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1,726,698

WATER COOLED MOLD FOR CENTRIFUGAL CASTING MACHINES

Filed March 2, 1928

2 Sheets-Sheet 1

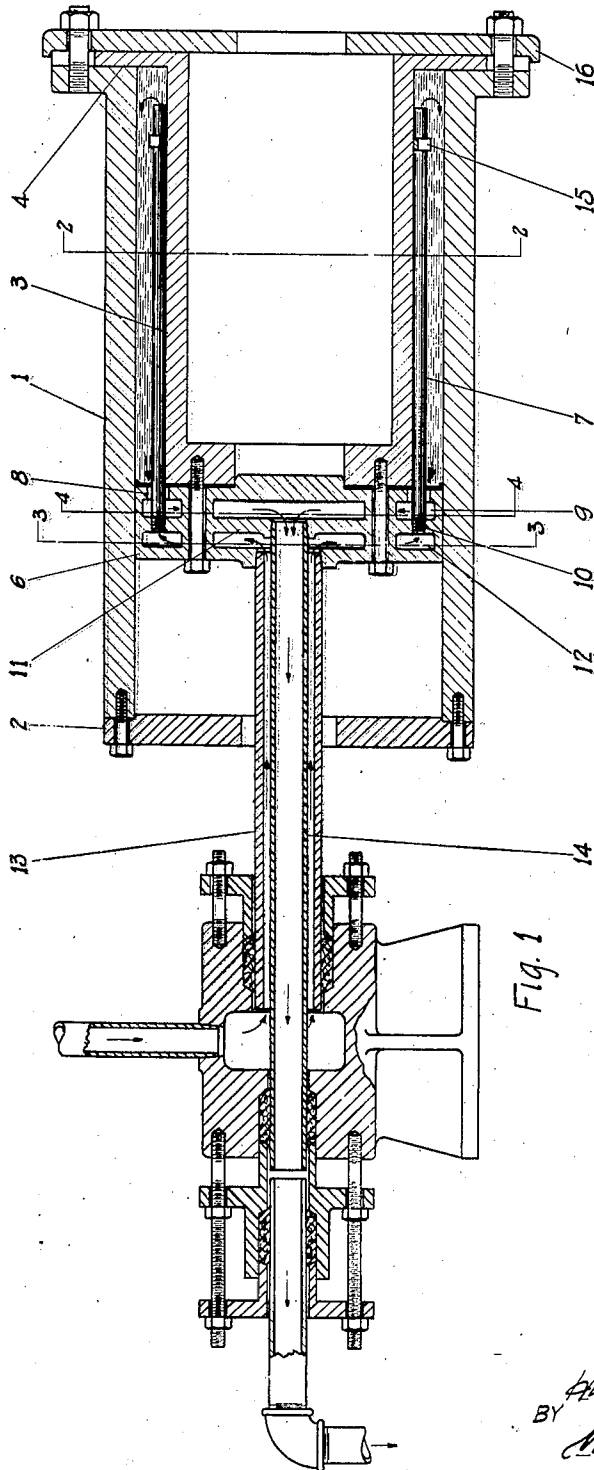


Fig. 1

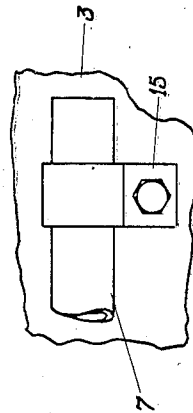


Fig. 5

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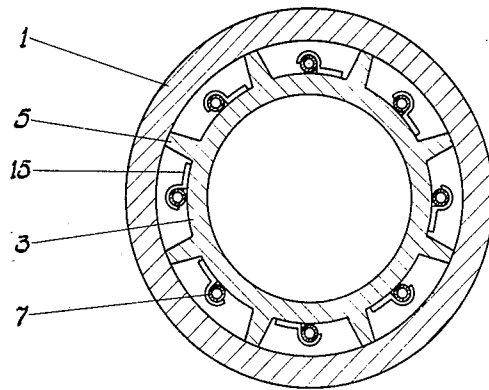


