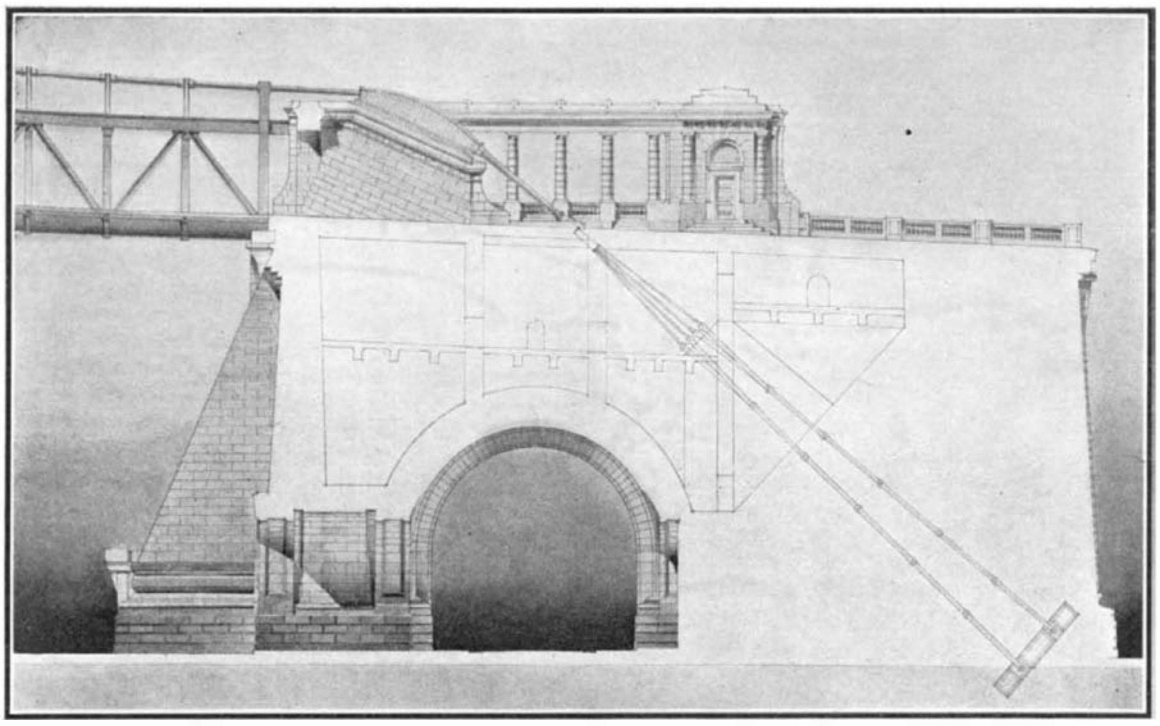
THE PLANS FOR THE NEW MANHATTAN BRIDGE.

Gustav Lindenthal's design for an eye-bar bridge across the East River has probably received its quietus. In its stead, plans for a wire-cable suspension bridge have been submitted to the Municipal Art Commission, which plans will probably be finally adopted. In the present article we shall dwell simply upon the architectural features of the new plans, leaving an engineering discussion of the bridge to a future issue.

It may be stated that structurally the new Manhattan Bridge is not very different from that which Mr. Lindenthal condemned. The stiffening truss, which has so successfully contributed to the monumental hideousness of the Williamsburg Bridge, will also be a feature of the Manhattan Bridge. It will be shallower than the Williamsburg truss, however, and architecturally less objectionable. In the original wire suspension plans, the cables passed under the stiffening truss, supporting the roadway and carrying it horizontally into a plain cubical mass of masonry, which constituted the anchorage. In the new bridge the cables will extend to the top chord of the stiffening truss and over the saddles on the anchorage. This new arrangement of cables has necessitated a redistribution of strains, and a modification of some structural details.

