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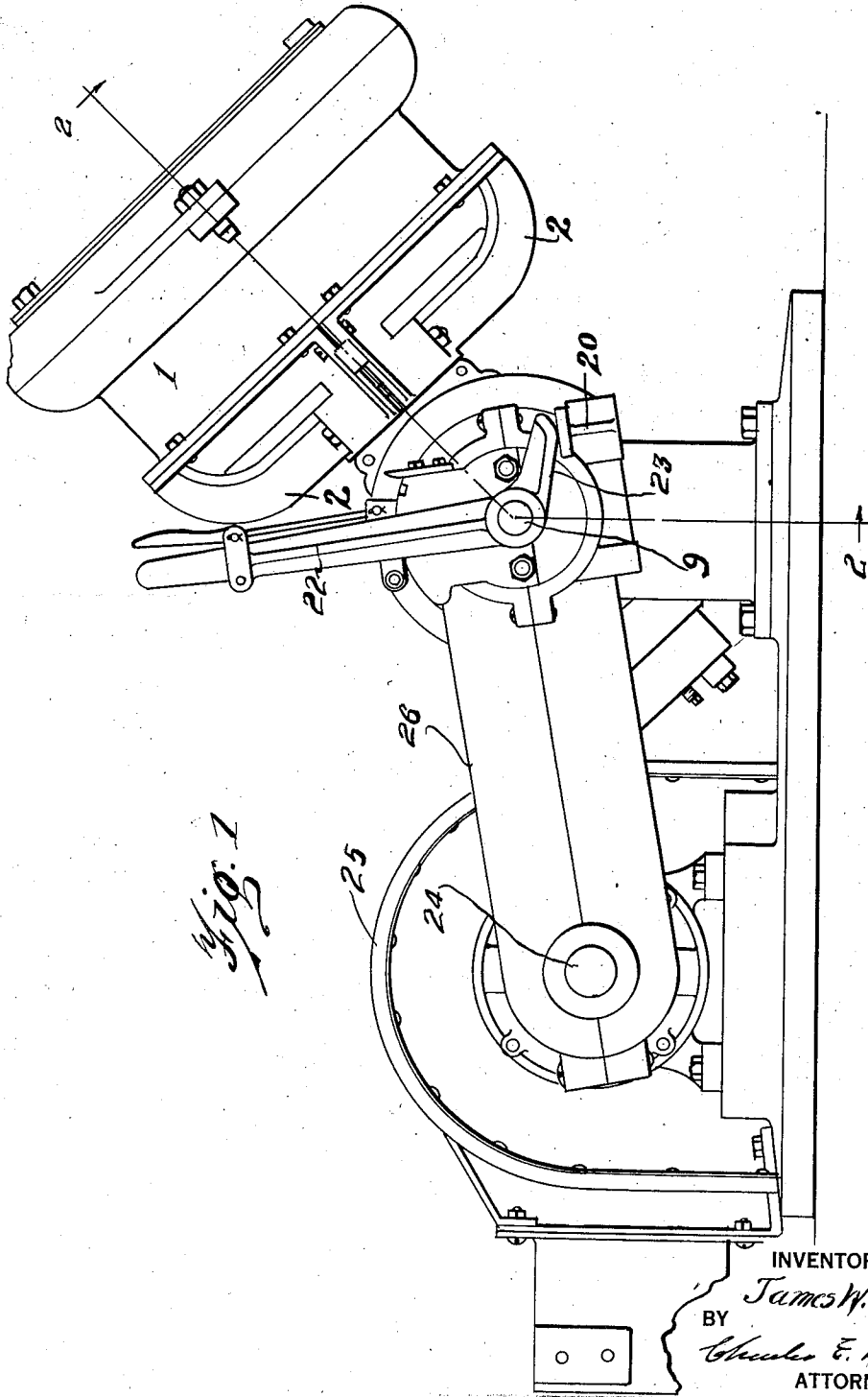
J. W. COBURN

