Jan. 24, 1933. W. F. EPPENSTEINER 1,894,983

APPARATUS FOR CASTING CORE MOLDS

Filed March 4, 1931

Fig. 1.

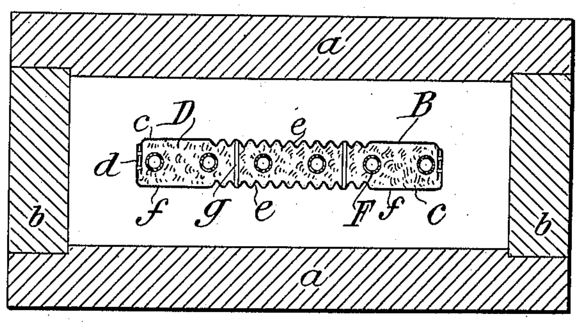


Fig. 2.

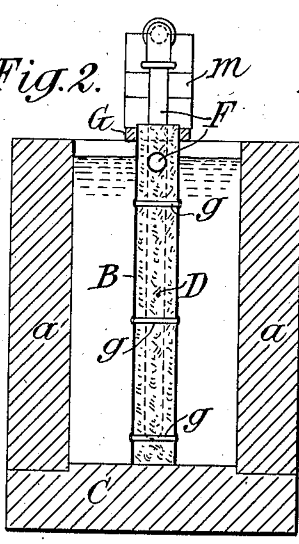


Fig. 3.

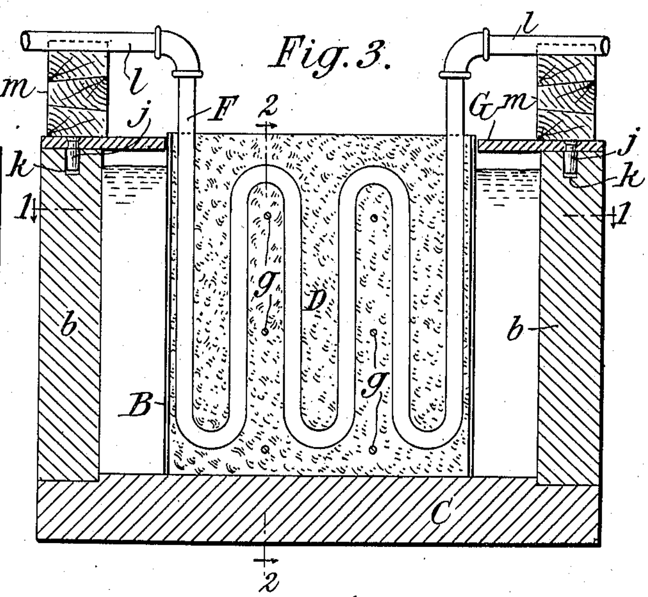


Fig. 4.

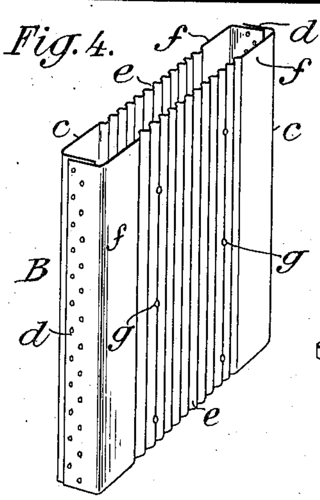


Fig. 6.

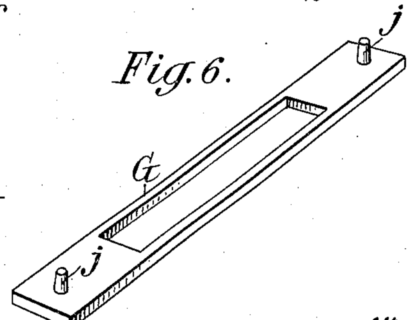
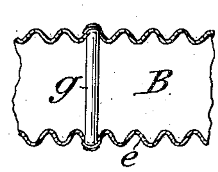


Fig. 5.



