APPARATUS FOR FEEDING METAL INGOTS INTO A CRUCIBLE

Filed Feb. 2, 1967

2 Sheets—Sheet 1

INVENTOR.

Josef Werner

BY

Water, Cole, Gindler & Water

Atty's.
APPARATUS FOR FEEDING METAL INGOTS INTO A CRUCIBLE

Josef Werner, Franzhusweg 10, Hannover, Germany
Filed Feb. 2, 1967, Ser. No. 613,635
Claims priority, application Germany, Feb. 3, 1966, V 30,289
Int. Cl. F27d 3/32
U.S. Cl. 266—33

ABSTRACT OF THE DISCLOSURE

An apparatus and method for feeding metal ingots to a melting crucible with pre-heating of the ingots on a feed belt and heating at the outlet end of the crucible. The temperature of the metal in the crucible can be held at a lower temperature than the temperature of the metal at the outlet spout of the crucible. A structure for periodically tipping the crucible is provided.

This invention relates to the casting with so-called pressure or die casting machines and includes a system for the continuous melting and delivery of the casting metal to a pressure casting machine. Particularly the invention relates to the casting of magnesium alloys such as alloys having percent weight additions of 7.5 to 9.0 Al, 0.3 to 0.8 Zn, 0.15 to 0.30 Mn, 0.005 to 0.0015 Be, rest Mg.

In the production of cast pieces, for example crank cases for internal combustion engines for automobiles of magnesium alloys as to large technical scale production, it is today necessary to melt the required fluid metal centrally from pigs, slabs or ingots in electric induction furnaces. The molten metal is then directed to a heat retaining pan or container for recasting and "washing" with salts to thereafter transport it to the individual pressure casting machines where again stationary heating furnaces are arranged. From this heating furnace, the fluid metal is pumped by means of a sensitive pump into a further container from which it is then guided into the filling opening of the pressure casting machine. This type of central preparation of the casting metal for a great number of pressure casting machines is particularly costly due to the multi-filling with molten metal which requires much manual work and requires careful and expensive cleaning procedures as well as the melt itself and driving and control means require considerable space.

It is, therefore, an object of this invention to provide pressure casting machines which will utilize easily oxidizable metals as magnesium alloys, to provide melting apparatus and installations which will make it possible to melt ingots of the raw metal in a single container from solid metal to molten metal and to maintain the molten metal at a definite temperature so that finally the molten metal will be poured from this container directly into the pressure or die casting machine. The molten metal for a single casting can be fed in a definite specific amount at a definite temperature so that the metal during feeding, heating and heat retaining and final flow into the casting machine can be carried out without exposure to air and thus is protected against contamination and oxidation. Also the metal is protected during melting against any developing gases, vapor, dust, etc., by simple means and if any impurities develop they are collected by certain means with use made of heat thereon and conveyed away.

A further object of the invention resides in the provision of preparing the casting metal in such a way and by such means that the life of the casting and melting container will be increased. Furthermore, in accordance with another object of this invention, the casting metal can be delivered with the correct and uniform temperature to the filling opening of the pressure casting machine and also by means of this invention it is not necessary to clean the melting furnace after use.

A still further object of the invention resides in the structure of the walls of the heating furnace, not only for melting the metal but also to maintain the metal in heated state in perfect running order, both before and after the main heating crucible.

Further objects will be apparent from the following description when considered in connection with the accompanying drawings in which:

FIG. 1 is a side elevation partly in section of a melting and casting machine along the longitudinal axis thereof, and

FIG. 2 is a side elevation partly in section of a melting and casting machine taken at right angles relative to the machine of FIG. 1.

The pressure casting or melting machine is designated by the reference character 1, in which the filling case or cylindrical box 2 receives the molten metal or alloy through the opening 3. The casting machine includes actually a structure for melting and supplying the metals and includes a melting and heat-retaining furnace or crucible in which the latter is tiltedly arranged around an axle 5 over a device 30 in which the case 2 is mounted. To tilt the melting furnace 4, there are provided support legs 6 arranged at the bottom part of the melting furnace and on the bottom ends of the legs there are secured rollers contacting and rolling on cams or eccentric 7. These cams 7 are rotatably mounted on a foundation or base 16 of the casting machine on a shaft 7a and the latter is driven by a motor 31 mounted at the foundation or base 16 by suitable flange structure and intermediate drive means 31a are connected to the motor 31 and the shaft 7a. Means, not shown, are provided to drive the motor in sequence and in proportion to the necessary amount of metal for a single casting step as to the starting and stopping of the motor.