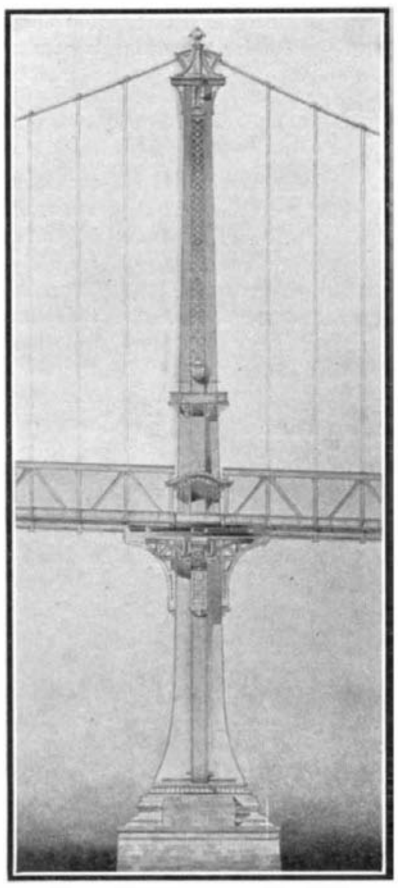
Architecturally considered, it must be confessed that the plans for the new structure are pleasing enough. The lifting of the cables above the truss has undoubtedly added to the beauty of the structure. The architects have devoted most attention to the anchorages. On either side of the footways peristyle courts are to be built, 120 feet above the water level. The anchorages, with their area of 225 feet in length by 175 in width, certainly lend themselves well to such treatment. An attempt has been made to utilize the masonry supports for the anchorage saddles by combining them with a colonnade. One of the pavilions of the colonnade on either side of the anchorage will be provided with staircases connecting with the interior of the anchorage, and finally with the street. Such has been the treatment of the anchorage courts and the towers, that the bridge will afford ample accommodation for those who care to rest under cover and obtain a view of the boroughs of Manhattan and Brooklyn. The bridge, therefore, becomes something more than a means of communication between two great communities that flank the East River; it will become, in a word, a vast "recreation pier" in the hot weather.



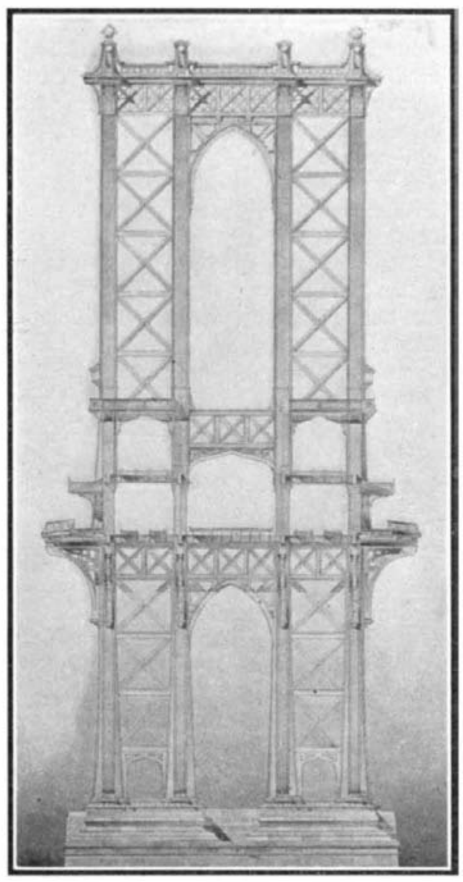
Longitudinal Section of an Anchorage.

Since the tower foundations have already been built, the main dimensions of the bridge will probably remain substantially what they were before Commissioner Lindenthal entered into office. The clear span is fixed at 1,470 feet, with two identical shore spans, each 725 feet long. The width of the bridge will be 120 feet. Comparing this with the 84 feet width of the old Brooklyn Bridge, it becomes evident that ample provision has been made for traffic. Over the roadway an elevated railway is to be built. The central roadway will be 35 feet wide, and the footpaths each 10 feet wide. Between the roadway and footpaths on each side double trolley tracks will be built.

