Correspondence.

Artificial Copper—A Denial from Prof. Remsen.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the article entitled "Artificial Copper," which appears on page 470 of your issue of June 8, I beg to say that this is entirely without foundation. I have so stated over and over again in the newspapers, but the correction seems to be less interesting than the original false statement. I disclaim all responsibility for the statement that Sir William Ramsay has discovered a method of making artificial copper. I hope you will give this correction as prominent a place as you gave to the article referred to. IRA REMSEN.

Johns Hopkins University, Baltimore, Md.

A Word Against Burial at Sea.

To the Editor of the SCIENTIFIC AMERICAN:

Will you be so kind as to explain why it is in this enlightened age that people who die on board our best Atlantic liners have got to be buried in the sea? I can understand why it should have been done forty or fifty years ago, but why it should be continued with all the conveniences the modern steamships have for caring for bodies, is a great mystery to me. If one of the leading steamship companies would advertise that they had abolished the "old-time custom" of burying their patrons at sea, it would make them very popular and force others to do likewise.

Waterloo, Iowa. CORTLANDT FIELD FOWLER.

Railroad Curve Mechanics.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with great interest the able article which appeared in your issue of March 2 on the dangers incurred by high-speed trains at curves. The conclusion reached by your discussion is that "special attention" must be given to the question of maintaining curves at their proper alinement and elevation. However, it seems to me that other factors enter into the problem which were not touched upon in your article.

A bicyclist on rounding a curve will incline his body toward the center of the curve, not when he *starts* to make the turn, but a moment or two *before;* for if he did not thus anticipate the centrifugal action he would be thrown from his wheel. Such an anticipatory inclination is just as necessary for a railway train as for the bicycle rider. It takes a moment or two to shift the center of gravity, whereas the centrifugal force being already existent in the frame makes itself evident on the very instant the curve is entered. It should be borne in mind that a car or locomotive is not a rigid body in which the lifting of the trucks at one side will instantly careen the entire structure; but that the car body is in a measure independent of the trucks, and hence, owing to its inertia or the centrifugal force which resists displacement in the vertical plane, it will respond comparatively slowly to tilting of the trucks. At such a time moments count, for a mile-a-minute train travels 88 feet every second. On this account the track should be banked not only at the curve, but for some distance before the curve is reached. Otherwise the train will be well on to the curve before the center of gravity can be shifted sufficiently to prevent an accident. But to this are opposed the general principles governing railroad construction which tend to maintain unalterable the level of the tracks.

There is another factor, and in my opinion the main factor, of danger which must sooner or later receive the attention it deserves. This is the old question of rigidly securing opposite wheels of a car or locomotive to a common axle. The inner rail of a curve is shorter than the outer rail, and yet these opposite wheels must travel over these unequal distances at the same speed and in the same time. Of course, one of the wheels must slip, grinding away the tread surface of the rail and the wheel. This effect, though well known, has been ignored on the ground of economy, although it would not cost much more to mount the wheels independently. But the fact which must not be ignored is that with the wheels thus coupled together the axles will not keep the ideal radial position and the grinding wheel flanges are thus liable to climb up on to the rail. As long as opposite wheels are rigidly coupled together, it will be impossible for the wheels of a car or locomotive to mold themselves to the curves, hence there will be friction at curves, and as long as there is any amount of friction between the wheels and the rails there will be danger of derailment. E. MUJICA CANTO.

New York, May 7, 1907.

[The gradual elevation of the outer rails preceding the curve is already carried out on railroads. The elevation commences from 125 to 175 feet from the point of curve and rises gradually to the full curve elevation.—ED.]

Do not wrap paper around an incandescent electric lamp for a shade. A fire may easily be started from the heat.

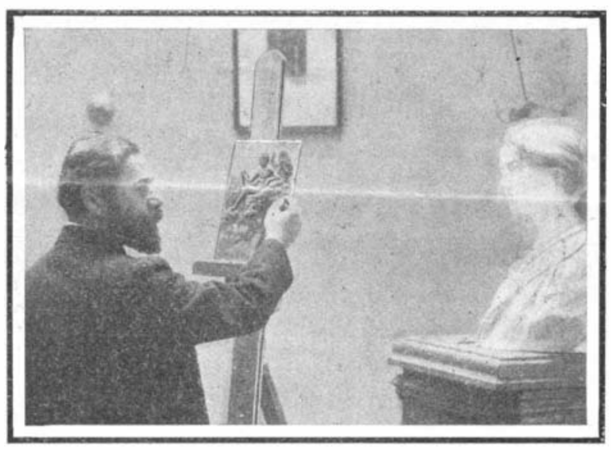
THE ART AND CRAFT OF THE MEDALIST.