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CENTRIFUGAL CASTING MACHINE

Filed Jan. 30, 1920

3 Sheets-Sheet 1



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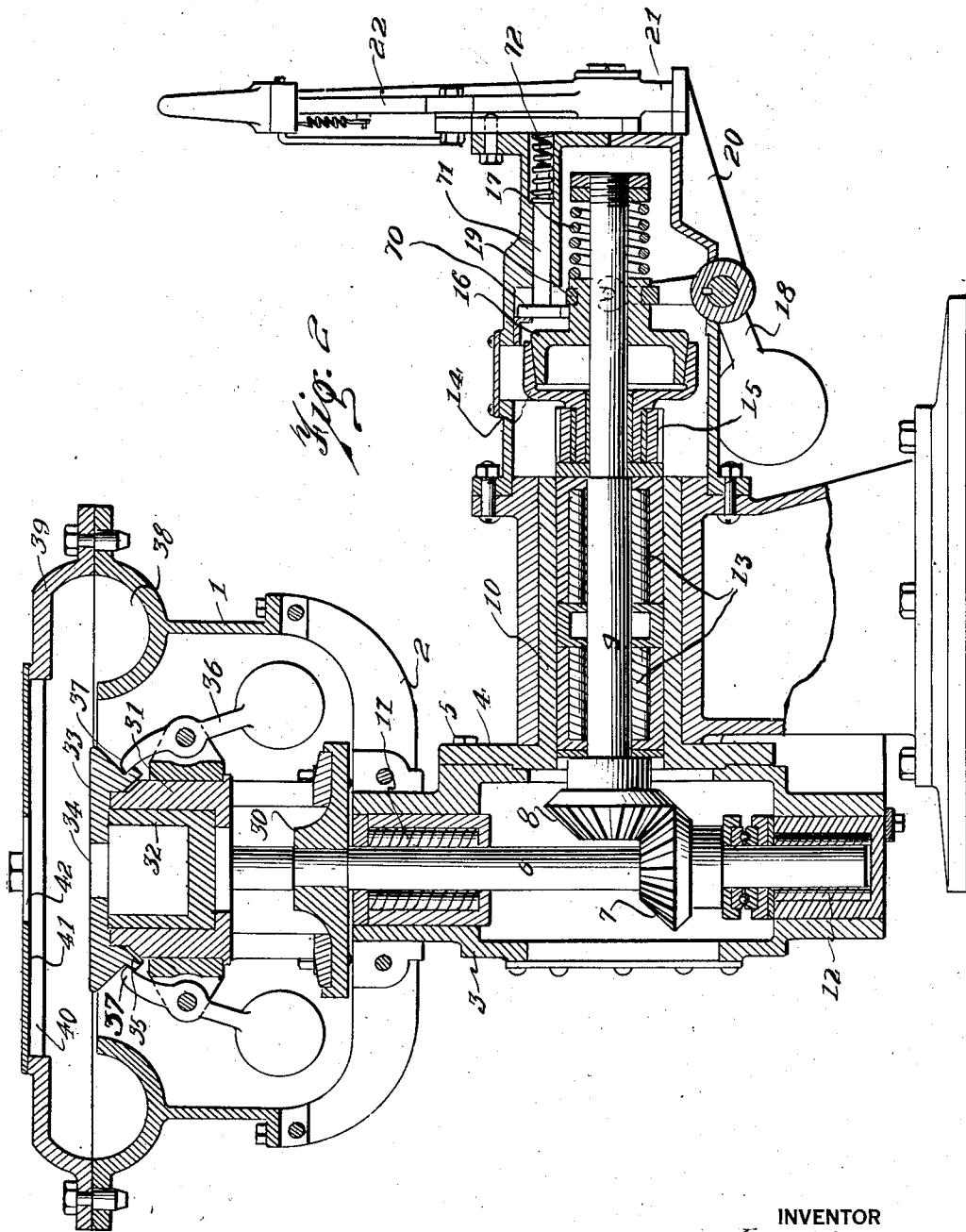
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CENTRIFUGAL CASTING MACHINE

