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Tenner

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[54] **METHOD OF CASTING QUIET MELTS**

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[56] **References Cited**

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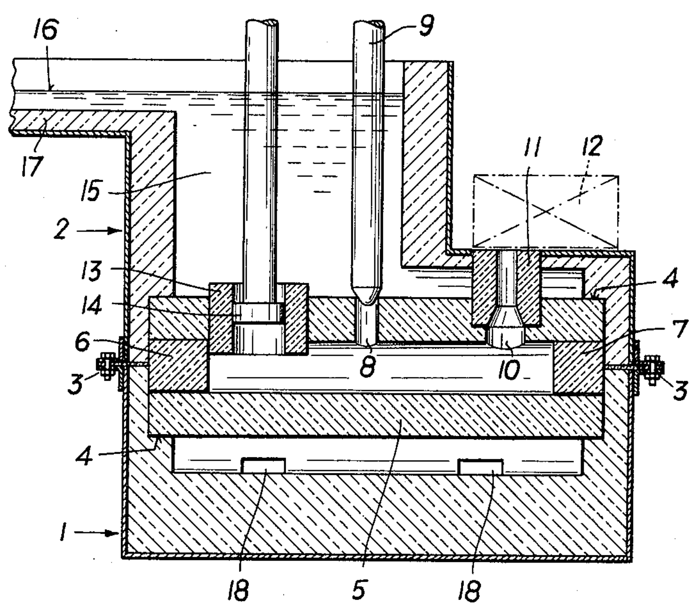
[57] **ABSTRACT**

The melt to be cast is dammed up in a supply chamber so as to flow by its own weight through an equalization chamber and from the latter through a nozzle into a mold. The melt is brought to a quiet condition before it reaches the mold by interrupting the flow of the melt into the equalization chamber and after the mold has been filled, a return flow of the melt into the equalization chamber is prevented by subjecting the melt in equalization chamber and in the mold to an increased pressure and the melt in the gate cross section of mold has solidified.

4 Claims, 1 Drawing Figure



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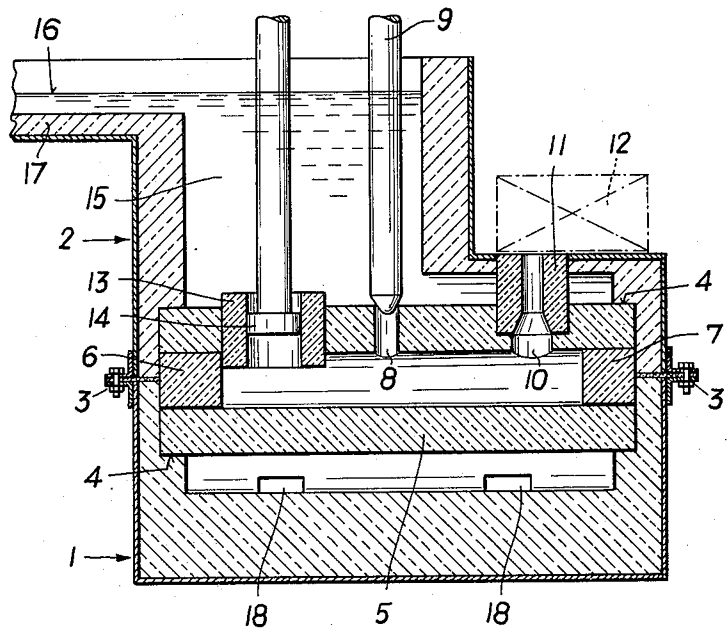

METHOD OF CASTING QUIET MELTS

The invention refers to a method of casting melts in which the melt is dammed up to a certain level in a supply container which causes a movement of the melt by its own weight through an equalization container and into a casting mold connected with said equalization container.

In the German Auslegeschrift No. 1,295,792 a method is disclosed in which a supply chamber and a casting-chamber are arranged at approximately the same level, and these two chambers are connected with each other by a conduit provided with a closure. This closure is capable of varying the speed of flow of the melt to any desired rate, so that the flow can be adapted to various requirements. Such an adjustment is also possible with another method described in the Austrian Pat. specification No. 239,979, in which the flow of the melt is throttled at the beginning of the casting method, so that at first the melt enters the mold at a low pressure and a low speed and later causes the melt to enter the mold with a full flow and entire opened cross section to obtain a complete filling of the mold with the entire available ferrostatic pressure. Another method is also well known in which the melt flows from a supply container into an equalization container having the form of an L with a plug closure device in the passage between the two containers.

