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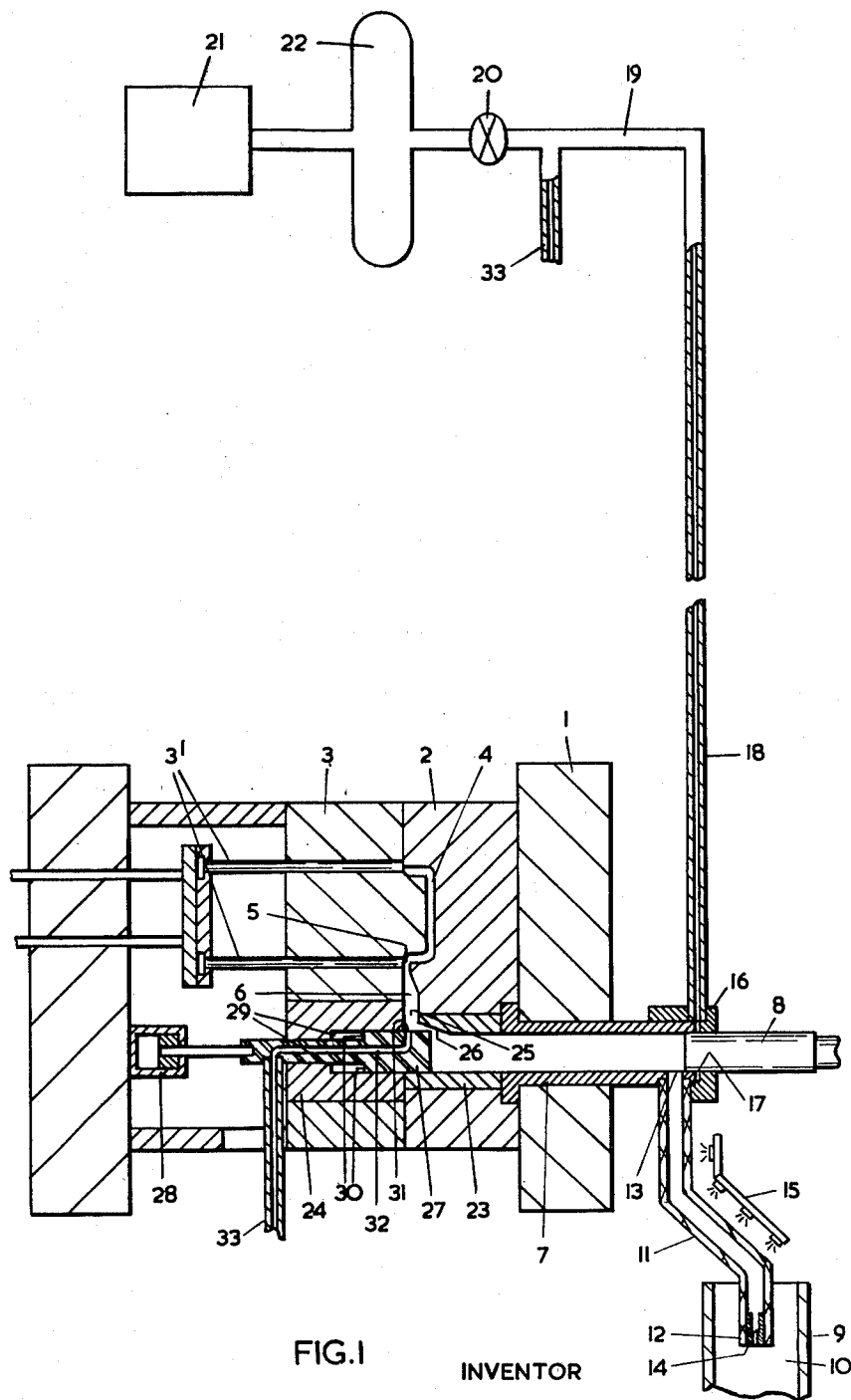
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DIE CASTING AND MOULDING MACHINE

