THE ILLINOIS AND ST. LOUIS BRIDGE.

[Condensed from the Report of the Chief Engineer, Capt. James B. Eads, C. E.]

On the twenty-sixth day of February, 1870, a contract was made with the Keystone Bridge Company of Pittsburgh, for the construction and erection of the superstructure of this bridge, including that of the approaches. By this contract the company agrees, under a severe forfeiture in case of failure, to complete the structure ready for use in all its parts in seventeen months from the time working drawings were furnished to it, provided it is not delayed by masonry work after the first of March 1871. In case of such delay, the time of completion was to be extended no longer than the time the company was so delayed. Completed working drawings were not furnished until the first of July, as the completion of certain parts of them was dependent upon data that were obtained from the testing machine, and which could not be ascertained at an earlier period. This delivery of drawings fixes the time for completion of the bridge on the first of December, 1871. Capt. Eads says in his report that he has no apprehensions that the masonry will not be completed in season to prevent any claim for an extension of time on the part of the Keystone Bridge Company.

The Wm. Butcher Steel Works Company, of Philadelphia, have contracted to furnish the cast steel that will be required in the work. Steel made by this company has shown limits of elastic reaction ranging from seventy thousand to ninety-three thousand pounds per square inch.

Capt. Eads has made several modifications in the general arrangement of the arches and in the details of their construction, since his original design, which will considerably improve the architectural appearance of the bridge and simplify its fabrication.

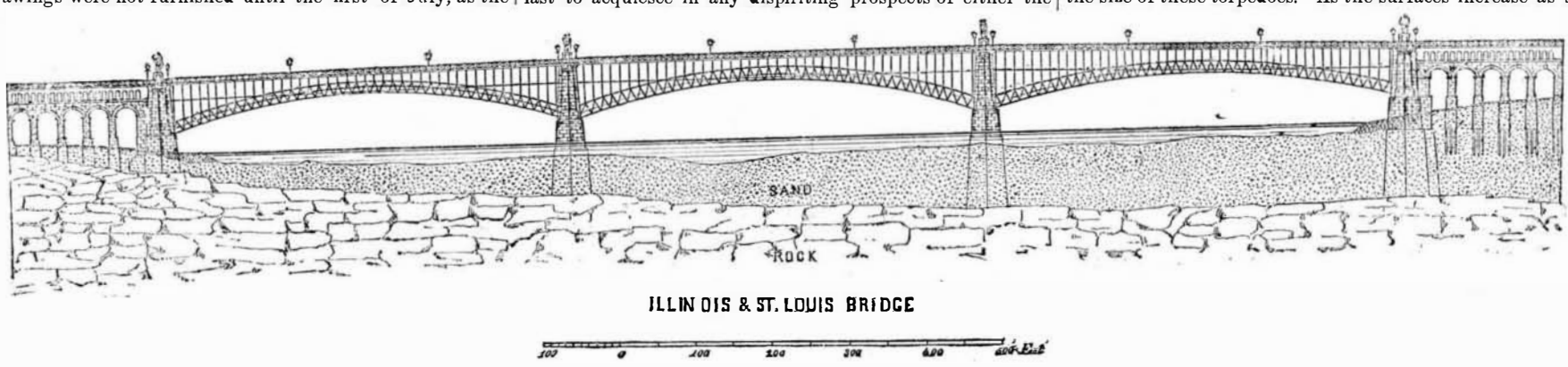
These changes consist mainly in using but one cast steel tube of eighteen inches diameter, instead of two of nine inches, in forming the upper and lower members of each one of the four ribbed arches composing each span; and in increasing the depth of each one of the arches from eight feet to twelve feet from center to center of these tubes.

The railways (which are below the roadway) are raised four feet, so that in no place will they appear below the arches, as they did in the original design. In that design the railways were eight feet lower than the center of the middle span. By deepening the arch four feet and raising the tracks four feet, they are brought level with the center of this span, or above the soffit of the arch. The lower ribs or tubes of the arches spring from the piers at their original level, consequently the arch has four feet less versed sine or rise than before. To lessen the grade of the railways it was necessary that the tracks should descend each way from the center of the middle span. This would cause them to fall below the centers of the side spans, to avoid which the level of the springing of these two spans has been lowered eighteen inches at each abutment. That is, the ends of the arches of the side spans resting against the abutment piers, will be eighteen inches lower than the other ends which rest against the channel piers. These arches, like the central ones, have four feet less rise than as originally designed, and by lowering their shore ends, as stated, an additional gain of nine inches depression is obtained at their centers, by which the gradients of the tracks are proportionally lessened towards the ends of the bridge.

