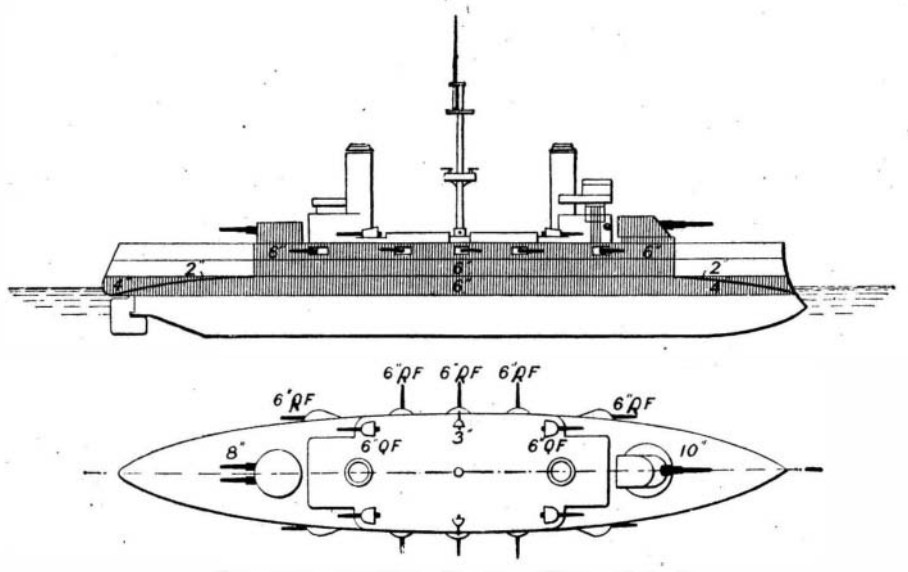
A SIMPLE LABORATORY BLOWPIPE APPARATUS.

Each downward stroke of the bellows raises the gasometer, which feeds air to the vaporizer and air blast. The quantity of air or gas is regulated in the usual way by stopcocks at the blowpipe. The machine gives a steady, even pressure, which can be increased at will by placing weights upon the gasometer. It is serviceable with any blowpipe, and is useful for other purposes where a supply of gas is necessary.

NEW JAPANESE ARMORED CRUISERS "KASAGA" AND "NIASIN."

