March 19, 1940. A. D. LUND 2,194,092

MOLD FOR BATTERY GRID PLATES

Filed Dec. 23, 1937 2 Sheets-Sheet 1

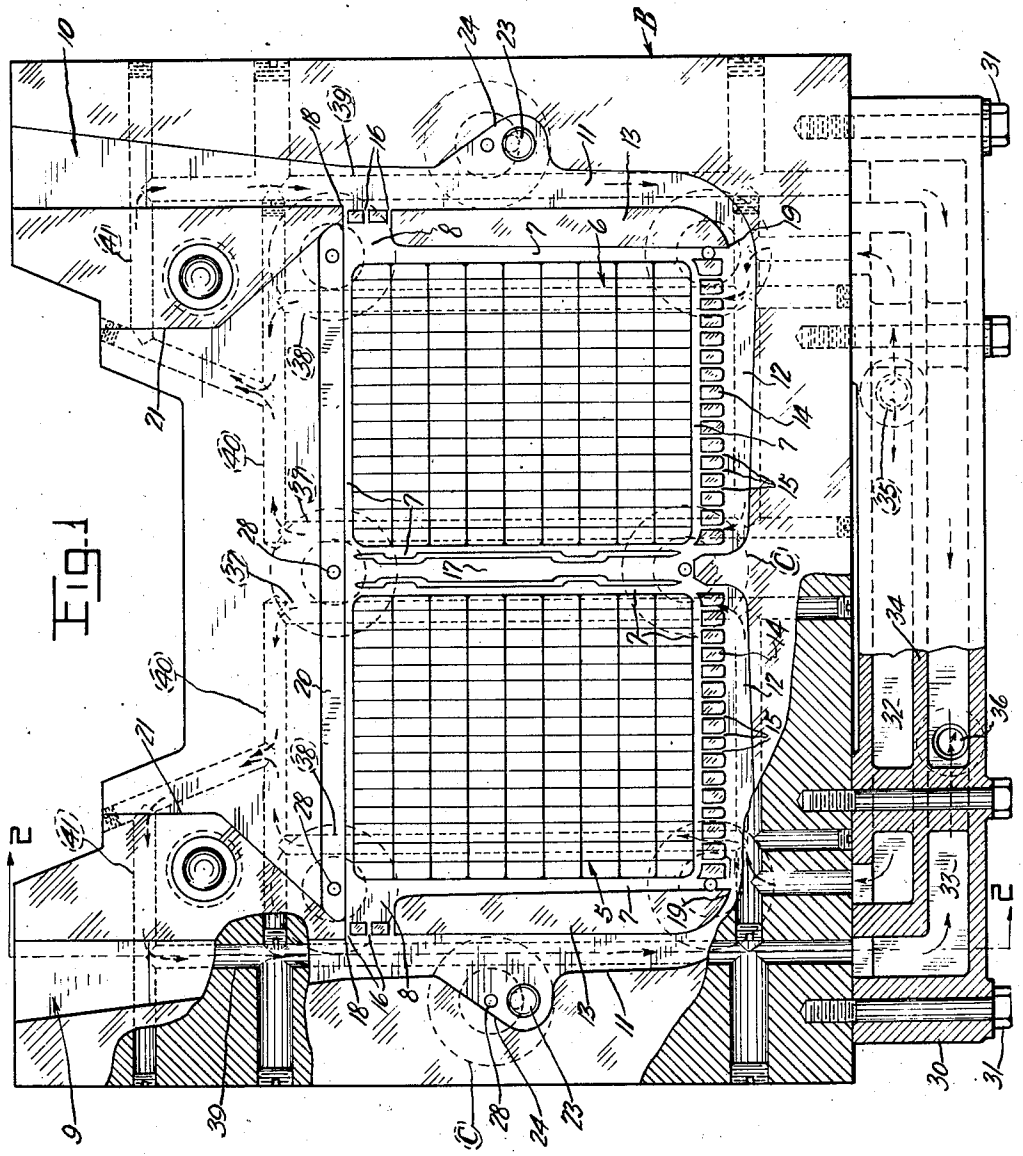


Fig. 1

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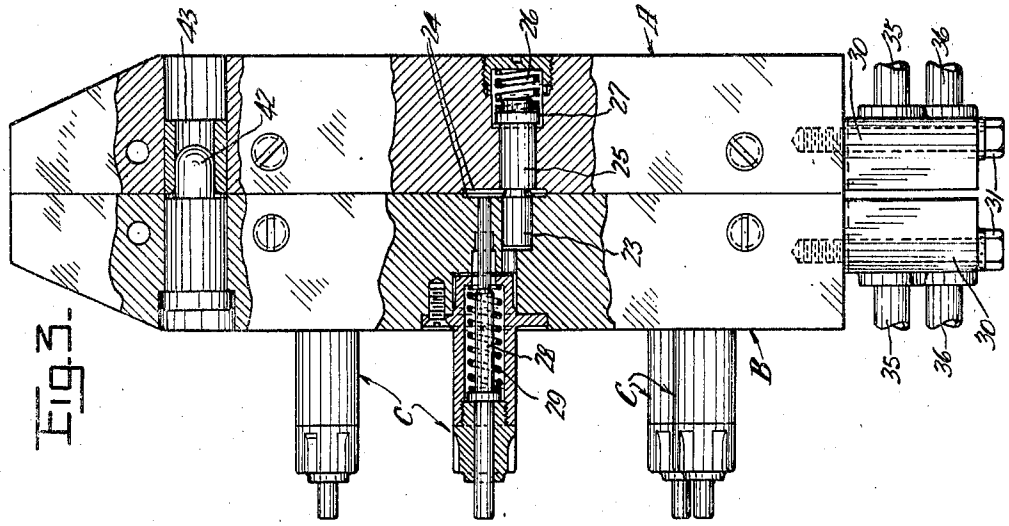


Fig. 3.

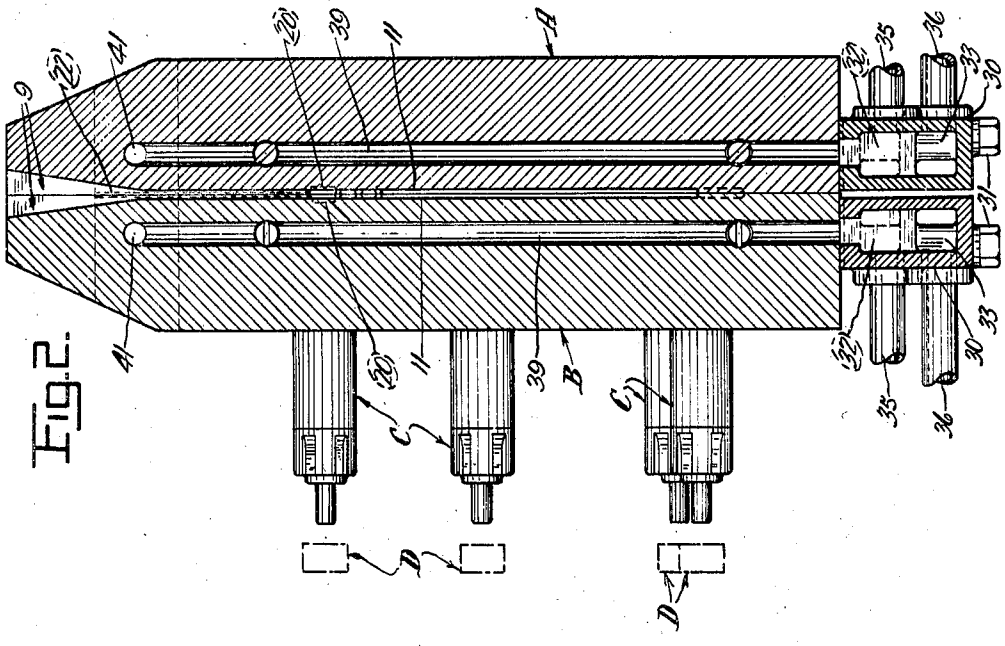


Fig. 2.

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MOLD FOR BATTERY GRID PLATES

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4 Claims. (Cl. 22—136)

This invention relates to improvements in molding devices for casting machines.

The molding device as herein referred to is of the type employed in grid casting machinery in which storage battery grids are cast. For this purpose the device is made up of two complementary molds or dies having in their meeting faces the intaglio or matrix surfaces which, when filled with the molten metal, will form the battery grid to the desired shape and formation. The molds of course are movable toward and away from one another in order to allow the removal of the formed grid after it has hardened between the molds. Hitherto, in devices of this kind, difficulty has been experienced in so feeding the molten metal between the molds that it will fill the entire matrix surface and which action of course is necessary in order to mold perfect and complete grids. This difficulty has arisen for two reasons, the first being that the feeding method itself has been unsatisfactory and the second being that no satisfactory means has been provided to enable the air in the space formed by the matrix surfaces to exhaust properly and completely. Difficulty has also been experienced due to the rapid cooling and contraction of the thin grids causing fracture and breaks around their margins.

