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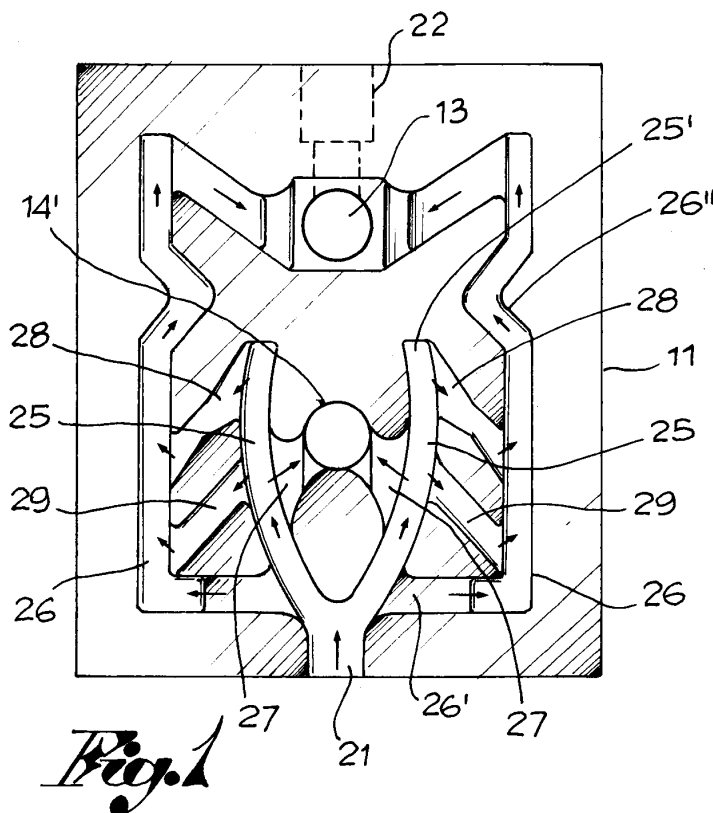
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(54) Suction valve for discharging air and gas from dies in pressure casting

(57) This invention concerns a suction valve for discharging air and gas from dies in pressure casting. It includes two internal channels (25), which fork from an incoming passage (21) and which encircle the area of a sealing piston (14), two external channels (26), which

branch out in opposite directions to the entrance (21) and which reach the area of a stopper (25) from opposite sides, at least one first laminar channel, retroflected from an internal channel (25) to a collateral external channel (24), and an internal branch (27) from each internal channel (25) to the area of the sealing piston (14).



EP 1 065 019 A1

Description

[0001] This invention concerns a suction valve for discharging air and gas from the dies in pressure casting of pieces in copper alloys, such as brass, as well as aluminium and its alloys.

[0002] The dies employed in pressure casting at present generally use a suction valve to allow the discharge of air and gas from the die and to prevent their inclusion in the piece being cast. The valve is connected to a suction pump at both the entry and exit side of the die.

[0003] The air and gas, removed by the pump, enter the valve together with a flow of metal. Then, while the metal cools in the valve body, the air and gas are discharged to the outside, until a stopper in the valve itself is closed by an actuator, operated by the fluid itself.

[0004] The valves which have been used up to now, however, have demonstrated problems of reliability, particularly with regard to pressure casting of metals with high heat conductivity, because the passages made in the valve are not always suitable for an effective slowing and cooling of the molten metal, or for preventing this metal from invading the housing of the stopper and, thereby, rapidly reducing the valve efficiency.

[0005] This represents a serious inconvenience which is well-known to operators in the sector, where the valve has to be substituted frequently for repair, and which the present invention is intended to make unnecessary.

[0006] In fact, the aim of this invention is to propose a suction valve for dies, which is perfectly efficient for the pressure casting of copper alloys as well as aluminium, thanks to the fact that the passages for the metal flow are structured in such a way as to reduce the speed of the metal, increase the heat exchange surface with the valve body and reduce the temperature of the metal, thereby obtaining an effective discharge of air and gas and ensuring that the stopper does not become restricted or impeded in its operation by the molten metal.

