Dec. 23, 1930. W. F. EPPENSTEINER 1,785,941

MOLD FOR CASTING METALS

Filed March 6, 1929

Fig. 1.

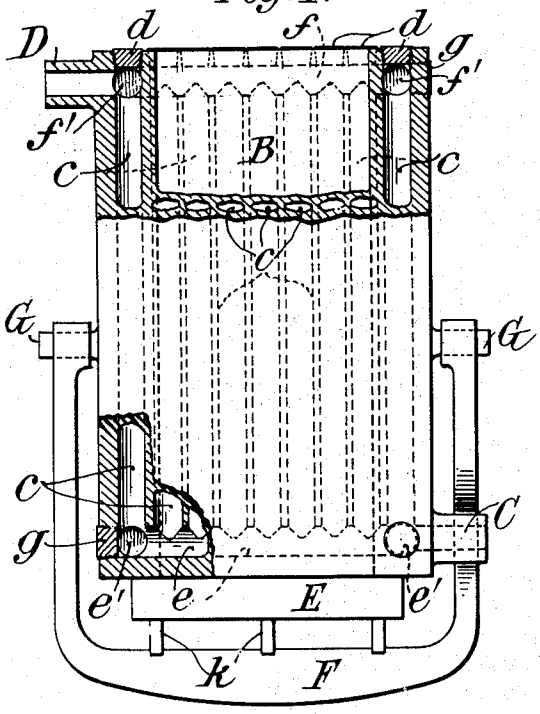


Fig. 2.

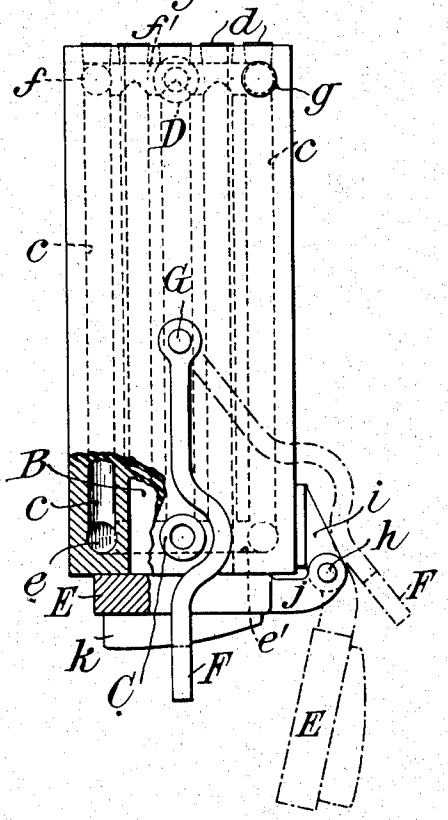


Fig. 3.

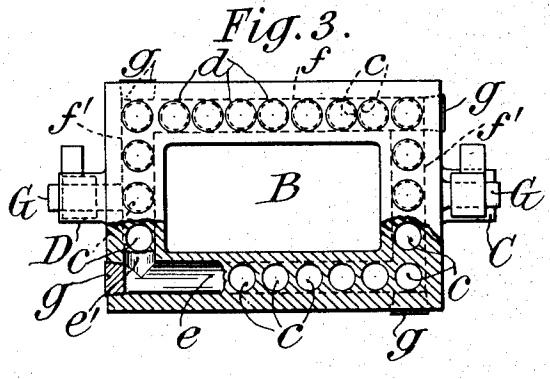
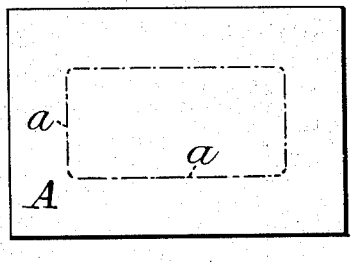


Fig. 4.



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UNITED STATES PATENT OFFICE

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MOLD FOR CASTING METALS

Application filed March 6, 1929. Serial No. 344,672.

This invention relates to vertical molds for casting copper or other metals to form cakes, billets, or other shapes.

The invention will be described with particular reference to the casting of copper, although applicable to the casting of other metals having properties substantially similar to those of copper.