The melting and heat retaining furnace or crucible 4 consists of a box or casing 9 lined with fire clay 8 and having an inserted and removable melting crucible or pot 10. This pot 10 embraces or includes a central main part 10a in which the raw metal is melted and kept hot as to the pigs, blooms or ingots 20 fed into the crucible. The pot 10 has a filling section 23 and an outlet or spout 11, provided at opposite sides or ends of the elongated crucible 10. Burners 15 in double rows are arranged and mounted in the free space, FIG. 1, in the fire clay layer 8 and the crucible 10, and these burners are fed with a gas mixture from tubes 16 and from tubes 17 with combustion air. The burners 15 are so-called incandescent burners which attain a temperature of over 1000° C. without any visible flame, whereby the air for combustion from the lines 17 may at the same time serve for cooling. A burner 27 branches off from the pipe 16, FIG. 2, which heats the outlet opening 12, the pouring spout 11 being near the under side of the outlet opening 12. The fluid
metal flowing to the casting outlet 11 from the main container 10 will be present in such state that it can be further treated by directing a gas flame thereon which is supplied by a suitable gas through the pipe line 29, FIG. 2, which feeds a burner which latter is not illustrated but which produces a flame of burning gas.

In the free space in the container 9, between the fire clay layer 8 and the crucible 10 of the melting furnace 4 there are provided a plurality of collecting lines 18 for various gases which may be formed and from these the branching lines 19, FIG. 1, are connected to lines 18 in order to lead the exhaust gases to a preheating zone 21a directed to the ingots 20.

The slabs or ingots 20 which are loaded on a conveyor belt or band 21 at a loading station 21b, will be conveyed to a height as indicated in FIG. 1. The end portion of the belt or band 21 is formed as a pre-heating zone 21a and at this zone, for example, the ingots 20 are heated to a temperature of approximately 500° C., that is, to a temperature which is slightly under the melting point of the metal. The conveying band or belt 21 will throw or cast the ingots, FIG. 2, on to a roller conveyor 22. This is provided laterally relative to the conveyor belt or band 21, so that the ingots will slide lengthwise, FIG. 2, under the influence of gravity on to the roller conveyor to the filling portion or sluice 23 of the melting furnace or crucible 4. The filling opening of the filling part 23 may be closed by means of a flap member 25 which latter will swing around on a horizontal axis in such a way that the ingots will force the flap 25 open to such an extent that such ingots can slide into the main chamber or container 10a of the crucible. Suitable return means, for example, a counterweight, can be secured to or provided for the flap 25 in order that it shall swing back to its closed position. In order to prevent the entry of air at the filling part 23, a cover 26 can be provided to hermetically seal the space above the melting furnace and a protecting gas line 24 can be provided which is, for example, fed by SO₂ gas in order to thus provide a protecting gas atmosphere at the filling opening 23 for the crucible. A suitable protecting gas line can also be provided at the outlet spout 11, as, for instance, the line 29 in FIG. 2, can be utilized in order to direct a protecting gas to the outlet end of the furnace or crucible. A suitable cover 28 which is removable will control the pouring spout and which covers the pouring outlet section of the furnace.

For the casting spout 11, 12, there is provided a filling tube 13 which when the furnace or crucible 4 is tilted by means of the structure 6, 7, 7a, 31, and 31a, the molten metal will be maintained in a heated state by means of a gas-fed heating tube 14 which extends along parallel to the pipe 13.

The filling tube 13 is so arranged, as shown in FIG. 2, that it is directed just above the inlet opening 3 for the charge for the container or injector 2.

The bottom of the main portion 10a of the melting crucible 4 is such that it will feed the correct amount of metal from the ingots 20 to the casting molds, for example, the volume of the main portion 10a of the portion of the melting crucible 4 can be so calculated as to its volume that it will take up approximately a certain number of the casting ingots and also it can be calculated as to volume to receive one ingot to produce two casting pieces.