BY VICTOR D. BRENNER.

To trace the origin of engraving, we might refer to our forefathers who dwelt in caves and taught their young the dangerous habits of certain animals, by scratching such images on their walls.

As civilization advanced and intercourse between the families was established, ornaments found their way in their daily lives for personal adornment, and as a token of friendship. Probably the earliest example of engraving upon a portable stone purely decorative may be seen in one exhibited in the British Museum. It is a peculiar kind of pink-veined marble, egg shape, about 2½ inches long, drilled from base to apex with a wide hole, evidently intended for mounting, as the head of a staff of office. The Babylonian inscription on this stone reads "I Sargon the King, King of Agade have dedicated (this) to Samos in Sappira." The date of this document is thought to be 3800 B. C.

The introduction of metal as a medium of exchange in the seventh century B. C. is known to have originated with Pheidon, of the Island of Aegina, and in Lydia at the same period, when each piece of metal was melted separately and weighed to contain the desired value. Some of the early coins were bean-shape or oval. They had the guaranty of the government and an indication of their value on one side, and on the other side four square or triangular holes. These four holes had no significance other than showing the projections of the iron upon which the piece of metal was placed in order to prevent it from slipping while the device was being struck. Later, we find coins bearing a device on both sides, and to strike the metal pieces on both sides necessarily required more complicated tools.



Modeling on the Enlarged Bas-Relief.

From the models found in ruins—one of which is to be seen in the Paris mint—we learn that in order to bring the two dies in a fixed position facing each other, a long piece of iron was welded to each die, the two pieces of iron being joined together somewhat after the fashion of a pair of tongs. The metal was then placed between dies and the imprint made by the blow of a hammer. The dies seem all to have been cut intaglio or negative, most likely with chisel and hammer, as is done in the carving of marble. The stonecutter's drill, or wheel, as used in the cutting of precious stones, may also have served the die-cutters of that day. Their preparation of the dies for the use of coining must have been substantially similar to our own.

In our own times after the idea is conceived sketches in soft wax are made to determine the desired relief and composition of lines. For the final model, a slate may be used in order to have an even surface; or a surface of wax upon which the design is traced with a point, and bit by bit the wax is applied until the full modeling of the design is obtained. The wax model is made four or five times the diameter of the finished medal.

In many cases the artist will oil the surface of his wax model, and make a mold of it in plaster of Paris. This mold is in turn filled with plaster of Paris and a positive or cameo is obtained representing the model. In other cases, after the wax model has been completed, the artist proceeds at once to translate his design into a block of soft steel, called a die or punch. In the process of cutting, the left hand holds the die firmly in position. In the right hand is held a steel graving tool called a burin, which cuts into the die by the pressure of the palm, guided by the four fingers. The thumb is used as a counterbalance on the die so as to prevent and stop pressure when it has reached the desired depth and length.

An outline sketch is first made freehand on the face of the soft steel by the artist, carefully following the design of the model. Then he commences to cut into the steel with his burin, producing an intaglio which eventually will be the die from which the medal is struck.

After almost every cut of the tool, the artist takes wax impressions of his die to see how the work is progressing and to note how it agrees with the original wax model.

A trained engraver's hand will in time develop an accuracy of touch that will save him many verifications by wax impressions. In leading his graver he can feel the direction of the cut or curve of line, no matter in what depth it may be. The above described process of cutting does not vary in the cutting of a cameo or punch, except that in cameo cutting the work is in relief and the whole design is visible during the entire operation.

Some hundred years before the introduction of the screw press as applied to the striking of coins and medals—an invention of the latter part of the sixteenth century—rollers were used which were engraved with the desired design, and fixed one upon the other, through which a strip of metal was run, thus obtaining as many impressions as the length of the metal permitted. The surplus metal was then cut away with shears or saw.