Raising the tracks to the hight of the centers of the arches will unquestionably improve the appearance of the structure, and it is generally conceded that the alteration in the level of the springing of the shore ends of the side spans is likewise an architectural improvement. The effect upon the eye caused by it, will be somewhat similar to that produced by the camber of the bridge.

Of course these changes involved the necessity of revising the former investigations and results, so as to ascertain the difference in the strains, and to determine the alterations required in the sectional areas of the various members of the structure, when thus modified. An entirely new set of detail and general drawings was likewise required in consequence of these changes.

The view of the bridge in our engraving is a very correct representation of the structure, as it has been definitely determined upon, and as now being constructed. This view also shows the depth of the bed rock at the site of the different piers, and the depth of sand overlying it during ordinary stages of water.



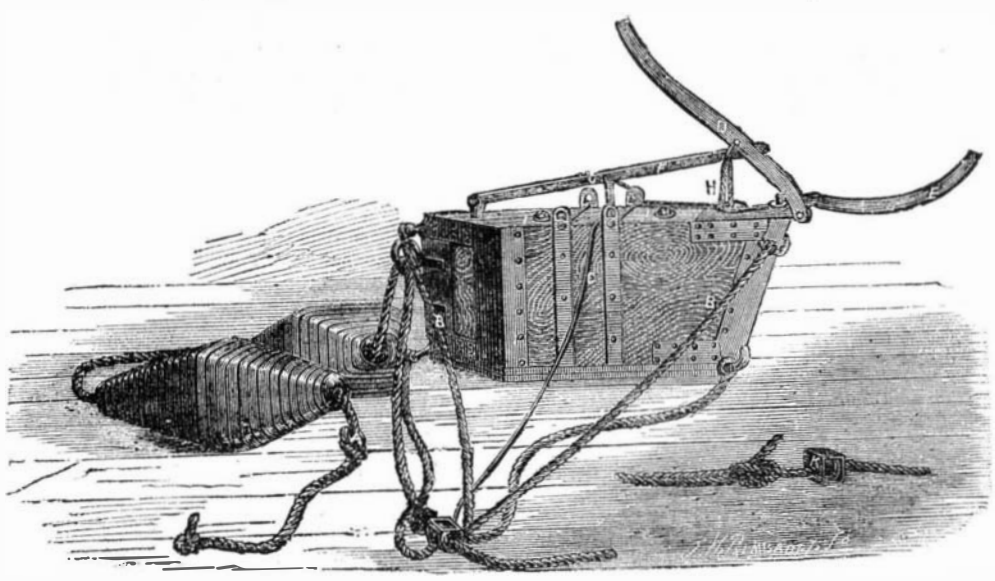
ILLINOIS & ST. LOUIS BRIDGE

The True Philosopher.

The character of the true philosopher is to hope all things not impossible, and to believe all things not unreasonable. He who has seen obscurities which appeared impenetrable in physical and mathematical science suddenly dispelled, and the most barren and unpromising fields of inquiry converted, as if by inspiration, into rich and inexhaustible springs of knowledge and power, on a simple change of our point of view, or by merely bringing to bear on them some principle which it never occurred before to try, will surely be the very last to acquiesce in any dispiriting prospects of either the present or future destinies of mankind; while, on the other hand, the boundless views of intellectual and moral, as well as material, relations which open on him on all hands in the course of these pursuits, the knowledge of the trivial place he occupies in the scale of creation, and the sense continually pressed upon him of his own weakness and incapacity to suspend or modify the slightest movement of the vast machinery he sees in action around him, must effectually convince him that humility of pretension, no less than confidence of hope, is what best becomes his character.—*Sir John Herschel.*

The Harvey Torpedo.

Our engraving shows a perspective view of the Harvey torpedo. It is shown in the position in which it is towed against an enemy's vessel, the torpedo ship, from which its movements are controlled, being a small, quick speed craft, so designed that the action of the enemy's shot will be of but little consequence to her when bow on. The casing of the torpedo is made of stout timber strengthened with iron straps at the ends and sides. The torpedoes are of various sizes, according to requirements; the one we have illustrated measures four feet six inches in length by two feet in depth and six inches in width. The torpedo, when being towed, has a divergence of 45° from the line of progression of the vessel towing it, which is due to the vertical plane of the torpedo being thrown at that angle by the manner in which it is slung. The tow line is seen at A in the engraving, B B being the slings which enable the operator to diverge the torpedo alongside the enemy's ship in meeting, parting, or crossing, whichever method of attack is adopted. C is the line by which the operator withdraws the safety key after the torpedo is well afloat. D is the top firing lever, and E, the side lever, either of which, when pressed, acts upon the after top lever, F, which, pressing down the exploding bolt, G, fires the charge. The top lever, D, acts directly upon the after top lever, the side lever being connected to it by means of the lanyard, H. This lanyard is reeved through the after top lever, and on to studs on the top lever, as a precaution against a back hit, which might part the levers, although such a hit could hardly happen. The eyes, D L, are for the purpose of attaching ropes for lifting the torpedo about.



