3 Sheets. Sheet 1.

M. Smith,

Casting Apparatus.

No. 70,038. Patented Oct. 22, 1867.

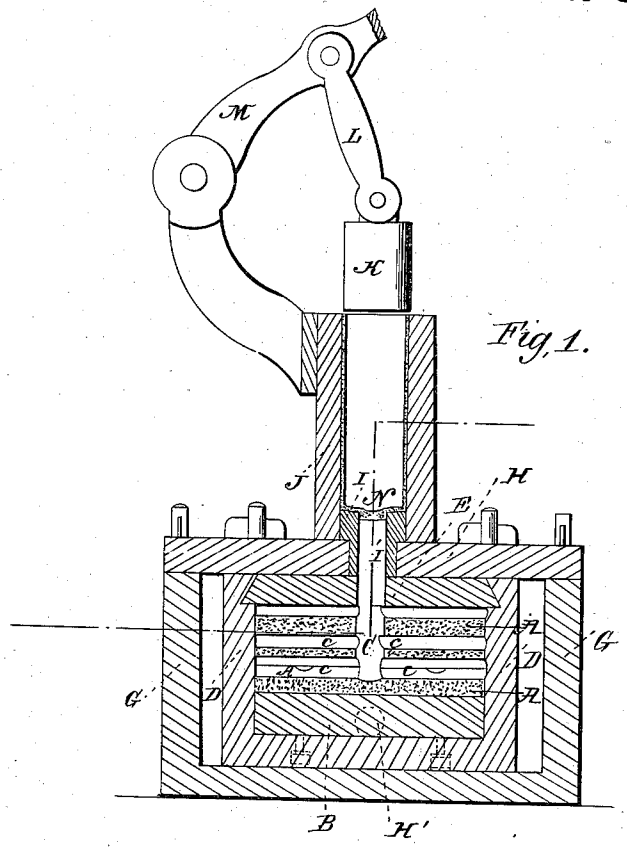
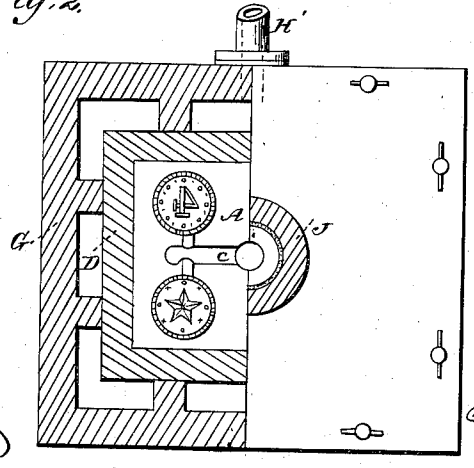


Fig. 1.

Fig. 2.



Witnesses.
Chas. O. Smith
J. J. Chr. Smith.

Inventor.
Micheal Smith
By Knight Bros

3 Sheets. Sheet 2.

M. Smith,

Casting Apparatus.

No. 70,038. Patented Oct. 22, 1867.

Fig. 3.

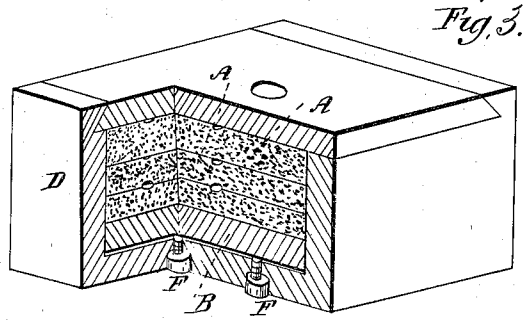


Fig. 4.

