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 APPARATUS FOR DELIVERING METERED SHOTS
 OF MOLTEN METAL FOR CASTINGS
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Fig. 1

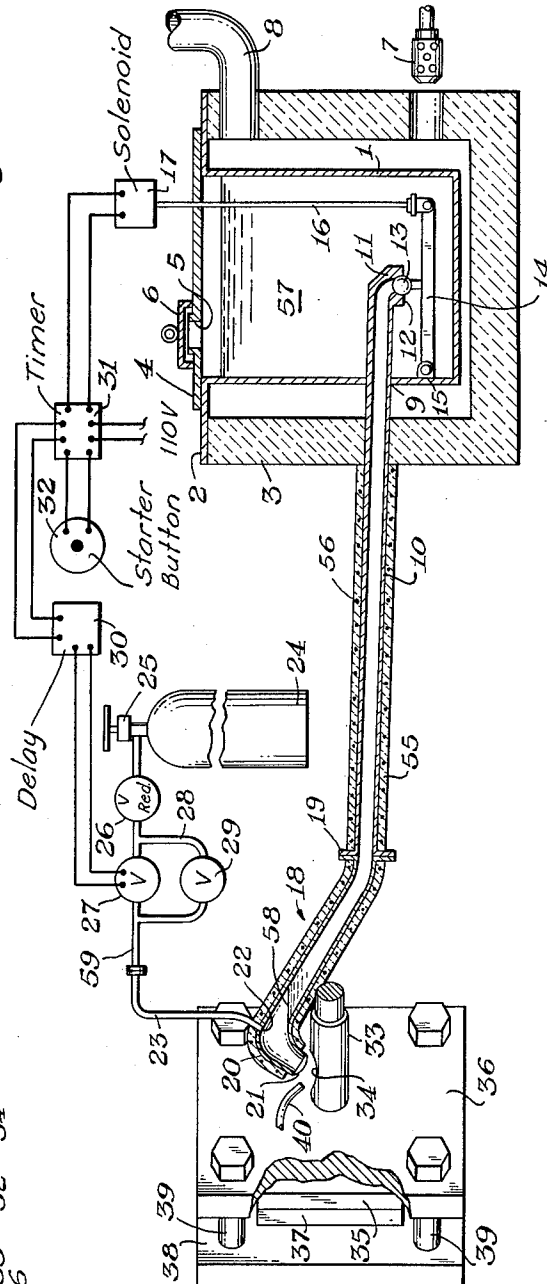
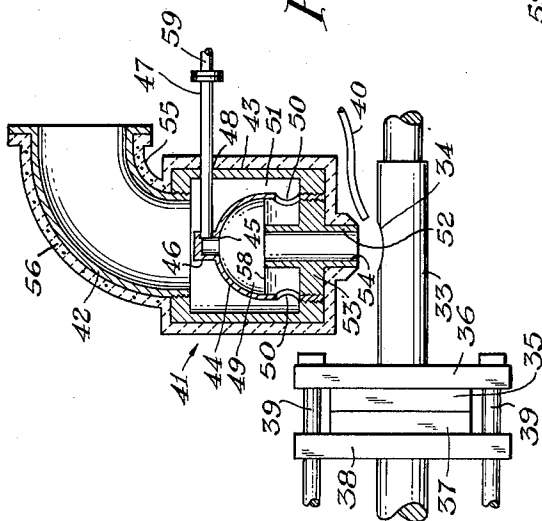


Fig. 2



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APPARATUS FOR DELIVERING METERED SHOTS OF MOLTEN METAL FOR CASTINGS

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1 Claim. (Cl. 22—79)

The invention relates to apparatus for delivering accurately metered shots of molten metal in rapid succession to a casting device, such as a die casting machine.

In my application Serial No. 268,001, filed January 24, 1952, now Patent No. 2,678,480, there is described an apparatus for delivering accurately metered shots of molten metal from a pot holding a supply of the metal to a die casting machine through a valved conduit. The flow of metal from the pot into the conduit for each shot is controlled by a valve on the input end, the size of the shot being determined by the interval of time during which the valve is held open. With the apparatus means are provided at the delivery end of the conduit for discharging the shot of metal without dripping or dribbling after the valve is closed. A feature of the apparatus is that in operation, the conduit remains filled with molten metal at all times from the discharge orifice at the end of the conduit to the pot. This mode of operation results from the combination of a relatively small discharge orifice close to a trap at the discharge end of the conduit which prevents the molten metal in the conduit from being displaced by air after the shot is made. A disadvantage of the foregoing apparatus is that fairly frequent cleaning of the discharge orifice is necessary to maintain it free of clogging deposits which result from oxidation of the molten metal in and around the discharge orifice as when metering molten magnesium and the magnesium-base alloys. Another disadvantage is that the size of the discharge orifice is necessarily small thus restricting the capacity of the apparatus.

