Sept. 11, 1934. H. N. TODT 1,973,550

MOLD

Filed Dec. 3, 1931 2 Sheets-Sheet 1

Fig. 1,

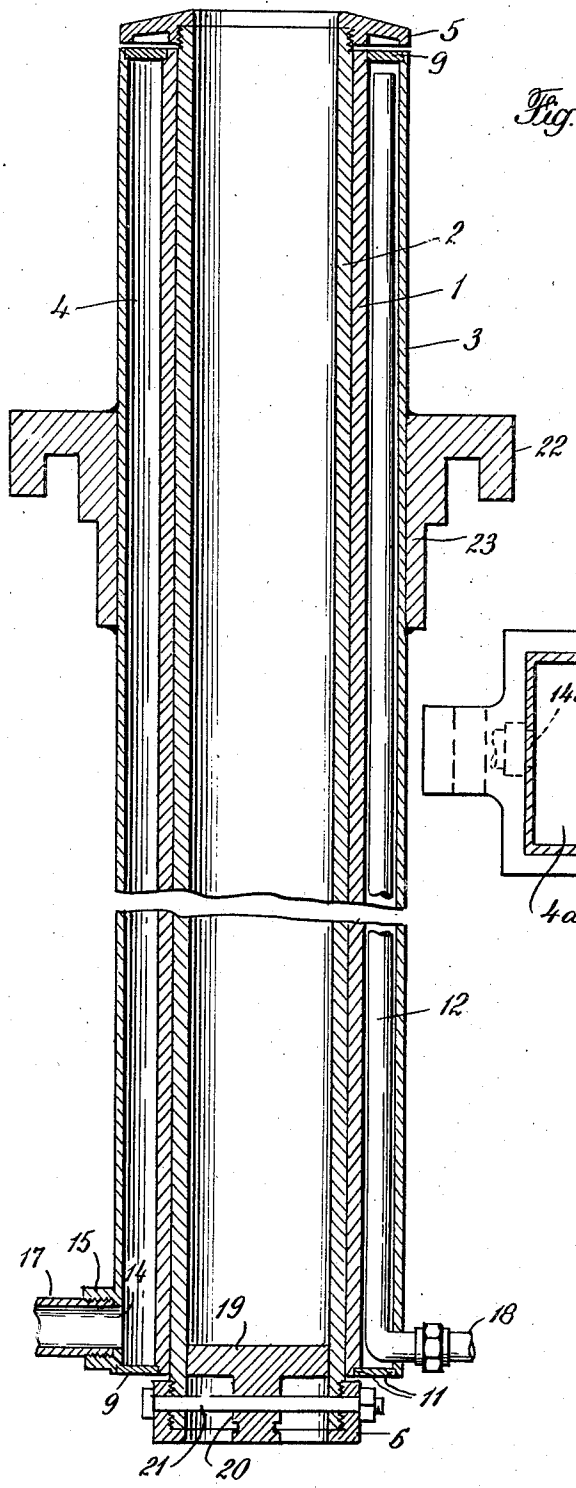
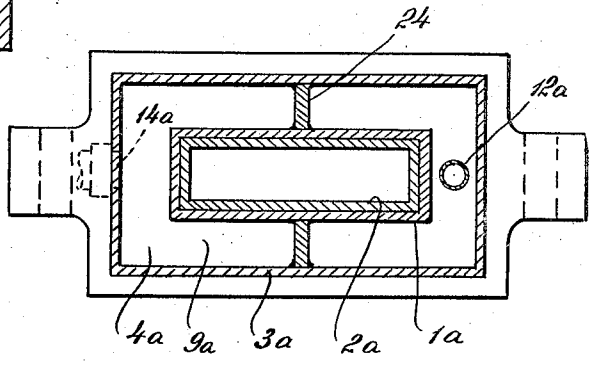


Fig. 2,



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Filed Dec. 3, 1931 2 Sheets-Sheet 2

