foot-tons muzzle energy, as against 30,750 foot-tons by the guns in the French navy and 25,985 foot-tons by the heavy ordnance on the American men-of-war.

MAKING LARGE PLASTER CASTS.

BY J. H. COLLINS.

In the making of monumental sculpture such as that used for the decoration of great exposition buildings or public edifices everything is done on a large scale. The sculptor has for his studio some lofty room with height enough to accommodate figures eighteen or twenty feet tall and space enough for barrels of clay and bins of plaster. He does his modeling from scaffolding and stepladders and thinks nothing of shaping a head half as high as himself or an arm as large around as his body.

The sculptor's first step however, is to fashion a miniature model out of a handful of clay. This is his rough sketch. It serves merely to embody, in a general way, the artist's conception and to present the mass and outline of the composition.

Next in the process comes the construction of a wooden skeleton, heavily made and able to sustain the weight of the clay that is to be laid upon it. For the joints of this skeleton some sculptors use an ingenious iron contrivance which permits change of attitude without loss of rigidity. Sculptor Bock, photographs of whose work illustrate the present article, is the inventor of an adjustable joint for this purpose. This wooden skeleton is adjusted to the desired attitude and braced upon a frame made of two uprights and a crossbar reaching about two-thirds the height of the figure. At this stage of the process everything is sacrificed to strength, as the weight of the clay to be sustained is great. The completed clay model of a single monumental figure sometimes weighs as much as ten tons.

To secure as much lightness as possible it is common to lay a foundation of excelsior and plaster about the wooden skeleton, roughly approaching in form the general outline of the figure. Over this is placed a thick coating of pure plaster indicating yet more clearly the main lines of the figure. This completes what may be termed the core of the model and upon it is laid the wet modeling clay, in huge and almost meaningless masses, to be shifted into form by the sculptor and his assistants.

In taking the plaster mold of the completed model, the first step is to coat the clay all over with soft soap. This prevents the plaster from sticking. Small strips of tin are then inserted upright into the clay, their purpose being to separate and outline the sections into which the mold is to be made. The number and size of these sections depend entirely upon the form of the figure. If the figure is a complicated one, the sections must be numerous and small accordingly. The mold of a simple, erect, draped figure like that in the illustration may be taken in comparatively few sections.

The arms of Mr. Bock's figure, for instance, were molded in two pieces, longitudinally. The head required several sections, while the straight, flowing drapery was made in a few large sections.

A layer of clay is now placed along the edges of the tin strips so that they may be easily located after the plaster has been applied.

Two coatings of plaster comprise the mold. The first is colored with yellow ocher and is applied all over the figure to the depth of about a quarter of an inch. The coloring is to warn the sculptor when the cast has been made and the mold is being chipped away. When his chisel lays bare the yellow plaster, the sculptor knows that the cast is close beneath. The rest of the mold is made of uncolored plaster, which is poured over the figure by the pailful, rapidly and with apparent recklessness. Just before the plaster sets it is braced with strips of wood which not only strengthen the mold, but also serve as handles by which the section of the mold may be removed.

When the plaster has set and before it becomes completely dry—for moist plaster is handled more easily than dry—the tin strips are located and the work of removing the mold in sections is begun. As a rule, the pieces come off easily. Occasionally some deeply-indented portion is removed with difficulty. The front and bottom piece over the drapery in the figure illustrated had to be pried off with a piece of 2 x 4 joist, and it took the combined strength of five men to start it. Even then it was broken at one corner and chipped at the edges. This, however, was easily repaired with a little clay.

When the several pieces of the mold have been removed they are thoroughly cleaned of any clay adhering to them with balls of clay and an application of soap and water.

The figure is cast in sections. The central figure of Mr. Bock's group was made in five castings, the two arms, the head, the torso, and the drapery from the waist down forming each a separate piece.

In making the castings, the mold is put together and a thin layer of plaster of fine quality is poured into it and splashed about until every crevice is filled to the thickness of a quarter of an inch or more. As this coating is to be the outside of the completed statue, it may be colored any shade desired. The rest of the cast is made of uncolored plaster mixed with strong hemp fiber. This composition, commonly known as "staff," is applied in successive layers as rapidly as possible until the cast has reached the desired thickness.

The mold is not removed from the cast in sections as from the clay model. Having now served its purpose it may be chopped away with hatchet and chisel, and destroyed. The sculptor and his assistants go about this with a vigor and carelessness which startle the casual spectator. But when the yellow plaster immediately incasing the cast is reached, greater care is exercised, and the final layer is chipped off inch by inch.