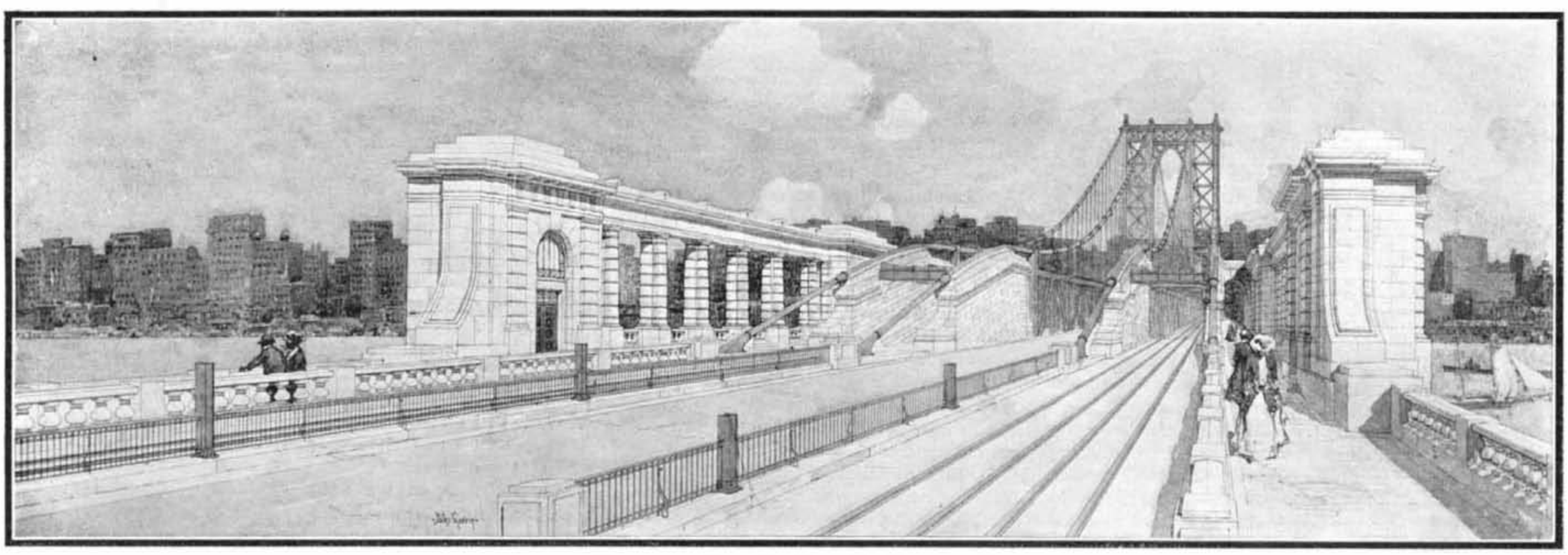
In striking contrast both to the old Brooklyn Bridge and the recently completed Williamsburg Bridge are the towers. These rise some 320 feet above the water level, and are extremely slender, almost delicately so, in form. They will be practically solid metal, and will be only 18 feet wide. The cuts show each tower to be an oblong frame of twin towers strongly braced, with a central arch not unlike that of the picturesque Brooklyn Bridge towers. The architects found the main lines of the cables and suspended trusses as designed by the engineers so graceful that further architectural treatment seemed to them unnecessary. Therefore the tops of the towers are ornamented simply with a cornice.



Side Elevation of a New Tower.



Front Elevation of a New Tower.



The Roadway Over the Anchorage, Showing the Colonnades.

THE NEW MANHATTAN WIRE-CABLE SUSPENSION BRIDGE ACROSS THE EAST RIVER AS IT WILL APPEAR WHEN COMPLETED.

Electric Sterilization of Milk.

BY EMILE GUARINI.

