

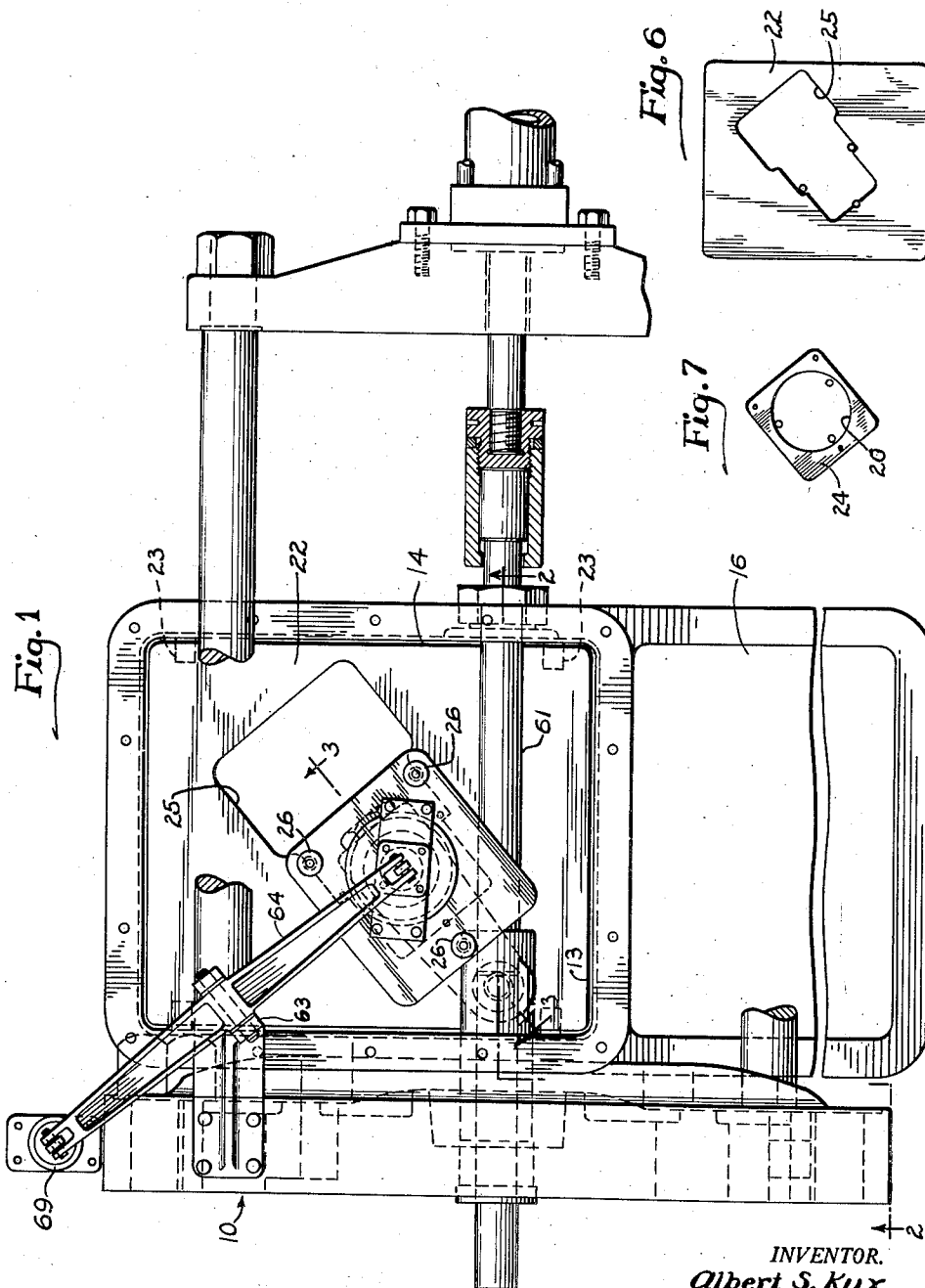
Jan. 8, 1952

A. S. KUX
MEANS FOR AUTOMATICALLY TRANSFERRING AND METERING
CHARGES OF MOLTEN METAL

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Filed Dec. 6, 1948

2 SHEETS—SHEET 1



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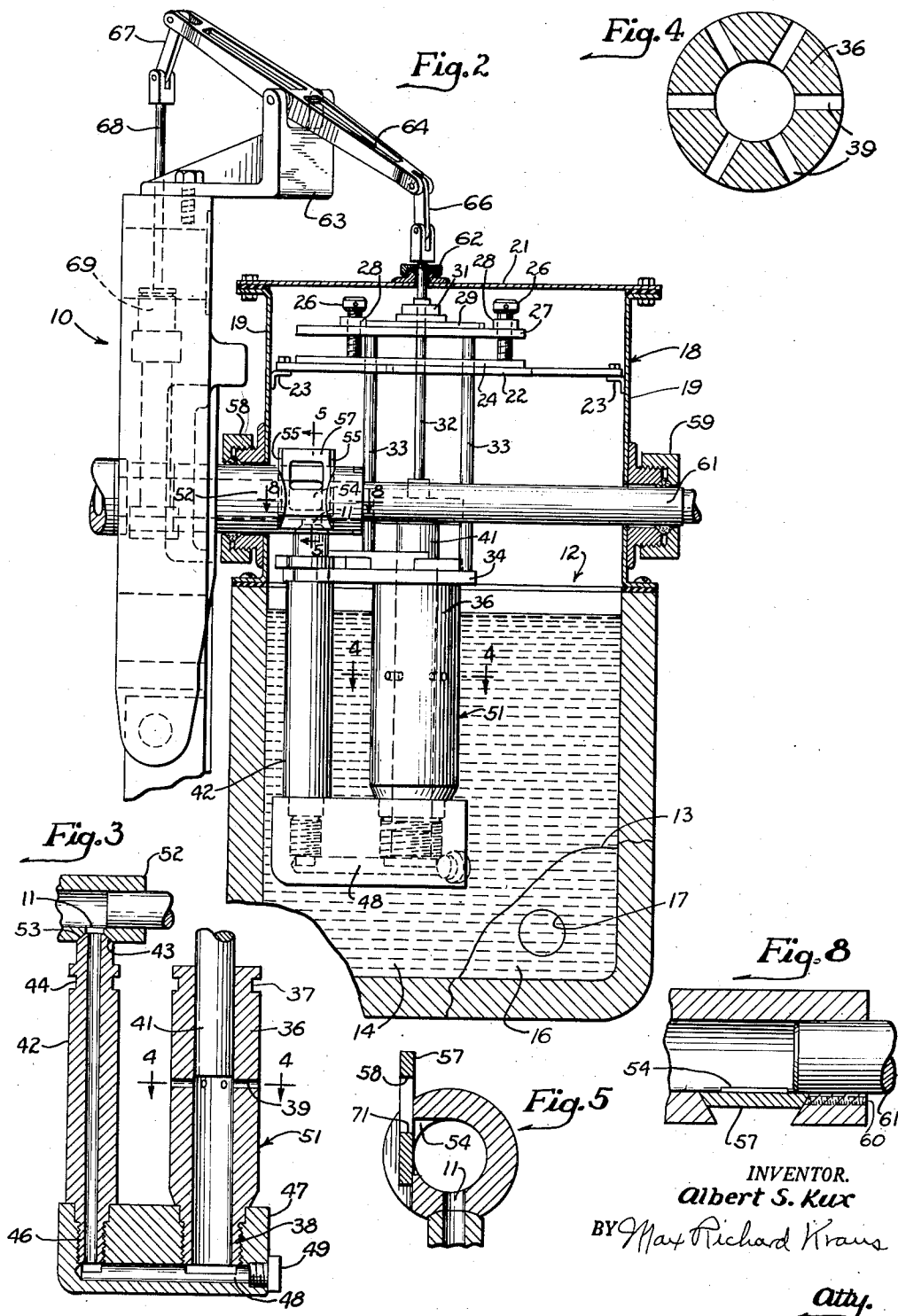
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UNITED STATES PATENT OFFICE

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MEANS FOR AUTOMATICALLY TRANSFERRING AND METERING CHARGES OF MOLTEN METAL

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7 Claims. (Cl. 22—79)

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This invention relates to means for automatically transferring and metering charges of molten metal.

For the purpose of this disclosure, the invention will be described as applied to a die casting machine, but it will be distinctly understood that the scope of this invention is not limited to the particular application and illustrative use of the invention.

Heretofore, in the operation of cold chamber die casting machines, a charge of molten metal was manually conveyed and ladled by an operator from the melting furnace associated with the machine into the injection cylinder. The character of the operation was disagreeable, highly fatiguing and dangerous from the standpoint of the operator, in view of the high temperatures surrounding the immediate zone of the melting furnace where the operator was required to stand and the liability of being injured by the spattering of molten metal. Additionally, in view of the human element present the quantity of each charge could lack uniformity and could result in imperfect castings. Accordingly, it is an object of my invention to provide automatic means for transferring molten metal from the melting furnace and metering said molten metal so as to deliver to the sprue of the injection cylinder, charges of molten metal, all of uniform volume, so as to insure the production of uniformly perfect castings.

