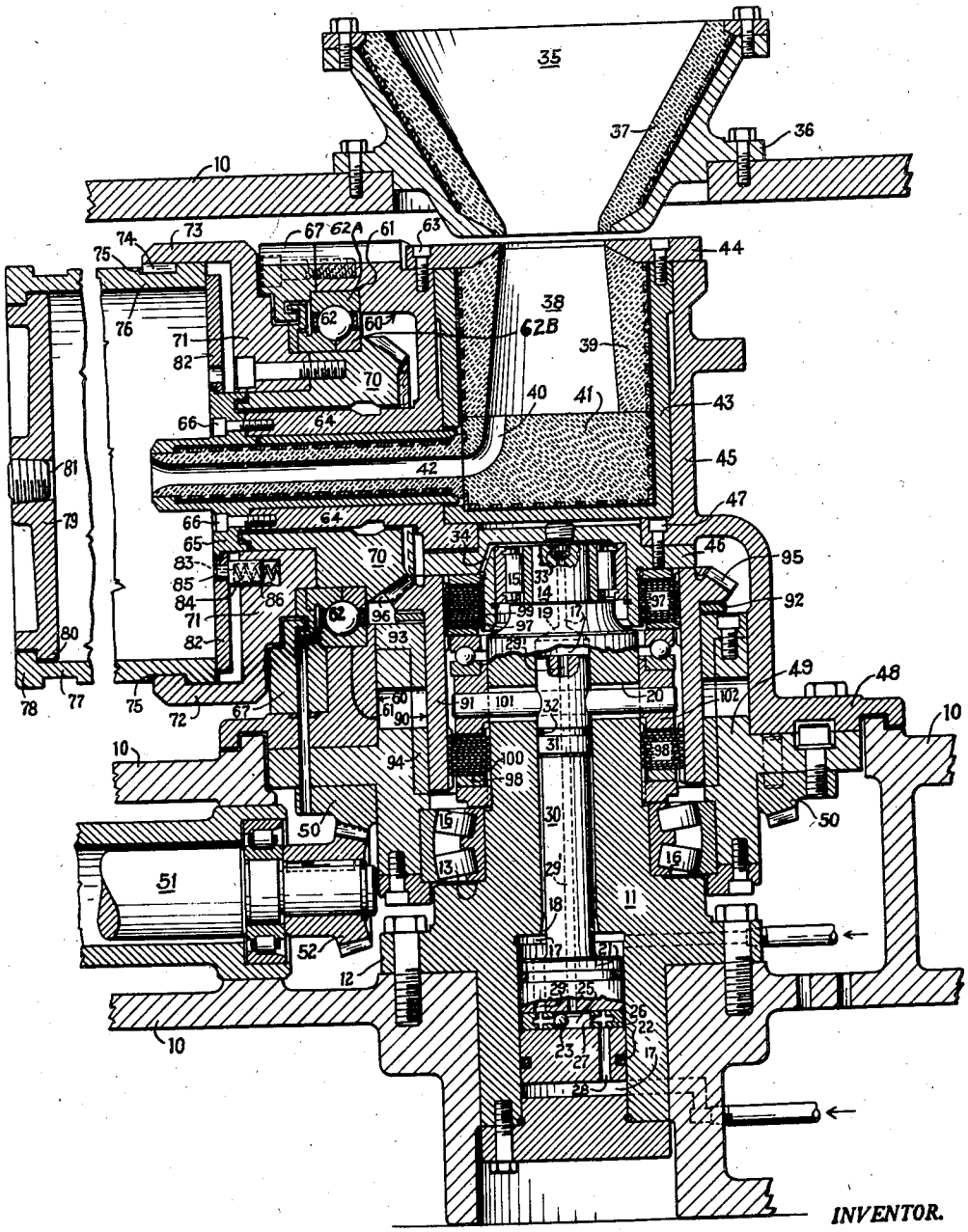
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CENTRIFUGAL CASTING APPARATUS

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CENTRIFUGAL CASTING APPARATUS

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2 Claims. (Cl. 22—65)

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This invention relates to a casting machine. It will be described in particular relation to a machine for casting iron, aluminum, or other metals, but it is to be understood that this particular description is illustrative and does not constitute a limitation of the invention.

It is an object of this invention to produce castings that are dense, uniform, free of imperfections such as voids, and substantially free of gas or air inclosures.

Another object of the invention is to produce a casting under the influence of centrifugal force about a plurality of axes.

Another object of the invention is to construct a casting machine adapted to subject the casting mold to centrifugal force about one axis and selectively to centrifugal force about a plurality of angularly arranged axes.