The sterilization of milk is a problem that was once regarded as solved, but which is at present being earnestly discussed. The technical press has for several years been making public the profound transformations that heat brings about in the nutritive ingredients of milk. In order to sterilize milk, in fact, and guarantee its preservation almost indefinitely, it is necessary to prolong the action of fire for a considerable length of time. Ebullition of the liquid, however, even for a long time, does not by any means destroy all its germs, and, in practice, we are obliged to attain a temperature of 120 deg. C. (248 deg. F.) and continue the operation for 20 minutes in closed vessels. It is not astonishing that, through such a treatment, the milk should undergo a great modification. It is especially in infants that, through the gastric disorders that it occasions, we recognize the absence of digestive properties in milk thus treated. We remark, besides, in infants fed with sterilized milk, a tendency toward rachitis, due, it seems, to a want of phosphorus. The true cause of such anomalies has been found within the last few months. A very able chemist recently presented to the Academy of Sciences of Paris a highly interesting study of this subject based upon a long series of experiments. From this it results that in milk sterilized by the action of fire, lecythine, the valuable ingredient that furnishes the organism with the phosphorus necessary for its normal development, becomes transformed and ill adapted for absorption by the stomach, especially by that of infants. Although, on the one hand, hygienists wish to ostracize milk thus sterilized, the same disciples of Esculapius, on the other, put mothers on their guard against the germs of tuberculosis insidiously concealed in milk that has not passed through the sterilizing digester. The problem that therefore confronts us is this: how shall the microbes of milk be killed without altering the latter's composition? Some efforts have been made to solve this question, and in several different ways. Ozone has been employed at various times on account of its bactericidal properties; and trial has been made also of oxygenated water, which is quite a powerful disinfectant, but the practical results obtained do not seem sufficiently encouraging to warrant the use of this agent. In order to effect the destruction of the germs without carrying the action of fire too far, a partial saturation with oxygen has been tried. It is probable that in this direction the perseverance of experimenters will some day reach the solution of the important problem of milk sterilization. Driven to despair, and not knowing to what other saint to turn, an appeal has been made by some to electricity to perform for milk one of those numerous miracles that it alone can effect. The researches made up to the present day, especially in Italy, have not, however, given the results that were anticipated. Mr. Guarini and Dr. Samarini, nevertheless, have just solved the problem at Brussels after numerous and long researches. They have not only succeeded in sterilizing milk electrically, but have also explained why their predecessors were unable to obtain results reached by themselves. The alternating as well as the continuous current had been employed and it was concluded from the unsuccessful issue of the experiments that the problem could not be solved by electricity. Such was not the opinion of Messrs. Guarini and Samarini when they took up the question, since it was evident, *a priori*, that the investigators had not made their experiments with a sufficient knowledge of the phenomena invoked by them. In fact, for the experiments with a continuous current they had employed one generated by a few batteries or a high-tension one furnished by a static machine. If we consider that the deadly effects of the electric current are not produced by the tension, but by the intensity of the current, we shall see that the effects sought could be obtained in neither case. In the case of batteries the tension was too low to permit a current of sufficient intensity to traverse the milk, being given the great resistance of the latter. In the second case, the tension was sufficient, but the intensity was negligible, as it generally is in static machines. In order to verify the matter, Messrs. Guarini and Samarini, after trying the experiment again, with the same negative results, rendered it more striking by substituting fishes in water for the microbes in the milk, and found that the animals exhibited no uneasiness in the presence of the current. The experimenters then employed a continuous current up to 170 volts, and, with a quart of milk, raised the intensity to 5 amperes. By extracting some of the milk at a certain distance from the electrodes, by means of pipettes, it was found that it was perfectly sterilized and could be preserved. Unfortunately, however, the experimenters were confronted by another difficulty, and that was that the milk, beginning in the vicinity of the electrodes, became coagulated. Upon employing fishes in water, the animals were of course perfectly electrocuted. Upon employing special electrodes with a current of water, the coagulation was much diminished and almost imperceptible. The experimenters nevertheless abandoned the continuous for the alternating current. In the first place they repeated the experiment of their predecessors, employing the Ruhmkorff coil. The milk was not sterilized, and the fishes, moreover, experienced but a slight shock. Messrs. Guarini and Samarini then had recourse to a 110-volt alternating current, with carbon electrodes. The milk was perfectly sterilized when the density of the current was adequate and was not coagulated when the frequency of the current was sufficiently elevated. It might be thought that it would prove advantageous to add to the milk certain substances of a nature to render it more conductive; but the experimenters found that such was not at all the case, and that in such an event it became necessary to employ a much stronger current. They made this fact evident by electrically treating some fishes in fresh and salt water. In the second case it required a much greater intensity to kill the animals than it did in the first, because the greater part of the current went through the water and not through the body of the living organism.