The most important improvements the screw press brought with it were a ring to encircle both dies, and the cutting of disks alike in size and of uniform thickness by means of a positive punch which fitted into a negative. These disks are cut a little smaller than the actual design, placed between the dies, which are held together by the ring, and pressed. By using the ring to hold the dies together, the disk, being pressed, spreads and fully fills the ring, and thus a uniform appearance and thickness of all impressions is obtained, which facilitates the placing of them one upon the other; and nowadays the piling of one upon the other is of great advantage in counting.

A cameo die, or so-called punch, can be sunk in a soft block of steel. This sinking of the positive into the negative saves much of the work that was necessary before in cutting of a new die—in case of one being broken. With a positive punch several dies can be prepared, in case of emergency. A die may also wear out by constant usage.

In the latter part of the nineteenth century, the manner of sinking the positive into the negative die was changed somewhat. Instead of using punches of small dimensions for hand use, and later larger punches, bearing the entire emblem which was to make the center of the coin or medal (and sunk by means of the press into the negative die, that afterward needed the cutting by hand of the border and lettering), positive punches bearing the complete design of the coin or medal are now in use. This latter improvement of sinking the positive punches with the complete design of the coin or medal is due to Chapu and Ponscarme. With the reducing machine that was invented some thirty years before their time, the engraver is enabled to finish his models in such a manner that they can be used either for casting or for a die. Merely leaving off the polished background in the die, which was in practice for about two centuries, it is possible to give to the medal a finish similar to that made by casting.

Since the introduction of the reducing machine the medalist has his model cast in bronze or iron, adjusts it to the machine and obtains a reduction in steel in any size desired. The reducing machine, which is a kind of pantagraph, was invented by the Frenchman Contamin early in the nineteenth century. A steel point following the model in its reliefs and cavities, transmits by means of a bar its movements to another point which cuts into the steel. This machine saves the artist much of the tedious work required in the cutting of dies by hand. It copies a model with but slight modifications in certain places, and if due allowance has been made in the model, will need but little retouching in the die.

The striking of a medal is entirely mechanical, and is obtained by either hydraulic pressure, or the screw press. The metal disk is placed between the dies, and pressed until the full image is obtained. According to the height of the relief, it may require from one to ten or even more pressures, and annealing the metal disk each time after it has received a blow is a necessary operation.

The medal is now ready to be colored, or as it is termed, have a patina produced on it, for it must be remembered that when a medal comes from the press, it is as bright as a new penny. The patina may be obtained by burnt sienna, by liver of sulphur, or sal-ammoniac, as the case may be, for the bronze. For silver, any oxide will do to give a dark background, and to relieve the surfaces, pumice stone is used with effect.

The popularity of the medal took its origin at the time of Vittore Pisano, of Verona, who was active as a medalist from 1439 to 1449, and who originally was a painter of reputation. We find that the Romans used metal disks bearing a portrait or allegory of some kind, of a larger size than the coins in use as a medium of exchange. These large disks were used as passes to the theater and also as ornaments. Although it is not certain whether the name *medaglio* originated with Pisano, it was he who introduced the cast medal and who made it known by that name. Pisano s ability as a medalist crowned him as the foremost of all. Apart from being the initiator, it was he who first introduced perspective on the medal, and that feeling of color so much sought after by the medalist of to-day. Attracted by his success, a great demand arose for portraits and allegories made permanent in the medal, and a large number of sculptors and painters devoted themselves to the modeling of medals. Not only did Pisano find followers in his own country, but we find that Germany and France sent their men of ability to study the medal in the place of its origin.

The process followed in the making of a cast medal differs but little at the present time from the earlier methods. It is first modeled in wax; plaster of Paris molds are taken from the wax medal, from which several positive plaster casts can be made, and again formed in sand or a preparation of some kind which constitutes the mold to receive the metal.

The medal differs from any other form of sculpture in low relief in that it must be independent of its surroundings, it must be complete in itself. Standing between sculpture and painting, it may possess all the qualities of a work of art in any of these other media; in miniature conveying a story, suggesting form, color, distance, and space, thus permitting us to enjoy, compressed in its two or three inches, a result which expressed in a work of sculpture or a painter's canvas requires much more room.