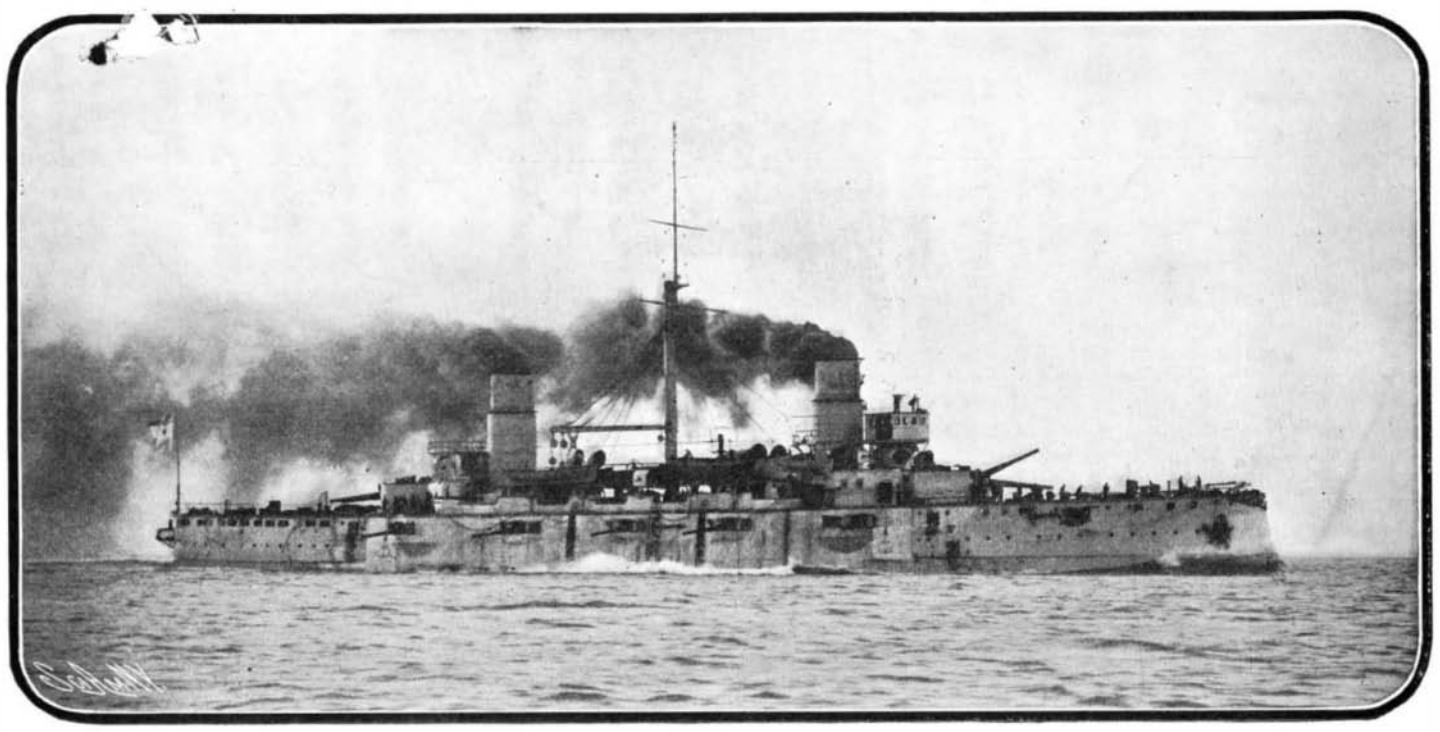
The recent agreement of Chile and Argentina to reduce their armaments has resulted in a very important accession to two of the leading navies of the world, those of Great Britain and Japan. At the time when the more pacific relations were established between the two South American republics, there were building for Chile two very fine warships of 11,800 tons displacement, the "Constitucion" at the Armstrongs', and the "Libertad" at the Vickers' yard, while two equally efficient and up-to-date armored cruisers of 7,700 tons displacement were under construction for Argentina at Ansaldo, Italy. When it became known that these four formidable vessels were on the market, the agents of the Russian government commenced negotiations for their purchase. These negotiations progressed so favorably that it seemed pretty certain that Russia was about to make an addition to its navy of four first-class fighting ships. This would have been more than sufficient to turn the balance of naval power in the Far East completely in her favor in the struggle that now looks to be so imminent between her and Japan. At the eleventh hour, however, agents representing the British and Japanese governments made such extremely liberal offers for the four vessels that the deal was closed, and the two battleships hoisted the British flag, and the two cruisers the flag of her possible ally, Japan.

The "Rivadavia" and "Moreno," as the two cruisers were known, have been rechristened the "Niasin" and "Kasaga," have hoisted the Japanese flag, and, with full crews aboard, are now making all speed by way of the Suez Canal for far eastern waters. The new cruisers are of the same general type as that most efficient vessel, the "Cristobal Colon," whose wreck still lies on the southern coast of Cuba, where she was headed off and driven ashore by the guns of Admiral Schley's flagship, the "Brooklyn," and the battleship "Oregon." The "Kasaga" and "Niasin" are identical in every respect but one; the one difference being that the main battery of the "Niasin" consists of one 10-inch gun and two 8-inch guns, while that of the "Kasaga" consists of four 8-inch guns. The accompanying very striking photograph of the "Kasaga" was taken when that vessel was on her trial trip, in which she averaged a speed of 20.2 knots, over a course 12 miles in length. While the speed is not a high one as speeds go in armored cruisers to-day, it is very creditable if we bear in mind the heavy armament and excellent protection that are secured on the limited displacement of 7,700 tons. The "Moreno" is 357 feet in length, 61½ feet in breadth, and draws 23 feet of water. She is driven by two sets of triple-expan-



"Kasaga" has two 8 in. in place of one 10 in. gun forward.

GUN AND ARMOR DIAGRAM OF THE "KASAGA" AND "NIASIN."



Displacement, 7,700 tons. **Speed,** 20.2 knots. **Bunker capacity,** 1,100 tons. **Armor:** Side, 6 in. to 4½ in.; turrets, 5½ in.; battery protection, 6 in.; two armored decks, 1½ in. and ¾ in. **Armament:** Four 8 in.; fourteen 6 in.; ten 3 in.; four small guns. **Torpedo tubes:** Four above water and behind 6 in. armor. **Complement,** 525.

