HYDRAULIC MACHINERY FOR OPERATING A DRAWBRIDGE.

As generally constructed, the mechanism by means of which a drawbridge is turned requires that a nice adjustment of the parts be always maintained, in order to insure perfect working. Those familiar with such appliances will be interested in the hydraulic machinery designed by Mr. Theodore Cooper, of this city, by which the drawbridge* across the Harlem River near Second Avenue, this city, is operated, because of its extreme simplicity and the reliability of its action under all possible conditions. While doing away with several of the expensive parts to be found in the old style of draw, it performs its duty better, and is not so much affected by ordinary wear and tear; in addition, the one part most liable to wear can be easily, quickly, and cheaply replaced when necessary. Aside from the practical bridge builder, this apparatus is also of interest to the mechanic, since it introduces a simple and ingenious method of accomplishing the rotation. To the general reader it is worthy of study, as it produces a seemingly anomalous movement of the draw, when we consider the direction in which the power is applied. The bridge moves in a direction directly opposite or against that in which the operating ropes ought (apparently) to pull it; in other words, the ropes pull in one direction, and the bridge moves in the contrary direction. This also appears the more strange as there is no connection whatever between the bridge or its machinery and the pier upon which it rests.

The bridge rests and turns upon a ring made up of 54 cast iron coned wheels, 16 inches in diameter at the base; the drum thus formed is 26 feet in diameter. The wheels are held truly radial by two guide rings, one inside and one outside of the wheels; the outer ring is grooved to receive the operating ropes. A tension rod connects the axle of each wheel with a movable center or hub (turning upon a steel shaft 6 inches in diameter), to which the guide rings are also braced by angle iron struts. The axes of the wheels are inclined upward toward the center at such an angle as to bring the upper bearing lines of the wheels in a horizontal plane. Heretofore, the axes of the wheels have been placed in a horizontal plane, thereby compelling the use of two inclined tracks for the wheels to roll between. But in this case the upper bearing plates, forming the upper circular track, are of wrought iron planed flat, while the lower track circle is made of cast iron segments, bolted together and firmly anchored to the masonry; its bearing surface is planed to conform to the inclined position of the wheels. On the upper bearing plate are springs for equalizing the load on the rollers.

The operating ropes—wire cables—are led by properly placed sheaves, as shown in the engraving, to a small room located in the center of the bridge, and the floor of which is at an elevation equal to that of the portals. There are four of these ropes, one at each corner, and the lower ends are secured to the guide ring at diametrically opposite points. These ropes act in pairs; two open the draw, and the other two close it. Those ropes at diagonal corners operate together, or in the same direction. One of these ropes, after being passed around a drum carried in a frame placed between and uniting the plungers of two hydraulic rams —as shown in the inverted plan view of the floor of the operating room, Fig. 4—is secured to the framing at a point alongside of its own ram. The rope that operates in the contrary direction is led around a drum in the same frame, and fastened alongside of the opposite ram. These two ropes are clearly shown in the large view. It will be seen that either of these ropes may be made to pull upon the guide ring, according to the direction in which the rams move. At the other side are two more rams, working together, and two ropes arranged in the same way. Each pair of rams has a stroke of 6 feet, so that the ropes and guide ring to which they are attached have a movement of 12 feet, but the bridge moves 24 feet and turns a quarter of a circle at each stroke. If the lower horizontal portion of the right hand rope shown in the large view be pulled in a direction toward the right, the bridge itself and the guide ring and rollers will move against this pull, or toward the left.

The cylinders of those rams that work together are connected with each other by pipes, as shown in Fig. 4. A small steam pump takes its supply from a tank, and pumps either to the rams or to the accumulators, which are two large wrought iron boiler shells, capable of standing a working pressure of 400 pounds to the square inch; they are simply large air chambers by which to obtain a permanent air pressure. They are so proportioned that, when filled half with water and half with air at 300 pounds pressure, the draw can be swung open and closed again without the use of the pump. The pumps are provided with small air check valves, so that the operator can supply any leakage, and on top of the accumulators is a valve by which any excess of air can be relieved. The piping is provided with the usual safety valve attached to hydraulic machinery. A four-way valve guides the water to and from the rams. As the working rams are operating, the remaining two push the water back into the supply tank.