It may be concluded from these very interesting experiments that, in order to effect an electric sterilization of milk, the three following conditions must be realized: (1) The milk must be traversed by an alternating current of sufficient frequency to prevent the decomposition of the liquid; (2) the density of the current must be sufficient to electrocute the microbes; (3) the alternating current must be of a sufficiently high tension to overcome the somewhat high resistance of the milk. If we have only an alternating current of low tension at our disposal, we might at a pinch add a salt or an acid to the milk in order to render it more conductive. In this case there would be required a much greater current intensity and substances capable of being subsequently eliminated without altering the quality of the milk.

As for the practical application of the process, the apparatus for that is very simple, and consists of a well insulated receptacle and two electrodes, say of platinized carbon. Two factors evidently intervene—the duration of the treatment and the intensity of the current. Since the use of electricity is daily becoming more general, it may be that the process will be adopted to a certain extent, since it gives absolutely sterilized and in no wise altered milk.

About a Baseball's Curves.

BY RICHARD MEADE BACHE.

It is now thirty-three years since the question arose at Yale University as to whether or not a baseball thrown from the hand could be made to deviate horizontally from a straight line. The experiment was then and there tried, proving that the flight of a ball could be made to curve to the right or to the left by skillful pitching. This was accomplished by the simple expedient of placing a plank upright on the ground and, from a point at right angles to the middle of one of its broad sides, twirling a ball to a point back of the center of the plank. Since then, it is accepted as fact by all baseball players, that the flight of a ball can also, under fine handling, be made to incurve abnormally downward or upward with reference to its landing place; that is, either in the direction of, or contrary to, the attraction of gravitation.

The period mentioned was in the infancy of skilled baseball playing. Since then, a generation of players of the game has grown up, and the constant repetition of the phenomenon mentioned has become so engrafted with common experience, that few persons conversant with the game ever think that it needs explanation. The character of the pitch, whatever it may be, seems just as natural to them as that of the slight vertical curve of the ball when compounded simply of the forces of its projection and the attraction of gravitation. To so feel about the abnormal curved courses of the ball is, however, only a habit of mind, habitual experience of any kind of action mostly assuming, without appreciating, the reason for things. The average baseball player accounts for the phenomenon by saying that it is caused by the pitcher's giving the ball a twist as it leaves his hand. But that statement does not account for its being thereby compelled to move in an eccentric orbit.

If, in a calm, one lets fall a feather, one sees that it descends slowly and with deviation from the vertical. But, let him cause a feather to fall from the top of the inside of the exhausted glass receiver of an air pump, and he will see that it falls plumb, like a shot. A body projected in space would proceed forever at the same rate, and in a straight line, were not space full of bodies that would attract it. This is one of Sir Isaac Newton's laws of motion. Resistance of some kind is, in a word, indispensable to making a moving body deviate from the particular speed and course impressed upon it by its original projectile force and by the attraction of gravitation.