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3 Sheets-Sheet 2



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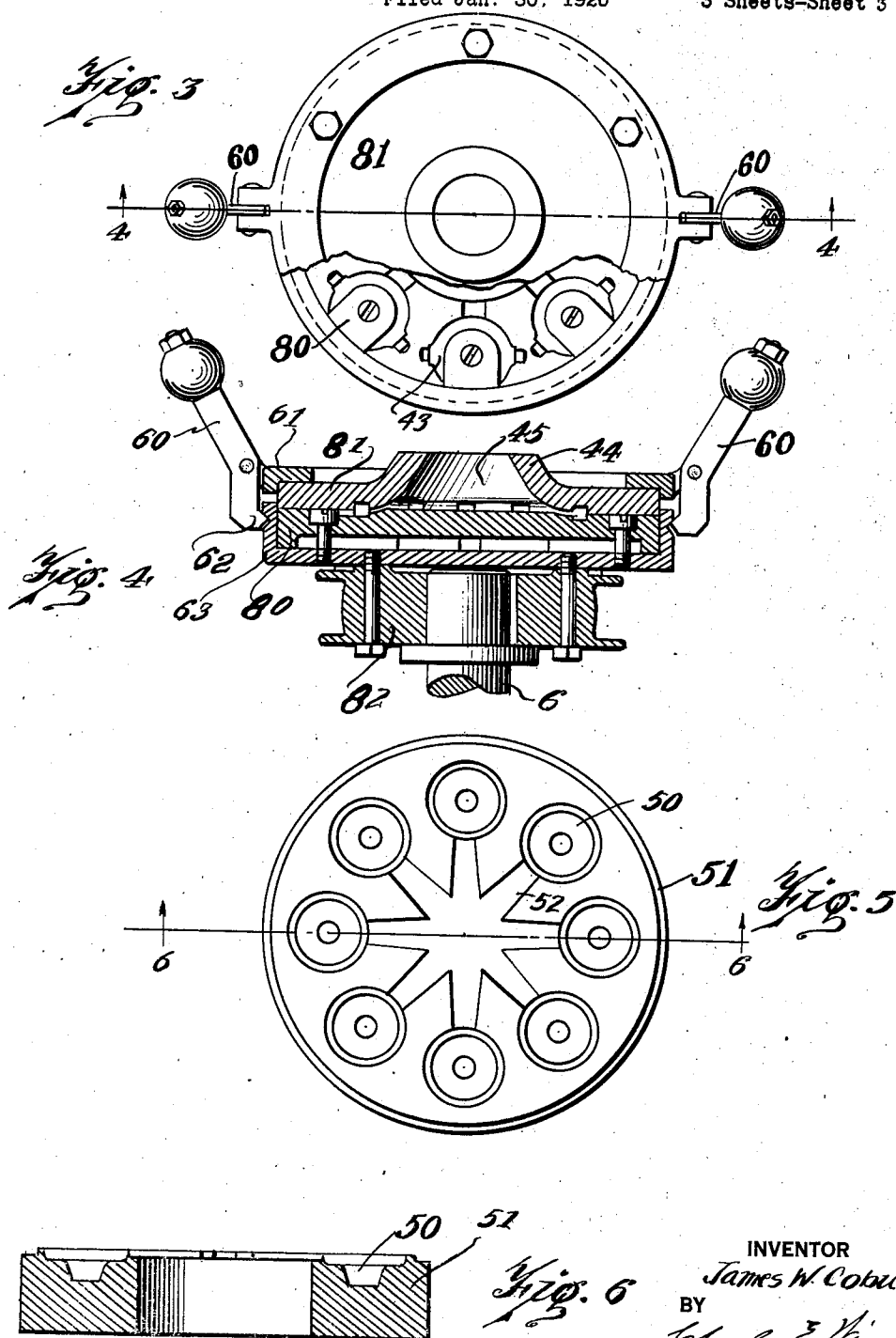
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CENTRIFUGAL CASTING MACHINE

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL CASTING MACHINE.