Fig. 3,

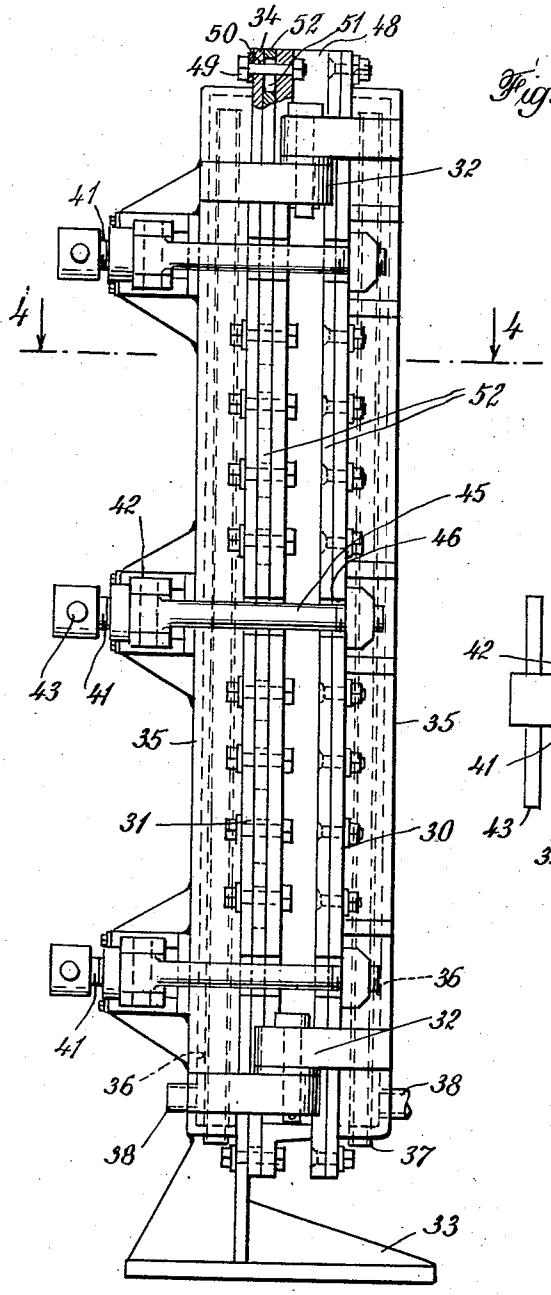
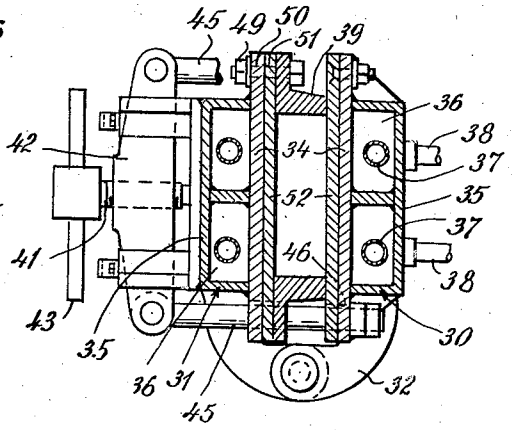


Fig. 4,



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UNITED STATES PATENT OFFICE

1,973,550

MOLD

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Application December 3, 1931, Serial No. 578,664

5 Claims. (Cl. 22—144)

This invention relates to molds and its general object is to provide a billet or slab mold of improved construction.

In casting metals having a relatively high melting point in iron or steel molds of the type now largely in use comprising a rigid single or multiple-part structure, contact of the hot metal with the inside of the mold produces expansion stresses due to the temperature difference between the interior and exterior of the mold and these stresses in time result in weakening of the mold wall as by warping or cracking. In those cases where the mold is surrounded by a cooling liquid any cracks developing in the wall of the mold permit liquid to seep into the mold cavity so that upon pouring a charge of metal into the mold an explosion is liable to occur by reason of the instantaneous vaporization of the liquid upon contacting with the hot metal charge. Furthermore, after repeated operations the mold becomes unfit for use by reason of burning or erosion of its walls by the action of the hot metal charge thereon and the entire mold then must be discarded.