In the casting of copper it is desirable to use integral or one-piece molds in preference to split or divided molds. It is also desirable to cast elongated shapes such as cakes, from which to roll sheets, and ingots which usually are of elongated cylindrical form, by vertical casting, so that the imperfections in the cast metal due to oxidation shall be confined to one end of the casting and thereby be of the minimum area. This is accomplished by casting in a vertical mold the top of which has an area much less than the area of either side including the entire longitudinal dimension of the casting. For casting copper in such vertical integral molds it has heretofore been customary to give the mold a very considerable taper so as to facilitate the dumping of the copper casting from the mold. This involves certain disadvantages, especially for the production of flat cakes which are to be rolled down to form sheets or strips, as difficulty is encountered if these cakes have a decided taper so that one end of the cake has materially greater dimensions than the other. The necessity for this taper is avoided by water-jacketing the mold and performing the casting under the conditions stated in an application of Eppensteiner and Green, filed February 13, 1928, Serial No. 253,825. In the practice of that process difficulty has been experienced in the construction of suitable molds. Various constructions of built-up molds have been tried, the elements of which have been united by welding or otherwise, but these molds have been found liable to give out at the joints, even where such joints have been electrically welded. A mold in which the shell enclosing the casting cavity is forged in one piece, and to which a forged exterior jacket is united by welding, is likewise objectionable, because of the early giving out of the welded joints. The difficulty with all the attempts that have been made is that the mold cost per unit casting is excessive, due either to the original high cost of the molds or to their short life, or both.

The present invention aims to overcome these difficulties, and has resulted in the production of a mold of moderate first cost and of such duration under repeated use in casting as to reduce the mold cost per casting unit to within a commercial figure, so that the casting of cakes according to the Eppensteiner and Green method above referred to has been rendered commercially practicable.

According to the present invention the mold is made of a single integral mass of suitable metal, having the requisite properties to resist the effects of the temperatures encountered in casting any particular metal for which the mold is to be used. In the casting of copper it has been found that the mold may be advantageously formed from a copper block or billet, although a billet or unitary block of mild steel has been found to give satisfactory results. The mold cavity extends through from end to end and is formed either by drilling out the solid billet, or may be formed in the forging or other production of the billet. The walls of the mold thus formed are sufficiently thick to provide for the necessary water jacket. This jacket is formed by drilling longitudinally through the walls of the mold, the successive holes thus drilled serving as water passages and being united by transverse passages near opposite ends of the mold, so that by admitting water to the passages at one end it flows in parallel courses through the drilled holes, being collected and discharged from the other end. The open ends of the drilled holes are, of course, suitably plugged. A bottom cover is applied to close the open lower end of the mold cavity, and suitably fastened. In this way a weldless mold is formed with an integral water jacket which provides for effective cooling of the mold. Such molds have been proven by experience to have relatively low initial cost and a total life greatly exceed-

ing that of any molds used for this purpose heretofore.

In the accompanying drawings are shown molds for casting cakes and ingots.

Figures 1 to 4 show a mold for making cakes or parallel-sided castings.

Fig. 1 is a front elevation partly broken away in vertical section.

Fig. 2 is a side elevation partly broken away.

Fig. 3 is a plan partly in horizontal section in two different planes.

Fig. 4 is a plan of the block or billet from which the mold is made, showing certain of the operations.

Referring to the drawings, a solid billet A (Fig. 4) may, for example, be forged from open hearth mild steel having not over .25 per cent. carbon. The cavity to be formed, lettered B in Figs. 1 to 3, is shown by dotted lines *a*, *a*. The internal face of this cavity may then be machined to render it suitably smooth by means of any conveniently-applied cutting tool, such as a shaper. Also, the top and bottom faces of the billet may be advantageously planed off smooth.

To form the water jacket, the wall of the billet is drilled with numerous vertical bores or holes *c*, *c* (Fig. 3) which may be as close together as is convenient. These may be drilled through from the top and stopped short of the bottom, as indicated in Fig. 1; or they may be drilled entirely through if the open bottoms are thereafter closed by inserting suitable plugs. The open tops of the holes are closed by means of plugs *d* which may be of steel and screwed into tapped holes, or may be made a driving fit, and in any case are desirably welded on the exterior. The top and bottom ends of the vertical passages thus formed are united by means of horizontal passages which may be drilled through from the outer faces, those on the bottom being lettered *e*, *e'*, and those on the top *f*, *f'*. These also may stop short of the opposite face of the billet so as to be closed at one end, the other end from which the drill enters being afterward closed by plugs *g*, *g*, fastened in the same manner as the plugs *d*. A water inlet C and a water outlet D are applied in convenient locations, preferably at the bottom and top of the mold, and on opposite sides, as shown. These inlets and outlets are formed by drilling holes to communicate with the respective bores *e*, *f'*, and applying bosses or nipples which may be tapped into the holes, and are advantageously also welded to the sides of the mold.