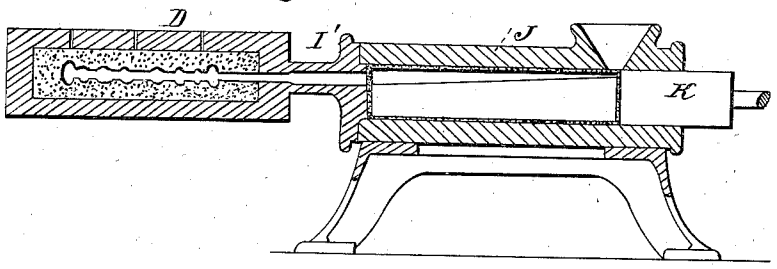
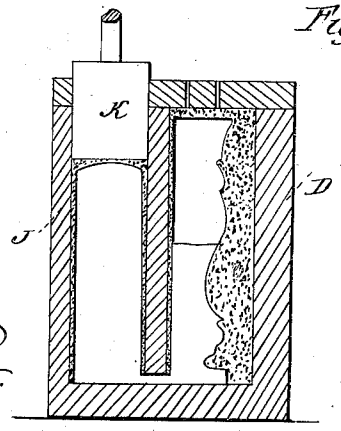


Fig. 5.



Witnesses.

J. J. Ch. Smith

Chas. D. Smith.

Inventor.

Michael Smith.

By Knight Bros

Attorneys

3 Sheets, Sheet 3.

M. Smith,

Casting Apparatus.

No. 70,038. Patented Oct. 22, 1867.

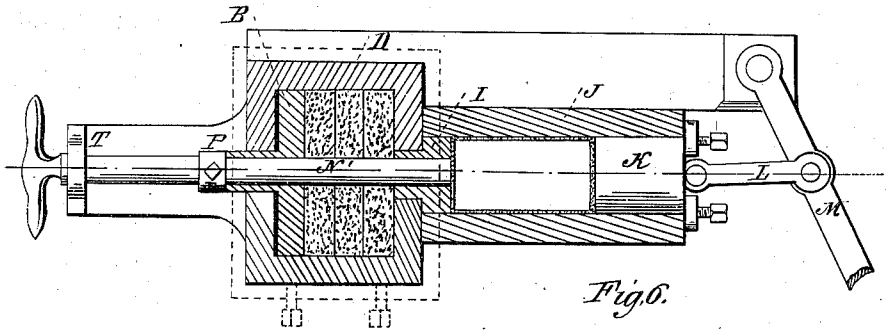


Fig. 6.

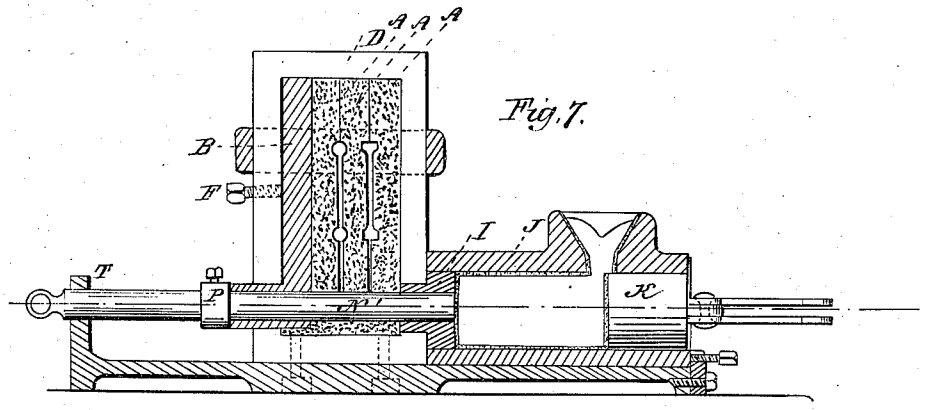


Fig. 7.

Witnesses.

J. J. Chs. Smith.

Chas. D. Smith.

Inventor.

Michael Smith

By Knight Bros

United States Patent Office.

MICHAEL SMITH, OF PHILADELPHIA, PENNSYLVANIA.

Letters Patent No. 70,038, *dated October* 22, 1867.