It is an object of the present invention to prolong the life of the mold by reducing deterioration resulting from the effect of the hot metal on the mold wall. This end I attain by providing a liner of high heat conductivity on the inside of the mold free to expand and contract upon changes in temperature. The liner serves to protect the mold wall from the deleterious action of the molten metal and by reason of its freedom of movement prevents buckling or cracking of the mold wall. The high heat conductivity of the lining material insures an even temperature throughout its thickness reducing the likelihood of cracking, and any cracks which may develop in the mold wall allowing the cooling liquid to intrude within the mold cavity are rendered innocuous by the liner which screens the liquid from the molten metal. Furthermore, by renewing the liner as occasion requires, lieu of scrapping the entire mold as is now the practice when its walls have become burnt, warped, cracked or eroded, the mold may be maintained in practically continuous service with an attendant reduction in the cost of operation of the casting plant.

The invention will be better understood by reference to the accompanying drawings illustrating several preferred embodiments of the inventive idea and in which Fig. 1 is a longitudinal cross-sectional view of a water-cooled cylindrical billet mold employing an expansible liner; Fig. 2 is a transverse cross-sectional view of a billet mold similar to the one shown in Fig. 1, but having a rectangular instead of a circular cross-section; Fig. 3 is a plan view of a water-cooled slab mold utilizing expansible liners; and Fig. 4 is a cross-sectional view on the line 4—4 of Fig. 3 showing the interior of the mold.

The billet mold of Fig. 1 is designed for casting round billets used in extrusion press work or for hot or cold rolling into smaller sizes. It is composed of three principal parts, namely, a shell 1 defining the mold wall, a liner 2 fitting within and extending throughout the shell 1, and a jacket 3 enclosing the shell and providing a chamber 4 for the reception of a cooling liquid. The shell and jacket may be made of cast iron, steel, copper, brass, or other suitable material. The liner is of tubular form, in this instance being of circular cross-section, and is made of copper, brass or other metal of high heat-conductivity. The liner is loosely push-fitted within the shell but is wholly unconnected therewith so as to be free to expand longitudinally. The liner extends beyond the ends of the shell and in order to maintain it in assembly with the shell, it has externally threaded upon one end a collar 5 and upon its other end a ring 6. The liner 2 may be renewed from time to time by unscrewing the collar 5 and ring 6, ejecting the old liner lengthwise from the shell, and inserting a new liner of proper size.

The jacket 3 comprises an outer cylindrical wall concentrically spaced with reference to the shell 1 by means of a pair of spacers 9 and seated within rabbets 11 formed in the end edges of shell 1 and jacket 3. Near the bottom of the jacket—it being understood that the mold will occupy a vertical position during casting—is an inlet 14 through which the cooling water enters the chamber. A nipple 15 is welded to the exterior of the jacket surrounding the inlet, this nipple being interiorly screw-threaded for connection to a supply pipe 17. The cooling water escapes from the chamber 4 through a tube 12 leading from the top of the chamber lengthwise thereof and passing through an opening in the jacket near its bottom. The discharge tube 12 may be connected with a drain pipe 18 as shown. It will be apparent that the cooling water entering the chamber 4 through the inlet 14 must circulate through the length of the chamber before escaping through the outlet tube 12.

The bottom of the mold during casting is closed by a removable plug 19. The plug has a stem 20 and a removable pin 21 passes through aligned openings diametrically intersecting the ring 6, liner 2 and stem 20, to key the plug in place. A pair of hooks 22 project from diametrically opposite sides of a strap 23 welded to the exterior of the jacket 3 for engagement with gripping mechanism when stripping the mold from the casting.

The form of mold of which a cross-section is shown in Fig. 2 differs from the mold just de-

scribed principally in regard to shape. As indicated in this figure the shell 1*a* is of box instead of cylindrical form as is the mold of Fig. 1. The two molds otherwise substantially correspond element for element. The rectangular shell 1*a* is snugly fitted with a liner 2*a* composed of copper or brass, and the shell is surrounded by a jacket 3*a*. The shell and jacket are connected by transverse ribs 24 to rigidify the structure, these ribs being suitably apertured so as not to interfere with the circulation of the cooling water in the chamber 4*a*. The top and bottom of the chamber 4*a* are closed by end plates 9*a* and cooling water is introduced into the chamber through an inlet 14*a* and discharged through an outlet tube 12*a*. In this mold construction, as in the one previously described, the liner is free to expand longitudinally and may be renewed when necessary.