It is, therefore, the resistance of the atmosphere, as well as the forces of projection and rotation of the baseball, which makes the ball describe a curve to the right, to the left, upward, or downward. The right-handed pitcher delivers his "outshoot" with much greater effect of incurve at the plate than he can accomplish with his "inshoot." The left-handed pitcher, in a reversed position, but correspondingly, delivers his "outshoot" more effectively than his "inshoot." The reason is that although, in each case, the speed of the ball for "outshoot" and "inshoot" is the same, the speed of its rotation is very different. The centrifugal rotary force impressed by the pitcher upon the ball, opposed by the friction of the atmosphere, packed by the ball's rapid duplex movement, being weaker in the "inshoot" than in the "outshoot," permits of less curvature there in the ball's flight than is possible in the "outshoot." In all cases, the ball makes its incurve at the plate, whether horizontally, from right or left, or vertically, from above or below, because friction of the atmosphere, compressed by the ball's combined velocity and speed of rotation, retards and finally exhausts its movement of rotation at the end of its flight. The two movements of the ball, and the resistance of the atmosphere, forming together three compounded forces, compel the flight of the ball to assume the form of a curve. As the ball leaves the hand of the pitcher, it whirls onward until, the quickness of its rotation being diminished by friction on its surface from the atmosphere, and thereby weakened, it curves either upward, inward, or from right or left with reference to the "plate" of the baseball field.

Anyone should be able to realize the truth of this demonstration of the principle through which the course of balls can be curved, if one has ever realized the density of the atmosphere, and the fact that it is a compressible, elastic gas. These properties of the atmosphere make of it, under the circumstances described, a continuous elastic cushion upon which the rotating ball impinges, and by the intervention of whose moderate resistance the course of the ball is modified in direction. The average pressure of the atmosphere, at the level of the sea, to the square inch of the earth's surface, is 14.7304 pounds, commonly called, in round numbers, 15 pounds. The average barometric height is about 30 inches at the level of the sea; but it is only 24.75 inches in height at Denver, Colorado, a difference in height between the two situations corresponding to a difference in weight of atmosphere of over two and a half pounds out of nearly fifteen. Yet it has been lately stated, that batting averages at Denver are the same as those on the eastern coast of the United States. However that may be (and it seems utterly irreconcilable with what has been shown here), there must be, in so rare an atmosphere as that of Denver, compared with that of the eastern coast of the United States, less possible curvature to the flight of balls than is common to pitching them in the latter region.

The main fact here elaborated as to cause may be concisely stated in language not forbiddingly scientific. The "upshoot," "downshoot," and right and left "outshoot" and "inshoot" of the baseball, thrown by pitcher to "plate" of baseball field, represent, through their various incurves at the "plate," resultants corresponding with the compounded forces of the projection of the ball, its rotation in varying positions of its axis of revolution, and the resistance due to the density of the atmosphere; the last factor being known as *vis inertiæ*, the force of inertness, which involves resistance to motion, and which is therefore truly regarded as a species of force.

Remarkable Phenomenon of Crystallization.

A curious phenomenon was observed lately by Prof. Stanislas Meunier, of the Paris University. He found that a certain number of plaster balls, left to dry after a short immersion in salt water, became entirely transformed into a conglomeration of gypsum crystals, and some of the latter reached 1-5 of an inch in length. In an account of this phenomenon which he gave to the Academie des Sciences, he states that although the balls of plaster had been formed under quite similar conditions and even used in the same experiments, they were far from showing the same crystalline appearance. In some of them a glass was needed to see the crystals, while in others they could be distinguished with the naked eye and were from 0.2 to 0.25 inch long. Some of the specimens showed a radial arrangement of the crystals which is not seen in the natural plaster stone. The crystalline structure varies with the distance from the surface in the same ball. It is scarcely noticeable on the surface, and the ball must be broken in order to observe it. When broken in halves, the crystallization is more strongly marked near the center than in the outer parts. At the periphery there is a compact coating or skin about 1-30 inch thick. Starting from this, the mass assumes the character of an irregular assemblage of crystals, more or less coherent, which often fall apart at the least shock. As to the cause of this remarkable phenomenon, it seems that the salt which was used to impregnate the plaster must have a kind of *crystallogenic* faculty, acting as it does to bring about the formation of crystals. If this is so, it is one step toward explaining the causes which bring the gypsum in the earth's strata into the crystalline state.