A further object of my invention is the provision of means of the type described which effects in operation an increase in the production rate of a die casting machine.

A further object of my invention is the provision of transfer and metering means of the foregoing character adapted to operate in an enclosed inert atmosphere whereby to eliminate the oxidation of the molten metal.

Other objects and novel aspects of the invention reside in certain details of construction, arrangement of parts and mode of operation thereof, all of which will appear as the following description proceeds in view of the drawing in which

Fig. 1 is a plan view showing an embodiment of my invention in operative relation to a cold chamber die casting machine, certain parts of which are illustrated, and with the cover plate of the gas tight hood removed.

Fig. 2 is an elevational view of my invention taken on line 2—2 of Fig. 1, partly in cross section, and showing my invention in relation to an injection cylinder of a die casting machine and a metal melting furnace associated therewith.

Fig. 3 is a cross sectional view on an enlarged scale, taken on line 3—3 of Fig. 1.

Fig. 4 is a cross sectional view on an enlarged scale taken on line 4—4 of Fig. 2.

Fig. 5 is a cross sectional view on an enlarged scale taken on line 5—5 of Fig. 2.

Fig. 6 is a plan view of a detail.

Fig. 7 is a plan view of a detail.

Fig. 8 is a cross sectional view taken on line 8—8 of Fig. 2.

Referring to the drawings wherein is shown a preferred embodiment of my invention, the numeral 10 designates generally a die casting machine only certain portions of which, necessary to the disclosure are shown in the drawing. Suitably supported under the sprue 11 of the injection cylinder 52 of the die casting machine is a melting furnace 12 which may include one or two compartments. In the embodiment shown the furnace is divided by a wall 13 into two compartments 14 and 16 which communicate with each other through aperture 17 in the wall 13.

Supported on the compartment 14 is a gas tight hood 18 which comprises side walls 19 and a cover plate 21 all suitably flanged to facilitate assembly with gaskets for effecting a gas tight closure.

A plate member 22 is supported on brackets 23 welded to the side walls 19 of the hood 18 and has a cut out portion 25 shaped substantially as shown in Fig. 6. Supported on plate member 22 is a plate member 24 provided with a circular cut out 20, as shown in Fig. 7. Bearing on said plate 24 are three symmetrically arranged threaded members 26 which carry plate member 27. The said plate member is provided with three internally threaded bosses 28 through which the threaded members 26 extend. Attached to the plate member 27 is a plate member 29 provided with a centrally disposed boss 31 which is bored to provide a bearing to slidably accommodate a piston rod 32 hereinafter to be described.

Attached to and depending from the plate member 27 are three symmetrically spaced rods 33 which support a plate member 34 which is provided with recesses for a purpose as will be presently explained.

A cylinder 36 preferably formed of graphite or any other suitable material capable of withstanding high temperatures and relatively long service without deterioration has provided near the top thereof an annular recess 37. The lower portion 38 of the said cylinder is threaded as shown in Fig. 3. Substantially medially thereof, the cylinder 36 is provided with a plurality of spaced radial apertures 39. A piston 41 formed of the same material as cylinder 36 and connected to piston rod 32 is adapted for reciprocation in said cylinder.

A second cylinder 42 of somewhat reduced cross sectional area and formed of the same material as the cylinder 36 is provided at the top thereof with a seating end 43 and is also provided with an annular recess 44 aligned in the same plane as

the recess 37. The cylinder 42 is similarly threaded at the lower portion 46 thereof and the threaded portions 33 and 46 of cylinders 36 and 42 are received in complementary threaded sockets of a connecting member 47 which is formed of the same material as the cylinders 36 and 42. The connecting member 47 is provided with a passage 48 which effects communication between the bores of the cylinders 36 and 42. A removable plug 49 is provided to facilitate drainage and cleaning of the passage 48.

The cylinders 36 and 42 and connecting member 47 form a substantially U-shaped structure which is indicated generally by numeral 51 and which is supported in depending position from the plate member 34, with the marginal edges of the recesses thereof received in the annular recesses 37 and 44 of the cylinders 36 and 42.

It will be observed that the U-shaped structure 51 just described is intended to be submerged in the molten metal contained in the compartment 14 of the melting furnace, as shown in Fig. 2.

In the particular application of my invention to a die casting machine, it is required that the structure of the injection cylinder 52 be somewhat modified by locating the sprue 11 on the under side of the injection cylinder and providing a complementary seat 53 to accommodate the seating end 43 of the cylinder 42 in substantially sealing engagement with the sprue 11, as shown clearly in Fig. 3.