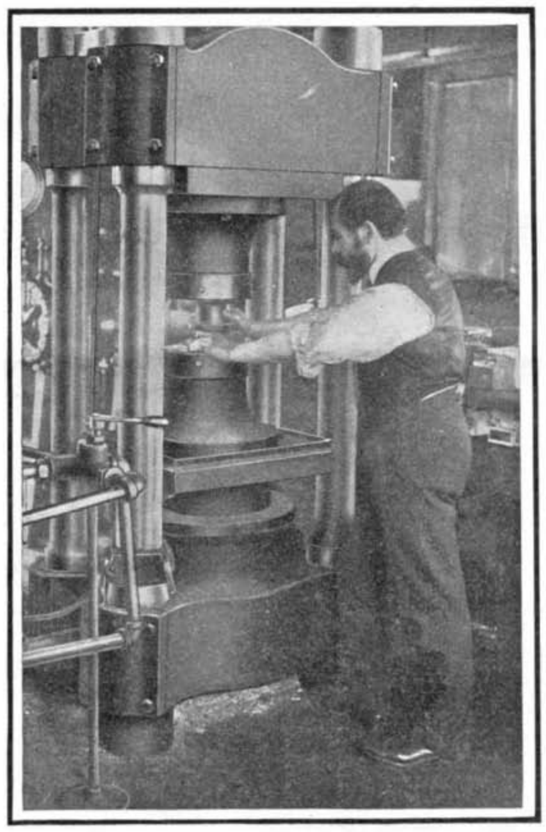
The Greeks, ever sensitive to the beautiful in all its forms, took pains to exhibit in their coinage the best expression of their art. The Romans, too, were heedful of the artistic in their coins. The Italians, closely followed by the Germans and the French, early in the fifteenth century struck souvenir medals to commemorate events of common interest, and to be given out at festivals. Princes and rich men of the Renaissance, as well as rulers of the state, had their portraits placed on the obverse of medals, with their coats of arms on the reverse, thus commemorating their names to future generations.

In Austria a school was opened for the education of medalists, by Maria Theresa in 1768. In 1803 a like school was instituted by the French government in Paris.

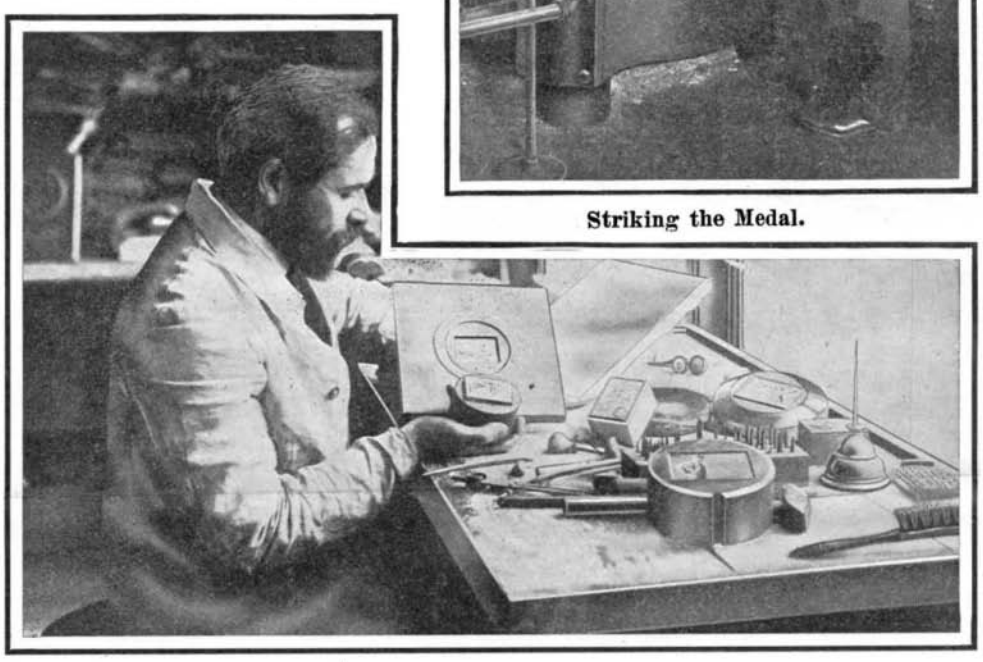
The Paris mint now strikes medals from almost all the dies in her cabinets and even buys from artists new medals, independent of the subject, and strikes medals or plaques from them to sell at cost as a means of education to the general public as well as those who may be specially interested in the subject.