Another object is to provide a centrifugal casting machine with novel and readily removable molds

Another object of the invention is to construct casting apparatus well adapted to withstand the forces generated by the rotation of one or a plurality of molds about one or a plurality of axes.

A particular object of the invention is to construct casting apparatus having a rotating ladle and pouring gate in which no metal will remain after pouring.

Another object is to provide a novel lubricating system for such machinery.

The above and further objects and novel features of the present invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawing. It is to be expressly understood, however, that the drawing is for purposes of illustration only and is not intended as a definition of the limits of the invention, reference for this latter purpose being had primarily to the appended claims.

The drawing is a vertical sectional view through machinery of the type described embodying the foregoing and other principles of the invention, as an illustrative embodiment.

Referring to the numerals of the drawing, a frame 10, which may conveniently be a massive casting of suitable shape, or a series of interfitting and mutually supported castings, supports upon its base a standard 11. This standard has a flange 12 which is bolted to the frame 10 and is provided with a bearing seat 13 and an annular stud 14 that serves at its top to mount the bearing 15. A bearing 16 is mounted upon the seat 13. The standard has a bore 17 that extends through-

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out its height and is reduced in size once at 18 and again at 19. A cross bore 20, shown in this instance to be near the top of the standard, is also provided.

Within the largest part of the bore is a piston 21 provided with appropriate sealing rings 22 and a two-way check valve of ball type 23. This check valve is of novel construction and is designed to assure the supply of oil under pressure through the piston to parts needing lubrication. A hole 25 is drilled through the piston and the ends are sealed by plugs 26 which have passage ways 27. These passage ways are aligned with drillings 28, 29 in the piston, one of which opens into the cylinder at one end of the piston and the other of which opens into the cylinder at the other end thereof. The piston is moved by oil from a source of pressure, the oil under pressure being admitted selectively, through the action of an appropriate valve, to the top or the bottom of the piston. When the oil under pressure is admitted to the bottom of the piston, it passes through the drilling 28 and the passage in one plug 26 to the chamber 25 where it forces the ball 23 into sealing engagement with the other plug, opening a line 29' which is provided, preferably by drilling, in the piston 21, and which extends through the piston rod 30 to the space in the bore 17 above the end of the rod.

The rod 30 is reduced for a part of its length in order to minimize friction, but is appropriately sealed against the escape of fluid by a machined section 31 and a ring 32. The bore 17 receives the oil under pressure from the line within the rod and transmits it through an appropriate opening, or through a pressure valve 33 that may be seated in the upper end of the bore. The oil thus delivered goes to the bearings 15 and through a passage way 34 to a clutch chamber and bearings.

When the oil is delivered under pressure to the upper end of the piston, the ball 23 is rolled to the other end of its chamber so that oil from the drilling 29 finds its way to the points of lubrication. The normal operation of the apparatus therefore accomplishes the oiling of the parts.

Mounted upon the frame above the standard is a funnel 35 that is bolted through an appropriate flange 36 to the frame and which is interiorly lined with a fire resistant refractory material 37.

Beneath the funnel 35, rotatably and axially mounted above the standard, is a ladle and pouring gate 38—42, of which, for convenience of description, the part 38 will be called the ladle and

the part 42 the gate. This ladle embodies a number of novel conceptions which contribute to the combination as a whole, and including some that may also be employed alone. Being mounted axially of the standard, its rotation is concentric with the axis thereof. The refractory wall 39 of the ladle is conical with the smaller end at the top. The angle of the cone is such that at the rotational speeds employed the centrifugal force is directed outwardly through the opening 40 in the refractory base 41 and into the gate 42 which projects in the direction of the centrifugal force to which the molten material is subjected during the rotation of the standard around the axis of the standard. By means of this construction the molten material, or casting material, poured through the funnel is received in the ladle and directed by centrifugal force as well as by gravity through the gate 42. In preferred practice the rotation is started and the machine is brought up to speed before the casting material is admitted to the ladle.

The ladle comprises a metal pot or cup 43 upon which is bolted a ring 44 that serves to hold the lining 39 in place, to clamp the pot firmly to the rotatable member 45, which is supported upon a flange-bearing cap 46 which is in turn supported by appropriate roller bearings 15, and by removal to permit an easy assemblage and dismantling of the parts of the ladle and gate. Appropriate bolts 47 connect the member 45 to the bearing cap 46. Bolted or otherwise fixedly secured to a flange 48 on the member 45 is an annulus 49 that serves as a seat for bearing 16 and as a support for the ring gear 50 by means of which the annulus is rotated. A drive shaft 51 and a pinion gear 52, which is in mesh with ring gear 50, serve to rotate the several parts 49, 48, 46, 45 and 43, and other parts attached thereto, which together constitute the rotating head of the machine. It is by this means that the ladle is rotated about the axis of the standard. In ordinary practice this mounting will be vertical, thus providing rotation about a vertical axis. Rotation of the mold about a horizontal axis is provided by other means operable in combination with the means have just been described.