Additionally, the injection cylinder 52 is provided with an aperture 54 located at a right angle to the sprue 11, and the wall of the said cylinder is machined to provide an angularly undercut recess 55 on each side of the aperture, the recesses 55 together forming a dove tail slideway. A dam or gate 57, the sides of which are formed complementary to the recesses 55, is arranged for vertical sliding adjustment therein. The said dam 57 is provided with an aperture 58 and screw means 60 is provided for locking the dam 57 in a position of adjustment.

The side walls 19 of the hood 18 are provided with packing glands 52 and 59 to accommodate the injection cylinder 52 and piston rod 61 respectively, and the cover plate 21 is provided with a packing gland 62 to accommodate the piston rod 32. As will be clearly seen in Fig. 2, the hood 18 encloses the zone of the die casting machine surrounding the sprue 11 of the injection cylinder, as well as the U-shaped structure 51 hereinabove described.

Supported on a suitable portion of the die casting machine 10 is a bracket 63 provided with spaced perforated lugs on which is pivotally supported a rock arm 64. The rock arm is connected through link 66 to piston rod 32. At the opposite end, the rock arm 64 is connected by link 67 to the piston rod 68 of a hydraulic cylinder 69 which provides the motive power for the actuation of the piston 41 in cylinder 36. The hydraulic cylinder 69 is connected into the hydraulic circuit of the die casting machine 10 and is adapted to be actuated in synchronism with the movement of the injection piston 61, as will be hereinafter described.

It will be understood that mechanical or electrical means other than hydraulic means may be employed to actuate the piston 41.

It is thought that the operation of this machine will be clearly understood from the foregoing, but briefly stated it is as follows, reference being had particularly to Figs. 2 and 3.

The dam or gate 57 is first adjusted so that the lower edge 71 of the aperture 58 is positioned

at a desired height corresponding to a predetermined quantity of molten metal desired to be injected into the die of the machine. It is of course understood that access to said dam 57 is gained through removal of the cover plate 21. When the cover plate 21 is replaced the space inside the hood 18 may be evacuated by any suitable means through a suitable port provided in the hood, or an inert gas may be introduced so that transfer of the molten metal to the sprue 11 may be carried out in a vacuum or in an inert atmosphere, thereby avoiding oxidation of the molten metal. At the beginning of a cycle of operations the injection piston 61 is in normal retracted position with the sprue 11 and injection cylinder 52 open preparatory to receiving a charge of molten metal. In this condition the cylinders 36 and 42 and connecting passage 48 are substantially filled with molten metal which has entered therein through the apertures 39. As will be apparent, the level of the molten metal in the cylinder 42 will coincide with the level of molten metal in the compartment 14, while the uppermost position of the piston 41 will determine the level of molten metal in the cylinder 36.

The operator causes the dies to be closed, and thereafter pressure fluid is admitted into the hydraulic cylinder 69 to cause piston rod 68 to move upwardly thereby rocking arm 64 so that piston rod 32 and piston 41 are caused to be moved downwardly forcing molten metal through the sprue 11 into the bore of the injection cylinder 52. The cylinder 52 is preferably of such size that the quantity of molten metal actually delivered thereto by a full stroke of piston 41 will always be greater than that required to fill the bore of the injection cylinder 52. Thus, it will be seen that the cylinder 52 will be filled with molten metal to the level of the lip 71 of the dam and that any excess metal entering into the cylinder 52 will spill over the lip 71 and drain back into the compartment 14 of the melting furnace. It should thus be readily apparent that by adjusting the dam 57 to any desired vertical position, the quantity of any charge of molten metal to be injected into the die may be accurately regulated, with the result that all charges of molten metal in the injection cylinder 52 preparatory to being injected in the die during a particular interval of machine operation are all of uniform quantity, thereby assuring the production of uniform castings.

It is to be understood that the quantity of a charge of molten metal to be injected may also be regulated by adjusting the length of the stroke of the piston 41 to displace only a predetermined quantity of molten metal into the injection cylinder 52. It will of course be understood that when the piston 52 alone is employed for injecting predetermined charges of molten metal, then the dam 57 is preferably moved to closed position or the lip 71 of the dam is at least elevated to a level above that to which the charge of molten metal would rise in the cylinder 52, so as to avoid spilling of the molten metal over the lip 71.