According to the present invention, the foregoing disadvantages are overcome by providing means between the trap and the orifice for displacing the molten metal quickly from the space between the trap and the orifice and filling the emptied space with an inert gas, while leaving the conduit filled with metal so that there is no molten metal at the orifice to cause clogging deposits.

Other features and advantages of the invention will appear as the description of the invention proceeds.

The accompanying drawing illustrates the invention embodied in both a simple and preferred form, it being understood that the form of the invention is susceptible of modification without departure from the true spirit and scope of the invention.

In the said drawing:

Fig. 1 is a side elevation of the apparatus partly in section.

Fig. 2 is a side elevation in section of a modification and preferred form of the discharge end of the apparatus of Fig. 1.

Referring to the drawing in detail, there is shown a pot 1 for maintaining in the molten state a quantity of the metal to be transferred, the pot has a flange 2 by which it is supported in the furnace setting 3. The pot is provided preferably with a cover 4 having a filling opening 5 which may be closed by a removable cover 6. In lieu of a cover, the usual saline protective fluxes may be used. The fur-

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nace setting is heated by a burner 7. A flue 8 exhausts the waste combustion gases.

Near the bottom of the pot at one side, an outlet 9 is provided through which extends into the pot one end of a molten metal conveying conduit 10. As shown, the end of the conduit extending into the pot carries a downturned elbow 11, the open end 12 of which forms a valve seat for a valve 13 which controls the flow of molten metal from the pot into the conduit 11. Valve 13 is carried by the lever arm 14, one end of which is pivoted on the bracket 15 which is supported by the pot 1. The other end of the lever arm is pivoted to the lower end of the push rod 16 which passes through the cover and is actuated by the solenoid 17 to raise or lower the valve 13 onto or off the seat 12.

The conduit 10 slopes upwardly from the outlet 9 toward the discharge end which carries an upwardly bent portion 18. This is secured to the conduit by a flanged union 19. The upwardly bent portion 18 terminates in a downturned end in the form of an elbow 20, the open end 21 of which forms the discharge orifice for the molten metal. With this arrangement of the upturned portion 18, it functions as a trap to retain molten metal in the conduit after a shot is delivered. In addition, there is provided an opening 22 in the bend of the elbow for a pipe 23 which connects the inside of the elbow to a source of inert gas, e. g. the compressed gas cylinder 24 from which inert gas is supplied to eject metal from the elbow at the conclusion of the shot while leaving molten metal trapped in the conduit 10 by the upturned portion 18.

As shown, the compressed gas cylinder has a shutoff valve 25, the outlet of which is connected to a pressure reducer valve 26. The outlet side of the pressure reducer valve is connected to the pipe 23 through an electrically operated shutoff valve 27, which is provided with a bypass 28, the flow through which is subject to control by means of the control valve 29. Operation of the shutoff valve 27 is subject to the time delay device 30 which is operated by the timer 31 which also controls the solenoid 17. The timer 31 is subject to the control of a push button 32 for starting the operation of the timer.

As the device is most useful for discharging in rapid succession accurately metered shots of molten metal to a die casting machine, the device is shown with the discharge orifice 21 arranged in position to perform this function. In the arrangement shown 33 is a shot cylinder of a conventional die casting machine with its charging opening 34 placed below the orifice 21 in position to receive the shot of metal discharged from the orifice. The shot cylinder is arranged to communicate with the two part die mold, one part 35 being held on the fixed platen 36 and the other 37 being held on the movable platen 38 which slides on the tie rods 39 in the usual manner. For protecting readily oxidizable metal from oxidation in and on the way to the shot cylinder if desired a pipe 40 connected to a supply (not shown) of protective gas, such as SO₂, may be arranged as shown to discharge the gas toward the shot cylinder opening 34.

In the modification shown in Fig. 2, the upturned portion 18 is removed at the flange 19 (Fig. 1) and replaced by the device indicated generally by numeral 41 in Fig. 2. This comprises a downturned elbow 42, the lower end being externally threaded. A cylindrical extension 43, which is internally threaded at both ends, is secured to elbow 42 by the external thread on the elbow engaging the upper internal thread of the extension. The dome-shaped member 44 which is both internally and externally threaded at the big end is secured in the cylindrical extension by means of the lower internal thread of the cylindrical member engaging the external thread of the big end of the dome-shaped member 44. The top of the dome has a threaded opening 45 in which is screw-threadedly

secured to one end of the elbow 46. A pipe 47 which extends through an opening 48 in the side of the cylindrical extension is screwthreadedly secured to the elbow 46 so as to provide a passage for inert gas into the inside space 49 of the dome 44. The wall of the cylindrical member 43 around the opening 48 is sealed to the outside of the pipe 47 so as to make fluid tight the wall 43. The dome is provided with openings 50 near the big end so as to provide communication between the space 51 inside the cylindrical extension 43 and the space 49 inside the dome. An orifice tube 52 having an externally threaded boss 53 on its mid-section is thereby screwthreadedly secured in the big end of the dome. As in the case of the discharge orifice 21 of Fig. 1, the opening 54 is placed over the opening 34 of the shot cylinder of a die casting machine in similar manner. It is desirable, if not necessary, to provide the conduit 10 and the trap means, i. e. either 18 or 41, whichever form is used, with thermal insulation 55 in which is embedded an electrical resistance heating element 56.