NEW JAPANESE ARMORED CRUISER "KASAGA"; ALSO SISTER SHIP "NIASIN."

sion, three-cylinder engines, and was designed to make 20 knots with 13,500 horse power. In her boiler rooms are four single-ended and four double-ended boilers. She carries a normal supply of 650 and a maximum supply of 1,100 tons of coal, and her full complement of officers and crew is 525. Her protection consists of a complete belt of armor from stem to stern, which is 6 inches thick amidships and tapers to 4½ inches at the ends. With this is associated a complete deck 1½ inches in thickness, which slopes at the sides to meet the bottom edge of the side armor. The space between the slopes and the side armor is utilized for coal bunkers, and back of the sloping deck are other coal bunkers. Further protection is afforded by the main deck, which is of steel ¾ of an inch in thickness. The 6-inch side armor is carried up amidships through the height of two decks, extending from below the water line to the upper or main deck, through a height of over 20 feet. This armor is carried athwartships around the bases of the barbettes, the bulkheads thus formed being of 4½-inch armor. The armor, by the way, is of what is known as the Terni type, which has shown qualities which compare favorably with the best Krupp armor. The main battery consists of four 45-caliber, 8-inch, rapid-fire guns, mounted in two turrets protected by 5½-inch armor, one forward and one aft, on the longitudinal axis of the ship. The intermediate battery consists of fourteen 6-inch rapid-fire guns, ten of which are located on the gun deck within the 6-inch armored citadel, while the other four are mounted behind heavy shields on the main deck, two on either broadside. The four 6-inch guns at the corners of the gun-deck battery and the four guns above mentioned are able to fire dead ahead or dead astern, the concentration of fire ahead or astern being, therefore, two 8-inch and four 6-inch guns. There are also ten 3-inch rapid-firers, four of them being mounted on the gun deck, two forward and two aft, and firing through ports, and six of them being mounted in broadside on the upper or main deck, three on each side between the pairs of 6-inch guns. The vessel also carries four above-water torpedo tubes, which are mounted on the berth deck and fire through discharges in the 6-inch side armor of the vessel, the protection for these tubes being, therefore, very satisfactory. There are two conning towers, one forward and one aft, the forward tower being protected by 4¾ inches of Terni armor. The vessels have two smokestacks and a single central military mast, in the tops of which are mounted two Maxim guns.

Altogether, for their displacement, we consider that these are as effective fighting units as have ever been designed. Of course, they do not have the advantage that comes from great size and high speed, such as characterize the 24-knot, 14,000-ton British cruisers of the "Drake" type, or the 22-knot, 14,500-ton armored cruisers of the "Tennessee" class now building for our own navy. At the same time, because of their shorter length, these vessels will prove very handy in maneuvering, and with their powerful batteries will be able to stand up against ships of considerably greater size than themselves. The Russians have only one armored cruiser of the same displacement, the "Bayan," that can compare with them. Although the latter has two knots more speed and is slightly heavier in the belt protection, she carries only two 8-inch as against four 8-inch rapid-firers, and eight 6-inch as against fourteen in the "Kasaga."

In the event of hostilities between Russia and Japan, there is no question that these two vessels will prove to be an invaluable addition to the fighting strength of the Japanese navy.

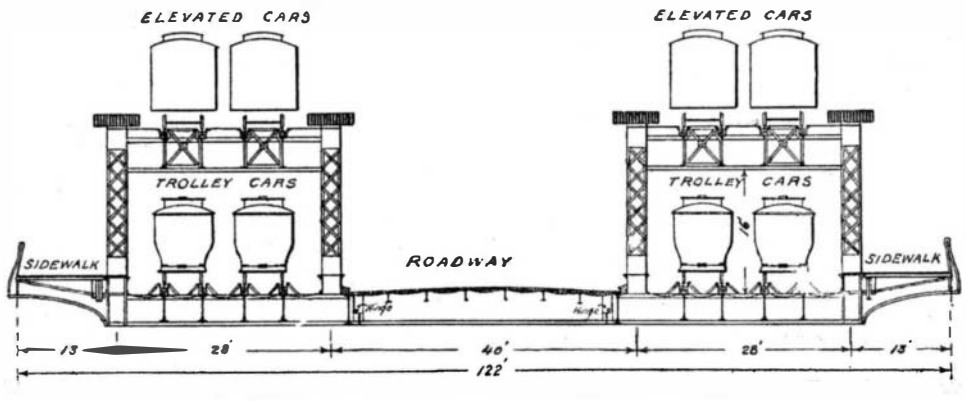
An apparatus in use in Germany for the purification of milk by ozonization is so constructed that the milk contained in a vessel flows thence in a thin stream into another vessel, placed below. An electric circuit is so arranged that sparking is caused through the stream or near it. The ozone which is thereby engendered from the oxygen of the air is said to be sufficient to kill all micro-organisms contained in the milk.