To provide for the case when the bridge may have a large momentum, and the operator desires to reverse or break the movement of the draw to prevent the water ram which would occur on the non-operating rams, the supply pipes are furnished with check valves, which lift and connect with the accumulators, thereby allowing the bridge to cushion on the air in the accumulators.

A small pump is introduced for the purpose of getting a plunger small enough to be worked by hand during repairs to the boiler. By the use of this pump, driven by hand, and the accumulators, which can be pumped up when the draw is not in operation, the addition of the ordinary hand gear was considered unnecessary.

The wedges are operated by two small rams—one is shown in Fig. 2, and both are shown to the right of the engine room in the main view—connected by rods with the arms of a bell crank in bearings secured to the floor beams at each end of the bridge. To the lower arms of these cranks are attached rods which move the wedges and rollers; the movement of this bell crank also locks and unlocks the bridge. In closing, the ends of the bridge swing clear of the masonry; when closed, water is admitted to the proper ram, which then turns the bell crank at each end of the bridge. The arms carrying the rollers approach the vertical position shown in Fig. 3, and each wedge moves in the same direction as its own roller, but not so fast. The ends of the bridge now rest upon the rollers, which in turn rest upon heavy iron plates on the masonry. The speed of the wedges is now increased, and they come to a bearing; the rollers move a little further, and the ends of the bridge are supported by the wedges. When the other ram works, the ends of the bridge are lifted by the rollers, the wedges are withdrawn, and the bridge is free to swing. The same hydraulic pressure, but of course controlled by an independent valve, operates these rams.

The liquid used in the rams is glycerine mixed with water in such proportion as to be unaffected by the coldest weather.

The main object of employing this form of mechanism for operating draws was the avoidance of toothed gear of any kind—a class of mechanism which usually gives a great deal of trouble on drawbridges because of the difficulty of getting a positive control of the bridge during high winds. This is caused by the necessary slackness of the gear, due to back lash, which permits the knocking of the bridge back and forth. A very small play between the teeth of the gears is sufficient to allow the ends of the bridge a considerable movement. The method above described differs from those employing gears, as there is no possibility of any of its parts binding so as to prevent the moving of the draw. An even bearing upon the rollers, if there should be a distortion of the bridge, is always obtained by the equalizing springs.

* This bridge was described and illustrated in the SCIENTIFIC AMERICAN of Aug. 1, 1885.

Invention of the Telephone.

To the Editor of the Scientific American:

I have read with much interest your articles on the invention of the telephone originally by Reis. I have also read the work of my friend, Professor Silvanus Thompson, on this subject, and I have discussed the matter with him. I think I am in a position to supply a small link in the chain of evidence, which, though not important, may really prove to have a good deal, and certainly is not devoid, of interest. I was a student of medicine in the University of Edinburgh from 1860 to 1865, and being much interested in physical research, I was very frequently in the shop of Messrs. Kemp & Co., which used to stand near the entrance of the old Edinburgh Infirmary. Probably many of your readers have, like myself, visited that well-known establishment, and they will remember that it consisted really of two shops—one in which chemicals were sold, and the other, which had a separate entrance from the street, yet connected with the first by a door of communication, was occupied chiefly by physical apparatus, and was not common to the ordinary customers of the shop. Mr. Kemp died somewhere about the year 1861, and the business for some time, until, I think, about the middle of 1864, was managed by an extremely intelligent assistant named Mr. Shearer, of whom for many years I have entirely lost sight. Could Mr. Shearer be discovered, I fancy that he could give some extremely interesting information about the point which I am about to indicate.

As near as I can identify the date, in December, 1862, a very simple-looking instrument was shown to a number of his customers by Mr. Shearer. That instrument is depicted accurately on page 342 of your journal (Nov. 28, 1885). It was connected in a circuit with a battery, and by means of wires to a transmitter of a rather different form from that which you figure on the same page, but precisely identical with one which is figured on page 97 of Professor Silvanus Thompson's work. Mr. Shearer had his apparatus in action, the transmitter being arranged in the one shop, while the wires passed through to the receiver in the other. In common with many others of those who frequented the shop, I heard articulate words, which I could appreciate accurately, pass through this instrument from one shop to the other. At that time Mr. Alexander Melville Bell was a well-known teacher of elocution in Edinburgh, giving public readings, to which many of the young men of the town were strongly attracted. He was, indeed, a very well-known man in Edinburgh, and lived there with his family.