Fig. 2

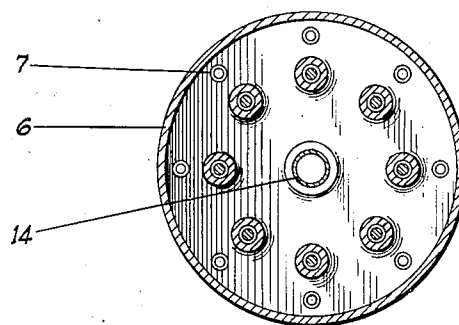


Fig. 3

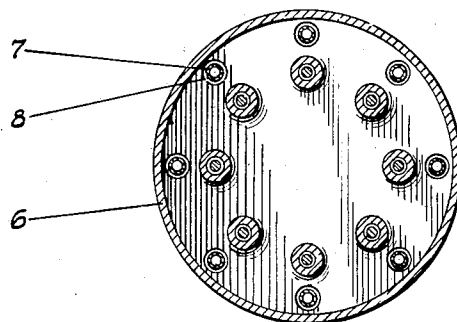


Fig. 4

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UNITED STATES PATENT OFFICE.

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WATER-COOLED MOLD FOR CENTRIFUGAL CASTING MACHINES.

Application filed March 2, 1928. Serial No. 258,518.

The invention to be hereinafter described relates to water cooled molds for centrifugal casting machines.

More especially it has to do with machines adapted to cast tubular bodies of considerable diameter and length and of variable diameter, length and wall thickness.

Broadly speaking these machines comprise a suitably mounted rotor or outer member adapted to be revolved at the proper speed to effect centrifugal casting of the desired article from the particular metal composition used, a suitable liner carried by the rotor and on which the metal is cast and means for delivering the molten metal to the interior of the liner. To enable the casting of objects of different lengths and different diameters in the same rotor, removable liners have been resorted to. They are constructed so that they all removably fit into the rotor and are carried and supported by it. Their lateral and longitudinal cross sectional areas vary according to the measurements and form of the object to be cast. The rotor and liner together, constitute a complete mold. To provide for rapid dissipation of the heat of the casting, the mold may be cooled in various ways. Among the more general arrangements are a bath of water in which the rotor travels, spraying of the outer surface of the rotor, water jacket on the rotor, water circulation between the rotor and liner. The last mentioned is in a broad sense in the same general category as the present invention and is well illustrated by the patent to Mills-paugh 1,235,994 Aug. 7, 1917.

In molds of this general type it has been difficult to provide a simple and efficient water cooling construction, or to provide a mold in which there is a simple economical construction by which both the length and cross sectional area of the casting may be varied within wide ranges while using the same rotor. The main objects of the present invention are to overcome these and other deficiencies.

In order to more clearly disclose the construction, operation and use of the invention reference should be had to the accompanying illustrative drawings forming part of the present application. Throughout the several figures of the drawings like reference characters designate the same parts in the different views.

In the drawings:

Fig. 1 is a central, vertical, longitudinal cross section through the invention, the rotor support being omitted;

Fig. 2 is a lateral cross section on line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 is a cross section on line 3—3 of Fig. 1, through the head block only, looking in the direction of the arrows;

Fig. 4 is a like view, on line 4—4 of Fig. 1, looking toward the right; and

Fig. 5 is a fragmentary view, showing one of the pipe holding clips in plan view, as applied.

The mounting and support of the rotor may be of any usual and well known construction and arrangement and is well understood by those having a fair knowledge of the art. Illustration or description of it would add nothing to an understanding of the invention. Accordingly it has been omitted from the present application.

Referring to the drawings in detail, 1 indicates the rotor or element adapted to be revolved at a suitable speed to effect centrifugal casting of molten metal which may be suitably delivered within the same. As shown, it is a metal member of such proportions and strength as to amply withstand all strains and stresses to which it may be subjected. Preferably, this rotor is provided with an outwardly directed radially extending annular attaching flange about the end through which the charge is fed by a spout or a dumper, as the case may be, to the interior. The opposite end may be closed by a suitable plate 2 provided for a purpose to be later disclosed. In the preferred form, shown, the plate 2 and rotor body 1 are made separate and then secured together by suitable bolts, headed screws, or the like. This is the more economical and practical method, though it will be obvious that the two may be made integrally.