With the above facts in mind it is the primary object of my invention to provide a molding device for this purpose in which the molten metal is fed to the matrix surfaces in a novel and extremely effective manner causing it to penetrate evenly to all parts of the mold. A further object is to provide means whereby the natural contraction of the metal as it cools is prevented from breaking or otherwise injuring any of the relatively thin portions of the grid, this being accomplished by feeding the molten metal into relatively deep recesses in the mold in such manner that a substantial mass of metal will be formed along one edge of the grid. This mass of metal thus will cool more slowly than the thin grid itself and as the metal in the grid hardens and contracts this still molten metal may expand to compensate for the contraction of the metal in the matrix surfaces. This action of course greatly facilitates the formation of perfect grids and entails no difficulty in expense since the wide "bar" thus formed may be trimmed from the grid and melted for use again. Another object is to provide a molding device in which adequate, and properly located, means is provided to allow the air to rapidly and completely exhaust from the mold cavities as the molten metal enters. Still a further object is to provide a molding device of this kind in which a plurality of grids may be cast in one operation and in one large plate to be subsequently trimmed to size and in which means are provided for ejecting the plates from the molds and for cooling both the plates and the molds to aid in hardening the plates and to prevent warping of the molds. These and still other more specific objects of my invention will be made apparent in the course of the following detailed specification, reference being had to the accompanying drawings, wherein:

Figure 1 is a face or inside elevation of one of the molds or dies constructed in accordance with my invention, fragments being broken out to better disclose interior construction.

Figure 2 is a cross section along the line 2—2 in Figure 1, but showing both mold plates in their operative positions.

Figure 3 is an edge or end view of the molds with parts shown in cross section to better illustrate the construction.

Referring now with more particularity to the drawings the reference character A designates the movable mold and B the stationary mold, the two of which constitute the molding device as provided in this invention. Machines for operating these molds, filling them with the molten metal, circulating the cooling fluid through the molds and otherwise performing the casting operation are so well known in the art as to require no description herein. The terms "movable" and "stationary" as employed herein are further understood to be purely relative terms and used solely for convenience in description since either or both of the molds may be movable and reciprocated by the machine. Thus features which are herein described as for the fixed mold, might as well be employed in a movable mold and vice versa. As herein disclosed, however, the mold A is secured to the machine by any well known means (not shown) while the mold B is arranged to be reciprocated by the machine by a conventional actuating means (also not shown) in such manner that the mold faces will be alternately moved together and apart as the machine operates. This action is continuous so long as the machine is in operation and it may here be noted, to enable a better understanding of the need and function of my invention in all its details, that the entire operation of filling the mold, hardening the grid and discharging it from the molds requires but a small fraction of a minute to complete. The molds or dies themselves take the form of blocks of suitable metal such as cast iron

properly chilled and annealed and in accordance with usual practice, the meeting or adjoining working faces of the molds are provided with the complementary intaglio or matrix surfaces designated generally at 5 and 6 spaced apart and designed to form two battery grids in a single cast plate which is subsequently trimmed and cut to divide the grids and prepare them for use. These surfaces 5 and 6 have the usual network of vertical and horizontal grooves for forming what are known as the "wires" and "ribs" respectively of the completed grid. The surrounding channels in the mold faces, designated at 7, form the outside frames for the completed grids and lateral extensions 8 at the upper ends of the outermost channels form tabs by which the grids are subsequently secured to the battery terminals.

There are also formed substantially L-shaped and reversely turned feeding channels 9 and 10 adjacent each end of each mold face and these comprise the vertical portions 11 which extend downwardly alongside the ends of the grid forming matrices 5 and 6 and the horizontally and inwardly turned distributing channels 12 spaced from the lower margins of the matrix surfaces. Intervening ribs or uncut portions 13 and 14 of the mold faces isolate these channels from the matrix surfaces as clearly shown. However, at the bottom and in the ribs 14, there are formed a series of narrow perforations or inlet grooves 15 through which the molten metal (entering through the channels 9 and 10) may stream and thus rise in the matrix surfaces to completely fill the same. Also there are provided additional grooves 16 adjacent the tab forming extensions 8 to admit a small quantity of metal to the upper corners of the matrix surfaces of the channels. The channels 12 are gradually restricted in width toward their inner, proximate ends, and these ends finally turn upwardly intermediate the surfaces 5 and 6 to form a channel 17 which will provide a medial connecting rib for the cast plate. The vertical channels 11 also taper in width from their upper to their lower ends and the purpose of this gradual restriction of the channels toward their discharge ends is to concentrate the metal as it is gradually fed to the matrix surfaces and ensure that it will be fed evenly across the full width of the bottom of these surfaces. In this connection it is noted that the channels are so formed that there are provided overhanging or projecting shoulders 18 and 19 before each series of grooves 15 and 16 and toward the inlet ends of the channels so that the greater part of the metal will be deflected past the adjacent grooves and on toward subsequent grooves which might otherwise not receive their full share of the metal. This feature assumes greater importance when it is considered that the filling of the matrix surfaces must not only be complete and even over their entire expanse but must be practically instantaneous in point of time.