In the drawing, only one gate and mold support are shown, but in preferred practice a plurality thereof will be provided, mounted in identical supports radially with respect to the ladle, and symmetrically with respect to each other, at angles which provide dynamic balance. Thus, two molds, three molds, or four molds, placed respectively at 180, 120, or 90 degrees from each other, may be provided, each of which will be supplied from the ladle through an appropriate gate similar to gate 42. These mold supports comprise a member 60 having an outer annulus 61 that serves as a seat for the ball bearing 62 and for attachment by means of bolts 63 to the annulus 44, and having an inner tubular support 64 within which is mounted the gate 42, being attached thereto by a flange 65 and bolts 66. The annulus 67 is bolted to the outer face of the member 60 and serves to hold the bearing 62 in position.

The ballbearing 62 having an outer bearing ring 62A mounted in the annulus 61 and having an inner bearing ring 62B upon which the mold support 70 is mounted, thus the whole weight of the mold-support together with the mold being supported by the bearing system 62A—62—62B.

By means of the structure which has just been described, the rotation, from any suitable source of power, of shaft 51 will rotate the ring gear 50 through the pinion 52 and with the ring gear the members 49, 48, 60, 44, and 43 about the axis of the standard. The rotation wil be centrifugal and the filling of the several molds will be facilitated. A gravitational effect is observed in such circumstances so that the molten metal first admitted to the mold will tend to fill first the bottom portion of the mold.

Mold support 70 is telescoped about the tubular portion 64 of the member 60. An annulus 71 is bolted to the member 70 and is provided with projecting arms 72, 73 with retainers 74 adapted to fit in bayonet slots 75 in the periphery of a mold 76. The mold is thus demountable and may be easily attached to or removed from the machine. The members 70 and 71 constitute a mold support which is carried by the ball bearing 62 which is in turn supported by the head or member 60. The mold and its support are rotatably mounted upon the head about a horizontal axis through the gate 42. It is desired that on some occasions the mold be not rotated about this axis and novel means are provided whereby the rotation about the horizontal axis is made selective. Before proceeding to the description of that novel mechanism, the novel mold itself will be described more fully.

The word mold, as employed herein, includes the mold casing 77, which is shown, and the mold itself, which is omitted from the drawing. Mold forms may be of infinitely various shapes and constructions, none of which need be particularly represented. The mold, in its preferred form, comprises a casing 77 having at one end an internal annular flange 78 upon which rests a base 79 having a cooperating flange 80 and at the center thereof a screw threaded opening adapted to receive a suitable plug 81. The mold may be removed from its support and placed upon its base 79, where it is prepared in the usual manner by the use of patterns and sand or any other methods known to the art of casting. The top 82 of the mold is preferably mounted, permanently or removably, upon the annulus 65 of the outer shell of the gate 42. When the prepared mold is mounted by means of the bayonet slots 75 upon the arms 72, 73, the mold is completed and is ready for the receipt of its charge. Preferably, the gate 42 projects through the cover 82 and into the interior of the mold. The cover is held resiliently in closed position against the rim of the annulus 77 by springs 83 which are mounted in a sleeve 84 from which a stud 85 projects and is carried by the cover 82. The sleeve 84 is received within a hole 86 in the member 71 and thus compels the cover 82 to rotate with the support. When the mold is put in position, it is done so against the power of the springs which thereafter not only seal the mold, but tend to keep the bayonet joint in locked position.

A clutch 90 is comprised of a sleeve 91 concentric with the standard 11 and rotatably mounted thereabout by means of bearings 92, 93, 94. The sleeve is provided with a gear 95 which is in mesh with the gear 96 on support 70. Mounted on the inside of the clutch member 90 are two sets of clutch plates 97 and 98, one set of which is well separated from the other set. A set of clutch plates 99 are mounted on the cap 46 in a position to be engaged with the clutch plates 97.