The so-called modern Renaissance of the medallic art had birth in France about fifty years ago. Those most active therein have been David, Chaplain, Oscar Roty, Alexandre Charpentier, of Paris; Anton Sharff, Powlick, Marschall, of Vienna. With them the medal assumed a wider scope even than it had known before, in that it was not only made to commemorate an event, or memorialize a person, but was made also the means of the artistic expression of the thought and fancy of the artist.

Relief Punch and Intaglio Die.



Striking the Medal.



The Medalist's Engraving Bench, Showing Die in Collar.

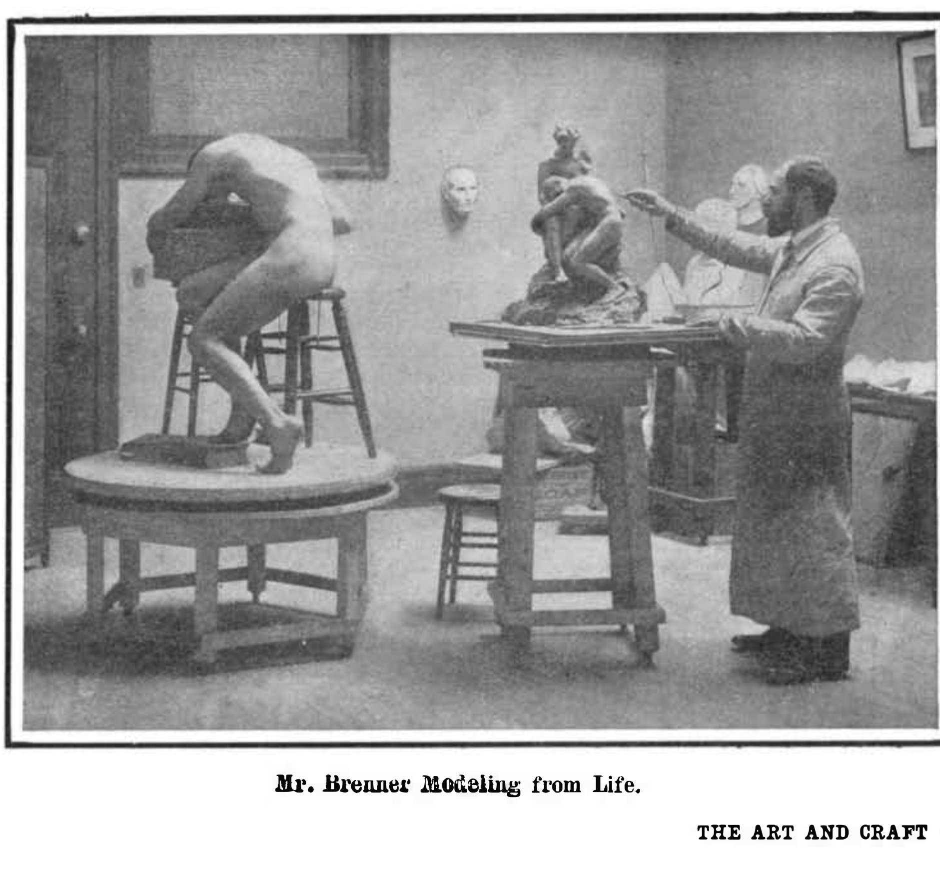
A New Process of Producing Iron.

In a lecture recently delivered at Christiania, Mr. A. Hiorth suggests a novel process of producing iron from Norwegian ore by the aid of Norwegian materials. Norway at present exports large amounts of iron ore, which is refined abroad, while the wants of the country are supplied from the import of goods manufactured from its own ores. Now, the extensive ore deposits, in connection with the plentiful waterfalls of the country, might be utilized to advantage by means of an electro-metallurgical process; and in order to be independent of other countries also in regard to the carbon used in reducing iron ores, Mr. Hiorth suggests the utilization of the extensive graphite layers which are found in many parts of Norway. This would be the more advantageous, as the graphite in question is not pure enough to be used as a material for manufacturing crucibles, pencils, and the like.