Formed along the upper horizontal edge of the entire matrix surface in each plate is an elongated narrow groove or chamber 20 which communicates along its lower margin with the matrix surfaces to thereby become filled with the metal arising from these surfaces but this groove is cut substantially deeper into the mold face than are the matrix surfaces and conducting channels. As a result there is formed a relatively thick bar or rib across the upper edge of the cast plate and which, after it serves its purpose as hereinafter described, may be trimmed off with other excess marginal portions of the plate. As an example of the increase in the depth of the groove 20 over that of the remaining recessed surfaces this groove may be about ten one-thousandths of an inch deeper and this relatively slight added thickness of material will serve its purpose.

From the groove 20 upwardly to its upper edge, the inner face of each mold A and B is evenly cut away between the margins 21 to a depth of about ten one-thousandths of an inch so that when the molds move together there is formed a wide clearance, indicated at 22 in Figure 2, which opens upwardly between the molds and communicates with the various cavities therein.

In the use and operation of the molds as so far described, the molten metal is poured into the upper ends of the channels 9 and 10 when the molds are pressed together and the metal then flows rapidly downward through these channels and fills the matrix surfaces 5 and 6 as well as all the surrounding channels, 7, 17 and 20. This filling action is evenly distributed by the novel arrangement of the series of grooves 15 along the lower edge of the matrix surfaces supplemented by the relatively small number of grooves at their upper and outer corners. The filling action is further facilitated by the restriction of the filling channels toward their discharge ends and by the overhanging shoulders 18 and 19 as described hereinbefore. All these features contribute to the final result by which the metal rises evenly up through the entire area of the matrices and other cavities and fills them completely. As the metal enters it must of course expel all the air in the various cavities and this is greatly facilitated by the location of the clearance space 22 directly opposite the point at which the metal enters in the greatest quantity. This arrangement prevents the trapping of any air in any part of the cavities and the resultant formation of air pockets in the finished grids as now often occurs. In this connection it is noted that the clearance space 22 opens into the mold cavities along their entire width or length and with no projecting corners whatever due to the peculiar formation of the margins 21 as indicated.

As the metal in the filled cavities hardens it naturally contracts slightly and hitherto this has sometimes resulted in fracturing or breaking the relatively thin "wires" formed by the vertically extended grooves in the matrices. This of course ruins the grids for use and results in considerable waste. In accordance with my invention, however, the relatively deep grooves 20 along the upper margin of the matrix surfaces forms a relatively thick mass of metal as it enters the grooves and this metal of course will cool slower than the grids themselves, due to its greater mass. Thus as the grids cool and contract this still molten metal in the grooves 20 may move downwardly and compensate for this shrinkage and so prevent the wire from breaking. The amount of this shrinkage is of course relatively small but nevertheless it has been found to cause the breakage described. Likewise it has been found that the formation of this relatively great mass of metal at the upper margins of the grids compensates for this shrinkage to the extent that the grids are perfectly formed.

For the purpose of properly aligning the cast plates in the trimming machine (not shown) the plates may be provided with pilot openings by

means of the core pins 23 which are seated in recesses formed in the movable mold B and terminate in tapered ends which are located in the lateral extensions 24 of the channels 11. These extensions of course become filled with the molten metal forming extended ears at the ends of the plates and the tapered ends of the pins 23 form openings in these ears which may subsequently serve to engage pilot pins in the trimming machine to properly locate the plate therein.

As each plate is cast and hardened it is necessary to remove it from the mold and this is accomplished automatically as the movable mold B moves back from the mold A so that the cast plate drops downwardly from between the molds. For this purpose the cast plate is first caused to adhere to the movable mold B until it clears the mold A by means of follower pins 25 which are slidably mounted in the mold A and are normally urged by the coil springs, 26, outwardly from the working face of the mold. In casting position and when the molds are pressed together these pins 25 rest against the pins 23 but as the molds move apart the pins 25, being larger than the pilot openings formed by the pins 23, engage the plate and move outwardly to press the plate against the mold B. This action is limited by the shoulders 27 on the follower pins but ensures that the plate will be substantially clear of the mold A when it is released from the mold B as will be evident.