[0007] The valve according to the invention can therefore be used continuously and effectively, without need for maintenance, for a far greater number of cycles than the existing valves, to the benefit of the productivity and the economy of a pressure die-casting machine.

[0008] The purpose and advantages mentioned above are obtained by a suction valve for dies in pressure casting according to claim 1.

[0009] For this reason, the molten metal entering the valve does not go directly to the piston or actuator which commands the stopper, in such a way that the fluid can cool down, reduce speed and increase the pressure on said piston at the moment of the stopper's closing. Before reaching the stopper, the fluid follows special channels, which slow the flow and contribute further to reducing the temperature. Thus, when the metal reaches the stopper, it has a low temperature and speed, at least sufficient to minimise the thermal loss, drawing etc., at

the level of the stopper.

[0010] Further details of the invention will become clear from the following description, made with reference to the enclosed drawings, in which:

Fig. 1 shows a view of the valve when open, to show the internal channels;

Fig. 2 shows a cross-section of the valve, to reveal the actuator and the stopper, according to one possible version;

Fig. 3 shows a drawing of the valve applied to a die; and

Figs 4, 5 and 6 show variations in the shape and layout of the channels.

[0011] The suction valve which is proposed here consists of a valve body 11, with its relative lid 12, and which can be equipped with a circulating fluid cooling system. Between the body and the lid, in one or the other, there are channels for the molten metal and, perpendicular to the plane of said channels, there is a stopper 13, normally open, and a piston or command actuator 14 for the stopper, for sealing the latter by means of an idle lever 15. However, this system of stopper - actuator - idle lever is already well-known and in use in existing valves.

[0012] The suction valve is applied to a die for pressure casting - Fig. 3 - which has at least one impression 18 of the piece to be cast. The valve body 11 is fixed to the mobile part 19 of the die, while the lid is fastened to the stationary part 20 of the die, or vice versa, so that when the die 19, 20 is sealed, there is a corresponding closure of the valve caused by the body and lid coming together.

[0013] The valve body 11 has, on opposite sides, an entry passage 21 - Fig. 1 - which connects to the impression 18 in the die 19, 20 via a conduit 20', and an exit hole 22 which connects to a suction pump 23, through a filter 24. The stopper 13 is placed next to the exit hole 22 - Fig. 2 - in an appropriate housing 13'; the piston or actuator 14 is located at a distance from the stopper 13 in its own housing 14', which is set in the part mid-way between the entrance 21 and the exit 22.

[0014] The entry passage 21 forks into two internal channels 25 which encircle the housing 14' of the piston or actuator 14 without joining up with their other extremities 25'. From the same entry passage 21 or, alternatively, from the internal channels 25, there branch off, in opposite directions, two external channels 26 which reach the housing 13' of the stopper 13 from opposite sides. Each external channel 26 has the part nearest to the body 26' tapered, that is, flattened or shallower, with a cross-section equal to about a third of that of the external channel from which it branches off. For the remaining part, the external channels 26 have a cross-section which is about the same as that of the internal channels 25. Furthermore, each external channel 26 may have at least one intermediate deviation 26", de-

signed to increase the overall length and which may be V-shaped or otherwise. In the area of the stopper, the external channels become at least 30% shallower.

[0015] Each internal channel 25, in an intermediate part, communicates with the housing 14' of the piston or actuator 14, via an internal branch 27. Ideally, each internal branch 27 diminishes in depth and/or width as it runs from its respective channel towards the housing 14'.