THE HARVEY TORPEDO

The exploding apparatus, the firing bolt of which is seen at G, consists of a tube containing one chemical agent and a bulb holding another. The nature of these chemicals is such that when they combine violent combustion ensues, which explodes the charge. Its action is as follows: The after top lever forces down the exploding bolt, the bottom of which presses upon a pin in the bottom of a brass tube. At the bottom of the exploding bolt is a specially prepared composition, and a bulb containing an acid; the puncturing of this bulb frees the acid, and the combination of the chemicals effects the explosion. The composition embodies certainty of action when combined with the acid, and great explosive power. The charge in the torpedo under notice consists of either seventy-six pounds of gunpowder or 100 pounds of dynamite, which is inserted through the two loading holes, I I. These holes are first closed with corks, and afterwards with screwed plugs, as shown in the engraving Although a somewhat small charge, it is nevertheless amply sufficient, as its full force is exerted upon the object of attack, the explosion only taking place by absolute contact. It may be as well to observe that there is hardly a limit to the size of these torpedoes. As the surfaces increase as the squares, and the contents as the cubes, a very slight increase in the dimensions would give a great increase of charge The present charge, however, is considered ample with reference to the conditions under which it is employed, and the torpedo as at present made is of a very manageable size. The highly dangerous character of this torpedo demands that every precaution should be adopted to insure the safety of the operators. With this view Captain Harvey has devised a safety key, which is inserted through the stem of the firing bolt, G, and to which is attached the line, C. This line is attached by a split yarn to an eye of one of the iron straps on the side of the torpedo. When the weapon is clear of the operating vessel, the key is withdrawn by slacking the tow rope and holding fast the safety key line, which breaks the yarn and withdraws the key, which is then hauled on board.

It will be observed that two buoys are attached to the torpedo, and these are sufficient to insure its flotation at any given depth. They are attached to the tow rope, A, on the further side of the thimble, K, to which the slings are made fast. The tow rope passes through the thimble, and the buoy rope through a large eye fixed to the upper part of the torpedo. The object of this arrangement is to enable the torpedo to be cut adrift, should the necessity arise. The tow line being severed on board the torpedo vessel, the torpedo would at once sink, the line passing through the thimble and the eye, and, being attached to the buoys, could be afterwards recovered. Such an emergency might arise from a missfire in the torpedo, which would be dangerous to haul on board, but which would thus be easily cut adrift. The torpedo can be used either by day or night, the latter time being preferred.

In operating with the Harvey torpedo, a small vessel of great speed is used, from which the weapon is launched. The tow line is paid out from a drum fitted with a strap brake, the safety key line being run out from a similar, although smaller, apparatus. The torpedo on being set afloat at once diverges at an angle of 45° from the ship, and is thus readily towed against an enemy's vessel. It offers but little resistance in towing, and the experiments at Portsmouth, England, against the *Royal Sovereign*, and further experiments with the *Pigeon* at Plymouth, with blind torpedoes, showed that contact was invariably made low down, in some instances near the keel. The exploding apparatus never failed when proper contact was secured by a reasonable amount of speed in the torpedo vessel. We may here mention that this torpedo can be so arranged as to be fired by electricity if desired, a special circuit-closing apparatus having been designed for that purpose by Captain Harvey. In changing a mechanical to an electrical torpedo, the exploding bolt and its casing are taken out, and a tube is inserted containing the means of effecting electrical communication with the charge. This arrangement of the torpedo, however, is not so perfect as the mechanical, inasmuch as the firing wires are liable to be broken, should too great a strain be accidentally brought upon the tow rope containing the insulated wire. This torpedo is considered to be one of the most effective now in use.

WE are pleased to learn, through our consul at Aspinwall, Chas. Erasmus Perry, Esq., that Mr. Charles E. Stewart has been appointed Master Mechanic of the Panama Railroad Company. Mr. Stewart has been connected with the mechanical department at Aspinwall for a number of years, and the appointment is his reward for abilities which the company rightly appreciate.