For the purpose of loosening the cast plate from the mold B after it has cleared the mold A a plurality of kick-out units as indicated at C are provided. These units each employ a pin 28 slidably mounted through the mold B to engage a portion of the plate cast therein and spring set by the spring 29 to horizontally just clear the plate. The outer end of each pin is exposed through the end of the mounting shown and as the mold B moves back away from the mold A each pin will strike an abutment D on the casting machine causing the pins to move axially and eject the cast plate so that it drops down between the molds. The kick-out units C are of course suitably located over the area of the cast plate to discharge it evenly from the mold.

In order to facilitate the rapid hardening of the metal after it fills the molds as well as to prevent distortion or warping of the molds themselves from the heat of the metal I provide the cooling system now to be described. Since the cooling system for each mold is exactly the same only one will be described in detail herein.

A manifold 30 is secured by bolts 31 along the lower edge of the mold and is cored out to form the inlet chamber 32 and outlet chamber 33, each isolated from the other by the intervening wall 34, but each having openings in the edge adjacent to the mold. An outlet connection 35 is formed for the chamber 32 and an outlet connection 36 is formed for the chamber 33 so that the cooling fluid, such as water, may enter the inlet chamber and discharge from the outlet chamber. The circulation between inlets and outlets is completed by flues 37, 38 and 39 bored vertically in the mold adjacent each matrix surface 5 and 6. The two innermost flues 37 and 38 are located adjacent to the vertical margins of the matrix surfaces 5 and 6 and communicate at their lower ends with the inlet chamber 32 while the outmost flues 39 extend in parallelism with the filling channels 11 and communicate with the outlet chamber 33. The upper ends of each set of flues are joined by ducts 40 horizontally extended above the matrix surfaces and having further upwardly extended branches 41 which lead to the flues 39.

The water thus circulates upwardly through the inner flues 37 and 38 and downwardly through the outer flues 39 to effect a cooling action on both the grid plates as they are cast and upon the molds themselves. While it might seem that the water should enter through the flues 39, due to the coolest water being needed at these hottest parts of the molds, it has been found that the greater volume of water carried by these flues 39 as relative to the volume handled by the inlet flues 37 and 38, more than offsets the fact that the water is warmest in the discharge flues. As a result the cooling is substantially even over the entire molds. The movable mold B will of course be provided with flexible connections (not shown) to its cooling system so that this system will continue to function as the mold reciprocates.

It may be noted that the movable mold B carrises a pilot or dowel 42 which engages in socket members 43 in the fixed mold A to guide the molds into proper register and relation as they move together.

It is understood that suitable modifications may be made in the structure as disclosed, provided that such modifications fall within the spirit and the scope of the appended claims. Having thus fully described my invention what I claim as new, and desire to secure by Letters Patent, is:

1. A casting mold having a matrix surface and having a channel formed inwardly along one side of the matrix surface, the said mold also having metal inlet grooves spaced along the channel and connecting the said channel and matrix surface whereby molten metal may be flowed inwardly along said channel and into the matrix surface, and a marginal portion of the channel being projected into the path of the flowing metal to divert the greater part of the metal past the inlet grooves nearest the outer end of the channel.

2. A casting mold having a substantially rectangular matrix surface, metal feeding means around the lower and outer sides of the matrix surface and spaced therefrom, the said mold having a series of grooves along the entire lower side of the matrix surface for feeding molten metal from the feeding means to the matrix surface, and the said mold also having a relatively fewer number of grooves at the upper corner portions of the matrix surface for feeding metal into the said surface at these points.

3. A casting mold having a substantially rectangular matrix surface, the said mold also having metal inlet channels extending along opposite vertical edges of the matrix surface and turned inwardly along the lower margin of said surface for feeding molten metal downwardly and inwardly around the matrix surface, feeding means connecting the lower inwardly turned portions of the channels to the matrix surface for conducting molten metal in relatively large quantities into the said surface, and feeding means at the upper lateral corners of the matrix surface for conducting lesser quantities of metal from the channels into the matrix surface.

4. A casting mold having a substantially rectangular matrix surface, the said mold also having metal inlet channels extending along opposite vertical edges of the matrix surface and turned inwardly along the lower margin of said surface for feeding molten metal downwardly and inwardly around the matrix surface, feeding means

connecting the lower inwardly turned portions of the channels to the matrix surface for conducting molten metal in relatively large quantities into the said surface, feeding means at the upper lateral corners of the matrix surface for conducting lesser quantities of metal from the channels into the matrix surface, and the said mold having an air escape channel along the entire upper margin of the matrix surface and immediately above the said feeding means at the upper corners of the matrix surface.

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