IMPROVEMENT IN APPARATUS FOR CASTING REFRACTORY METALS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, MICHAEL SMITH, of the city and county of Philadelphia, in the State of Pennsylvania, have invented a new and useful Improvement in Casting Refractory Metals; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, which are made part of this specification.

My invention has for its object the casting of brass and other of the refractory metals, with the greatest practical density and freedom from blow-holes, and so as to present a perfectly sharp and well-defined *fac simile* of the original pattern; and my invention relates to the class of devices which, for the above objects, employ mechanical pressure on the molten metal.

Figure 1 is a vertical section of an apparatus embodying my invention.

Figure 2 is a partially-sectionalized top view thereof.

Figure 3 is a partially-sectionized perspective view of my nest or series of moulds detached.

Figures 4 and 5, 6 and 7, show modifications of my invention.

Similar letters of reference indicate corresponding parts of the several figures.

The invention may be applied to one or any number of moulds, but I have selected, for illustration, a series or nest of moulds. A A A (fig. 1) are a series of moulds formed of baked clay, in manner hereafter explained, adapted to be stacked or piled one above the other, and supported on a slab, B. Orifices or cavities C *c*, provided in said moulds, afford, in their collective capacity, gates or sprues for the admission of the molten metal from the injecting apparatus to be presently described. Said moulds and slab are confined in a box, D, whose sides may be provided with suitable chinks or orifices for the escape of air and gas in the act of casting. An aperture, E, in the top of the box D, in continuation of gate C, serves to admit the metal thereto. Set-screws F, tapped through the bottom of said box, and bearing against the under side of the slab, serve to press the series of moulds firmly together and against the top of the box. The box D is enclosed in an air-tight chest, G, having a perforation, H, at the top in line with the orifices C and E. By means of the pipe H′ and an air-suction pump the air is exhausted from the space between the box D and chest G for the purpose to be explained. The perforation H receives a tube or thimble, I, whose central orifice forms the channel of communication for the entering metal. The cylinder J may be easily slipped off of the thimble I when the metal has become "set," and the employment of said thimble obviates the difficulty of detaching the cylinder from a superincumbent head of metal, which difficulty would exist in case of the formation of a shoulder upon said cylinder at the point of discharge into the mould. The said thimble I may be divided longitudinally into two parts, to enable the same to be readily detached from the metal in the central gate after the casting is completed. Fitting snugly around and extending upward from the said thimble is a tube or cylinder, J, to which is loosely fitted a plunger, K, which is linked at L to a lever, M, by means of which the operator is enabled to lift the plunger clear out of the cylinder, or to press the same downward within the latter. The cylinder J is made of capacity fully exceeding that of the moulds, so as to leave a good head of metal within the cylinder after the moulds have been entirely filled by the pressure exercised on the fluid metal.

The operation is as follows: Take clay, such as used in the manufacture of stone-ware, in a dry state, reduce the same to powder, and sift it through a fine sieve, then moisten the same about as much as sand is moistened for ordinary moulding. The pattern from which the mould is to be taken is then coated with oil, and with a thin layer of a fine paste of the same clay as a facing, and the moistened clay is then applied intimately to every part of it by a strong pressure. This will produce a mould more sharp and well defined than can be obtained by the use of gypsum, and much better calculated to sustain, without giving way, the impact of the rapidly-entering stream of metal injected into the moulds on my plan of operation.

Clay moulds thus made being liable to warp in the act of drying, I keep them for about two days in a close box or case, at a temperature of about 150° Fahrenheit, from which evaporation takes place but slowly, and afterwards burn them in the ordinary manner for burning pottery. I then take fine white potters' clay, and thoroughly blend the same with an equal quantity of pulverized plumbago, and moisten the mixture sufficiently to convert it into a cement or paste, with which I line the cylinder J, the application being made by means of