Within this rotor is removably disposed a liner 3. In this instance it is shown as a metal liner for casting metal directly on metal. The general exterior contour of the liner body is substantially that of the interior contour of the rotor and its lateral cross section is appreciably less than the corresponding cross sectional bore of the rotor whereby the liner may be readily inserted within and with-

drawn from said bore. About the open end of the liner—the end through which the charge is received—an annular flange 4 is provided, directed outwardly and extending radially. Flange 4 corresponds to and is adapted to cooperate with the flange about the end of the rotor, as will later appear. It limits the inward movement of the liner, as will be clear on reference to Fig. 1. On reference to Fig. 2 it will be noticed that the liner is provided with a plurality of ribs 5 extending radially at intervals about its circumference. These ribs act as spacers between the body of the liner and the inner wall of the rotor, to prevent continuous contact throughout adjacent surfaces of the two elements, to provide cooling chambers (as will later appear), and to maintain the two elements in concentric relations. Necessarily they must be of such length as to allow for expansion due to the great heat of the casting, without binding, while, at the same time, avoiding such looseness as may result in harmful vibration between the parts during high speed rotation of the machine. This may be accurately calculated for the machines of various dimensions.

Preferably, these ribs extend from the flange 4 to the opposite outside end of the liner, so that, when assembled within the rotor, there will be a plurality of similar longitudinal chambers regularly disposed about the liner, between the liner and the rotor and the respective ribs; as shown in Figs. 1 and 2.

Completing the liner, as a unit, is a chambered head block 6 adapted to be bolted to the inner end of the liner. This head block extends completely across the bore of the rotor making the same kind of a fit throughout its contact with the inner wall of the rotor as do the ribs 5 and, when clamped in position, it makes similar contact with the inner ends of ribs 5. Assuming the head to be clamped in position and the liner to be inserted so that flange 4 engages the corresponding flange on the end of rotor 1, each of the plurality of cooling chambers will be defined by flange 4, head 6, a pair of ribs 5 and the rotor and liner walls.

To supply a cooling fluid, preferably water, to these chambers, each is provided with a pipe 7. Pipes 7 extend longitudinally through the chambers to a point a little distance from flange 4. The opposite end of each is passed in spaced relation, through an enlarged opening or bore 8 in the nearest wall of the head 6, through an outlet chamber 9 in the head 6 and threaded into a bore 10 in the partition 11 which acts to divide the head 6 into the outlet chamber 9 and inlet chamber 12. Thus, water or other fluid cooling medium may flow freely from chamber 12, through the pipes 7, into the chambers between the ribs 5, back along the pipes 7, out through the bores 8 and into the outlet

chamber 9. Of course a suitable water-tight packing is provided between the head 6 and the adjacent end of the liner. Likewise the end of the liner body may have a central opening into which a corresponding raised portion of the head may be snugly fitted by tightening of the clamping screws, if desired, as will be obvious. Such a construction has been shown. It is equally clear that such opening may be omitted and the liner formed with that end closed.

In these machines castings may range from a few inches in length to twenty-five feet or more and from four or five inches to forty-four inches or more in diameter. For the greater lengths the metal is fed through what is well known in the art as a dumping trough. It is simply a long tubular member secured at one end to a hopper or tank from which it receives the molten metal. This trough extends horizontally from the tank and lengthwise into the mold, and is provided with a longitudinal slot or series of slots or openings for the delivery of the molten metal, by a partial rotation of the trough, through suitable well known mechanism. The leverage of the free end, especially when loaded with metal, exerts a great strain on the connections at the opposite end. To relieve this, the free end of the trough or a suitable extension on it rests upon the longitudinal wall of the opening through the inner end of the liner, adjacent the raised centering portion of the head 6. Or, alternatively, such raised portion may be thickened and provided with a recess or socket for the same purpose. Or, if that end of the liner is continuous—without the central opening—it may be similarly recessed or socketed, for the same purpose.