[0016] The farthest extremity 25', or, at least a part of each internal channel 25 upstream from the internal branch 27, communicates with an intermediate part of the collateral external channel 26, by means of a first laminar channel 28 which is bent back and flows into said external channel at an angle of less than 60°, in the opposite direction to the flow of the fluid in the same external channel. The term "laminar" is used here to mean a channel with a depth that is considerably less than its width, thereby increasing the surfaces for heat exchange with the valve body, cooling the fluid passing through the channel more than in those channels where the depth and the height may not be equal but are similar.

[0017] The cross-section of each retroflexed first channel 28 is inferior to that of both the internal channel 25 and the external channel 26 that it connects and, anyway, is not more than 20-30% bigger than the cross-section of the entry passage 21. Furthermore, each retroflexed first channel 28 may also benefit from a double-coned shape, with a tapering in its middle part. This will help increase the speed of the fluid towards the lateral channel and provide resistance to the metal which is advancing down this channel towards the stopper 13.

[0018] As shown in Fig. 1, an intermediate part of each internal channel 25 may also be connected to the collateral external channel 26, via a second retroflexed laminar channel 29, practically parallel to the first one 28. This further increases the heat exchange between the fluid metal and the valve body, reduces the temperature of said metal and provides further resistance to the metal flow in the lateral channel. This second retroflexed channel 29 will have a smaller cross-section than the first retroflexed channel 28. When a second retroflexed channel 29 is used between collateral internal and external channels, the first retroflexed channel 28 will have a cross-section at least equal to the sum of the cross-sections of the second retroflexed channel and the nearest part 26' of the external channel.

[0019] The arrows in Fig. 1 indicate the flow of molten metal and gas which pass into the valve connected to the suction pump and coming from the die during pressure-casting. This flow enters the valve via the entrance 21 and is forced to run mainly along the internal channels 25 and then finally the external channels 26, cooling down steadily as it goes. From the internal channels, the metal flow is forced to run along the internal branches 27 towards the actuator 13 and the one or two retroflexed laminar channels 28, 29, towards the external

channels 26 and, via these, towards the stopper for the discharge of the gas and air.

[0020] The cooling of the valve body and the dividing up of the metal flow into the internal channels 25 and the external ones 26 by means of the retroflexed laminar channels 28, 29 all helps reduce the temperature and speed of the fluid. This results in, on the one hand, an increase in the pressure applied to the piston or actuator 14 designed to close the stopper and, on the other hand, a limit to the flow and drawing of the metal at the level of the stopper when the latter is closed, thereby bringing the advantages mentioned above and increasing the efficiency and useful life of the valve.

[0021] Finally, it should be noted that, provided the general principle and purpose of the distribution of the fluid flow around the valve is observed, the internal, external and retroflexed channels may have courses and shapes that differ from those shown in Fig. 1, without departing from the subject of the invention. Some of these alternative configurations are shown in Figs 4, 5 and 6.

Claims

1. Suction valve for discharging gas and air from dies for the pressure-casting of copper alloys, aluminium and aluminium alloys, consisting of a valve body (11) and a corresponding lid (12), where the valve body has an entry passage (21) for the flow of molten metal, air and gas arriving from the die, and an exit hole (22) for the air and gas which is connected to a suction pump via a filter, and where the exit hole (22) is coordinated with a stopper (13), normally open, commanded for its closure by a piston or actuator (15) when it is reached by the metal flow arriving from the die, said command piston (15) being connected to said stopper by means of the idle lever (14), characterised by the fact that, on the plane between the valve body (11) and the lid (12) there are two internal channels (25) which fork away from the entry passage (21) and encircle the area of the piston or actuator (14), without joining up with their farthest extremities, two external channels (26) which branch off in opposite directions from said entry passage (21) or from said internal channels (25) and which reach the area of the stopper (13) from opposite sides, at least one first laminar channel (28) bent back from an internal channel (25) to a collateral external channel (26) and flowing into this external channel at an angle contrary to the flow of the fluid in the same external channel, and an internal branch (27) from each internal channel (25) to the area of the piston or actuator (14), said internal branch being upstream of the first retroflexed laminar channel (27), considering the direction of the flow in this channel.