THE MANHATTAN BRIDGE ACROSS THE EAST RIVER.

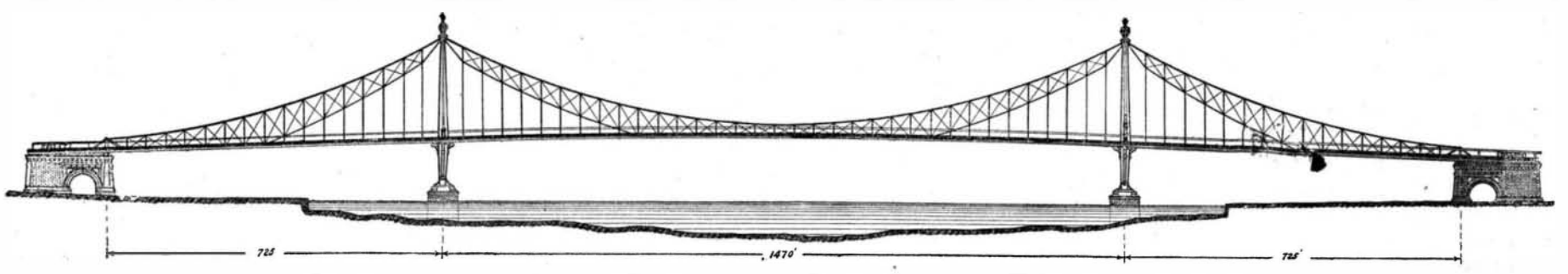
The foundations and piers for the new Manhattan Bridge across the East River are nearly completed, and the plans and specifications for the steel superstructure are in shape ready for the letting of the contracts. This bridge will run from near the intersection of the Bowery and Canal Street in New York to Willoughby Street between Prince and Gold Streets in Brooklyn. It will be considerably the longest of the big bridges across the East River, measuring about 10,000 feet between terminals. The original design of the structure, a small sketch of which is shown on the front page of this issue, called for a steel-wire, cable, suspension bridge, carried on four towers of a general rectangular cross section and consisting of heavily-trussed columns of a type resembling, in a general way, those of the recently opened Williamsburg Bridge. When the late Commissioner assumed control, it was decided to take advantage of the backwardness of the foundations for the bridge, and revise the plans and build a structure of greater capacity and more pleasing appearance. The work of preparing the plans was put in hand at once, and, as we have said, matters are now in shape for the immediate commencement of the construction. The floor of the bridge will be 122 feet wide over all, and therefore a little wider than the floor of the Williamsburg Bridge. The center span will measure 1,470 feet from center to center of towers, or 130 feet less than the center span of the Williamsburg Bridge, and each of the side spans will be 725 feet in length from center of towers to anchorages. The two steel towers will rise to a height of 400 feet above mean high water. With a view to expediting the construction and avoiding the great delays incidental to the laborious and necessarily slow process of stringing steel wire cables, and also with a view to bringing the structure up to the most modern and approved methods of design for long-span suspension bridges, it was decided to build the cables of nickel-steel eye-bars; and instead of constructing separate stiffening trusses as part of the floor system, it was decided to build these trusses as part of the suspension chains, utilizing the chains as the top chords of the trusses. Apart from the great ease and rapidity of erection, and the graceful appearance of the finished structure, there was a constructive advantage in the fact that the deepest part of the trusses occurs at the quarter lengths of the span, where the bending stresses are greatest, while the trusses are shallowest at the center of the span, where theoretically they ought to be shallow, in order to reduce the stresses due to changes of temperature. There will be four lines of eye-bar chains with their stiffening trusses. They will have fixed connections at the top of the towers, the cradles on rollers being dispensed with as an obsolete arrangement. The chains will be made up of 18-inch nickel-steel eye-bars. At the point of connection to the towers each chain will consist of four bars 18 inches in depth by 1⅝ inches in thickness and sixteen bars 18 inches in depth by 1 11-16 inches in thickness. The trusses will be built with panels 45 feet in length, and at each panel point there will be pin-connected suspension members, which will support the roadway.