In order to supply water to the chamber 12 and thence through pipes 7 to the cooling chambers between the ribs 5, an inlet pipe 13 is provided, connected with a suitable source of supply. Preferably it is threaded into a boss surrounding a central opening in the outer wall of chamber 12. To provide an outlet from chamber 9, a second pipe 14 similarly communicates therewith. It is spaced from and concentric with pipe 13 and suitably connected to any desired discharge or outlet. The larger or feed pipe 13 is extended through the central opening of plate 2, the clearance between the pipe and adjacent wall of such opening being ample to permit free movement of the pipe relatively to such plate. The respective projecting ends of the pipes 13 and 14 are suitably revolvably supported to have free rotation with the rotor and relatively to their respective supports. As shown, such support may comprise a block with inlet and outlet passages communicating with the respective pipes and bearings for revolvable mounting of the respective pipe ends. Pipes 7 connected only at one end, lying between the ribs 5, as in Fig. 2, due to

the rotation and centrifugal action, would soon be torn loose from their connections unless further secured. To this end, clips 15 are provided. As many as may be desired for each pipe are disposed about the respective pipes and then drawn snugly home by suitable bolts, so that the pipes, in effect, become part and parcel of the liner and all "whipping" tendency is avoided. Other means of course, may be provided.

It will be noticed that the liner illustrated is considerably shorter than its rotor. With this construction and disposition, a liner either longer or shorter than that shown, may be used, or one of either greater or less interior cross sectional area. This makes possible a very wide range of castings from the same rotor—both as to length and as to diameter.

When the liner has been slid into the rotor until the flange 4 engages the corresponding flange of the rotor it will be secured in such position by the detachable face plate 16 which extends across the open end of the liner and has a central opening for insertion and withdrawal of a suitable pouring spout or dumping trough. It forms a front wall against which the corresponding end of the casting solidifies. It is clamped in position by bolt and nut or other suitable means, the bolts extending from the flange of the rotor, through notches in flange 4 and through and beyond the face plate so that by tightening the cooperating nuts the liner will be forced strongly to its innermost position and solidly clamped there, as will be evident.

While continuous ribs 5 have been shown, it will be understood that the ribs need not be continuous, nor need they be truly parallel to the longitudinal axis of the liner. Or they may be continuous but provided with grooves, notches, or bores whereby the successive chambers will be in communication instead of separate. Of course, the same will be true where the ribs are not continuous or where they do not extend the full length of the liner. The preferred construction, however, is that shown.

It is also to be understood, of course, that the flange 4 and cooperating flange on the rotor need neither be continuous. Either or both may be, instead, a plurality of short flanges, ears, or the like. The continuous flange is simple, easy, strong and economical and is preferred. Of course, where there is communication between successive cooling chambers, as by passages through the ribs 5, the number of pipes 7 may be decreased. In some sizes, by such arrangement, a single pipe will doubtless be sufficient. Necessarily the angle and disposition of openings through 5 will have great influence on the direction and force of circulation of the cooling medium.

While the pipes 7 have been shown as im-

perforate and delivering only through their free ends, it is to be understood that they may be perforate or slotted and deliver from points intermediate of their ends as well as from their free ends or instead of from such free ends.

Or, the pipes may be of varying lengths some delivering near the end adjacent flange 4, as in Fig. 1, others near the opposite end, and others at intermediate points. By the various constructions and dispositions above set forth, the cooling fluid is caused to mix and circulate in cross currents so that a more uniform temperature may be maintained throughout the length of the mold and there will be less tendency to have the mold and casting cooled considerably more in one area than in another. The outflowing hot water will be met and mixed with the incoming cold water and the whole will be thoroughly mixed, as will be well understood. Likewise, where the ribs are inclined, they will set up additional currents to increase the mixing effect. It is thought that these several details and their effect will be clear from the preceding detailed description and that further illustration would add nothing to a clearer understanding, while at the same time simply further increasing the size of the record.

With the parts assembled as in Fig. 1, the operation is as follows: The rotor is driven at the desired speed, water under pressure enters between pipes 13 and 14 and passes into inlet chamber 12 where the force of its initial pressure is increased by the added centrifugal force so that it is forced through pipe 7 and out into the cooling chamber where, through contact with the liner wall it abstracts the heat from the liner and the casting and passes in the opposite direction along the chambers to and through the openings 8 into chamber 9, through outlet pipe 14 and to the discharge, carrying with it the heat abstracted from the casting and cooling the casting.

It is thought that the construction, operation and use of the invention will be clear from the preceding detailed description, wherein a single construction has been disclosed in a purely illustrative manner and without intention to in any way limit the scope of the invention by such illustrations.

