Oct. 5, 1948. A. K. HIGGINS 2,450,755

METHOD OF CENTRIFUGAL CASTING

Filed June 10, 1944

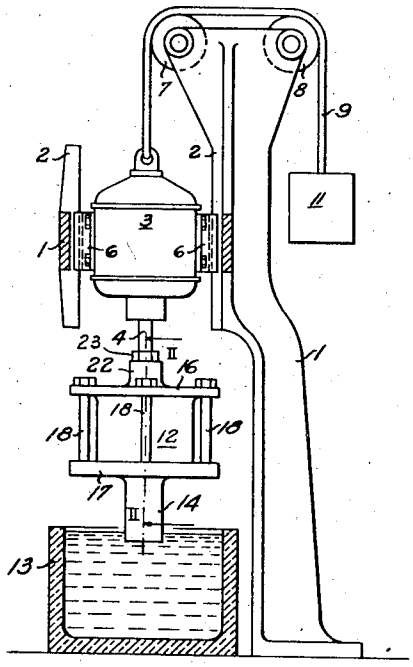


Fig. 1

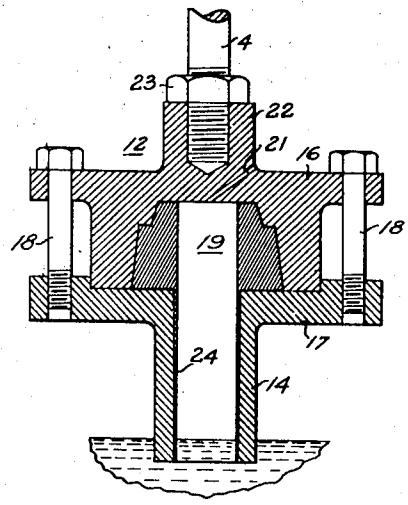


Fig. 2

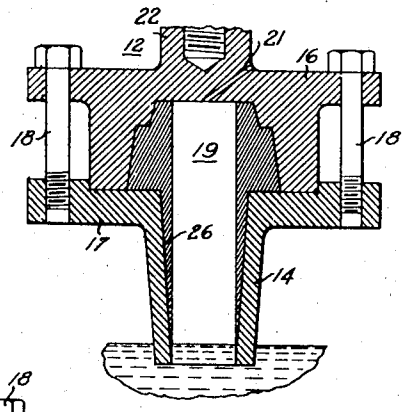


Fig. 3

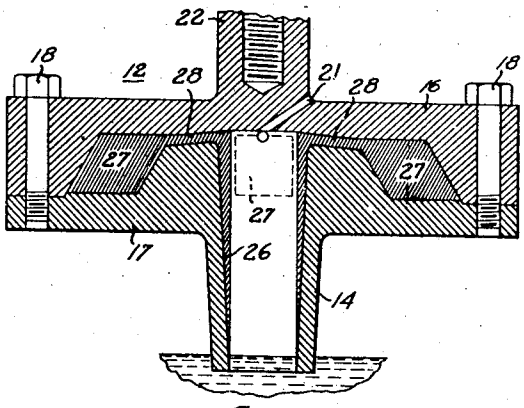


Fig. 4

Inventor
Arthur K. Higgins

by K. S. Wyman
Attorney

Patented Oct. 5, 1948

2,450,755

UNITED STATES PATENT OFFICE

2,450,755

METHOD OF CENTRIFUGAL CASTING

Arthur K. Higgins, Waukesha, Wis., assignor to Allis-Chalmers Manufacturing Company, Milwaukee, Wis., a corporation of Delaware

Application June 10, 1944, Serial No. 539,636

6 Claims. (Cl. 22—200.5)

1

This invention relates to centrifugal and centrifuged castings and has for its object the provision of an improved method for producing such castings in a manner affording one or more of the following advantages: (1) minimizing loss of heat in the transfer of the molten metal from the melting container to the mold; (2) reducing to a minimum or entirely eliminating the formation of dross on the metal as it is transferred from the melting container to the mold and also on the metal contained in the mold cavity; (3) the introduction of molten metal into the mold cavity with a minimum of turbulence and agitation; (4) eliminates the necessity of weighing or otherwise measuring the molten metal prior to its introduction into the mold; (5) eliminates the handling and the resulting spillage heretofore usually experienced in transferring the molten metal from the melting container to the mold; and (6) the production of cleaner and more accurately dimensioned castings.

The procedure necessary for attaining one or more of the advantages hereinabove mentioned will become readily apparent as the disclosure progresses and particularly points out additional features considered of special importance and of general application with respect to rotating mold structures although illustrated and described in connection with a mold designed for the centrifugal casting of brass bushings.