During the time that the ingots are heated in a pre-heating temperature at 21, FIG. 1, which is slightly under the melting point of the metal, it may, for example, be advantageous to heat the main part 10a and the casting nozzle 11 in such away that the metal at the casting nozzle may have a temperature of approximately 760° C., whereas in the main part there is a lower temperature of approximately 50° C. lower. This will heat the casting metal so that it will melt at an essentially lower temperature and this temperature is maintained so that the metal will flow out of the furnace through the outlet 11 for this purpose there may be provided, in addition to the pre-heating burner 27 probably additional burners 29 at the outlet 11, having a temperature regulator in the main part 10a and at the casting nozzle 11 of the furnace 4 so that the temperature control which is not illustrated can be such that in the main part 10a and of the melting crucible 4 there may be a definite lower temperature than is present at the outlet part 11 which latter is maintained at a higher temperature. In large production installations in connection with a longer casting system, it has been determined, in accordance with the invention, that the different temperature ranges have maintained a longer life for the melting furnace or the crucible itself. Furthermore, it has shown that the consumption of heat energy with the new apparatus for melting and conveying casting metal for pressure casting machines is only a fractional part of the energy necessary to melt the metal in a central melting furnace from which it is distributed by means of transporting vessels, etc. to the several casting machines.

In order to control the periodic movement of the conveyor band 21, there is utilized a structure which is generally indicated in FIG. 1 by the reference character 32.

The installation may be utilized in connection with devices for pressure casting machines in combination with a structure in which the conveyor band for feeding the ingots is connected to the mechanical drive for feeding the casting metal. Also the conveyor 21 can be so operated that it can be synchronized with the machine 1 and so as to any number of ingots 20 can be fed to the machine at any particular time. If, for example, the volume of the cast piece is the same as the volume of an ingot 20 then the conveyor 21 must be operated as to each ingot compared with the cast piece. The invention is not limited to the specific form as shown, but is actually limited to the scope of the claims attached hereto.

I claim:

1. An apparatus for melting and conveying casting metal to a pressure casting machine comprising a conveying band for metal ingots, a container in the main part of which the ingots are fed therein to be molten and maintained in heated condition, a part of the container feeding the ingots thereinto and a part from which the molten metal flows out of the container, the capacity of the container being a multiple of the volume of molten metal necessary for the single casting and a multiple of the volume of a single ingot, means for preheating the metal on the conveying band, means for transferring the ingots from the conveying band to the container, means to close the container in gas tight condition, a sluice on the container through which the ingots are fed thereto, said conveying band advancing stepwise in dependence with the operating sequence of the pressure casting machine, means for heating a main part of the container, special means for heating the outlet part of the container, and means for controlling the temperature in the main part of the container and its outlet part, the controlling means being so adjusted that the temperature of the molten metal in the main part of the container is lower than its temperature at the outlet part, and means whereby a container may be interchangeably replaced in a refractory lined housing, said housing being fixed at its outer end tiltable about an axle and said outlet and said inlet end for the metal ingots to be arranged opposite to one another with respect to the container.

2. An apparatus according to claim 1, in which the means for transferring the ingots from the conveyor band to the container includes a roller conveyor provided at the upper end of the conveyor band to feed the ingots from the latter into the container, and in which a self-closing flap closure is provided at the inlet end of the container to be actuated by the ingots, the closure having means to close the flap after passage of an ingot.
3. An apparatus according to claim 1, in which support legs are provided secured to the bottom of the container, means operable on the legs for tilting the container including cams, and a drive member for the cams which is adapted to drive the cams in relationship to the rhythm of the casting machine.

References Cited

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Date</th>
<th>Inventor(s)</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,587,727</td>
<td>3/1952</td>
<td>Horswell et al.</td>
<td>266—33 X</td>
</tr>
<tr>
<td>2,709,529</td>
<td>5/1955</td>
<td>Kleff et al.</td>
<td>266—33 X</td>
</tr>
<tr>
<td>2,950,570</td>
<td>8/1960</td>
<td>Cowles et al.</td>
<td>266—33 X</td>
</tr>
<tr>
<td>3,059,788</td>
<td>10/1962</td>
<td>True</td>
<td>214—18</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Date</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,171,877</td>
<td>3/1965</td>
<td>Germany</td>
</tr>
<tr>
<td>3,187,394</td>
<td>6/1965</td>
<td>Great Britain</td>
</tr>
</tbody>
</table>

J. SPENCER OVERHOLSER, Primary Examiner
J. E. ROETHEL, Assistant Examiner

U.S. Cl. X.R.