Many changes may be made in the construction, arrangement and disposition of the several parts of the invention without in any degree departing from the field thereof and it is meant to include all such within the scope of the appended claims forming part of this application, the specific construction disclosed being understood and intended as merely illustrative of one of a very large number of widely varying constructions all equally embodying the invention.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:—

1. A mold for centrifugal casting machines

- comprising, a rotor, a liner mounted in spaced relation therein, means within said space for circulating a cooling fluid between said rotor and liner, means for delivering the cooling fluid from the space between said rotor and liner and means extending longitudinally within said space at intervals circumferentially about said liner for delivering a cooling fluid to said space.
2. A mold for centrifugal casting machines comprising, a rotor, a liner mounted in spaced relation therein, a chambered head carried by said liner, means for delivering a cooling fluid from said head through the space between the liner and rotor, outlet connections between said head and the space between said rotor and said liner, and connections for delivering of cooling fluid to and from said head.
3. A mold for centrifugal casting machines comprising, a rotor, a liner mounted in spaced relation therein, a chambered head carried by said liner, a conduit carried by said head and establishing communication between said rotor and liner and a chamber in said head, outlet connections between said head and the space between said rotor and liner, and means for delivery of cooling fluid to and from said head.
4. A mold for centrifugal casting machines comprising, a rotor, a liner mounted in spaced relation therein, a chambered head carried by said liner, a conduit carried by said head and extending through one chamber thereof and establishing communication between another chamber thereof and the space between said rotor and said liner, outlet connections between a chamber of said head and the space between said rotor and said liner, and connections for delivery of cooling fluid to and from said head.
5. A mold for centrifugal casting machines comprising a rotor, a liner mounted in spaced relation therein, means for circulating a cooling fluid between said rotor and liner, means for delivering the cooling fluid to and from the space between said rotor and liner, and a head carried by said liner and carrying said fluid delivering means and provided with a socket to receive and support the end of a dumping trough.
6. A mold for centrifugal casting machines comprising, a rotor, a liner mounted in spaced relation therein, means for circulating a cooling fluid between said rotor and liner, means concentric with the longitudinal axis of the rotor for delivering the cooling fluid to and from the space between said rotor and liner, and a head separate from and carried by said liner and provided with means for supporting the free end of a dumping trough.
7. A mold for centrifugal casting machines comprising, a rotor, a liner mounted in spaced relation therein and provided with a flange adapted to limit the inward movement of said liner relatively to said rotor and to close, at that end, the space between said rotor and liner, a head carried by the opposite end of said liner, means for delivering a cooling fluid to and through said head and into said space, and means for delivering a cooling fluid from said space to and through said head and to a discharge.
8. A mold for centrifugal casting machines comprising, a rotor, a liner mounted in spaced relation therein, a chambered head carried by said liner, a conduit carried by said liner and establishing communication between said head and the space between said rotor and liner, means for securing said conduit to said liner to prevent relative movement therebetween, and means for delivering a cooling fluid to and from said head.
9. A mold for centrifugal casting machines comprising a rotor, a liner mounted in spaced relation therein, a plurality of conduits within said space for circulating a cooling fluid between said rotor and liner and terminating at different points longitudinally of said space, and means for delivering the cooling fluid to and from the space between said rotor and liner.
10. A mold for centrifugal casting machines comprising, a rotor, a liner mounted in spaced relation therein, a plurality of conduits within said space and terminating at different points circumferentially of said space, and means for delivering the cooling fluid to and from the space between said rotor and liner.
11. A mold for centrifugal casting machines comprising, a rotor, a liner mounted in spaced relation therein, a plurality of conduits within said space and delivering said fluid at different points longitudinally and circumferentially of said space, and means for delivering the cooling fluid to and from the space between said rotor and liner.
12. A mold for centrifugal casting machines comprising, a rotor, a liner mounted in spaced relation therein, a plurality of conduits within said space and delivering said fluid at different points within said space, spacing members between said rotor and liner provided with passages adapted to permit circumferential flow of said fluid through said space and among said conduits, and means for delivering the cooling fluid to and from the space between said rotor and liner.

Signed at Sandusky, Ohio, 1928.

HILAND R. FARNSWORTH.