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A GREAT BRONZE CASTING.

The steps in the naturalization of a foreign industry in this country are always of interest. For many years monumental bronze casting was peculiarly a foreign art. Munich or Paris was called upon when statues of generals or other distinguished men were to be produced. Within a few years several bronze foundries have been started in this country. One of the most recent is illustrated here. It is of interest, as being in New York City, and as having recently been the scene of the heaviest bronze casting yet made in America.

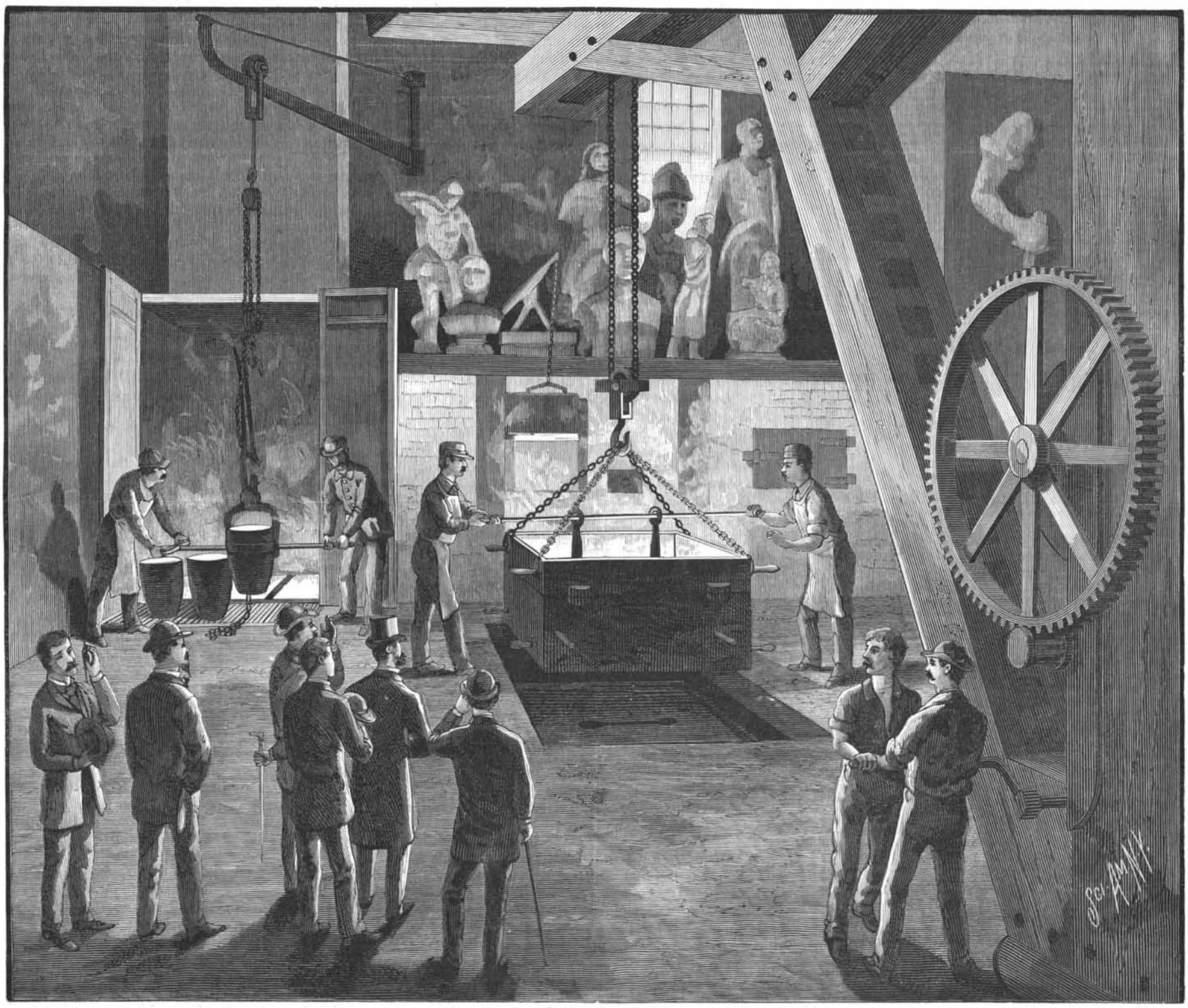
The Union Pacific Railroad decided to place a bronze buffalo's head over the eastern portal of their new bridge at Omaha. The design was most fitting, as the crossing of the Missouri River signalizes the traveler's entrance into the old buffalo ranges, now unfortunately deserted, and deprived by death and flight of their former tenants. Mr. Edward Kemys, Jr., of this city, was the artist selected for the work. His model, executed with great vigor and depth of cutting, represented the well-known bison's head, adapted by its boldness of design to the elevation it was to be placed at. It is about nine feet high. Mr. Etienne Favy was selected as the founder. His foundry, also in this city, is probably the best arranged in the country. He undertook the task of casting the great head in one piece, with the exception of the horns. These were cast separately. To obtain some idea of the intricacy of the mould and core, the illustration of the great head should be consulted; the bold contour, with deeply sunken eyes and nostrils, and the surface of the head completely covered with curling hair, involving a great amount of undercut work.