When the several parts of the figure have been cast, they are fitted together. Strips of fiber dipped in plaster are used to fasten them together, the strips being placed along the inside seams. On the outside

MODEL OF MR. BOCK'S STATUE OF "PEACE."

THE COMPLETED CLAY FIGURE.

INSERTING THE TIN STRIPS.

THE FIRST PLASTER CAST.

THE PLASTER JACKET.

TAKING OFF THE SECTIONS.

the seams are pointed with pure plaster applied with a small spatula, and any little imperfection or damaged spot is repaired in the same way.

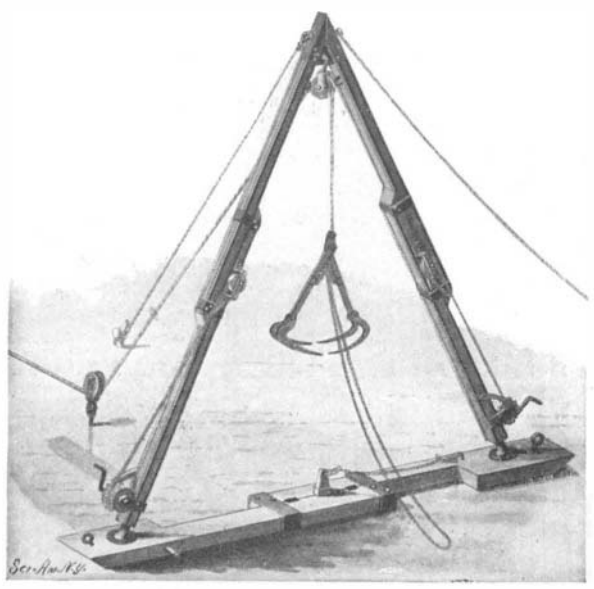
In placing the statue in its permanent place, an iron framework is constructed to give it strength in the same way as the wooden skeleton was used to give rigidity to the clay model.

The final touch is a coat of paint, to give protection from the weather. If the paint is renewed at proper intervals, the plaster statue should last for many years. Work done in this manner a century ago in Europe is still in good repair.

The monumental group "Peace," photographs of which illustrate the process described in this article, is the work of Richard W. Bock, of Chicago, and decorates the arcade of one of the commercial buildings of Minneapolis. The sculptural work on the Chicago, Burlington and Quincy depot at Omaha was also done by Mr. Bock.

A NOVEL HAYSTACKER AND DERRICK.

A patent has been issued to Marvin C. Hutchings, of Bozeman, Mont., which provides a hoisting device to be used as a haystacker, derrick and the like. As our engraving shows, the device consists of a base constructed in adjustable sections locked together by a key which is inserted in one of three recesses formed in the sections. In sockets at the ends of the base sections, side sections having ball ends are received. Thus universal joints are produced. The side sections are composed of sliding members, the upper of which are raised by a ratchet-drum and rope. Forked guy-ropes support the side sections, corresponding members of the forked



A HAYSTACKER AND DERRICK.

portions of the guy-ropes being connected at the same side of the side members and adjacent to each other. A pulley is suspended between the upper portion of the upper members of the side sections; and over the pulley a hoist-rope is carried. Our illustration shows a hay-fork attached to the rope and provided with a trip-rope extending to the ground. The end of the hoist-rope, if it be so desired, may be connected with a sling, a platform, or with any device necessary in hoisting material of different kinds.

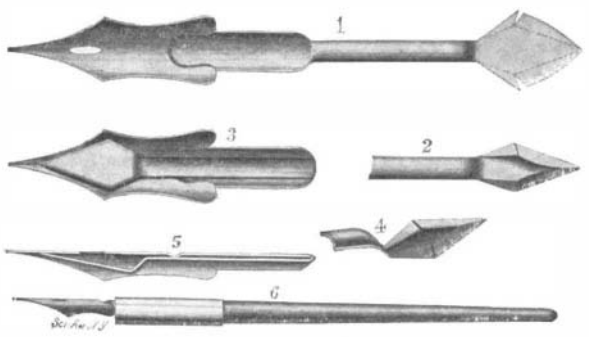
A PEN WITH INCREASED INK CAPACITY.