Filed July 14, 1961

2 Sheets-Sheet 1



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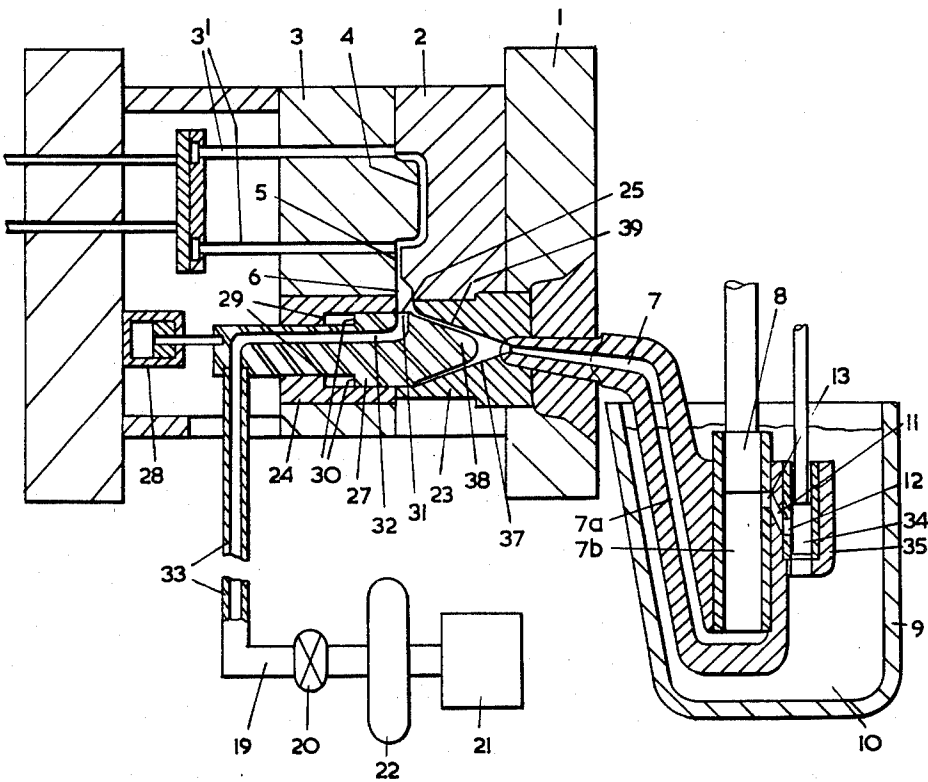


FIG.2

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DIE CASTING AND MOULDING MACHINE

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2 Claims. (Cl. 22—68)

This invention relates to apparatus for pressure die casting of metals.

It is an object of this invention to provide improved apparatus for die casting in which molten metal is caused to enter a charging chamber from a reservoir in a controlled manner, without surging and splashing which could lead to undesirable premature entry and solidification of metal in parts of the die cavity.

According to the invention we provide a pressure die casting machine wherein the die cavity and a charging chamber in communication therewith are both evacuated for a predetermined period of time via a vacuum control valve associated with the die.

The feed of said molten metal into the charging chamber may be effected by the vacuum and may be controlled by a control orifice between the die and the charging chamber.

The feed of molten metal into the charging chamber may be effected by the vacuum and may be controlled jointly by a first control orifice between the die and the charging chamber, and by a second control orifice located at the intake end of a feed tube which communicates with the charging chamber, and by a vacuum seal between the charging chamber and a charging plunger which is slidable therein.

The first control orifice may be defined by co-action between the vacuum control valve and a part of the die structure when the valve is in an open position in which the die cavity and charging chamber are connected by the valve to a source of vacuum.

Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

FIG. 1 is a diagrammatic sectional side elevation of a die casting machine according to the invention; and FIG. 2 is a diagrammatic sectional side elevation of another form of die casting machine, also according to the invention.

Referring to FIG. 1, a fixed die plate 1 carries a fixed die part 2. A movable die part 3 (actuated by conventional means, not shown) mates with the fixed die part 2, and when the die parts 2 and 3 are in the closed position illustrated, they provide between them a die cavity 4, a gate 5 and a runner 6. The usual knock-out pins 3' are movable relative to the die part 3.

A cylindrical charging chamber 7 is mounted horizontally in the fixed die plate 1, and a charging plunger 8, shown in its fully retracted position, is slidable in the charging chamber 7. A heated crucible 9 for molten metal 10, such as aluminium or zinc base alloy, is disposed below the charging chamber 7, and a feed conduit 11 having its lower end 12 immersed in the molten metal 10 extends upwardly from the crucible 9 to a port 13 in the bottom of the charging chamber 7. An insert 14 having a flow control orifice therein is mounted in the lower end 12 of the feed conduit 11.

Gas heating flames acting on the exposed part of the feed conduit 11 are indicated at 15.