When I met Mr. Graham Bell at Plymouth, in 1877, when he first exhibited his telephone, I immediately recognized him as the son of Mr. Melville Bell. I cannot say whether he was resident in Edinburgh at the time that Shearer exhibited Reis' telephone in Kemp's shop, but I think it is very likely he was, and I feel almost certain that I have seen Mr. Melville Bell as one of the frequenters of that shop. So that it seems to me that nothing is more likely than that it was through this chain that Reis' telephone was transferred to America, and there became developed. Mr. Melville Bell was then engaged in the contrivance of a universal alphabet, upon which he has published an extremely interesting book. Reis' telephone was greatly talked about in Edinburgh at the time of its exhibition by Shearer, and I think it is extremely likely that Mr. Melville Bell would go to the shop to see it, and he might have been accompanied by his son.

LAWSON TAIT.

Birmingham, December, 1885.

[It is almost unnecessary to remind our readers that Dr. Tait is an eminent British physician, of distinguished ability, well known in this country.—EDS.]

Best Mode of Ventilation.

Speaking upon the subject of the ventilation of dwelling houses before the Toronto Sanitary Association, Mr. David Dick controverted the theory that the carbonic acid of an inhabited room can be drawn off by outlets placed at the floor level, which is the French practice. He pointed out that, in view of the principle of the diffusion of gases, it is impossible to expect that carbonic acid, although the heavier gas, will so far separate itself from the other components of the atmosphere as to be susceptible of withdrawal at a low level. According to Mr. Dick, the only factor to be regarded in ventilation is temperature. The air is cold at the floor line and warm at the ceiling; the difference in rooms artificially heated or full of people being seldom less than 20° Fah. Owing to this tendency of heated air to rise, and to be supplanted at the floor line by cold air coming in from crevices in the doors and windows, etc., Mr. Dick considers that a room cannot be properly warmed solely by the radiant heat of a fire. The heat from this source should be helped by some means for preventing the draughts of cold air on the floor.

With this view, Mr. Dick advises that rooms should be provided with many inlets for warmed fresh air at the floor line, the effect of which would be to drive up all impure air toward the hotter stratum near the ceiling. An outlet at the ceiling line would then carry off the whole of the vitiated air. As the warm air begins to rise as soon as it enters the room, the more it is subdivided into separate inlets the better, because it will ascend by the most direct line to the outlet; and therefore a number of small streams will move the general body of air in the room more effectually than one large current, which would be likely to pass through the body of air without affecting anything that did not happen to be directly in its path.

The temperature of the inflowing air should be moderate, and its velocity low. It is desirable, however, that there should be only one outlet for foul air from an apartment, because if there were more than one the draught might be unequal, and then one would pull against another, causing a flow of air down one and up the other, instead of from the proper inlets. Of course, the one outlet need not appear as such in the apartment, as its mouth may be concealed by a perforated cornice or other device.

Another Great California University.