Inventor

William F. Eppensteiner

By his Attorneys,

Fraser, Myers & Manley

Patented Jan. 24, 1933 1,894,983

UNITED STATES PATENT OFFICE

WILLIAM F. EPPENSTEINER, OF RAHWAY, NEW JERSEY, ASSIGNOR TO THE AMERICAN METAL COMPANY, (LIMITED), OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

APPARATUS FOR CASTING CORE MOLDS

Application filed March 4, 1931. Serial No. 519,936.

Such molds are used for casting parallel-sided copper cakes or slabs as set forth in Patent No. 1,779,534, dated October 28, 1930. A suitable mold for that purpose is set forth in Patent No. 1,785,941, dated December 23, 1930. For casting copper cakes or slabs it is preferable to make the mold of copper with suitable provision for water-cooling, preferably by providing cored passages in the mold walls as in the last-named patent. For making such copper molds it is preferable to cast the mold around a core which forms the central casting cavity of the mold; but great difficulty has been heretofore encountered in such casting by reason of the tendency of the cast copper in contracting around the core to develop cracks which, if they penetrate the water passages which are afterward drilled in the walls of the mold, give rise to leakages such as would make the use of such molds highly perilous because of the liability of explosions. This difficulty is corrected by the present invention, whereby the casting of the mold is formed around a specially constructed, yielding core which is made of a shell of sheet metal. This metal shell is filled with some heat-conducting material, preferably comminuted metal, such as copper chips or shavings. Such filling supports the shell while yielding sufficiently for the purpose. Such filling material affords numerous air spaces so that the imprisoned air has a cooling effect upon the core. It is important to further cool the core by providing a cooling coil suitably located within it through which water is circulated.

A suitable and preferred embodiment of the invention is shown in the accompanying drawing, where it is applied for the making of a mold adapted for the casting of flat cakes for rolling down into sheet copper, according to the method set forth in Patent No. 1,779,534, granted October 28, 1930. The perfected construction of mold for casting such cakes is set forth in Patent No. 1,785,941, dated December 23, 1930, and illustrated in Figs. 1, 2 and 3 thereof. For making such mold of copper it is preferable for many reasons to cast it around a core which forms the central casting cavity of the mold; but great difficulty has been heretofore encountered in such casting by reason of the tendency of the cast copper in contracting around the core to develop cracks which, if they penetrate the water passages which are afterward drilled in the walls of the mold, give rise to leakages such as would make the use of such molds highly perilous because of the liability of explosions. This tendency to crack is due to the fact that molten copper in cooling and after it has apparently solidified, passes through a plastic condition before finally hardening, in which condition it has so little cohesion that it cannot resist the tensile stress due to its contraction around an unyielding core. This difficulty is corrected by the present invention, wherein the casting of the mold is performed around a specially constructed yielding core, as will be more particularly described.

In the drawing:

Figure 1 is a horizontal section of the mold ready for pouring.

Fig. 2 is a transverse vertical mid-section thereof.

Fig. 3 is a longitudinal mid-section.

Fig. 4 is a perspective view of the sheet metal core.

Fig. 5 is a fragmentary enlargement of a part of Fig. 1 showing a detail.

Fig. 6 is an inverted perspective of a frame for holding the core.

In the drawing, A designates the outer mold in which the future cored mold is to be cast, and B designates the core. C is the bottom of the mold A. The mold A is shown as made of opposite side plates *a*, *a* and end plates *b*, *b*. These plates are held together in any suitable manner, preferably by bands or straps surrounding the exterior of the mold and tightened by wedges or otherwise. Such holding means forms no part of my invention and is known in the art, and may be substituted by any other means for fastening the members or sections of the outer mold together. The bottom C may also be fastened in any suitable way, it being sufficient with a mold of suitable weight to rely on the weight of the mold to hold it in place.

The core is held centered within the mold in any suitable way, as for example, by a means which will be later described.