A seal 16 is provided around the charging plunger 8 as the outer end of the charging chamber 7, and is constructed so as to leave an annular space 17 around the charging plunger 8. A first vacuum conduit 18 which communicates with the annular space 17 extends vertically upwards to a horizontal conduit 19, which con-

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tains a vacuum valve 20 by means of which the system can be connected to or isolated from a source of vacuum such as a vacuum pump indicated at 21. A vacuum reservoir 22 is located between the vacuum pump 21 and the vacuum valve 20, and a second vacuum conduit 33 extends downwards from the horizontal conduit 19 on the side of the valve 20 remote from the pump 21 for a purpose which will presently appear.

Two bushings 23 and 24 are inserted in bores in the fixed and movable die parts 2 and 3 respectively so as to be co-axial with the charging chamber 7. The first bushing 23 forms a continuation of the charging chamber 7, having the same diameter, and is cut away at the port indicated by the numeral 25 at the top thereof so as to provide a space which is an extension of the runner 6. An inclined groove 26 is formed in the inner surface of the top of the first bushing 23 adjacent to the cut away part 25.

The second bushing 24 provides a housing for a cylindrical valve member 27 which is actuated, for example, by mechanical means, or by the hydraulic actuator indicated at 28, between the open position shown in FIG. 1, and a closed position which is defined by engagement of a shoulder 29 in the bush 24 with a shoulder 30 on the valve member 27. When the valve member 27 is in the open position illustrated in FIG. 1, the end 31 of a vacuum passage 32 therein communicates with the die cavity 4 via the runner 6 and the gate 5, and with the charging chamber 7 via the inclined groove 26 in the first bushing 23. The other end of the vacuum passage 32 in the valve member 27 communicates with the abovementioned vacuum conduit 33. When the valve member 27 is in the closed position, the end 31 of the vacuum passage 32 is closed by virtue of the fact that it has moved within the bore of the second bushing 24.

With the parts of the apparatus in the positions shown in FIG. 1, i.e. ready for a cycle of operations to begin, the cycle commences with the opening of the vacuum valve 20 by the actuator 28. The vacuum reservoir 22 ensures that a good degree of vacuum is produced virtually instantaneously in the first and second vacuum conduits 18 and 33. The spaces which are in communication with the second vacuum conduit 33, viz, the die cavity 4, the charging chamber 7 and the feed conduit 11 are therefore evacuated, and a steady non-surfing feed of molten metal enters the charging chamber 7 via the feed conduit 11 due to atmospheric pressure acting upon the surface of the molten metal 10 in the crucible 9, the charge of molten metal accumulating along the bottom of the charging chamber 7 well below the level of the groove 26 leading to the die cavity 4.

The molten metal is caused to enter the charging chamber 7 in a controlled manner, i.e. without surging or splashing which could cause it to enter the die cavity 4 prematurely, by the controlling action of the inclined groove 26, which with the valve member 27 in the open position illustrated in FIG. 1, forms a control orifice which ensures a steady evacuation of the charging chamber 7 and the feed conduit 11. Evacuation of the annular space 17 via the first vacuum conduit 18 provides a vacuum seal between the charging chamber 7 and the charging plunger 8, and ensures that air cannot leak into the charging chamber 7 past the seal 16 to cause splashing or surging of the molten metal entering the chamber 7 through the port 13.

At the end of the charging period, the plunger 8 commences its charging stroke, and simultaneously the valve member 27 is moved to its closed position by the actuator 28, and the vacuum valve 20 is closed. Molten metal is forced by the plunger 8 into the die cavity 4 through the runner 5 and gate 6 to form the required casting. In accordance with normal practice in die casting machines,

the movements of the various parts in timed relation are effected by power-operated means.

It will be apparent that the quantity of molten metal which enters the chamber 7 to form a charge is dependent upon the duration of the evacuation period which effects the feed of the metal, the degree of vacuum, and the size of the flow control orifice in the insert 14. The latter may be exchangeable for controlling the amount of a charge, and fine control thereof is achievable by variation of the duration of the evacuation period.

It will be appreciated that a maximum charge of metal in the chamber 7, with the piston 8 in the retracted position indicated, is spread along the bottom of the chamber 7 and never approaches the level of the evacuation groove 26 at the top forward end of the chamber until the piston 8 advances to force the charge into the die.

In the embodiments shown in FIG. 2, the same reference numerals are used to denote similar parts. The charging chamber 7 has a contiguous extension 7^a leading to a vertical cylinder 7^b which is immersed in molten metal 10 in the heated crucible 9. The charging plunger 8, shown in its fully retracted position, is slidable in the cylinder 7^b. The feed conduit 11 in this embodiment is completely below the surface of the molten metal 10. One end 12 of the conduit 11 leads from the molten metal 10 and is closable by a gooseneck plug 34 sliding in a sleeve 35, and the other end communicates with a port 13 in the wall of the cylinder 7^b.