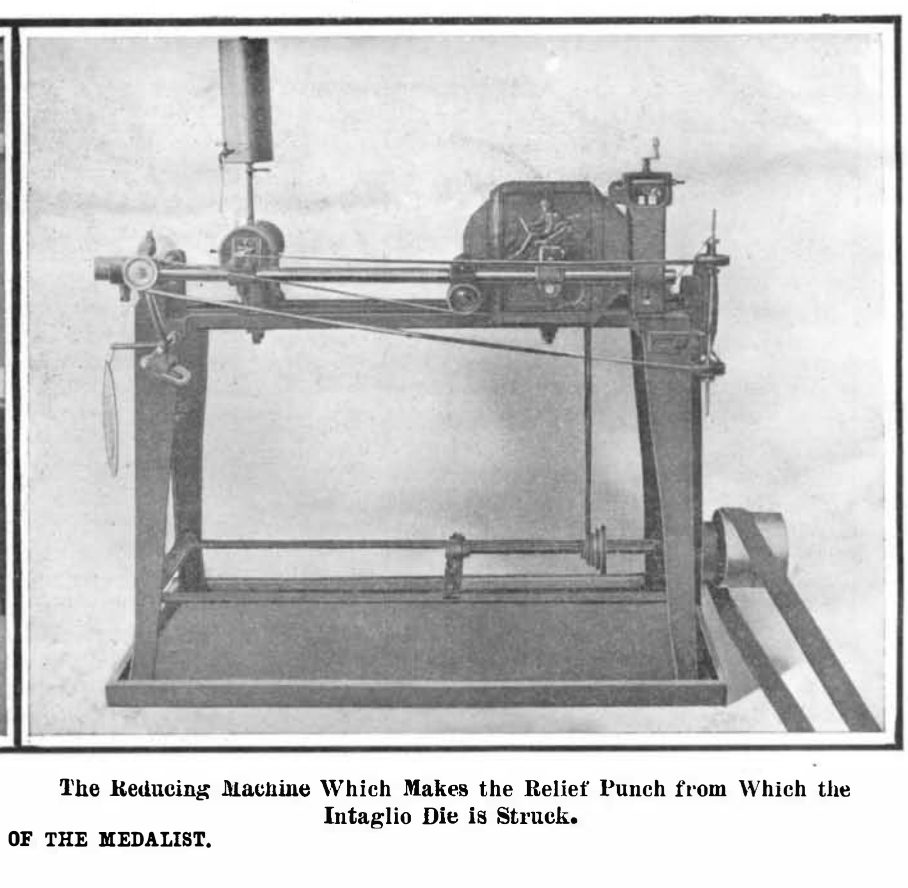
Graphite is the heaviest and purest carbon found in nature, and is extremely stable in regard to chemical reactions. It is unable to burn like coal. However, Mr. Hiorth some time ago suggested producing carbide by smelting graphite with lime, apparently with a low consumption of energy. Whereas the carbon otherwise used in the manufacture of carbide has first to be converted to graphite, the immediate use of graphite obviously warrants a saving of energy.

In view of the satisfactory results obtained in this connection, the author was led to using it as reduction agent. It may be said that about one ton of coal is used in the blast furnace for each ton of iron, while in the electrical furnace the maximum amount of coal corresponding to the same quantity of iron is one-third, the melting heat being supplied by electricity. The cost of carbon is reduced to about one-ninth as against the blast furnace process by using graphite in the electric furnace. The author feels confident in assuming that this process would allow iron to be manufactured on a satisfactory basis, his recent laboratory experiments having shown graphite to be an excellent agent of reduction for iron ore. In fact, fine pig iron can be obtained in the electric furnace even from very low-grade ores and graphite holding upward of thirty per cent of silicates and silica.

The iron thus obtained from practically valueless carbon and iron ore, which otherwise would be quite unfit, is practically free from any impurities of the raw material, these constituting the slag. Even the latter could be used as excellent building material.



Mr. Brenner Modeling from Life.



The Reducing Machine Which Makes the Relief Punch from Which the Intaglio Die is Struck.

THE ART AND CRAFT OF THE MEDALIST.