A disadvantage of the two first-mentioned methods is that the flow pattern of the melt which is guided into the mold cannot be controlled. All of the mentioned methods have the disadvantage that the control interval during which the pressure of the melt in the mold can be changed, is dependent on the ferrostatic level of the melt in the supply container and is for that reason relatively limited. No regulation is possible during the static state which occurs after filling of the mold, for in a static pressure system there is everywhere the same pressure depending on the ferrostatic level. When producing small castings, if it is questionable when the apparatus is not very small whether the operation takes place in the dynamic or in the static state, this leads to uncontrolled conditions not conducive to an orderly production.

It is also known to immerse in the melt a pump-housing which is filled by a valve with melt coming from the supply chamber and in the wall of which is guided a displacement body formed by a piston. (See German Pat. specification No. 246,267.). The movements of the piston and the valve are synchronized according to the operation of a pump, and the melt is exclusively displaced by the piston from the interior of the pump into the mold. The pump housing used for this method is essentially composed of a pressure chamber, a casting chamber, and a conduit connecting these two chambers with each other, whereby these three elements have different cross sections. Such an arrangement makes it impossible to control the flow pattern which leads to a higher rate of waste. There is another disadvantage, namely, that for larger size castings, the filling of the mold must be done with only one stroke of the piston, otherwise the material would again leave the mold. Therefore, it is necessary to have a larger pump-housing which at the higher pressures requires larger dimensions than for smaller pump-housings. Thus, either only low pressures should be used for large castings or the construction of the apparatus becomes extremely expensive. The cycle interval is another disadvantage caused by the long piston strokes, so that the cycle interval of the apparatus is relatively long. The result of longer strokes is excessive wear requiring frequent repairs causing a loss of productivity.

It is an object of the invention to obtain a good filling of the mold with little mechanical effort and short cycle intervals and slowly hardening castings; thus avoiding the disadvantages of the known methods. In accordance with the invention the flow of the melt, before it fills the mold completely, is interrupted by stopping the flow of the melt into the equalization chamber, so that the melt enters the mold in a quiet state, and after filling the mold any return flow of the melt from the equalization chamber is stopped and then an increased pressure, which is higher than the pressure on the melt during the filling of the mold, is exerted on the melt in the equalization chamber and in the mold. In this manner in which the melt prior to the filling has reached the mold directly, the melt during the filling from a quiet state is accelerated directly into the cavity of the mold without being subjected to turbulence prior to the filling of the empty conduits. Thus, it is possible to fill the mold almost without turbulences.

The pressure application according to the invention permits theoretically the production of any desired high pressure at low expense, because the equalization chamber for the purpose of fulfilling its function may be relatively small. This function consists in stabilizing the melt after it has passed the shutoff device (separating the supply chamber from the equalization chamber), which stops the flow of the melt in the equalization chamber. A small pressure chamber requires less force than a larger one. The filling of the mold occurs automatically by ferrostatic pressure and therefore there are hydrostatic conditions at the moment when the elevated pressure is produced. That is why this production of pressure is much easier and the increased pressure may be produced more quickly and released as if the flow of the melt is produced by artificial pressure. This leads to shorter cycle intervals and therefore to an increased production, as compared with known methods. The entire arrangement will be smaller in size and thus will be less expensive than the existing arrangements.

With the method of the invention, it is easy by means of the already mentioned shutoff device to control the casting speed. It is also possible to regulate easily the casting temperature by the arrangement of the equalization chamber and by the flow of the melt according to the invention to the mold so that, for instance, a casting with sand cores may be produced, for it is possible to employ lower superheated temperatures, and the controlled flow prevents a destruction of the sand cores. Therefore, castings with thicker walls may be produced which is quite difficult when the heretofore known die casting methods are used, because the steel cores which are generally used in these prior art methods of die casting, limit considerably the production program. This disadvantage is overcome by the method of the present invention.

The method of the present invention also makes it possible to produce a homogeneous structure throughout the wall of the castings, thus considerably eliminating waste during the further processing methods.

A further feature of the invention is that the melt in the equalization chamber is conducted during the filling of the mold over a straight portion with equal cross section until the melt is substantially free of turbulence. In this manner, much better casting conditions are created and waste is still more reduced because this flow of the melt settles the turbulence which originates from passing the shutoff device which controls the flow of the melt into the equalization chamber. According to the invention, it is advisable to maintain the elevated pressure on the melt until the melt in the gate cross section of the mold has become solid, because this leads to a better structure of the casting.

According to the invention, the elevated pressure in the equalization chamber can be very easily produced by a mechanical pressure increase of the melt in the equalization chamber, for instance by means of a displacement body which is immersed in the melt. The displacement body acts on the hydrostatic system and therefore only very small movements of this displacement body are necessary to produce a maximum of pressure.

The FIGURE of the drawing shows schematically an example in a vertical sectional view of an apparatus which may be used to practice the method in accordance with the invention.