A new pen which will hold, without danger of blotting, a much larger amount of ink than the ordinary pen, and which can be used in any holder, has been invented by Mr. Clarence E. Fowler, of 118 Center Market, Washington, D. C.

Fig. 1 is a bottom plan view of the blank form from which the pen is made. Fig. 2 is a bottom plan view of the blank bent into shape. Fig. 3 is a bottom plan view of a complete pen. Fig. 4 is a detail perspective view of a reservoir formed by the bent-up blank. Fig. 5 is a longitudinal section of a complete pen. Fig. 6 shows the pen attached to a penholder.

The invention seeks to provide a pen having an integral underlying reservoir, so formed and arranged that it will in no wise interfere with the desired flexibility of the pen. The shank of the pen as shown in Fig. 1 is formed integrally with a second long shank carrying at its outer end a blank which is to be bent on the dotted lines of Fig. 1. When thus bent the blank assumes the form shown in Fig. 2. The reservoir thus formed from the blank is then bent down to lie snugly within the shank of the pen as shown in Figs. 3 and 5, the shank of the pen and the shank of the blank being oppositely curved so that one will lie within the other (Fig. 5). The double shank produced can easily be fitted within an ordinary pen-holder (Fig. 6). At its juncture with the reservoir, the long shank is given a downward bend (Fig. 4) which holds the rear end of the reservoir away from the body of the pen and affords space at either side of the rear end of the reservoir for the entrance of ink. The entrance of ink is also facilitated by tapering the struck up portions of the blank as shown.

The apex of the diamond-shaped reservoir lies with the apex contiguous to the slit of the pen and extends just past the eye. Thus the reservoir operates to feed the ink to the point. The peculiar form of the reservoir exposes but a small surface of the ink



THE FOWLER PEN.

to the air. Experience has shown that the ink does not run out when the pen is laid down by reason of the adhesion.

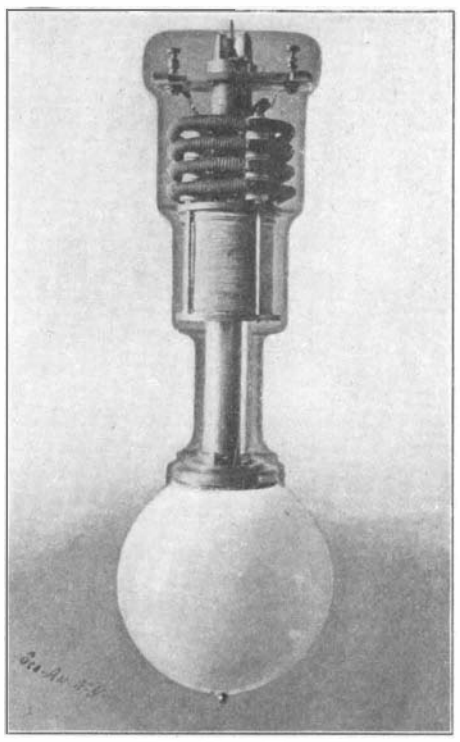
A COMPLETELY INCLOSED ARC LAMP OF SMALL SIZE.

A well-conceived, excellently designed lamp has been patented by Mr. Gustav Rasmus, of 239 Winan Street, Long Island City, N. Y., which is remarkable for its great efficiency and compactness.

The lamp comprises a frame supporting a resistance-coil, connected at one end with a leading-in wire and at the other end with a central metallic tube capped by a hood. Within the frame is a solenoid, comprised in the circuit and designed to operate the upper carbon. Extended through the solenoid is a brass tube in which a tubular core operates, which core is rigidly connected with an inner tube within which the upper carbon is located. The upper end of the carbon is held in a socket. The lower end of the upper carbon passes through two plates insulated from each other and carried by the outer brass tube. A central hub on the lower plate carries a threaded ring by which the globe is so supported that the carbons are completely inclosed, as our illustration shows. The lower carbon is mounted in a socket carried by the globe itself—a feature not to be found in other lamps.

When the current is cut out momentarily the upper carbon will move downward in contact with the lower carbon. Clamping devices by which the upper carbon is normally held will then momentarily release the carbon. When the current is closed, the solenoid is energized, drawing the core up and causing the clamping devices to engage and raise the upper carbon to form the arc.

The merits of this construction are obvious. Only one solenoid and one resistance-coil are used. An efficiency of 90 per cent is claimed for the lamp. No valve is used. The arc is entirely inclosed, so that when the oxygen has been consumed, the carbon burns slowly away in an atmosphere which is void of oxygen.