The mould was made under the direct supervision of Mr. Favy. Two men's labor for three months was devoted to it. Probably as many as 1,200 pieces entered into the composition of the mould. Each piece had its own separate frame or backing of iron rods, forged to suitable shape and outline. When finished, it was taken to pieces and removed from the model, and again set up. It was next used for forming the core. This was made within it. Then piece by piece the intricate mould was again taken apart and withdrawn, leaving the solid core, itself a model of the head. This had to be reduced in size. Three days were devoted to carefully reducing it by paring off its surface. The object was to execute this work so as to leave a space of ¼ inch thickness for the metal to run in.

The mould with the core within it, leaving the space alluded to, was set up. The drying of the two parts was executed, not in the usual drying oven, but in the moulding pit itself. The Favy foundry is peculiarly fitted for heavy work, as, in addition to several crucible furnaces, it has a reverberatory furnace, on whose hearth several thousand pounds of metal can be fused in one heat. Directly in front of this furnace, the casting pit was arranged. It was deep enough to receive the mould, with three feet or more to spare. Near its bottom several large grates were placed, and on them the fires were started to dry the mould and core. Flues led the products of combustion away from the pit. For ten days the fires were kept up. After this period, they were allowed to die out.

As the object was so large and intricate, it was decided to adopt the process of bottom casting. As will be obvious from the description, this secures the purest metal. A large, deep flask was prepared with clay lining of sufficient capacity to hold over six thousand pounds of metal. In its bottom two holes were made, which could be closed by plugs of iron. The plugs rose above the top of the flask and terminated in eyes, so that they could be simultaneously extracted. The two apertures corresponded in distance apart with two openings in the top of the mould. From the latter a number of diverging gates or channels for the metal ran to all parts of the head. The idea was to place the metal reservoir solidly on top of the mould, to set the

(*Continued on page* 148.)



CASTING THE BRONZE BUFFALO'S HEAD FOR THE UNION PACIFIC BRIDGE AT OMAHA.

A GREAT BRONZE CASTING.

(*Continued from first page.*)

plugs in position, to fill it with melted bronze, and by withdrawing the plugs to allow the metal to run down through the gates into the space between mould and core.

This plan was carried out. The flask, lined with clay, was lowered upon the mould. Its lining, before the casting took place, was heated by a charcoal fire to avoid chilling the metal. Then, when the plugs were solidly in place and all seemed ready, the reverberatory furnace was tapped and the melted bronze allowed to run into the reservoir. Three crucibles full of additional metal were added to the bath. These were plumbago or graphite crucibles, holding nearly four hundred pounds apiece. This gave a total of six thousand pounds of the finest bronze. The plugs were then withdrawn, and in seventeen seconds the white hot bronze had disappeared in the recesses of the mould. The entire operation of filling the reservoir and casting only occupied fifteen minutes. On that short period the success of the four months of labor depended.

For over ten days the casting was left undisturbed, so as to cool perfectly. It was then withdrawn from the pit, and cleaned with scratch brushes and washed over with ammonia. The horns were dropped into their sockets and screwed fast. The seam marking their junction with the head was calked or hammered, so as to be imperceptible, and the head was ready for its destination.

When it is remembered that no two important pieces are cast on the same plan, as modifications are continually required to meet the exigencies of the different shapes, the skill required to fill the profession of a bronze founder can be realized. It is said that the practice of fifteen years is needed to train a man so that he can execute all kinds of work. A failure is irreparable. Small holes can be filled, but if any large part fails in casting, the work must be begun again. This illustrates the responsibility involved in casting so large a piece. When cleaned it represents some four thousand pounds of metal, an excess of two thousand having been provided in the bath. In building and bracing the mould, and in all the appurtenances of the casting, metal, mould, etc., about sixty thousand pounds of material were used.