Referring to the drawing, the apparatus for practicing the method of the invention comprises a horizontally disposed lower part 1 and a horizontally disposed upper part 2. Both these parts are screwed together by means of marginal flanges 3. A horizontally arranged tube arranged within the cavity formed by the parts 1 and 2 forms an equalization chamber 5. The ends of the tube are closed by plugs 6 and 7 and are arranged in circular recesses 4 formed in the inner end walls of the lower part 1 and the upper part 2, respectively. The equalization chamber 5 has a straight horizontal axis and has at least a constant cross section in the area between its lateral inlet 8, which can be closed by a plug 9 which controls the flow of the melt into the chamber 5, and its outlet 10 which has a casting nozzle 11 mounted therein which leads to a mold or a die 12. This cross section of the chamber 5 may have any desired form and depends on fluid mechanics and on construction requirements. The exterior cross section or circumference of the tube forming the equalization chamber 5 can be selected in dependently of the inner cross section of the equalization chamber 5.

Next to the inlet 8 a hollow cylindrical member 13 is mounted in the wall of the equalization chamber 5. In this hollow cylinder 13 is slidably mounted a piston 14, which constitutes a displacement body. The space surrounding the chamber 5 in the inner chamber of the lower part 1 and of the upper part 2 constitutes a supply chamber 15 which together with an upper extension 20 is filled with melt up to a level 16. To maintain this level as constant as possible, the supply chamber 15 is connected with a conduit 17 to a melting furnace, not shown. This may be done, for instance, by means of communicating vessels. For the maintainance of a constant metal level in the supply chamber, the use of an intermittent feed of the melt from a ladle or from a furnace is possible, and the feed to the supply chamber may be synchronized to the cycle interval of the casting process. Openings 18 in the lower portion of the supply chamber serve as a connection with an induction heating device (not shown) which maintains the melt at the desired temperature.

A horizontal nozzle may also be used for casting, it is inserted in place of the plug 7 in the end wall of the tube forming the equalization chamber 5.

The described apparatus according to the invention, operates as follows: The supply chamber 15 and the equalization chamber 5, and if possible also the casting nozzle 11 are filled with quiet melt, for the plug 9 is closed and the piston 14 stands still. After positioning the mold 12, the plug 9 is raised and the inlet 8 is opened to such an extent as to obtain the required casting speed for the casting to be produced. By this means it is possible to produce different castings without changing the apparatus. When the mold is filled exclusively by the action of the ferrostatic pressure of melt in the supply chamber 15, which is determined by specific filling gauges or by controlled means, the plug 9 is lowered and closes the inlet 8. After that the desired higher pressure on the melt is produced by lowering the piston 14, but the plug 9 keeps the inlet 8 closed; thus a return flow of the melt from equalization chamber 5 to supply chamber 15 is stopped. The higher pressure produced in the equalization chamber 5 is higher than the pressure which occurs during the filling of mold 12 and is maintained until the melt in the gate cross section has hardened. Thereupon the piston 14 is somewhat raised, the mold 12 is emptied or replaced by a new mold and the casting cycle starts again.

In this method of producing the desired pressure in the melt, only a very short stroke of piston 14 is necessary, because only the difference of the volume has to be equalized which is produced during the solidification of the melt whereas the mold 12 is filled only by the ferrostatic pressure of the melt. The piston 14 and the plug 9 can be controlled in a mechanical, hydraulic, electrical or electronic manner.

The distance between inlet 8 and outlet 10 and also the inner cross section of equalization chamber 5 are selected in such a manner that a quiet flow of the melt in the equalization chamber and in the mold 12 is produced, and the melt enters the mold practically without turbulence through the outlet 10 and the nozzle 11, respectively; thus perfect castings are the result.

This method can be used for any kinds of metals; i.e., metal melts, such as iron, steel, brass, bronze, etc., or for plastic melts.

What I claim is:

1. Method of casting melts in which the melt is dammed up to such a level in a supply chamber that the melt flows by its own weight through an equalization chamber connected to said supply chamber and fills a casting mold connected with said equalization chamber, wherein the improvement comprises the steps of bringing the melt to a quiet condition before the melt reaches the mold by interrupting the flow of the melt into the equalization chamber, then introducing the quiet melt into the mold and after filling the mold preventing a return flow of the melt from the equalization chamber to the supply chamber, then subjecting the melt in the equalization chamber and in the mold to an increased pressure which is higher than the

ferrostatic pressure acting on the melt during the filling operation of the mold.

2. Method according to claim 1 in which the melt in the equalization chamber is caused to flow during the filling of the mold along a straight passage having a constant cross section until the melt is substantially free of turbulence.

3. Method according to claim 1 including the step of maintaining said increased pressure on the melt until the melt has solidified in gate cross section of the mold.

4. Method according to claim 1, in which the raised pressure on the melt is produced mechanically inside said equalization chamber.

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