The main floor of the bridge will be carried upon plate-girder floor beams, one at each panel point, which will be supported at the ends and at two intermediate points from the suspension chains. The floor beams will have short cantilevers projecting beyond the outside points of support, which will carry the footways, each of which has about 12 feet of clear width. These footways being on the outside of the trusses will afford to pedestrians a clear view of the river. The space between each pair of trusses will be devoted to the elevated and street railroads. The elevated cars will be carried upon an upper deck which, at the center of the bridge, will be about on a level with the chain cables, while the street cars will run upon the floor of the bridge. The center of the suspended structure will be devoted to a 35½-foot carriage and vehicle roadway, which will provide sufficient space for four three-horse teams to drive abreast if need be.

The towers of the bridge are of novel construction, and are of extremely light and pleasing appearance. Each consists of four very massive columns standing in one transverse plane, the columns being located in the same vertical planes as the chain cables. Instead of the base of the towers being carried out to a broad base, as in the lately finished Williamsburg Bridge, the columns viewed from the side elevation taper from their greatest width of 22 feet at the platform down to a width of 14 feet, where they rest upon a large hollow forged steel pin, two feet in diameter. The pin itself rests in a massive ribbed cast-steel footing. The object of this construction is to insure that the load of the tower will be distributed evenly over the top of the masonry pier. By causing the load to pass through a central pin, from whence it is distributed through a broad steel pedestal, the possibility of uneven pressure on the masonry is entirely eliminated, and every part of the pier will receive its proper share of the load. Theoretically, the tower is free to rock on this two-foot pin, in the direction of the axis of the bridge, but actually the movement of a few inches one way or other at the top of the tower, due to changes in form of the chain resulting from live load and temperature, will be taken care of by the elasticity of the tower itself. It must not be supposed that the presence of the hinged joint threatens the stability of the tower; for it must be remembered that the chain cables are rigidly attached to the top of the tower, and consequently hold it permanently in its proper vertical position. The use of a massive saddle on roller bearings at the top of suspension bridge towers had come to be regarded by leading bridge engineers as an obsolete construction before this bridge was designed. In a study for a North River bridge of 3,000-foot span, the late George S. Morison omitted the movable saddle, and attached his cables rigidly to the top of the tower. For the erection of the towers temporary steel wedges are provided, which will afford a base sufficiently broad to give stability during erection; or, if it were preferred, the towers could be built with a slight inclination toward the river (sufficient to give a safe margin against overturning by wind pressure) and be tied back to the anchorage until their full height was reached. Four wire construction cables could then be laid from tower to tower, and the towers drawn back to vertical position. Calculation shows, however, that the towers could be run up vertically to their full height on the base provided and still have, because of their great weight, an ample margin of safety against overturning by wind pressure. After the towers are completed, erection cables will be run over the towers from anchorage to anchorage, and from these, traveling erecting cradles will be slung, from which the eye-bars will be lifted up and pinned together, commencing and working out from the towers. The first step would be to string the alternate two and three central eye-bars of each set of twenty, and then slip the other bars over the ends of the pins in pairs until the complete chain was assembled. There is absolutely nothing new about this system of construction, and it has been used for over half a century in the erection of bridges of this type. The web members of the stiffening trusses will be threaded on the pins in their proper relative positions, and then the bottom chord pieces of the trusses will be lifted into place and pinned together at the intersections, after the manner of the erection of any ordinary pin-connected truss bridge.



SECTION THROUGH FLOOR AT CENTER OF SPAN.



THE NEW MANHATTAN SUSPENSION BRIDGE ABOUT TO BE BUILT ACROSS THE EAST RIVER, NEW YORK.