Moreover, although it may be apparent that the invention is particularly applicable for casting metals and alloys having high melting points, such for example as copper, brass and steel, into articles of annular shape, it is in no manner so limited and may accordingly be considered as consisting of the various methods and of the apparatus including details of construction, correlations of elements, and arrangements of parts as is more fully set forth in the appended claims and in the detailed description, reference being had to the accompanying drawing, in which:

Fig. 1 illustrates a casting machine embodying the invention;

Fig. 2 is an enlarged section taken on line II—II of Fig. 1;

Fig. 3 is a view similar to Fig. 2 illustrating a modified mold structure; and

Fig. 4 is another view similar to Fig. 2 illustrating still another modified mold structure.

Referring to Fig. 1, it is seen that the invention may be practiced with the aid of apparatus comprising a rigid supporting structure 1 presenting a pair of spaced vertically extending, parallel guide rails 2, a motor 3 having a rotatable shaft

2

4 and projections 6 guidingly engaged with the rails 2, a counter balanced mechanism including pulleys 7 and 8 mounted on the structure 1 and a cable 9 passing over the pulleys 7 and 8 and having one end attached to the casing of motor 3 and its other end secured to a weight 11, a mold 12 detachably connected in coaxial relation to the lower end of shaft 4 for movement therewith, and a molten metal container 13 disposed beneath and in coaxial relation with respect to shaft 4 and mold 12.

The mold 12 (see Fig. 2) is provided with a coaxially depending cylindrical spout portion 14 and the arrangement of parts thus far described is such that the motor and mold may be moved as a unit vertically up and down in coaxial relation to the container 13 for the purpose of selectively dipping the lower end of spout 14 into the body of molten metal confined in container 13. Mold 12 preferably consists of a main body element or portion 16 and a cover element or portion 17 detachably connected in cavity forming relation in any suitable manner such as by means of stud bolts 18. Spout 14 is illustrated as being integral with cover element 17 and in coaxial communicating relation with respect to the bottom portion of a bushing-forming mold cavity 19 which is in turn disposed in coaxial relation with respect to shaft 4. Body element 16 is preferably provided with a vent passage 21 communicating with the top central portion of mold cavity 19. The lower end of shaft 4 is externally threaded and the body portion 16 of the mold is provided with a coaxial, internally threaded hollow boss 22 by means of which the mold can be readily secured to and removed from the shaft 4; such a connection preferably including a lock nut 23 on the threaded portion of shaft 4.

In practicing the invention with apparatus of the type hereinbefore described, molten metal is placed in container 13, motor 3 is lowered until the lower end of spout 14 extends beneath the surface of the molten metal in container 13 as shown in Fig. 2 (rotation of the mold causes molten metal confined within the lower end of spout 14 to ascend same and fill the mold cavity to the extent indicated in Fig. 2) rotation of the mold being continued while in either its lowered or raised position until the metal contained in cavity 19 solidifies whereupon the motor may be stopped, the main and cover elements of the mold separated to remove the casting (if desired, the mold may be first removed from shaft 4 and another mold put in its place to speed production),

and the mold reassembled for repeating the procedure.

The introduction of molten metal into the mold cavity in the manner just described is accomplished by dipping the end of the spout into the molten metal a distance sufficient for molten metal to be forced into the lower end of the spout by hydrostatic pressure and by rotating the mold at a speed such that the rotating body of confined metal (the metal confined within the lower end of the spout is caused to rotate by frictional contact with the confining wall surface) acquires a centrifugal force or pressure acting at right angles to the longitudinal axis of the spout which is sufficient to cause a thin layer of molten metal to ascend the wall of the spout and enter the mold cavity; the molten metal continuing to flow up the spout and into the mold cavity until the cavity is filled as indicated in Fig. 2, whereupon the ascension of molten metal ceases unless the speed of rotation is increased. The mold may be rotating at the desired speed when the spout is dipped into the molten metal or its rotation may be initiated after the spout has been so dipped.

In this connection, it is entirely immaterial whether the dipping of the spout and the introduction of molten metal into the mold is accomplished by moving either the mold or the body of molten metal or both as the only requisite in this respect is a correlation of parts such as will permit establishing a superposed relation of the mold relative to the body of molten metal with the lower end of the spout dipped into the metal and a relative movement of the mold and/or the body of molten metal effective to cause the molten metal entering the lower end of the spout to move upward therethrough and into the mold cavity. Moreover, it is also entirely immaterial whether the interior of spout **14** has a smooth cylindrical surface **24** as shown in Fig. 2 or a surface of a different nature and shape adapted to assist the movement of molten metal upward thereover. For example, the spout may have a smooth surface **26** of inverted frusto-conical shape as is clearly shown in Fig. 3 in which like numerals are used to designate the same or corresponding parts. With a spout of this shape, the flow of molten metal upward through the spout is greatly increased thereby permitting the mold cavity to either be filled more rapidly for a given speed of mold rotation or in the same time with a lesser speed of rotation. In addition, this shape of spout affords an additional advantage in that it facilitates the removal of the thin layer of solidified metal remaining in the spout.