Two bushings 23 and 24 are inserted in bores in the fixed and movable die parts 2 and 3 respectively. The first bushing 23 has a conical bore 37 which forms a continuation of the charging chamber 7, and is cut away at the part indicated by the numeral 25 at the top thereof so as to provide a space which is an extension of the runner 6.

The second bushing 24 provides a housing for a cylindrical valve member 27 which is actuated between the open position shown in FIG. 2 and a closed position in a similar manner to that described for the embodiment of FIG. 1. The valve member 27 of FIG. 2, however, has a conical end 38 which is of similar contour to the conical bore 37 of the first bushing 23, but which is of such a size as to leave a narrow passage 39 between the end 38 and the bore 37 when the valve member 27 is in the open position illustrated. The narrow passage 39 thus provides a means of communication between the charging chamber 7 and the end 31 of the vacuum passage 32 in the valve member 27.

With the parts of the apparatus in the positions shown in FIG. 2, i.e. ready for a cycle of operations to begin, the cycle commences with the opening of the vacuum valve 20 by the actuator 28. The vacuum reservoir 22 ensures that a good degree of vacuum is produced virtually instantaneously in the vacuum conduit 33. The spaces which are in communication with the vacuum conduit 33, viz, the die cavity 4 and the charging chamber 7, are therefore evacuated, and when the gooseneck plug 34 is drawn upwards, a steady non-surfing feed of molten metal enters the charging chamber 7 due to atmospheric pressure acting upon the surface of the molten metal 10 in the crucible 9.

The molten metal is caused to enter the charging chamber 7 in a controlled manner, i.e. without surging or splashing which could cause it to enter the die cavity 4 prematurely, by the controlling action of the narrow passage 39, which acts as a control orifice to ensure a steady evacuation of the charging chamber 7.

At the end of the charging period, the gooseneck plug 34 is lowered to close the end 12 of the feed conduit 11;

the plunger 8 commences its charging stroke, and simultaneously the valve member 27 is moved to its closed position by the actuator 28 and the vacuum valve 20 is closed. Molten metal is forced by the plunger 8 into the die cavity 4 through the runner 5 and gate 6 to form the required casting. As in the embodiment of FIG. 1, in accordance with normal practice in die casting machines, the movements of the various parts in timed relation are effected by power-operated means.

I claim:

1. In a diecasting machine including first and second die parts defining a die cavity therebetween, said first die part movable relative to said second die part, means defining gate and runner passages extending outwardly from said cavity to a charging chamber, said chamber adapted for receiving a supply of molten metal from a receptacle for delivery to said die cavity, in combination therewith, a vacuum conduit selectively connectable with said die cavity, a vacuum control valve means operably movable between open and closed positions and carried by said first die part, said valve means including a substantially hollow body portion connected to said conduit, actuator means operative to move said vacuum control valve relative to said first die part into said open position and to protrude a portion of said valve body outwardly of said first die part toward said second die part, a bushing insert in said second die part forming a continuation of said charging chamber, said bushing insert co-acting with said protruding valve portion to define between them a restricted control orifice between the die cavity and the charging chamber operative to modify the effect of vacuum in the charging chamber.

2. A diecasting machine including first and second die parts defining a die cavity therebetween, said first die part movable relative to said second die part, means defining gate and runner passages extending outwardly from said cavity to a charging chamber, said chamber having forward and rearward ends, said chamber connected with said runner passage at said forward end for directing a supply of molten metal from said charging chamber to said die cavity, means defining a feed conduit connecting said charging chamber with a supply of molten metal, a charging piston slidable in said charging chamber, a vacuum conduit selectively connectable with said die cavity, a vacuum control valve means movable between controlling positions carried by said first die part, said valve means including a substantially hollow body portion connected to said vacuum conduit, means for mounting said valve in said first die part for sliding movement between open and closed positions, actuator means operative to slidably move said valve body relative to said first die part and into said open position to protrude a portion of said valve body outwardly therefrom toward said second die part, a bushing insert in said second die part forming a continuation of said charging chamber, said bushing insert co-acting with said protruding portion of said valve to define a restricted control orifice between the die cavity and the charging chamber operative to modify the effect of vacuum in the charging chamber, and a vacuum seal means between the charging chamber wall and the charging piston adjacent the rearward end of said charging chamber.

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