(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 430 974 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
13.09.2006 Bulletin 2006/37

(51) Int Cl.:
B22D 17/14 *(2006.01)*

(21) Application number: **04075678.5**

(22) Date of filing: **30.06.2000**

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

Saugventil zum Abführen von Luft und Gas aus Giessformen beim Druckgiessen

Soupape d'aspiration pour évacuer de l'air et des gaz de matrices pendant la coulée sous pression

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
RO SI

(30) Priority: **02.07.1999 IT BS990064**

(43) Date of publication of application:
23.06.2004 Bulletin 2004/26

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
00830461.0 / 1 065 019

(73) Proprietor: **Bresciani, Edoardo**
25070 Sabbio Chiese (Brescia) (IT)

(72) Inventor: **Bresciani, Edoardo**
25070 Sabbio Chiese (Brescia) (IT)

(74) Representative: **Crippa, Paolo Ernesto et al**
JACOBACCI & PARTNERS S.p.A.
Piazzale Arnaldo, 2
25121 Brescia (IT)

(56) References cited:
US-A- 3 991 971
US-A- 4 489 771
US-A- 4 995 445
US-A- 5 488 985
US-A- 5 683 730

- **PATENT ABSTRACTS OF JAPAN vol. 1998, no. 02, 30 January 1998 (1998-01-30) & JP 09 267162 A (TOYOTA MOTOR CORP), 14 October 1997 (1997-10-14)**
- **PATENT ABSTRACTS OF JAPAN vol. 1997, no. 03, 31 March 1997 (1997-03-31) & JP 08 309504 A (TOYOTA MOTOR CORP), 26 November 1996 (1996-11-26)**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 1 430 974 B1

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] A valve of this kind is known, for example, from US 5,683,730.

[0005] 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.

[0006] 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.

[0007] 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.

[0008] 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.

[0009] The purpose and advantages mentioned above are obtained by a suction valve for dies in pressure casting according to claim 1.

[0010] 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.

[0011] 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.

[0012] 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.

[0013] 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.

[0014] 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.

[0015] 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", designed 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.

[0016] 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'.

[0017] 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 DEG , 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.

[0018] 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.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] 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 scope of the invention as defined by the appended claims. Some of these alternative configurations are shown in Figs 4, 5 and 6.

Claims

1. Suction valve for discharging gas and air for pressure-casting of copper alloys, aluminium and aluminium alloys, comprising a valve body (11) and a corresponding lid (12), where the valve body has an entry passage (21) for the flow of the 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 (14) when it is reached by the metal flow arriving from the die, said command piston (14) being connected to said stopper by means of a idle lever (15), **characterised in that** on the plane between the valve body (11) and the lid (12) there are two internal channel (25) suitable to force to run along them a flow of molten metal entered into the valve via said entry passage (21); internal branches (27) suitable to force to run the metal flow from the internal channels (25) towards the piston or actuator (14); and one or two retroflexed laminar channels (28, 29) suitable to force to run the flow of molten metal from the internal channels (25) towards external channels (26) and, via said external channels (26), towards the stopper (13) for the discharge of the gas and air.

2. Suction valve according to claim 1, in which 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 retroflexed 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.

3. Valve according to claim 2, 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.

4. Valve according to claims 3, 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).

5. Valve according to claims 1-4, in which each first retroflexed laminar channel (28) flows into the respective external channel (26) at an angle no greater than 60 DEG , in the opposite direction to the flow of fluid in said external channel.

6. Valve according to claims 1-5, in which each first retroflexed laminar channel (28) has a double-coned course, with a tapered zone in its middle part.

7. Valve according to any of the previous claims 1-6, in which the nearest part (26') of each external channel is tapered or shallower than the rest.

8. Valve according to any of the previous claims 1-7, in which each external channel has at least one deviation (26") to increase its length.

9. 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).

10. 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).

11. Valve according to claim 10, 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.

12. 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.

13. Method for discharging air and gas from dies for the pressure-casting and reducing the speed of the molten metal flow comprising the following steps:

- providing a suction valve according to claim 1;
- entering a flow of molten metal into the valve via an entry passage (21);
- forcing said molten metal flow to run mainly along internal channels (25);
- forcing said metal flow to run from said internal channels (25) along internal branches (27) towards a piston or actuator (14) for the closure of the valve;
- forcing said metal flow to run from said internal channels (25) along one or two retroflexed laminar channels (28; 29) towards external channels (26) and, via said external channels (26), towards a stopper (13) for the discharge of the gas and air,

said metal flow being cooled down steadily as it goes along said internal and external channels.

