

another mass of checkerwork built up alongside the first-named mass, and is conducted to the furnace by two flues, which are located on each side of and above the gas flue. Here the gas and air mingle and combustion takes place at extremely high temperatures, ranging from 2,700° to 3,000° F. The products of combustion pass over the charge and out at the opposite side of the furnace, and through a set of flues and checkerwork exactly similar to those through which the gas and air entered, raising the checkerwork to a high temperature. About every twenty minutes the lever controlling the regulating valves is thrown over and the gas and air are directed through the now heated checkerwork and flues on the left-hand side of the furnace. Here they are re-generated to from 1,500° to 1,800° F. The flow of gas is reversed every twenty minutes during the ten to twelve hours occupied by the process.

It takes about six and a half hours to melt the charge, and four to six hours are consumed in boiling down to get rid of the carbon and various impurities. As soon as the heat is melted, samples are taken from the furnace and carefully analyzed, and these tests are repeated at frequent intervals until the heat is ready for casting. One of the views shown on our front page is taken at the back of the open hearth furnace above the casting pit and shows the process of casting. As soon as the steel has reached its proper composition, a tap hole is opened and the steel is run off into the large ladles, which are shown in the engraving, from which it is run into the molds by opening a tap hole in the bottom, which is ordinarily closed with a plug of fireclay. In all of these castings a considerable excess of metal, known as the "sinking head," is formed at the top of the mold, which serves the double purpose of compressing the lower portion of the ingot, increasing its density, and closing any cracks or holes which might form during cooling. It also serves to collect the impurities in the metal, which rise by their lesser gravity to the surface. The metal which is to be worked up as gun steel, is subjected to hydraulic pressure in what is known as the fluid compression process, a description of which will be given in a succeeding article; but a few of the largest castings for gun steel and all of the armor plate castings, on account of their great size, are cast direct in the form of massive ingots. One of our illustrations represents the great 100-ton ingot which was cast for the manufacture of the 16-inch army gun, which is now nearing completion at the Water-vliet Arsenal.

MOLYBDENITE is proving to be of value in the manufacture of steel. The present market value in Pittsburg is \$200

#### PROPOSED NATIONAL MEMORIAL BRIDGE ACROSS THE POTOMAC AT WASHINGTON.

The Secretary of War has just accepted the final plans for the proposed Memorial Bridge to be built across the Potomac to Arlington. The successful winner of the competition is the well-known bridge engineer, Prof. W. H. Burr, of the Department of Civil Engineering of Columbia College, New York. Four prominent bridge constructors, namely, Prof. W. H. Burr, George S. Morrison, Leffert L. Buck and William H. Hutton, all of New York city, were especially in-

cluded that the general design of Mr. Burr should be designated as first in the order of merit and should be adopted, subject to a few modifications, such as width, slope of roadway, towers, provisions for tramcars, and such other minor modifications as might develop during the progress of the work.

The main features of Prof. Burr's design No. 1 are as follows: The whole structure, with the exception of the bascule over the main channel, will be of arched construction, and will consist of the bridge proper over the river channel, and a long approach at either end; the four main arches and bascule which constitute the former being constructed of steel and the approaches of masonry.

The design is for a double deck bridge, 60 feet in width between railings, providing for two side-walks, each 10 feet wide, and a roadway 40 feet wide. A double-track street railway is provided for upon the lower deck. The total length of the openwork of the bridge proper and ap-

proaches will be 3,440 feet. The bridge is to consist of two 283-foot steel arches, one steel draw span having a clear width of 213 feet, and two more 283-foot steel arches. The draw-span has two bascule arms supported on trunnions, balanced by rear extensions and counter-weights. The clear opening is about 167 feet, and the span from center to center of trunnions, 235 feet. The floor is to be of asphalt cork block. It is proposed to operate the draw by electric motors. The bascule and the adjacent piers are to be built on bed rock by the pneumatic process, the caissons to be filled with concrete; the other piers are also to be founded upon bed rock and built up within cofferdams. The 283-foot steel arches are segments of a circle, the springing line being 24 feet above mean low water. The Washington approach is to consist of fifteen 46-foot spans, masonry arches, back of which is an earthen embankment, 500 feet long. The Arlington approach will consist of twenty-one 46 foot masonry arches, approached by an earthen embankment 1,500 feet long. The principal divisions of the bridge are marked by massive masonry arches and towers, decorated with emblematic groups of statuary, etc., commemorating men distinguished in the foundation and development of the Republic. The cost of the structure is estimated at \$4,083,850.