In Figs. 3 and 4 another application of the invention is illustrated. The slab mold shown is of the general form shown in United States Patent No. 1,615,086, granted January 18, 1927, to Otto Junker. It comprises generally two sections 30 and 31 supported in vertical position upon a base 33 and hinged together as at 32 so as to swing to and from each other. Each of these sections comprises a flat plate 34 forming one side wall of a rectangular mold cavity and on the outside of the plate is a jacket 35 forming a chamber 36 containing cooling water. The cooling water is introduced into the chamber through an inlet 38 at the bottom of the chamber and is discharged therefrom through an outlet tube 37 extending from a position near the top of the chamber. To form the remaining walls of the mold cavity, namely its two sides, and bottom, there is provided a U-shaped spacing ring 39 adapted to be clamped between the two flat plates 34 of the sections 30 and 31 by means of clamping screws 41. Each of these screws 41 is threaded through an equalizing bar 42 and bears at one end against the section 31 and is provided at its other end with a key 43 for turning the screw. To opposite ends of the two equalizing bars are attached links 45 engageable within slots 46 formed in the section 30. As will be evident from the construction just described, when the key is turned the two sections of the mold will be drawn into firm engagement with the spacing ring 39. Metal may then be introduced into the mold cavity through an opening 48 provided at its top.

In this embodiment of the invention, the flat plates 34 of the two sections are protected on their sides exposed to the hot metal within the mold cavity by liners 52 of copper or other metal possessing a high degree of heat conductivity. These liners are commensurate in size with the flat plates 34 and are fastened thereto by bolts 49 extending through openings 50 and 51 in the plates and liners respectively and located outside of the area enclosed by the spacing ring 39. In order to permit expansion and contraction of the liners through changes in temperature, the openings 51 in the liners through which the bolts extend are elongated in the direction of the length of the liner so that these sheets may shift relative to the plates 34 whereby to avoid any tendency of the liners to buckle.

The liners 52 perform the same function in this form of mold as in the forms shown in Figs. 1 and 2, namely, to protect the inner walls of the mold against the deleterious action of the hot metal charges and the more extreme temperature changes. When the liners become burnt or eroded to an appreciable degree they may be replaced with new ones merely by detaching the bolts 49. Should cracks develop in the plates 34 permitting the cooling water to seep through from the chamber 36 into the interior of the mold, danger of explosion is averted since the liners 52 will prevent the water from coming into contact with the hot metal in the mold cavity.

I claim:

1. A stationary mold for casting metals comprising a receptacle for confining a charge of molten metal, a water jacket on the exterior of said receptacle, and a one-piece fluid-tight liner of high heat conductivity disposed within the receptacle and in sliding contact therewith and free to expand relative thereto.

2. A stationary mold comprising a vertical, elongated, tubular receptacle for receiving a charge of metal, a fluid-tight liner for said receptacle composed of a metal of high heat conductivity, a water jacket surrounding said receptacle, said liner being slidingly received within said receptacle and free to expand relative thereto, means closing the lower end of the receptacle, and stop members located on opposite ends of the liner for maintaining the liner and receptacle in association.

3. A stationary mold of the elongated, upright type, comprising a receptacle for receiving a charge of metal, a liner for said receptacle composed of metal of high heat conductivity, said liner being slidable with respect to said receptacle under the influence of expansion or contraction, a water jacket in association with said receptacle, said jacket having an opening at the bottom for admitting water, and a pipe open at the top of said jacket for withdrawing water therefrom.

4. A stationary mold comprising two substantially flat plates adapted to form two sides of a mold, an angular spacing ring forming three sides of the mold clamped between said plates, and metal liners of high heat conductivity covering said plates and free to expand relative thereto, and water compartments upon the exterior of said plates.

5. A stationary mold comprising two substantially flat plates adapted to form two sides of a mold, an angular spacing ring forming three other sides of the mold clamped between said plates, and metal liners of high heat conductivity covering the opposed faces of the plates, a water jacket on the exterior of each plate, and means fastening said liners to said plates to permit expansion of said liners relative to said plates, said fastening means comprising bolts supported by the plates outside the confines of the spacing ring and passing through elongated openings in the liners.

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