2. Valve according to claim 1, in which said internal channels (25) and said external channels (26) have a cross-section that is more or less equal and each first retroflexed laminar channel (28) has a smaller cross-section than that of each of the internal and external channels (25, 26), said first retroflexed channel (28) being much shallower than it is wide. 5
 3. Valve according to claims 1 and 2, in which each first retroflexed laminar channel (28) has a cross-section that is no more than 30% bigger than the cross-section of the entry passage (21). 10
 4. Valve according to claims 1-3, in which each first retroflexed laminar channel (28) flows into the respective external channel (26) at an angle no greater than 60°, in the opposite direction to the flow of fluid in said external channel. 15
 5. Valve according to claims 1-4, in which each first retroflexed laminar channel (28) has a double-coned course, with a tapered zone in its middle part. 20
 6. Valve according to any of the previous claims 1-5, in which the nearest part (26') of each external channel is tapered or shallower than the rest. 25
 7. Valve according to any of the previous claims 1-6, in which each external channel has at least one deviation (26'') to increase its length. 30
 8. Valve according to any of the previous claims, in which each internal branch (27) has a depth and/or width which diminishes as it runs from the internal channel (25) towards the area of the piston or actuator (14). 35
 9. Valve according to the previous claims, also consisting of a second retroflexed laminar channel between an internal channel (25) and a collateral external channel, said second retroflexed channel having a smaller cross-section than the first retroflexed channel (28). 40
 10. Valve according to claim 9, in which said first retroflexed laminar channel has a cross-section at least equal to the sum of the cross-sections of the second retroflexed laminar channel and the nearest part (26') of the external channel. 45
 11. Valve according to any of the previous claims, in which each lateral channel of the stopper area has a depth that is at least 30% less than the rest of the same channel. 50
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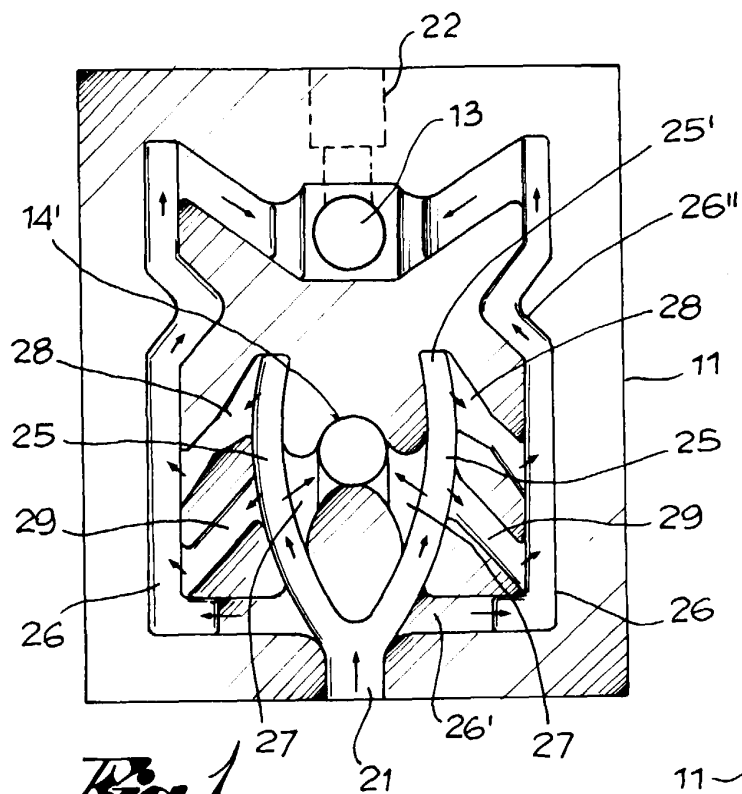
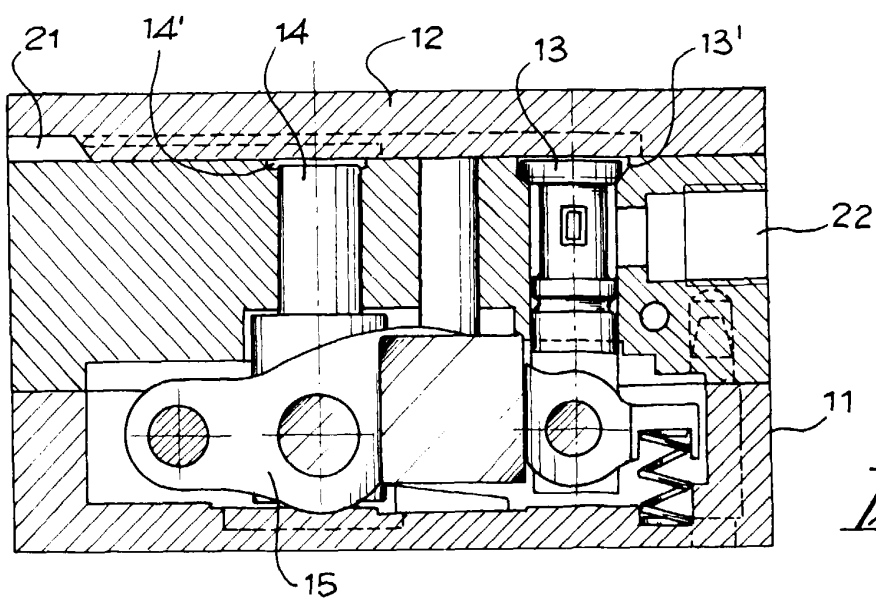
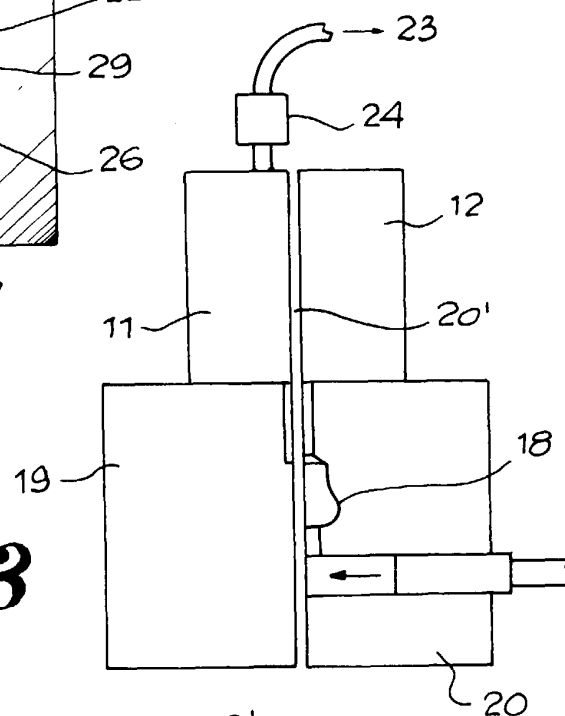