Patentansprüche

1. Saugventil zum Abführen von Luft und Gas für das Druckgießen von Kupferlegierungen, Aluminium und Aluminiumlegierungen, umfassend ein Ventilgehäuse (11) und eine korrespondierende Abdeckung (12), wobei das Ventilgehäuse einen Einlasskanal (21) für den Fluss aus geschmolzenem Metall, Luft und Gas aufweist, der von der Druckgießform kommt, sowie eine Auslassöffnung (22) für die Luft und das Gas, die über einen Filter mit einer Saugpumpe verbunden ist und wobei die Auslassöffnung (22) auf ein Schließteil (13) abgestimmt ist, das normalerweise geöffnet ist und für seine Schließung von einem Kolben oder Betätigungsglied (14) angesteuert wird, wenn es von dem von der Druckgießform kommenden Metallfluss erreicht wird, wobei der genannte Steuerkolben (14) mit dem genannten Schließteil mittels eines Leerlaufhebels (15) verbunden ist, **dadurch gekennzeichnet, dass** auf der Ebene zwischen dem Ventilgehäuse (11) und der Abdeckung (12) zwei Innenkanäle (25) vorgesehen sind, die geeignet sind, einen Fluss aus geschmolzenem Metall, der über den genannten Einlasskanal (21) in das Ventil gelangt ist, zwangsweise so zu führen, dass er in ihnen entlang fließt; innere Abzweigungen (27), die geeignet sind, den Metallfluss zwangsweise von den Innenkanälen (25) zu dem Kolben oder Betätigungsglied (14) zu führen; sowie eine oder zwei rückgerichtete Laminarkanäle (28, 29), die geeignet sind, den Fluss des geschmolzenen Metalls zwangszweise von den Innenkanälen (25) zu den Außenkanälen (26) zu führen und über die genannten Außenkanäle (26) zu dem Schließteil (13) zum Abführen des Gases und der Luft.

2. Saugventil nach Anspruch 1, bei dem auf der Ebene zwischen dem Ventilgehäuse (11) und der Abdeckung (12) zwei Innenkanäle (25) vorgesehen sind, die sich im Anschluss an den Einlasskanal (21) gabeln und den Bereich des Kolbens oder Betätigungsgliedes (14) umgeben, ohne sich mit ihren am weitesten entfernt liegenden Enden wieder zu verbinden, ferner zwei Außenkanäle (26), die in entgegengesetzte Richtungen von dem genannten Einlasskanal oder von den genannten Innenkanälen (25) abzweigen und den Bereich des Schließteils (13) aus entgegengesetzten Richtungen erreichen, wobei zumindest ein erster rückgerichteter Laminarkanal (28) von einem Innenkanal (25) nach hinten zu einem parallelen Außenkanal abgewinkelt ist und unter einem Winkel in diesen Außenkanal hineinführt, der dem Fluidstrom in diesem Außenkanal entgegengesetzt ist, sowie eine Innenabzweigung (27) von jedem Innenkanal (25) zu dem Bereich des Kolbens oder Betätigungsgliedes (14), wobei sich die genannte Innenabzweigung vor dem ersten rückgerichteten Laminarkanal (28) befindet, wenn man die Fließrichtung dieses Kanals betrachtet.

3. Ventil nach Anspruch 2, bei dem die genannten Innenkanäle (25) und die genannten Außenkanäle (26) Querschnitte haben, die mehr oder weniger gleich sind und jeder rückgerichtete Laminarkanal (28) einen kleineren Durchmesser aufweist als jeder der Innen- und Außenkanäle (25, 26), wobei der genannte erste rückgerichtete Kanal (28) viel flacher ist als breit.

4. Ventil nach Anspruch 3, bei dem jeder erste rückgerichtete Laminarkanal (28) einen Querschnitt aufweist, der nicht mehr als 30% größer ist als der Querschnitt des Einlasskanals (21).

5. Ventil nach den Ansprüchen 1 - 4, bei dem jeder erste rückgerichtete Laminarkanal (28) unter einem Winkel von nicht mehr als 60° in den jeweiligen Außenkanal (26) übergeht und dabei in Gegenrichtung zum Fluidstrom in dem genannten Außenkanal ist.

6. Ventil nach den Ansprüchen 1 - 5, bei dem jeder erste rückgerichtete Laminarkanal (28) einen doppelkonischen Verlauf hat, mit einer sich verjüngenden Zone in seinem Mittelstück.

7. Ventil nach einem der vorgehenden Ansprüche 1 - 6, bei dem die Anfangszone (26') jedes Außenkanals sich verjüngt oder flacher ist als der Rest.

8. Ventil nach einem der vorgehenden Ansprüche 1 - 7, bei dem jeder Außenkanal zumindest eine Auslenkung (26") aufweist, um seine Länge zu vergrößern.

9. Ventil nach einem der vorgehenden Ansprüche, bei dem jede Innenabzweigung (27) eine Tiefe und/oder Breite aufweist, die in dem Maße kleiner wird, wie sie sich vom Innenkanal (25) zum Bereich des Kolbens oder Betätigungsgliedes (14) hin erstreckt.

10. Ventil nach den vorgehenden Ansprüchen, ferner umfassend einen zweiten rückgerichteten Laminarkanal zwischen einem Innenkanal (25) und einem parallelen Außenkanal, wobei der genannte zweite rückgerichtete Kanal einen kleineren Querschnitt aufweist als der erste rückgerichtete Kanal (28).

11. Ventil nach Anspruch 10, bei dem der genannte erste rückgerichtete Laminarkanal einen Querschnitt aufweist, der zumindest gleich groß ist wie die Summe der Querschnitte des zweiten rückgerichteten Laminarkanals und der Anfangszone (26') des Außenkanals.