The selection of the design marks an important step in this commendable project, which contemplates the spanning of the Potomac River between the government reservations at Washington and Arlington with a monumental structure which shall form a fitting national monument to American patriotism in its highest and broadest sense.

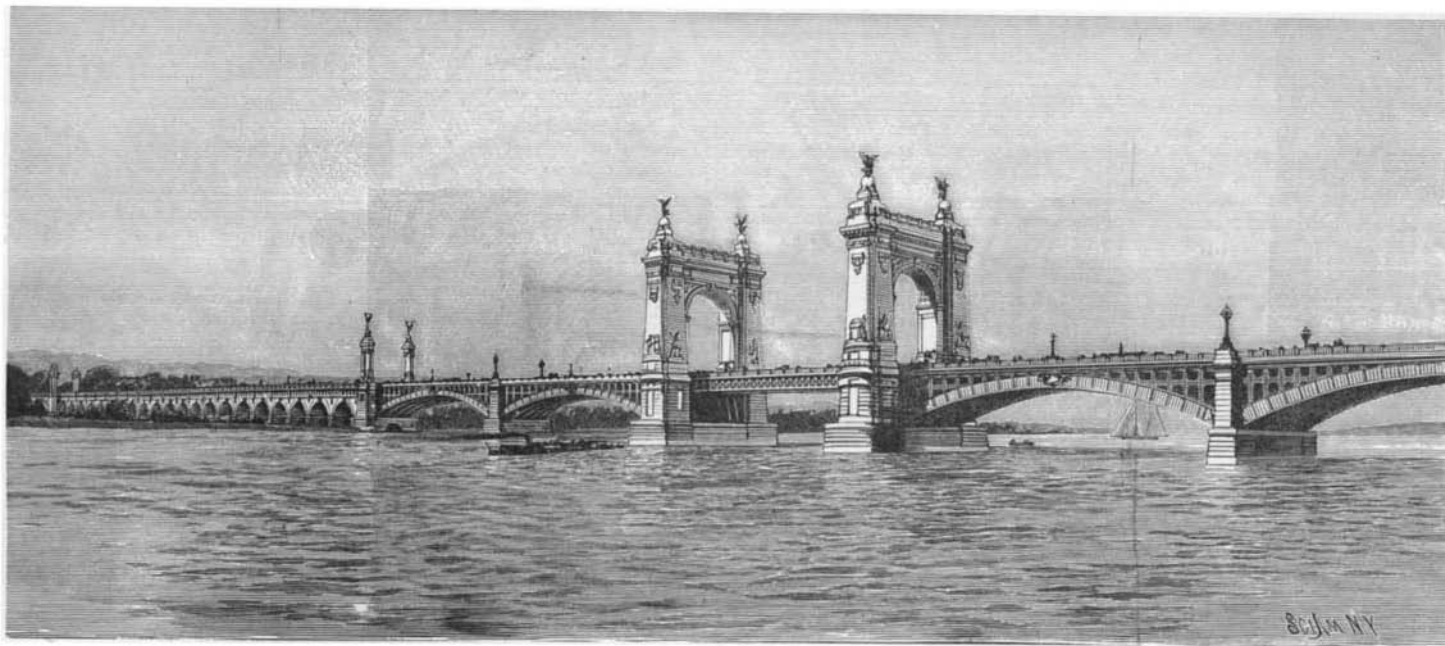
The specifications called for the presentation of two designs, one for a bridge with a draw opening and to provide for street cars as well as for ordinary vehicles and pedestrians; the other for a bridge with draw opening, but without provision for street cars, etc. After full consideration of the various plans for the bridge and approaches, including the architectural features, ornamentations, cost, etc., the board con-

cluded that the general design of Mr. Burr should be designated as first in the order of merit and should be adopted, subject to a few modifications, such as width, slope of roadway, towers, provisions for tramcars, and such other minor modifications as might develop during the progress of the work.

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#### ALEXANDRE III. MEMORIAL BRIDGE, PARIS.

The Pont Alexandre III., though completed, was not relieved of unsightly superstructures until a day or two prior to the official opening of the Paris Exposition. As it stands today, this superb bridge, with its four lofty towers, each surmounted by a golden Pegasus that glitters in the sunlight, forms the connecting link between two new sections of the city and the Fair, the fame of which will soon be world-wide. The new



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ALEXANDRE III. MEMORIAL BRIDGE, PARIS.