Application filed January 30, 1920. Serial No. 355,287.

To all whom it may concern:

Be it known that I, JAMES W. COBURN, a citizen of the United States, residing at Highland Park, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Centrifugal Casting Machines, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to centrifugal casting machines, and its object is to provide an apparatus and method for casting metal articles in a metal mold by centrifugal action, the form of the article being accurately determined by the mold. A further object is to provide an apparatus and method of casting metal articles by centrifugal force in a rotatable mold member into which molten metal in excess of that required to form the article may be delivered and the excess metal discharged from the mold box, an article of the desired size and thickness of wall being accurately determined by the character of the mold. An additional object of the invention is to provide a centrifugal casting machine having a rotatable mold box provided with a plurality of peripheral mold cavities positioned about the exterior of the box and open to the hollow interior within which the molten metal is to be deposited. Thus, also, the object of the invention is to provide a process and mechanism whereby a quantity of molten metal may be deposited in the box and made to flow by force imparted to the mass into the mold cavity or plurality of cavities through a channel open to atmosphere. Other novel features of the invention reside in the mechanism employed for the casting of cylindrical articles of specified width of the wall and in the construction of the mold itself having a plurality of cavities open to the common hollow interior and in the mechanism for controlling the mold operations all as is hereinafter more specifically described and claimed. An embodiment of my invention is shown in the accompanying drawings in which—

Fig. 1 is a side elevation of a centrifugal

casting machine constructed according to my invention.

Fig. 2 is a section taken on line 2—2 of Fig. 1 showing one form of mold box.

Fig. 3 is a plan view showing a different type of mold box.

Fig. 4 is a section thereof taken on line 4—4 of Fig. 3.

Fig. 5 is a plan view of the portion of a mold box showing a different type of mold cavity.

Fig. 6 is a section taken on line 6—6 of Fig. 5.

The apparatus consists of a head or cage 1 containing the mold box which is adapted to be positioned at an angle to the vertical as will be understood from Fig. 1. This member 1 is mounted on arms 2 secured to a casing 3 which casing is fastened to a flange 4 and adapted to be positioned at various angles to the vertical by means of bolts 5 extending through the flange into the casing 3 fitting thereagainst. The casing 3 contains the vertical shaft 6 having a bevel gear 7 thereon which meshes with a bevel gear 8 on the horizontal shaft 9 carried within a casing 10 provided with the flange 4. The shaft 6 is provided with common type of roller bearings 11 and 12 at opposite ends and the shaft 9 is supported by similar bearings 13 within the casing 10. On the shaft 9 is one member 14 of a cone clutch and this member has a sprocket 15 thereon and further is loosely mounted on the shaft 9. The companion clutch member 16 is splined to the shaft 9 and a spring 17 is provided to force the clutch member 16 into engagement with its companion 14. A weighted rock lever 18 is provided having a forked arm engaging a ring 19 provided in the circumferential groove on the clutch member 16 and the rocking of the lever toward the left of Fig. 2 disengages the clutch members. This lever 18 also has an arm 20 extending to and beneath the shoe 21 on the pivoted control lever 22. This shoe 23 as may be understood from Fig. 1 may be made to depress the end 20 of the lever to disengage the clutches and, by release of the lever, the spring 17 and weighted end of the lever 18 act to bring the clutch members into engagement.

The gear 15 is to be understood as being

connected by what is known as a "silent chain" with a similar gear on the drive shaft 24 of the motor indicated at 25, the chain being enclosed within a casing 26 extending between the shafts 9 and 24. With the clutch members in engagement, as shown in Fig. 2, the motor rotates the shaft 6 which revolves the head 30 secured thereto and to this head is secured the box 31 containing the mold 32.