The core B, instead of being a solid casting as heretofore, with cored or drilled passages for water circulation, is made as a shell of sheet metal, as best shown in Fig. 4. The metal used is preferably copper, in the form of sheet copper or thin plate copper. Its thickness may vary, but from one-sixteenth ($\frac{1}{16}$) to one-eighth ($\frac{1}{8}$) inch thickness affords a suitable range. The top and bottom of the core are best made open, the metal sheets or plates *c*, *c* being bent to form the sides and ends of the core. The best construction is to make the core of two sheets or plates flanged up at their sides, these flanged portions *d*, *d* being strongly united by double riveting, as clearly shown. While the plates may be flat on the sides, it has been found preferable to corrugate them in order to provide for taking up expansion when the plates are heated during pouring and thereby to prevent warping or distortion of the core. This corrugated portion is shown at *e*, *e*. While the corrugated portion may extend over the entire sides of the plates, it is found preferable to confine it to the middle portion, as clearly shown in Figs. 1 and 4, leaving bands *f*, *f* uncorrugated adjacent the edges of the core. To further prevent any bulging or distortion of the core, due to the heat imparted in casting, it is desirable to connect the opposite sides at intervals by means of stays *g*, *g*, which may be constructed as copper rods passing across the core, their ends entering through holes in the copper sheets and riveted down thereto, as shown in Fig. 5.

The shell thus constructed is set in place in the mold A and is filled with some substance which will prevent or limit its contraction under external pressure. The filling material has two purposes: (1) to reinforce the thin shell against collapse under the pressure of the metal poured around it, at which time it is weakened by the heat imparted to it, and (2) to provide means for conducting heat away from the sheet metal shell and thereby protect it against being melted out. It also provides interstices within which air or other gas or fluid is imprisoned for cooling purposes. The best results are obtained with metal, preferably copper, in subdivided form, such as chips, plainings, shavings, or the like. The filling is packed in firmly enough to afford an adequate support for the core walls.

Cast molds of copper are best made with a core of sheet copper and a filling of comminuted copper, the core being suitably held in its central position within the mold. Before placing the core, or in any event before pouring, the core should be carefully coated with the usual bone-ash mixture; and dry bone-ash should be sprinkled around the junction of the core with the base plate C of the mold. After casting, and when the cast copper is sufficiently cooled, the outer mold A is taken apart and removed, and the filling, which remains mostly detached, is taken out from the core. The sheet metal shell then remains, usually partly attached within the cored cavity of the cast mold, and is then to be stripped therefrom, except for some portions,—particularly at the lower corners of the core,—which are found to have become fused to the copper constituting the cast mold. Any such mold requires that its cored cavity be dressed out by machining, and this operation readily removes any adhering portions or fused-in portions of the shell. By making the core and filling of copper, any contamination of the cast metal is avoided. While the filling ordinarily sustains the core against the pressure due to the weight of the copper poured around it, yet if the core may yield in places to this pressure, its collapse from that cause is very slight, and the result is readily corrected in the course of this machining of the core cavity.

For effectively cooling the core, it is necessary to provide it with an internal cooling means, preferably by circulating water through a coil placed therein. Such cooling coil is lettered F, and is best introduced from above, being suitably held in place within the hollow core and being located therein before the filling D is introduced. The coil is best made of reversed bends, as shown in Fig. 3, and the cross-ties *g*, *g* are so located that their presence does not interfere with the insertion of the coil after the hollow shell has been placed in its proper location within the outer mold. A rapid circulation of water is maintained through the coil during the casting; a pressure of from 30 to 50 pounds per square inch and a temperature of from 190 to 210 degrees Fahrenheit have been found suitable. It is preferable to make the coil of copper pipe, although iron or steel pipe may well be used.

With such water-cooled core the method consists in placing the hollow sheet metal shell (suitably coated with bone-ash, as usual) in the mold, holding it temporarily by any suitable means, such as blocking; then lowering the coil into place within the shell, fastening the coil fixedly in place by any suitable means (such as will be described), and then pouring in the filling material and packing it down thoroughly to fill the spaces around the coil and within the shell as firmly as may be necessary. After removing the blocking, the mold is then ready for pouring. After the casting has solidified and cooled sufficiently, the outer mold is taken apart and the coil and filling are removed, and the sheet metal shell of the core is removed from within the cast mold in the manner already described.