The casting was executed at the Favy Foundry, Forsyth Street, New York, on August 9, 1887.

BRONZE BUFFALO HEAD FOR UNION PACIFIC BRIDGE AT OMAHA.

The American Institute of Christian Philosophy.

This society, which has just held its sixth anniversary and its tenth summer school of science and philosophy, should be better understood and appreciated by the public. The Institute was originated by a number of prominent American scientists at the suggestion of the Earl of Shaftesbury. It is designed to accomplish in this country results analogous to those achieved abroad by the Victoria Institute of Great Britain. Its president, from the first, has been Rev. Charles F. Deems, D.D., the accomplished pastor of the Church of the Strangers, in New York City. Among its vice-presidents may be named Bishop Bedell, ex-president Noah Porter, of Yale University, Hon. T. F. Bayard, Rev. Joseph Cook, of Boston, Professor Alexander Winchell, of Ann Arbor, and other men of mark. The secretary is the noted botanist, Professor C. M. Davis, of Bloomfield, N. J., and the treasurer is William Harmon Brown, of New York City. The gift of fifty dollars makes the donor a member for life; while annual members pay but five dollars a year for the privileges of the Institute, namely, the use of the library, tickets to the lectures given under its auspices, and copies of all official publications. The entire membership at present is exactly 484, including members from the United States and Canada, representing all of the various branches of scientific investigation, all of the learned professions, and every phase of religious belief.

The Institute must not be regarded as in any sense sectarian or exclusive; nor is it a school of theology. On the contrary, theological discussions are expressly interdicted as foreign to the legitimate aims of the society. These aims, as set forth in the constitution, are as follows: To promote the full and impartial investigation of all scientific or philosophical questions, especially in their relation to religion; the association of men of science, in order to consider the mutual relation of the several branches into which science is divided; the examination of seeming contradictions and conflicting hypotheses, with reference to final causes and the fundamental principles of philosophy and of faith; and finally, the publication of lectures and addresses for the promotion of scientific and religious culture. This latter work is done by means of "Christian Thought," a bi-monthly magazine published in New York City.

Monthly meetings of the Institute are held in this city. The annual meetings and the summer schools of science and philosophy are usually held at some place of summer resort. This year the place of meeting was at Key East, near Ocean Grove, N. J. An invitation has been received to meet next year at Round Lake, N. Y. The interest taken by those who attend these meetings is deep and earnest, although there is not as large an attendance as might be inferred from the long list of members.

The following papers were read and discussed during the summer session of 1887, from August 17 to 25: "Certain Aspects of Modern Skepticism," by Lyman Abbott, of New York; "History, a Demonstration under the Moral Law," by James F. Riggs, of Bergen Point, N. J.; "Paul's Psychology," by Isaac F. Hopkins, president of Emory College, Oxford, Ga.; "Physical Theories of the Mind," by J. T. Bixbee, of Yonkers, N. Y.; "Bishop Berkeley's Philosophy," by C. F. Deems, of New York; "Subterranean Scenery," by H. C. Hovey, of Bridgeport, Conn.; "History and Philosophy of Sunday Legislation," by A. H. Lewis, of Plainfield, N. J.; "Some Aspects of Theistic Logic," by Professor A. T. Ormond, of Princeton, N. J.; "Christian Evolutionism and its Influence on Religious Thought," by Professor D. S. Martin, of New York; and the closing address by Thomas Hill, ex-president of Harvard University, was on "The Absolute, a Person."

The custom is to devote an hour to the free criticism of each paper, to which the author has the privilege of reply. A glance at this year's programme suggests the question if philosophy does not crowd out the more practical sciences, and also if, as an American institute, there ought not to be more papers from other places than New York and New Jersey. But these defects, if they are so considered, can easily be remedied. The general aim and scope of the society are manifestly wholesome, and the organization is worthy of appreciation and encouragement.

The Sprinkler in Theaters.