As is hereinafter more fully shown the mold member may be of various types. In the case shown in Fig. 2 the mold 32 is cylindrical in form closed at the lower end and open at the upper end fitting within the recess in the box 31. A cover member 33 is provided for this mold having a central aperture 34 less in diameter than the internal diameter of the mold 32 and the extent to which the cover member 34 projects over the open upper end of the mold 32 determines the thickness of the wall of the cast cylinder. In operation the molten metal is poured through the aperture 34 into the mold member during revolution of the mold or even prior to revolution thereof and the mold immediately whirled. Centrifugal action forces the metal to the periphery of the mold and due to the high speed of revolution (which is about 1500 revolutions per minute) the material in excess of that required to form the thickness of the wall flows out through the aperture 34. By this method of forcing the metal to the circumference of the mold the lighter material or slag which may be poured into the mold with the metal will be discharged through the aperture 34 in the cover and thus the cast metal will be of uniform density and character, the centrifugal force compacting the particles and producing an article more dense in character than with the usual method of casting in a sand mold. Furthermore, no voids are possible in this method of casting as the gases will be discharged through the central orifice and the article will be uniform texture throughout.

The cover 33 is loose on the box 31 which is formed to receive flanges 35 on the cover and the weighted levers 36 are pivotally mounted on the box 31 each having an end 37 engaging over the flange 35. These weighted levers, due to the centrifugal force securely hold the mold box in place during the casting operation but, upon cessation of rotation of the mold box, the weighted levers automatically release the cover and permit its ready removal. Hinged covers for this purpose have been found impracticable due to the great force applied thereagainst during the casting operation but, by use of the weighted levers, the greater the centrifugal force applied, the greater the pressure will these levers exert to hold the cover in position and yet by this construction a cover

that is freely and readily removable upon cessation of operation is secured. The head or cage 1 has an annular channel 38 provided thereabout on which is placed a cover 39 having a central aperture 40 and an additional cover 41 thereon which in turn has a central aperture 42 through which the metal may be introduced into the mold and all material that is discharged through the orifice 34 of the cover 33 for the mold is, by centrifugal force, thrown outward into the channel 38 and after a period of time the metal in this chamber may be removed by removing the cover member 39.

Various types of castings may be made in the mold above described as for instance bearings, piston ring pots and various other cylindrical objects and, while I am aware that cylindrical objects have been made by whirling a mold, the new features of this invention as regards the casting of a cylindrical object is found in the provision of centrifugally operated levers for holding the cover in position and in the provision of a cover projecting over the open end of the mold to determine the thickness of the cylinder to be cast and permitting the introduction of an excess amount of metal over that required to form the article for which the mold is designed. A new feature is here also involved in that provision is made to permit introduction of excess material and subsequent discharge of the excess and the provision of the receptacle for the discharged material. This in fact is productive of a new method in centrifugal casting operations in that by a construction permitting the introduction of an excess amount of material the dross is discharged and the cast article is of uniform density. In such centrifugal machines in which a measured amount of molten fluid is introduced as is required to form the article, the dross will be embedded in the inner surface of the cast article and in the subsequent machining operations defects will be found but by this method above described and introduction of an indeterminate quantity of the molten fluid in excess of that required enables the dross and slag to be discharged as such material is of lighter weight than the metal itself and, therefore, under the conditions stated in which the metal is driven to the periphery of the mold the resultant article is of uniform character both on the inner and outer surface.

So far as I am aware machines for casting articles by centrifugal force have heretofore been utilized in the casting of a cylindrical article somewhat after the manner heretofore described. I have in practice, however, found that, by the proper design and construction of the mold supported on the revolving head, articles of various shapes and of peculiar and nonuniform section may be cast as readily as cylindrical