In timed relation with the transfer of a charge of metal into the injection cylinder 52 the injection piston 61 is actuated to inject the charge into the die. During such interval the piston 41 is maintained at the end of its stroke until the injection is completed. After a predetermined cooling interval the die is opened to permit removal of the cast part therefrom. Thereafter

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the die is closed and then the injection piston 61 is caused to be returned to non-operating position and concurrently therewith the hydraulic cylinder 69 is actuated to move the piston thereof downwardly. Such action draws the piston 41 upwardly in the cylinder 36 exposing the apertures 39 and permitting molten metal to flow therethrough into the cylinders 36 and 42 and communicating passage 48.

The sequence of operations hereinabove described are repeated in each following cycle of machine operation.

Since it is expected that the U-shaped structure 51 will require periodic inspection and servicing, I have provided novel means for readily assembling and disassembling the same in relation to the die casting machine. It will be apparent that when the supporting threaded members 26 are unscrewed the rods 33, plates 27, 29, and 34 and U-shaped structure 51 are dropped downwardly so that the seating end 43 of cylinder 42 is disengaged from the seat 53. The whole structure above described may then be slid laterally off the supporting plate 22 to clear the aperture 25 and may then be raised up through the top opening of the hood 18. After the necessary servicing or inspection the structure is replaced by a reverse manipulation and when the threaded members 26 are screwed in, the entire structure is elevated and the seating end 43 of the cylinder 42 is brought into fluid tight relation with the seat 53.

I claim:

1. In a die casting machine of the type having a receptacle containing molten metal, an injection cylinder and means for conveying molten metal from said receptacle to said cylinder, said cylinder having a lateral opening in the wall thereof, a closure member for said opening, and retaining means on said cylinder for slidably supporting said closure member in a vertical plane, said closure member being adjustable vertically for varying the quantity of molten metal in said cylinder.

2. In a die casting machine of the type having a receptacle containing molten metal, an injection cylinder and means for conveying molten metal from said receptacle to said cylinder, said cylinder having a lateral opening in the wall thereof, an adjustable dam for said opening, means for slidably supporting said dam in alignment with said opening so that the elevation of said dam may be varied to vary the quantity of molten metal retained in said cylinder.

3. In a die casting machine of the type having a receptacle containing molten metal, an injection cylinder having a sprue on the under side thereof and a lateral opening disposed at a right angle thereto, means communicating with said sprue and said receptacle for conveying molten metal from said receptacle to said cylinder, a closure member for said opening, and retaining means on said cylinder for slidably supporting said closure member in a vertical plane, said closure member being adjustable vertically for varying the quantity of molten metal in said cylinder.

4. A die casting machine as defined in claim 1, said conveying means comprising a piston pump of graphite material and substantially submerged in said molten metal.

5. A die casting machine as defined in claim 3, said conveying means comprising a substantially

U-shaped structure substantially submerged in said metal, said U-shaped structure including a vertical cylinder having a reciprocable piston in the bore thereof and an opening in the wall to admit molten metal into said bore, a second vertical cylinder having one end in substantially fluid-tight engagement with the said sprue and a horizontal cylinder connecting said vertical cylinders, and means for actuating said piston to displace molten metal from said cylinder to said injection cylinder.

6. A die casting machine as defined in claim 3, the said conveying means comprising a substantially U-shaped structure substantially submerged in said molten metal, said U-shaped structure including a vertical cylinder having a reciprocable piston in the bore thereof and an opening in the wall to admit molten metal into said sprue, a second vertical cylinder having one end in substantially fluid-tight engagement with said sprue and a horizontal cylinder connecting said vertical cylinders, each of said vertical cylinders having shoulders thereon, a member supported on said receptacle above the top thereof, means depending from said member and engageable with said shoulders for supporting said U-shaped structure in dependent relation to said member, screw means for moving said U-shaped structure vertically, and means for actuating said piston to displace molten metal into said injection cylinder.

7. A die casting machine as defined in claim 3, said conveying means comprising a substantially U-shaped structure substantially submerged in said metal, said U-shaped structure including a vertical cylinder having a reciprocable piston in the bore thereof and an opening in the wall to admit molten metal into said bore, a second vertical cylinder having one end in substantially fluid-tight engagement with said sprue, and a horizontal cylinder connecting said vertical cylinders, a first member supported on said receptacle above the top thereof, a second member having a plurality of screw elements resting on said first member, a plurality of elongated elements depending from said second member, a third member carried on the ends of said elements and adapted to engage with said shoulders to support said U-shaped structure in dependent position, said screw elements being adapted for moving said U-shaped structure vertically, and means for actuating said piston to displace molten metal into said injection cylinder.

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