THE RASMUS ARC LAMP.

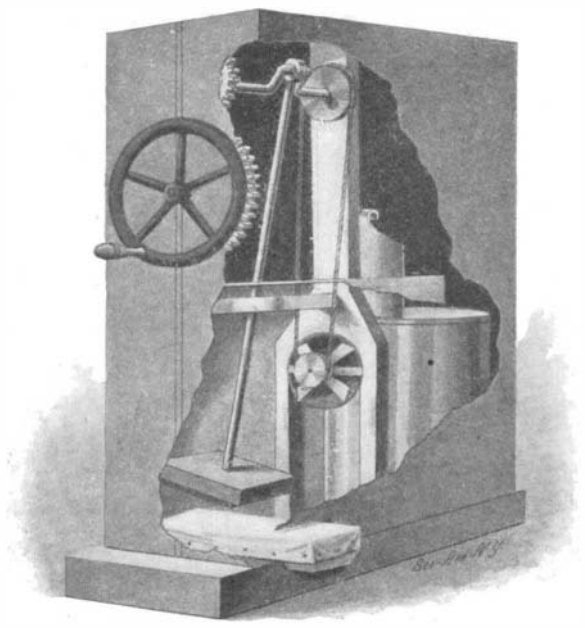
With a current of 4½ amperes and a difference of potential of 110 volts, a soft, uniform light of 1,000 C. P. is maintained. Although the lower carbon is 5 inches and the upper carbon 12 inches long, the full length of the lamp is not quite 20 inches. By mounting the lower socket directly in the globe, no shadow is formed. A sheet of white paper held horizontally below the lamp at a distance of 1½ inches or in any position beside the globe will reveal no shadow. The usual difficulty of securing a uniformly-distributed shadowless light being thus overcome, the inventor found that he could readily construct a compact arc lamp which had a life of 55 hours, and which could be readily fitted in an ordinary incandescent bulb socket. This miniature arc lamp is but ten inches long, has a candle power of 320, and uses the same current as four incandescent lights, which ordinarily give but 64 C. P.

A MACHINE FOR CLEANING BLACKBOARD ERASERS.

Among the patents recently granted in the United States is one issued to Terrence McSpirit, of 97 Beebe Avenue, Long Island City, for a machine for cleaning blackboard erasers.

In an inclosed upright frame a crank-shaft is journaled, which is turned by a crank-wheel through the medium of gearing. A rod is carried by the crank of the shaft, to the lower end of which rod a beater is secured. The rod and beater operate in a casing provided with a removable extension. A collar on the extension receives a fan driven from the crank-shaft by a belt and pulley.

The eraser to be cleaned is placed face upward in the base of the machine below the beater. As the handwheel is turned, the beater rises and falls and strikes the cleaning-surface of the eraser. The beater has also a lateral reciprocating motion, so that at each stroke of the rod the beater, after striking the cleaning-



A BLACKBOARD-ERASER CLEANING-MACHINE.

surface of the eraser, tends to force the eraser out from the machine a given distance. The dust beaten from the eraser is blown by the fan into the extension previously mentioned. When the extension is to be cleaned, the collar containing the fan is closed by a slide, and the extension, or that portion of the casing containing the extension, removed.

Acetylene Gas vs. Petroleum in Germany.

Up to the present time Germany has imported each year from $25,000,000 to $30,000,000 worth of American petroleum. This industry, however, seems to be threatened somewhat by the introduction of acetylene as an illuminant, in a convenient and safe form, for house, store, and other uses. This has resulted from the low price at which calcium carbide is being produced there, and also from the rise in the cost of petroleum in the German market.

The Current Supplement.

The current Supplement, No. 1320, is unusually interesting. "The Function of Hand Work in the School," by Prof. Charles R. Richards, is elaborately illustrated by ten engravings made from the actual objects. "Grisson Gearing" describes a new method of mechanical transmission. "The Influence of Submarine Cables upon Military and Naval Supremacy" is by Capt. Geo. O. Squier, U. S. A., and is a very full article. "Electrical Oscillation and Electric Waves," by Dr. J. A. Fleming, is concluded. "The Improved Hughes Printing-Telegraph" describes the latest form of this apparatus. The usual "Trade Notes and Receipts," and "Selected Formulæ," etc., are given.

Contents.

(Illustrated articles are marked with an asterisk.)