articles and this is accomplished by use of a mold of the character shown in Fig. 4. This type of mold consists preferably of two parts 80 and 81. The member 80 is supported directly upon the revolving head 82 which may be directly connected to the shaft 6 as in the previous instance. This member 80 has provided circumferentially thereabout a series of depressions 43 as shown in plan in Fig. 3 and the member 81 of the mold has corresponding depressions therein as will be understood from Fig. 4 registering with these depressions 43. With the two mold members 80 and 81 secured together as shown in Fig. 4, a mold cavity of the desired shape and character is provided between these two members and at a distance from the center of the said members. The member 81 has a truncated hollow cone shaped portion 44 at the center providing an opening through which molten metal may be introduced into the hollow of the mold. These complementary mold cavities in the two members open to this central hollow cavity within the portion 44 and, upon introduction of metal into the cavity 45 and subsequent rotation of the mold, the metal is driven outward by centrifugal force into the mold cavities and in this case as in the former case the heavier metal is driven to the periphery and the dross and lighter weight material remain in the center. With this shape of throat or portion 44 which extends at an angle over the bottom of the mold, the flow of excess material from the mold is retarded insuring the filling of the cavities. The portion 44 may be made cylindrical in form in which case a more rapid discharge of excess material will result. With the curved type of cavity the cast articles will be found connected together by a thin center web from which they may be readily broken after the material has cooled. In the case described the mold cavities are shaped to provide the ends of forked arms but any other shape may be as readily provided as for instance as is shown in Fig. 6 where the cavities 50 are provided of a shape to form valve heads as will be understood from the cross section Fig. 6. In this case the mold cavity may be formed practically wholly within the mold member 51 and, if so made, this mold member should have channels 52 leading from the hollow center of the mold to each cavity or the cavities may be formed partially within both members of the mold as in the case shown in Fig. 4. In this latter case as in the other case the heavier material is impacted into the cavities and, due to the centrifugal force compacting the material therein all voids are eliminated as the gas escapes through the inlet to the cavities 43 to the center of the mold and passes out through the aperture provided in

the upper portion and, if any material is left in the mold, the lighter weight material will be in the web connecting the several cast articles.

In the type of mold shown in Fig. 4, the two parts are held together by the weighted levers 60 which are pivoted to a ring 61 engaging the periphery of the member 41 with the points 62 of the levers engaging in a groove in the support 63 for the said mold members which is attached to the shaft 6. The mold members as shown in Fig. 4, are held with the mold cavities in registration by means of the usual dowel pins in one of the elements fitting apertures in the other and the said levers 60 pivoted on the ring 61 prevent separation of the two parts of the mold by centrifugal force and yet when the mold has ceased rotation the removable mold is easily disengaged by first removing the ring 61.

As heretofore stated, the lever 22 is used to operate the clutch member 16 to withdraw the same from the clutch member 14, and to cause quick cessation of rotation of the mold a brake member 70 is provided which has a shaft 71 attached thereto against which the coiled spring 72 engages forcing the same to the left of the position shown in Fig. 2. Upon moving the clutch member 16 backward the face of the brake member 71 is engaged thereby causing a frictional resistance to rotation of the clutch member and thereby causing cessation of rotation of the mold.

As heretofore stated, the head 1 carrying the mold member and the shaft 6 for rotating the mold are positioned at an angle to the vertical as shown clearly in Fig. 1. The opening to the mold is therefore of ready access and the excess of molten metal is readily discharged by centrifugal action into the receiver provided therefor.

Having thus fully described my invention, what I claim and desire to secure by Letters Patent of the United States is—

1. In a centrifugal casting machine, a revoluble mold of hollow, cylindrical form having integral side and bottom walls and an open upper end, a removable cover therefor having a central opening of a diameter less than the distance across the mold, the rotation of the mold discharging excess material through the central opening, the thickness of the metal retained in the mold being determined by the distance to which the cover extends over the mouth of the mold.

2. In a centrifugal casting machine, a revoluble mold having an open end, a cover therefor having a central opening of a diameter less than the open end of the mold for retaining material in the mold, centrifugally operated means for holding the cover in position during the revolution thereof, and an annular channel member open through

the inner wall positioned about the cover in position to receive excess material discharged through the opening of the cover by centrifugal force.