A practical demonstration of fire extinction in a theater was given recently in the new one which is being built in London for Edward Terry. In this theater special precautions are being introduced, in order to guard against the spread of fire should an outbreak occur. Each part of the house has two exits, and the whole, including the roof, is constructed of concrete and iron, no wood being used in the auditorium except for the doors and windows. The woodwork before and behind the curtain will be coated with Sir Seymour Blane's fireproof paint. The fire-extinguishing arrangements consist of a complete system of hydrants, placed in the best positions both before and behind the scenes, while the whole of the stage and flies, both above and below, is commanded by a system of overhead sprinklers, governed by valves at the stage door and capable of immediate use. The sprinklers are fixed on pipes which are in direct communication with the water company's mains, the water being at about ninety pounds pressure. At the recent experiments a large fire was made on the middle of the stage, that being the least likely point at which a fire would occur. The flames rose some twenty-five feet high, when the signal was given to the fireman at the stage door, who instantly opened the valves and admitted water to the sprinklers. The result was that the fire was quickly extinguished, the sprinklers being set at an angle which commands the whole of the stage as well as the flies. There will be forty-five sprinklers in all, and thus, while the auditorium is fireproof, it was shown that the stage and flies could be deluged with a perfect cloud of water at few moments' notice. The exhibition was witnessed by various notable persons and by Captain Shaw of the London Fire Brigade. It will be observed, says *Fire and Water*, that the device is simply the application to a theater of the automatic sprinklers so well known in this country. We have often wondered why they were not adopted in theaters, hotels, and other places where crowds of persons assemble, for they would certainly give confidence to all who knew of their presence, and in an emergency many lives might be saved at the cost of merely a severe drenching. An unexpected shower bath would certainly be preferable to roasting alive in a burning building.

[In the above case, we observe the sprinklers are not automatic, but it would be better if they were. We think the time has come when laws should be passed requiring all owners of tenement, manufacturing, and mercantile buildings to put in the automatic sprinklers. In default of this, let the taxes on such buildings be increased.]

Origin of the Letter X in Mathematics.

The letter x, used to designate the unknown in equations, has been explained as a modification of the letter *s* used by the Arabs; but Government Engineer Ritter, in a note to *La Nature*, shows that such is not the case. He says:

"In writing the as yet unpublished biography of the immortal inventor of modern algebra, Francois Viete, Maitre des Requêtes of the King's Palace, Counselor of State, and personal friend of Henri IV., and in translating his mathematical works, I have necessarily had to extend my researches in algebra. I am, therefore, able to explain to your readers the origin of the letter x in equations. Ancient algebra, before Francois Viete (Ἀριθμητικά of Diophantus, *Aljebr wâh-mukâbalah* of the Arabs, *Ars magna* of Cardan, and *Ars rei* or *Ars cossica* of the Italians), was reduced to the solution of numerical equations. In Diophantus, the unknown (ἀριθμος, 'number') is represented by the letter ς′ with the numeral index (′). In the Arabian authors that I have been able to consult, the calculations are always written in all letters, and the unknown is designated by an Arabic word that has been translated as *res*, *cosa*, the 'thing.' And, says the learned Dr. Nesselmann, the Arabs are so consistent in the application of this rhetorical method that they do not once employ a numeral sign in their texts. . . .

"Francois Viete, in his introduction to arithmetic by symbols, substituted the literal for the numerical equation, and he thus succeeded in establishing modern algebra and in discovering the relations that exist between the given and the unknown in equations of different degrees. He represented the former by the capital consonants of the Latin alphabet (B, C, D, etc.), and the latter by the first small letters of the alphabet (*a*, *b*, *c*, etc.) Later on, Descartes changed this notation, and designated the known quantities by the first small letters of the alphabet (*a*, *b*, *c*, etc.), and the unknown by the last (*x*, *y*, *z*). . . . As in France, especially, the history of mathematics is not much known, it will certainly be for the first time that most of the readers of *La Nature* will read the name of one of the greatest geniuses that have rendered our country illustrious, and whose place is in the same rank with that assigned by posterity to Archimedes, Descartes, and Newton."

An Exhibition of Postage Stamps.

An international exhibition of postage stamps is now in progress at Anvers, says a foreign exchange. One exhibitor, a Mr. De Beer, has alone sent thither a million stamps. Among the varieties to be seen at the exhibition is the oldest postage stamp in existence, belonging to the 18th century, and a postal card that made the tour of the world in 80 days. The latter belongs to a Haarlem schoolmaster, who would not part with it at any price.

It seems that there are no less than 600,000 postage stamp collectors in the world, 375,000 of whom are Americans, 200,000 are Europeans, and 25,000 belong to other parts of the world.