Fig. 4 shows a mold having a spout similar to that shown in Fig. 3 and a plurality of separate similar cavities **27** symmetrically arranged with respect to the spout **14** and a corresponding number of gates **28** placing the upper portions of the cavities **27** in communication with the upper interior portion of the spout; the gates being preferably inclined upward toward the spout to facilitate venting of the cavities. This mold is similar in all other respects to those shown in Figs. 2 and 3 and consequently like numbers have been used to designate the same or corresponding parts. The invention may be practiced with this type of mold in exactly the same manner as herein set forth with respect to Figs. 1 and 2 and therefore a further description in this connection is deemed unnecessary for a complete understanding of the invention.

The invention is of general application with respect to the production of centrifugal and centrifuged castings of various shapes and may be practiced with apparatus other and different from that herein shown and described for purposes of illustration. And it should therefore be understood that it is not intended to limit the invention to details of the methods herein disclosed as various modifications within the scope of the appended claims may occur to persons skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. A method of introducing molten metal into a mold having a spout projecting therefrom and communicating with an interior cavity which comprises providing a body of molten metal, establishing a superposed relation of the mold relative to the body of molten metal with the lower end of the spout extending beneath the surface of said metal, and causing the molten metal entering the lower end of said spout to rotate therein with sufficient speed to move upward therethrough and into the mold cavity substantially entirely through the effect of said rotation of the molten metal and in sufficient quantity to fill the cavity to the extent required to form the article to be molded.

2. A method of introducing molten metal into a mold having a spout projecting therefrom and communicating with an interior cavity which comprises providing a body of molten metal, establishing a superposed relation of the mold relative to the body of molten metal with the lower end of the spout extending beneath the surface of said metal, and effecting a relative rotation of the body of molten metal and mold sufficient to cause molten metal entering the lower end of said spout to move upward therethrough and into the mold cavity substantially entirely through the effect of said relative rotation of the molten metal and mold and in sufficient quantity to fill the cavity to the extent required to form the article to be molded.

3. A method of introducing molten metal into a mold having a spout projecting therefrom and communicating with an interior cavity which comprises providing a body of molten metal, establishing a superposed relation of the mold relative to the body of molten metal with the lower end of the spout extending beneath the surface of said metal, and rotating the mold at a speed sufficient to cause molten metal entering the lower end of said spout to move upward therethrough and into the mold cavity in sufficient quantity to fill the cavity to the extent required to form the article to be molded and substantially entirely through the effect of said rotation of the mold.

4. A method of casting comprising providing a mold having a spout projecting therefrom and communicating with the interior of the mold, providing a body of molten metal, establishing a superposed relation of the mold relative to the body of molten metal with the lower end of the spout extending into the metal, rotating the mold at a speed sufficient to cause molten metal entering the lower end of said spout to move upward therethrough and into the mold cavity in sufficient quantity to fill the cavity to the extent required to form the article to be molded and substantially entirely through the effect of said rotation of the mold, and continuing rotation of the mold until the metal confined therein has solidified.

5. A method of casting comprising providing a

mold having a spout projecting therefrom and communicating with an interior mold cavity, providing a body of molten metal, establishing a superposed relation of the mold relative to the body of molten metal with the lower end of the spout extending beneath the surface of said metal, rotating the mold at a speed and for a time sufficient to cause molten metal entering the lower end of said spout to move upward therethrough and fill said cavity to the extent required to form the article to be molded and substantially entirely through the effect of said rotation of the mold, and separating the mold and body of molten metal while continuing rotation of the mold until the metal confined in said cavity has solidified.

6. A method of casting comprising providing a mold having an annular cavity and a filling spout therefor projecting from said mold in coaxial relation with respect to said cavity, providing a body of molten metal, establishing a superposed relation of the mold relative to the body of molten metal with the lower end of the spout extending beneath the surface of said metal, rotating the

mold about an axis coincident with the axis of said spout and at a speed and for a time sufficient to cause molten metal entering the lower end of said spout to move upward therethrough and fill said cavity to the extent required to form the article to be molded and substantially entirely through the effect of said rotation of the mold, and separating the mold and body of molten metal while continuing rotation of the mold until the metal confined in said cavity has solidified.

ARTHUR K. HIGGINS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
893,037	Underwood	July 14, 1908
1,528,303	Rockwell	Mar. 3, 1925
1,636,228	Gray	July 19, 1927
2,042,015	Moormann	May 26, 1936
2,282,501	Suijk	May 12, 1942