a brush or otherwise. This lining serves several useful purposes. It serves to pack the space between the piston and cylinder, and prevents the intrusion of molten metal between the two, which intrusion would be liable to rapidly clog the parts and prevent their action. (It should be explained that the plunger K is larger in diameter than the internal diameter of the lining, and that at every operation the cylinder must be recoated or relined with the clay and plumbago paste, as such lining is detached from the cylinder J, and pushed in advance of the plunger K at every forward movement of the latter, the effect of which is to close the joint and prevent the intrusion of the metal between the plunger and the side of the cylinder, as above stated. The importance of this detachable packing or lining can scarcely be over-estimated, since it constitutes the only practical means for preventing the molten metal from chilling and adhering to the sides of the cylinder and plunger, and thereby arresting the motion of the plunger and precluding successful operation.) It also serves as a non-conductor, to conserve the heat of the molten metal and prevent it getting "mushy" or chilled, and it also serves, by preventing the direct contact of the molten metal, to prevent the distortion of the cylinder.

I then stop the orifice I' with a plug or tamp of clay, N, and having secured the moulds in their places, as already explained, I pour the desired quantity of molten metal into the cylinder, and then, pressing down the plunger upon it, I, by that means, break the plug N, and create a passage for the same into the moulds with such force as to pack the metal at once closely into the various cavities prepared for it, and continue the pressure until the moulds and sprues are entirely filled and are all equally subjected to the desired pressure.

I have selected, to illustrate my invention, the preferred type or form thereof, but do not propose to restrict myself thereto, so long as the same results are obtained by means substantially equivalent; for example, the pressure of condensed air or steam may be employed in place of the piston and lever, or I may, for some purposes, employ such modifications as shown in figs. 4 and 5, 6 and 7, and in which corresponding parts are indicated by the same letters.

In the modifications, figs. 4 and 5, the clay plug may, if desired, be dispensed with. This construction of apparatus is merely represented as a simplified form, involving few parts in its construction. The object of the tamp or plug N is to prevent the gradual passage of the molten metal from the cylinder to the moulds and effect the rapid introduction of the metal, upon which depends the attainment of the sharp, well-defined surface above referred to.

In the apparatus, shown by horizontal and vertical sections in figs. 6 and 7, the construction is essentially the same as in figs. 1, 2, and 3, the only difference being the introduction of a sliding-rod, N', for temporarily closing communication between the cylinder J and moulds A. This rod is used as a substitute for the plug N, its function being the same, that is to say, to retard the passage of the metal into the moulds until the pressure is applied. When the pressure is applied to the metal in cylinder J, the rod N' will be forced backward by the metal so as to open communication between the cylinder and the moulds. The extent of motion of the rod N' may be regulated by means of the adjustable collar P, which arrests the rod by coming in contact with an abutment, T.

By providing a separate vessel or cylinder for the molten metal previous to its introduction into the moulds, and having a pressure to bear upon the same in the very act of injecting it into the proper moulds, the elimination of the imprisoned gases commences with the very act of pouring, and continues in full activity until the complete filling of moulds A.

This mode of operation I find to produce a much more perfect and well-defined surface on the casting than by any process heretofore employed.

The relief of atmospheric pressure from the outside of the box D facilitates the escape of the imprisoned gases therefrom.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The provision, in a mould for casting metals, of a plunger, K, and a separate injecting-vessel or cylinder, J, having a lining of clay and plumbago or other suitable non-conducting material, to be detached in the manner described, and a temporarily-closable communication with the moulds, substantially as and for the purpose set forth.

2. The combination of the mould-box D, detachable thimble I, injecting-cylinder J, and plunger K, all constructed, arranged, and operating in the manner and for the purposes explained.

3. The arrangement of a series of moulds having consecutive orifices or gates, a slab or follower, B, and set-screws F, and box D, as and for the purpose set forth.

4. I claim the subject of the clause last recited when enclosed within a tight chest, G, having suitable connection with an air-exhaust, for the purpose stated.

To the above specification of my improvement I have signed my hand this seventh day of May. 1867.

MICHAEL SMITH.

Witnesses:

J. J. CH. SMITH,

CHAS. D. SMITH