In operation, a supply of molten metal 57 is maintained at a suitable casting temperature as by means of a burner 7 and heating current is supplied to the heating element 56. Referring more particularly to Fig. 1, the timer 31 is set to operate the solenoid 17 so as to depress the push rod 16 and thereby open the valve 13 to allow molten metal to flow into the pipe 10 until it flows from the orifice 21. Valve 25 is opened and the pressure reducer valve 26 is set to give a gas pressure of about 6 pounds per square inch, although other pressures may be used. Valve 29 is opened and adjusted to permit a small but continuous flow of gas (e. g. 0.1 to 10 cubic feet per day) from the reducer valve through pipe 28 to pipe 23 and thence through the outlet 22 into the elbow 20. From the elbow, the gas passes out of the orifice 21 and thereby prevents air from reaching the molten metal surface 58 in the trap 18 when flow of molten metal through the conduit has stopped. The timer 31 which controls the length of time that the solenoid 17 holds valve 13 open is set to give the desired volume of metal for each shot. The interval of time will depend more or less on the size and length of the conduit, the size of the inlet and outlet passages for the metal, the height of the metal in the pot over the orifice 21 as well as the size of the shot desired. Following the setting of the timer to give the desired size of shot the delay 30 is set to momentarily open valve 27 at an instant shortly after the timer has actuated the solenoid to close valve 13. The purpose of the momentary opening of valve 27 is to provide a sudden flow of gas into elbow to quickly empty it back to the level 58 set by the trap 18 after each shot. In this way, the ending of the flow of the shot is quickly achieved, thereby not only minimizing the time the last portion of the shot can be attacked by the ambient atmosphere but also oxidation of metal within the elbow is precluded. The duration of the momentary opening of valve 27 is best ascertained by trial for the usual size of castings the valve 27 may be opened about 0.1 second after valve 13 closes and may be held open for about 0.3 to 0.4 second.

The operation of the apparatus when the modification of Fig. 2 is substituted for the trap 18 is similar.

Once the delay has been set to give the desired momentary burst of gas through pipe 23 to clear the orifice and the timer 31 has been set to provide the desired size of shot, thereafter shots may be made in rapid succession by

operating the starter button 32 as soon as a shot has been completed as evidenced by the closure of valve 27. It will be apparent that with the modification of Fig. 2 pipe 47 replaces pipe 23 and the inert gas from the pipe 59 passes through pipe 47 into the space 49, quickly ejecting the tail end of the shot of metal which flows from the conduit 10 through the elbow 42, the cylindrical extension 43 thence through the openings 50 and out the orifice 54. After the shot, the small continuous flow of inert gas through valve 29 constantly purges the space 49 until the next shot of metal is made.

Among the advantages of the invention are that the apparatus may be operated for long intervals of time without difficulty from oxidation of molten metal in and around the discharge orifice. The size of the shot of metal is accurately controllable. The apparatus has a high capacity, that is to say it is capable of delivering not only a large shot but also many shots in rapid succession.

I claim:

In a device for delivering accurately metered shots of molten metal from a supply thereof to a casting apparatus the combination which comprises a vessel for holding a supply of the molten metal, said vessel having an outlet above the bottom thereof; a first valve in the vessel on the said outlet; lever means connected to the said first valve adapted to start and stop the flow of molten metal from inside the vessel through the said outlet to meter the shots; a conduit having one end below the level of the molten metal in the vessel, said conduit being connected to the said outlet; a trap on the other end of the conduit for maintaining the conduit filled with molten metal when the said first valve is closed, said trap having a downwardly directed discharge opening, said conduit, trap and opening forming a continuous passageway for conveying molten metal from said outlet to the said opening; a pipe connected to the upper side of the said passageway near the discharge opening thereof for conveying an inert gas from a gas source and delivering it to a point in the passageway between the trap and the discharge opening; a second valve, said second valve being in the said pipe and adapted to be quickly opened and closed; a by-pass for by-passing gas around the said second valve; a third valve, said third valve being in the by-pass and adapted to regulate the gas flow rate in the by-pass; a timer associated with the said first valve adapted to control the length of time the said first valve remains open; a delay means associated with the timer and said second valve adapted to momentarily open said second valve shortly after the said first valve closes.

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