With this construction of water jacket the water entering at the inlet C flows around through the horizontal passages *e'*, *e*, traversing all four sides of the mold; the water then ascends through the vertical bores *c*, *c*, to the top of the mold, and the streams reunite in the upper horizontal passages *f*, *f'*, and flow out from the latter through the outlet D. The walls constituting the mold are thus very effectively cooled by the numerous parallel streams of water ascending through these closely drilled passages.

The bottom of the mold is closed during casting by a bottom cover E which is best constructed as a drop bottom by suitably hinging it to the lower part of the mold, so that when released it will fall out of the way, so as to permit the free discharge of the casting. For this purpose it may be hinged or pivoted on a rod *h* at one side of the mold, which may be hung in brackets *i* suitably fastened to the side of the mold, as shown in Fig. 2. The most convenient way of holding the bottom closed during casting is to confine it by a swinging bail F hung upon trunnions G, G, projecting from the mold. The bottom E is conveniently formed with hinge ears *j* engaging the hinge rod *h*, and with ribs *k*, these latter having eccentric underfaces which may be wedgingly engaged by the bail F. When the bottom is closed, the bail swings under it by gravity, and a slight tap will cause it to wedge the bottom up tightly in place against the bottom of the mold; when after casting the metal has solidified, the bail is easily driven back by a light blow, whereupon the bottom opens by gravity, so that the bottom and bail occupy approximately the positions shown in dotted lines in Fig. 2. The trunnions G, G may conveniently be screwed into tapped holes in the sides of the mold and welded in place.

The mold is preferably made with a parallel-sided cavity B, so as to cast a cake which has no taper. The water cooling of the mold so chills the casting that it shrinks sufficiently to drop out freely upon the opening of the bottom.

Molds thus constructed have been demonstrated to outlast the best construction of previously-made molds fully ten times; their cost per unit casting is less than one-fifth that of the best previous molds.

For copper casting the mold may advantageously be made of copper instead of steel, it being perfectly feasible to cast copper in a water-cooled copper mold. To make a mold of copper according to the present invention it is cast in the form of a billet, either solid, as is shown in Fig. 4, or by using a metal core to displace the metal occupying the mold cavity B, it may be cast as an open frame. In either case the metal is continuous, so that all welding and joints are avoided. The inner surface of the mold cavity could be smoothed by machining, as before described, and the water-jacketing holes *c*, *c*, are drilled, as also the horizontal holes *e*, *e'*, *f*, *f'*; and all these holes are plugged by tapping and putting in tight-fitting screw plugs. The water inlet and outlet nipples or couplings C, D, are ap-

plied in the same manner already described, except that with copper there is no welding. Or the bosses for these couplings may be formed integrally as a part of the original casting. The trunnions G, G, may be applied as already described, or be cast on.

The copper mold thus formed is very effectively cooled and will considerably outlast copper molds as heretofore made. One of its advantages over the steel mold is that when no longer usable as a mold, its metal may be utilized by melting down.

The present invention is also applicable to the construction of molds for casting other shapes of copper and for making castings of other metals or alloys having more or less the same properties as copper. For casting cylindrical shapes the construction requires to be somewhat modified, and a mold for that purpose is claimed by me specifically in another application to be filed approximately concurrently herewith.

I claim as my invention:—

1. An integral weldless mold comprising solid walls enclosing a parallel casting cavity open at both ends, and having parallel passages through such walls, and with a water inlet and outlet communicating with said passages, whereby cooling water may be circulated through such passages to cool the mold.

2. An integral weldless mold comprising solid walls enclosing a parallel casting cavity open at both ends, and having parallel passages through such walls, and transverse connecting passages uniting them at top and bottom, with a water inlet and outlet to such connecting passages respectively, whereby the cooling water circulates in parallel streams from end to end of the mold.

3. An integral weldless mold comprising solid walls enclosing a parallel casting cavity of rectangular cross-section open at both ends, and having parallel passages through such walls, and transverse passages through such walls near the opposite ends of the molds, uniting the parallel passages and communicating with each other to form passages for conducting water to and from said parallel passages, and with water inlets and outlets communicating with said end passages respectively.

In witness whereof, I have hereunto signed my name.

WILLIAM F. EPPENSTEINER.

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CERTIFICATE OF CORRECTION.

Patent No. 1,785,941. Granted December 23, 1930, to

WILLIAM F. EPPENSTEINER.

It is hereby certified that the assignee in the above numbered patent was erroneously described and specified as "The American Metal Company", whereas said assignee should have been described and specified as The American Metal Company (Limited), as assignee by mesne assignments of the entire interest in said invention, as shown by the records of assignments in the office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 20th day of January, A. D. 1931.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)