A set of clutch plates 100 are mounted on the standard 11 in position to be engaged by clutch plates 98. A cross arm 101 is carried at the upper end of rod 30 and projects through the cross bore 20 in the standard. The cross bore and cross arm are of such relative size that the cross arm can move within the bore sufficiently to force one or the other of the sets of clutches into engagement. When oil under pressure is admitted beneath the piston 21, the clutches 97, 99 are forced into engagement and the annular clutch support 91 is compelled to rotate with the head so that no relative motion occurs between the gear 95 and gear 96. Under these circumstances, there is rotation about the vertical axis only. When, by appropriate valve action, the oil under pressure is admitted to the top of the piston, the piston is depressed and the cross arm 101 acting through annular member 102 engages the clutch plates 98, 100, releases the clutch plates 97, 99 and fixes the sleeve 91 and the gear 95 with respect to the standard, and the gear. Under these circumstances the support 70 is compelled to rotate upon the gear 95 and the mold is given rotation about the vertical axis of the standard and rotation about the horizontal axis of the gate. When the cross arm is in mid position, neither clutch group is engaged.

Another advantage of the invention is in the simple construction of parts, few of which require refinement to close tolerances.

Another advantage of the invention is in the mounting of a ladle rotatably between a funnel and a support, which for convenience may be called a standard regardless of its shape, and in the detachable mounting of a mold about a gate projecting from the ladle. This mounting of the ladle rotatably between the support and the funnel or other charging means is a great improvement over prior art constructions.

Still another advantage of the invention lies in the novel construction of the removable mold casing whereby the mold and a completed casting therein can be readily pushed out of the casing by sliding end plate or base 79 through the cylindrical casing part 77 after the latter has been detached from the machine. By providing shims in the form of rings between flanges 78 and 80, or in the form of plates between member 79 or 82 and the mold, the mold casing may be adapted for receiving molds of different sizes while at the same time insuring proper compression of the mold and preventing movement thereof within the casing during the casting operation.

Although only a single embodiment of the present invention has herein been illustrated and described, it is to be expressly understood that the invention is not limited thereto. Various changes may be made, particularly in the design and arrangement of the parts and in the materials used, without departing from the spirit and scope of the invention, as will now be apparent to those skilled in the art. For a definition of the limits of the invention, reference is had primarily to the appended claims.

What is claimed is:

1. A known centrifugal casting machine having a non-rotating machine support, a vertical shaft, a machine frame rotatably mounted on said shaft, means to rotate said machine frame about said vertical shaft, a central main-pouring gate mounted on said machine frame coaxially with said shaft and provided at its top with an entrance opening and at its bottom part with a distributing plate, a mold casing mounted rotatably about and coaxially with an axis of rotation provided therefore at an angle to a vertical line, at least one exit channel per each said mold casing being provided in said bottom part between said central main pouring gate and said mold casing, in combination with a mold casing supporting collar like bearing cup mounted on the top of that surface of said mold-casing which is closest to said vertical shaft rigidly in respect to said frame and coaxially with said axis of rotation, a bearing means mounted on one of its bearing rings on said bearing cup by means of a bearing-cup-holding-member, a mold casing support mounted on another bearing ring of said bearing means, an interlocking means provided on said mold casing support to interlock and to unlock said mold casing with said mold casing support, a first gear mounted rigidly on said mold casing supporting collar like cup coaxially with said axis of rotation, a second gear mounted on said machine support coaxially with said shaft, said second gear being in mesh with said first gear, thereby when said machine frame is rotated about said vertical shaft, said mold casing is rotated about said shaft.

2. A known centrifugal casting machine having a non-rotating machine support, a vertical shaft, a machine frame rotatably mounted on said shaft, means to rotate said machine frame about said vertical shaft, a central main-pouring gate mounted on said machine frame coaxially with said shaft and provided at its top with an entrance opening and at its bottom part with a distributing plate, a mold casing mounted rotatably about and coaxially with an axis of rotation provided therefore at an angle to a vertical line, at least one exit channel per each said mold casing being provided in said bottom part between said central main pouring gate and said mold casing, in combination with a mold casing supporting collar like bearing cup mounted rigidly in respect to said frame and coaxially with said axis of rotation, a bearing means mounted on one of its bearing rings on said bearing cup by means of a bearing-cup-holding-member, a mold casing support mounted on another bearing ring of said bearing means, an interlocking means provided on said mold casing support to interlock and to unlock said mold casing with said mold casing support, a first gear mounted rigidly on said mold casing support coaxially with said axis of rotation, a second gear mounted on said machine support coaxially with said shaft, said second gear being in mesh with said first gear, gear interlocking clutch means to rigidly interlock and to unlock said second gear in respect to said machine support, said vertical shaft being a hollow shaft having an internal cylinder bore coaxial with the axis of said shaft and having a reciprocable piston mounted therein, a hydraulic pump system interconnected with said bore, said piston being operatively interconnected with a plurality of clutch disks to engage and to disengage said clutch means by actuating and stopping to actuate said hydraulic pump, thereby moving to and fro said piston in said bore.

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