The core and coil may be variously held in place within the mold A. This may be done by providing means for holding the shell in place, the coil being located by the intervening packing material; or by holding the coil in place and utilizing the packing material to hold the core in position. While either means may be successfully applied, the latter is considered preferable. To hold the shell in its proper location, a frame G (shown separately in Fig. 6) is slipped over its upper end, as shown in Figs. 2 and 3, and is itself suitably located with respect to the mold A; this being conveniently done by providing the frame G with pins or dowels *j* which enter into sockets *k* in the top of the end plates *b*, *b*. The bottom of the shell may be temporarily blocked in place, or the bone-ash sprinkled around it may afford a sufficient hold, there being no strains tending to displace it at the bottom. The coil F is then lowered into place within the shell and the filling material is introduced, being tamped down around the coil, while holding the bottom portion of the coil centrally within the shell. The filling thus introduced serves to keep the coil and shell properly spaced relatively to one another. During this operation the coil is temporarily held in place, as by placing wooden blocks *m*, *m* under its horizontal pipes *l*, *l*, as shown in Figs. 2 and 3. After introducing all of the filling material, these blocks are no longer needed and may be removed, as well as any blocking that may have been introduced around the bottom of the shell. The mold is then ready for pouring, as already described.

The improved yielding or slightly collapsible core provided by the present invention has certain important advantages over a rigid core. With a rigid or solid core, whether water-cooled or not, the core can not yield to the contraction of the surrounding cast metal, which gives rise to the liability that the cast metal in cooling may crack by reason of the internal strains developed within it. The collapsible core may yield inwardly under the compression exerted against it by the cast metal in cooling. While for this purpose it is preferable to make the core of corrugated metal, successful results may be attained with a shell of uncorrugated metal. While perfect castings may be made by the use of such a core without any other cooling than that afforded by the presence of the filling material, yet it is preferable to water-cool the core by applying a circulating coil within it, of which the construction shown affords the best example.

The construction herein shown and described is believed to be the best way of carrying the invention into practice, but it is to be understood that it is susceptible of considerable modification within the scope of the appended claims, since the construction and mode of operation may be varied according to the shape and dimensions of the mold to be cast, and particularly of its cavity which the core is to form. The present invention is applicable to the casting of molds of the shape shown, as well as other shapes. It is applicable to molds for casting cylindrical billets, such as are illustrated in Patent No. 1,776,355, granted September 23, 1930. The particular construction and dimensions of the elements of the core and of the means for holding the parts during casting may be varied according to the skill or judgment of the metallurgist or casting expert as required by the particular work to be done.

While the present invention has been designed for the casting of cored molds of copper, for which purpose the core shell is best made of copper, yet it is believed that the invention is applicable for the casting of molds of other metals, and particularly of metals having melting points not materially higher than copper, and when such other metals are used it may be found preferable to make the core shell of the same metal as that to be cast, although for metals having not too high a melting point the use of copper for the core shell is preferable for obvious reasons.

What I claim is:

1. An apparatus for making a cast mold having a parallel casting cavity, comprising an outer mold having a cavity conforming to the exterior of the mold to be cast, a core of the shape of the object to be cast in such mold, such core comprising a shell of sheet metal with a heat-conducting filling material of comminuted metal within it, and a cooling coil within the core embedded in such filling material.

2. Apparatus according to claim 1, the core comprising a shell of sheet metal having corrugations.

3. Apparatus according to claim 1, the core of sheet metal having opposite flat sides and transverse stays connecting said sides to prevent bulging of the core when packed with the filling material.

4. Apparatus according to claim 1 for the casting of a copper mold, the sheet metal core being of copper and the filling material within it of comminuted copper, whereby in case of fushion of the core and filling to the casting the latter is not contaminated.

In witness whereof, I have hereunto signed my name.

WILLIAM F. EPPENSTEINER.

CERTIFICATE OF CORRECTION.

Patent No. 1,894,983. January 24, 1933.

WILLIAM F. EPPENSTEINER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, before line 1, insert the following paragraph: "This invention relates to apparatus for casting metal molds having a cored cavity."; 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 14th day of March, A. D. 1933.

M. J. Moore,

(Seal) Acting Commissioner of Patents.