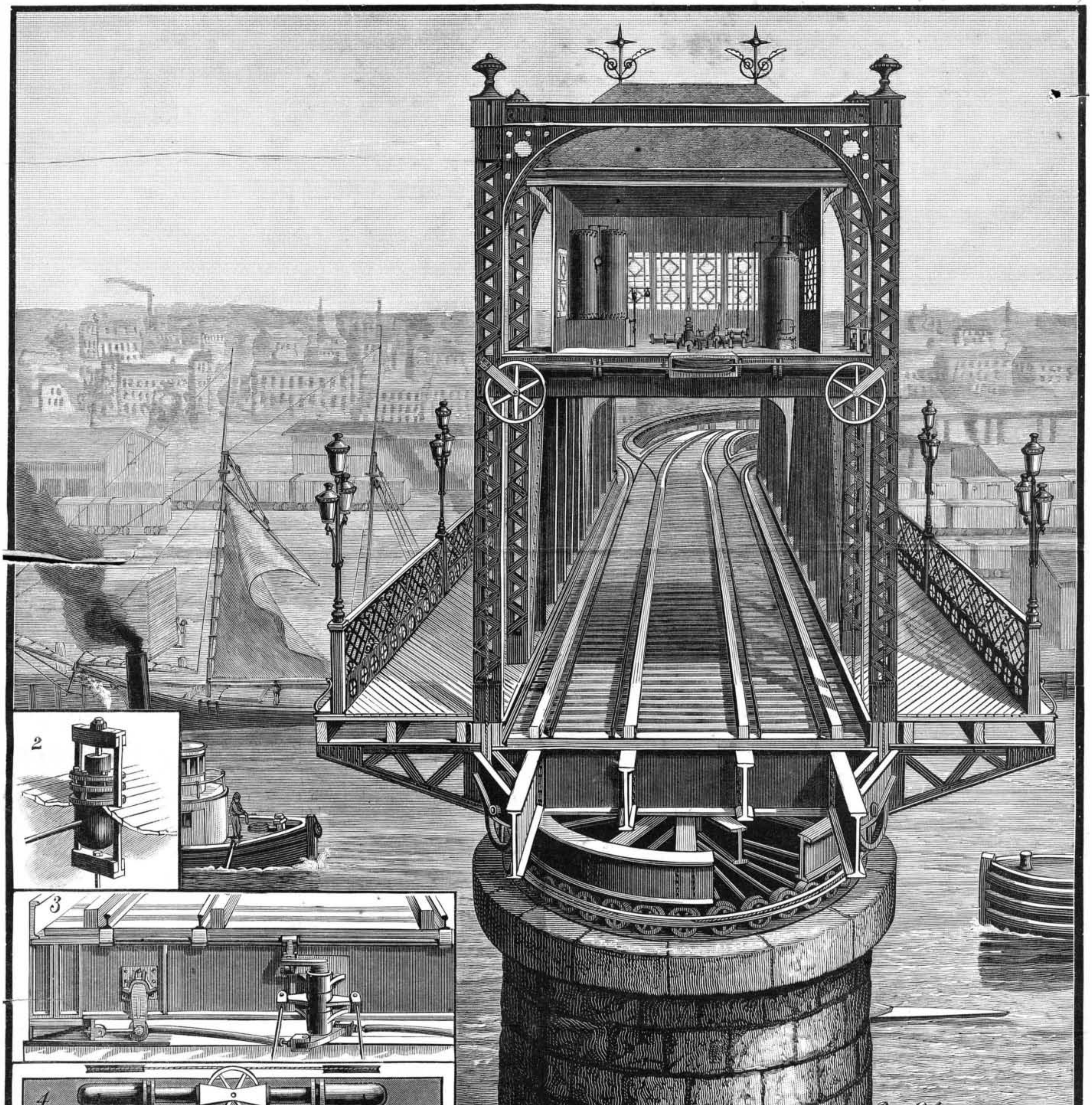
Senator Stanford, of San Francisco, has executed a deed of trust by which lands and funds to the value of $20,000,000 have been devoted to the establishment of a great university at Palo Alto, Cal. This is the largest gift ever received by any institution, and makes the endowment of the new university larger at the beginning than that of any of the oldest colleges in the country. For several years Senator Stanford has been laboring to devise a satisfactory plan by which his wishes would be promptly carried out in case of death, and he has now accomplished this by the appointment of a Board of Trustees. He reserves the power to revoke their acts should they not carry out the spirit of the trust, and has taken every legal precaution to prevent the interference of his heirs with the enforcement of the bequest. The new university is a princely memorial to the Senator's dead son.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LIV.—No. 1. [NEW SERIES.]] NEW YORK, JANUARY 2, 1886. [$3.20 per Annum. [POSTAGE PREPAID.]



HYDRAULIC MACHINERY FOR OPERATING THE DRAWBRIDGE ACROSS THE HARLEM RIVER AT SECOND AVE. N. Y. CITY.—[See page 6.]