Fig. 3



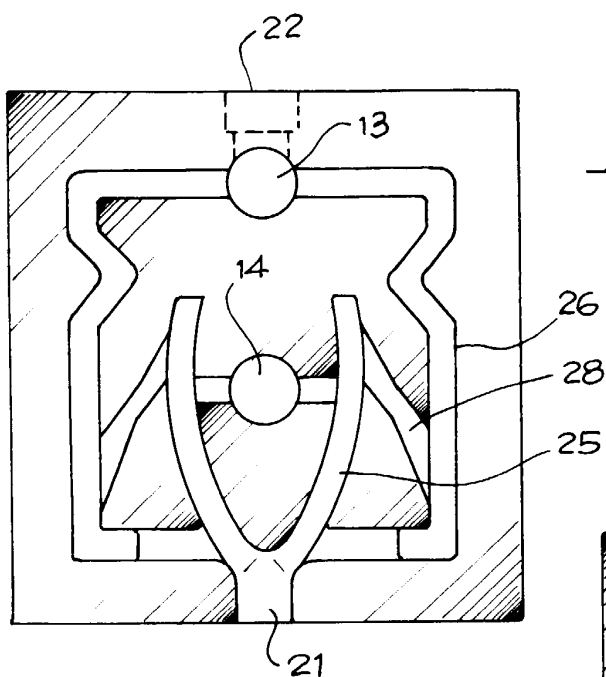


Fig. 5

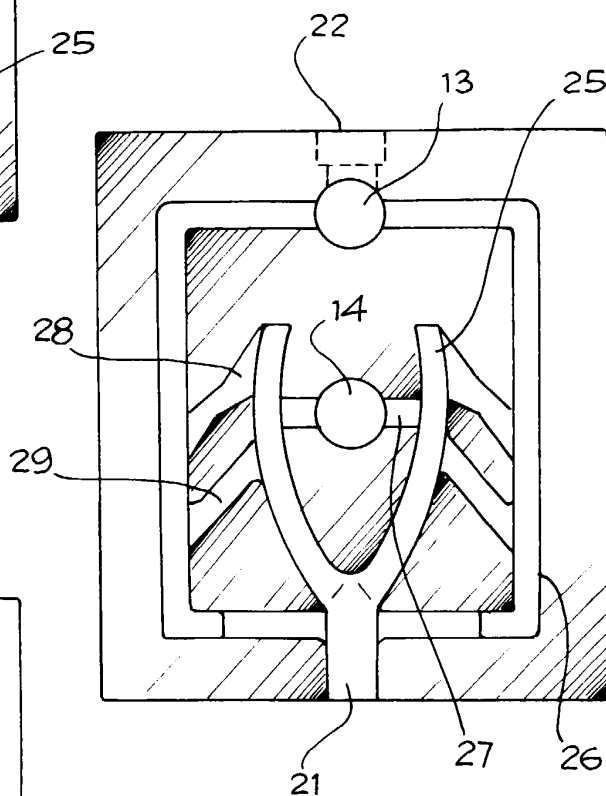


Fig. 4

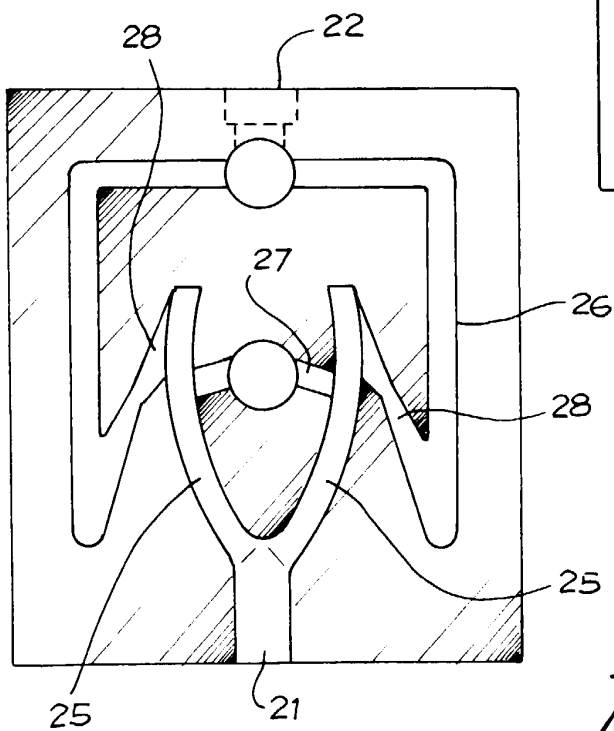


Fig. 6



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Application Number
EP 00 83 0461

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18 October 2000	Examiner Mailliard, A
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