3. In a centrifugal casting machine, a revoluble mold having an open end, the longitudinal axis of which is at an angle to the vertical, a cover therefor having a central opening of a diameter less than the diameter of the open end of the mold, pivotally supported, weighted, levers actuated by centrifugal force during revolution of the mold for retaining the cover thereon, and means for positioning the mold with the longitudinal axis thereof at various angles from a vertical to nearly a horizontal position.

4. In a centrifugal casting machine, a revoluble mold member, a shaft on which the mold is supported, a casing provided with a bearing for the shaft, a bevel gear on the shaft, a driving shaft, a bevel gear thereon meshing with the mold shaft gear, a frame or casing provided with bearings for the driving shaft, the mold shaft casing being attachable to the driving shaft frame and adapted to be adjusted in position thereon about an axis coinciding with the longitudinal axis of the driving shaft.

5. In a centrifugal casting machine, a revoluble mold member having an open end, the longitudinal axis of which is at an angle to the vertical, the mold cavity being substantially cylindrical in form, a cover for the said open end having a central opening of a diameter less than the diameter of the said end, the portion of the cover projecting over the mold determining the thickness of the wall of the cast body, and a receiver for material discharged through the central opening positioned circumferentially about the cover and into which excess material is discharged by centrifugal force.

6. In a centrifugal casting machine, a revoluble mold, a shaft for rotating the same, the axis of rotation of the shaft and mold being at an angle to the vertical, a driving shaft therefor, a clutch member loosely mounted on the shaft, means for rotating the said member, a clutch member splined to the shaft, and means for withdrawing the said splined member from engagement with its companion, and a brake device adapted to be engaged by the splined member upon its withdrawal to cause cessation of rotation of the mold.

7. In a centrifugal casting machine in combination, a rotatable shaft, driving means therefor, a housing for the shaft of a character to permit adjustment of the shaft at various angles relative to the vertical, a head on the said shaft, a mold member supported by the head consisting of two parts providing a hollow interior, a series of mold cavities complementary portions of which are formed in the meeting faces of the two

parts, said head being of a character to receive and support one of the said parts and having a lateral flange extending about the periphery of both the said parts in a manner to hold the same in axial alignment, a retaining member for the second part, pivotally mounted weighted levers attached to the retainer and having a portion adapted to engage the said flange of the head to clamp the mold parts together by centrifugal action.

8. In a centrifugal casting machine, an open, hollow, revoluble mold member having the longitudinal axis thereof at an angle to the vertical, the mold member being formed of two separable parts, there being a series of mold cavities complementary parts of which are formed in the meeting faces of the two parts and opening to the hollow interior, and centrifugally operated retaining means for holding the parts together during rotation of the mold.

9. In centrifugal casting machine, a revoluble mold having a hollow interior and being positioned with the axis of revolution at an angle to the vertical, a cover member therefor, centrifugally operated means for retaining the cover in position, the cover having a central aperture less in diameter than the open end of the mold, and a cylindrical receiver member about the periphery of the mold adapted to receive material discharged through the cover aperture.

10. In a centrifugal casting machine, a frame member, a driving shaft, said frame member having a housing for the driving shaft, open at one end through which the shaft projects and also having a lateral flange adjacent said open end, a gear on the said end of the driving shaft, a driven shaft, a gear thereon meshing with the driving shaft gear, a housing for the driven shaft, said housing having an opening through which the driving shaft extends and being provided with a part complementary to the flange of the driving shaft housing, means for fixedly attaching the driven shaft housing to the flange of the driving shaft housing, the arrangement permitting the positioning of the driven shaft at various angles relative to the vertical, and a revoluble mold member carried on the upper end of the driven shaft.

11. In a centrifugal casting machine, a revoluble mold member formed of two separable parts, the meeting faces thereof having a series of mold cavities formed therein, the plane of the meeting faces being substantially at a right angle to the longitudinal axis of the mold and the outer mold having a hollow central open ended portion for introduction of metal, a shaft to which the inner mold member is attached adjustable at an angle to the vertical, and centrifugally operated levers holding the two

parts of the mold together during revolution thereof.

12. In a centrifugal casting machine, a mold member, a revoluble shaft to the end of which the mold member is secured, a frame supporting the mold shaft, means providing a driving connection between the driving and mold shafts, a frame for the driving shaft, the mold shaft frame and driving shaft frame being adapted to be secured together in fixed relation to maintain the mold shaft and frame at any one of a number of positions about the axis of the driving shaft.

13. In a centrifugal casting machine, a revoluble mold member having an open upper end into which molten metal may be introduced and from which excess material may be discharged by revolution of the mold, the mold member having an open end through which molten material may be introduced, a removable cover member having a central aperture less in diameter than the diameter of the mold defining the thickness of the wall of the casting, said cover having a flange, a series of weighted levers pivotally supported on the housing having parts adapted to engage the flange and providing the sole means for retaining the cover in position on the mold.

14. In a centrifugal casting machine, a revoluble mold member having an open upper end, a removable cover therefor having a central opening of less diameter than the said open end of the mold and through which molten metal may be introduced and excess molten material discharged by centrifugal action, a stationary support, and a receiver detachably secured to the support into which excess material is finally discharged.

15. In a centrifugal casting machine, a revoluble mold member having an open upper end through which molten metal may be introduced and through which material may be discharged by revolution of the mold, a receiver member encircling the mold and of an inner diameter greater than the mold, said receiver member having an inner peripheral opening through which material discharged from the mold may enter the receiver, and a detachable cover for the receiver.

16. In centrifugal casting machine, a revoluble mold member having an open upper end through which material may be introduced and through which excess molten material may be discharged by revolution of the mold, a stationary receiver member of circular form consisting of two detachable parts spaced apart at the inner edges providing an opening encircling the mold through which the discharged material may pass into the receiver.

17. In a centrifugal casting machine, a

mold member of cylindrical form having an open upper end, a revoluble housing supporting the mold, a cover for the mold having a central aperture less in diameter than the open end of the mold determining the thickness of the wall of the material remaining in the mold during the casting operation, the excess material being discharged through the aperture of the cover, and a receiver positioned about the mold and cover having an inner circumferential opening through which excess material may pass.

18. In a centrifugal casting machine, a hollow mold member open at the upper end for introduction of molten metal, a revoluble housing supporting the said mold member having an open end for introduction or removal of the mold, and a cover member adapted to be placed over the open end of the mold and housing retaining the mold therein, said cover having a central aperture less than the diameter of the open end of the mold and defining the thickness of material retained in the mold, and means for maintaining the mold with its axis at an angle to the vertical.

19. In a centrifugal casting machine, a revoluble mold member having an open upper end into which molten material may be introduced and through which an excess of material may be discharged by centrifugal force, a receiver member of cylindrical form positioned about the mold and having a central opening of greater diameter than the mold, said receiver having an inner peripheral opening through which material discharged from the mold may flow, said receiver member being of greater capacity than the mold and being adapted to retain the material discharged thereinto, and a cover member supported by the receiver and covering the mold.

20. In a centrifugal casting machine, a cylindrical mold member open at one end only, a revoluble housing supporting the mold member into which the mold may be introduced or removed, a cover member extending over the open end of the mold to retain the same in place, said cover having a central aperture less in diameter than the diameter of the mold means for supporting the housing with the axis of the mold member at any one of various angles to the vertical.

21. In a centrifugal casting machine, a hollow mold member, a revoluble housing supporting the mold member and into which the mold may be introduced or removed, a removable cover member adapted when in position to retain the mold in the housing, and centrifugally actuated means for holding the cover in place, the cover having a central aperture through which molten metal may be introduced into the mold means for supporting the housing with the axis of the

mold member at any one of various angles to the vertical.

22. In a centrifugal casting machine, a hollow mold member, a revoluble housing
5 supporting the mold member and into which the member may be introduced or removed, and a cover removable member adapted to retain the mold in place and having a central

aperture through which molten metal may be introduced into the mold means for holding the axis of the mold member at an angle to the vertical.

In testimony whereof I sign this specification.

JAMES W. COBURN.