12. Ventil nach einem der vorgehenden Ansprüche, bei dem jeder Seitenkanal des Schließteilbereichs eine Tiefe aufweist, die zumindest 30 % geringer ist als der Rest desselben Kanals.

13. Verfahren zum Abführen von Luft und Gas aus Formen für das Druckgießen und zum Reduzieren der Geschwindigkeit des Metallschmelzeflusses, umfassend die folgenden Schritte:

Bereitstellen eines Saugventils gemäß Anspruch 1;
Einlauf eines Metallschmelzeflusses in das Ventil über einen Einlasskanal (21);
Zwangsführen des genannten Metallschmelzeflusses, so dass er hauptsächlich durch die Innenkanäle (25) fließt;
Zwangsführen des genannten Metallflusses, so dass er von den genannten Innenkanälen (25) entlang von Innenabzweigungen (27) zu einem Kolben oder Betätigungsglied (14) fließt, um die Schließung des Ventils herbeizuführen;
Zwangsführen des genannten Metallflusses, so dass er von den genannten Innenkanälen (25) entlang eines oder zwei rückgerichteten Laminarkanälen (28, 29) zu Außenkanälen (26) fließt und, über die genannten Außenkanäle (26), zu einem Schließteil (13) zum Abführen des Gases und der Luft, wobei der genannte Metallfluss stetig abgekühlt wird, wenn er entlang der genannten Innen- und Außenkanäle fließt.

Revendications

1. Soupape d'aspiration permettant d'évacuer du gaz et de l'air pour le moulage sous pression d'alliages de cuivres, d'aluminium et d'alliages d'aluminium, comprenant un corps de soupape (11) et un couvercle (12) adapté, sur lequel le corps de soupape dispose d'un orifice d'entrée (21) pour l'écoulement de métal fondu, de l'air et du gaz provenant de la matrice, ainsi qu'un orifice d'évacuation (22) de l'air et du gaz raccordé à une pompe d'aspiration via un filtre et sur lequel l'orifice d'évacuation (22) est associé à un bouchon (13), normalement ouvert, dont la fermeture est commandée par un piston ou un vérin (14) lorsque l'écoulement de métal provenant de la matrice atteint ce dernier, ledit piston de commande (14) étant raccordé au dit bouchon au moyen d'un levier de ralenti (15), **caractérisé en ce qu'**il existe, sur le plan situé entre le corps de soupape (11) et le couvercle (12), deux canaux internes (25) pouvant être forcés pour laisser passer du métal fondu ayant pénétré dans la soupape via ledit orifice d'entrée (21) ; des ramifications internes (27) pouvant être forcées pour laisser passer l'écoulement de métal provenant des canaux internes (25) jusqu'au piston ou vérin (14) ; et un ou deux canal/canaux laminaire(s) rétrofléchi(s) (28, 29) pouvant être forcé(s) pour laisser passer l'écoulement de métal fondu provenant des canaux internes (25) jusqu'aux canaux externes (26) et, via lesdits canaux externes (26), jusqu'au bouchon (13) pour l'évacuation du gaz et de l'air.

2. Soupape d'aspiration selon la revendication 1, dans laquelle existent, sur le plan situé entre le corps de soupape (11) et le couvercle (12), deux canaux internes (25) qui s'éloignent en bifurquant de l'orifice d'entrée (21) et encerclent la zone du piston ou du vérin (14), sans rejoindre leurs extrémités les plus éloignées, deux canaux externes (26) qui bifurquent dans des directions opposées au dit orifice d'entrée (21) ou aux dits canaux internes (25) et qui atteignent la zone du bouchon (13) depuis des côtés opposés, au moins un premier canal laminaire rétrofléchi (28) replié à partir d'un canal interne (25) vers un canal externe parallèle (26) et s'écoulant dans ce canal externe selon un angle opposé à l'écoulement du fluide dans le même canal externe, et une ramification interne (27) partant de chaque canal interne (25) et se dirigeant vers la zone du piston ou du vérin (14), ladite ramification interne étant en amont du premier canal laminaire rétrofléchi (27), en fonction de la direction de l'écoulement dans ce canal.

3. Soupape selon la revendication 2, dans laquelle lesdits canaux internes (25) et lesdits canaux externes (26) présentent une section transversale plus ou moins égale et chaque premier canal laminaire rétrofléchi (28) présente une section transversale plus petite que celle de chacun des canaux internes et externes (25, 26), ledit premier canal rétrofléchi (28) étant beaucoup moins profond que large.

4. Soupape selon la revendication 3, dans laquelle chaque premier canal laminaire rétrofléchi (28) présente une section transversale dont la taille n'est pas plus de 30 % supérieure à celle de la section transversale de l'orifice d'entrée (21).

5. Soupape selon les revendications 1 à 4, dans laquelle chaque premier canal laminaire rétrofléchi (28) s'écoule dans

le canal externe respectif (26) selon un angle qui n'est pas supérieur à 60 degrés, dans la direction opposée à l'écoulement du fluide dans ledit canal externe.

6. Soupape selon les revendications 1 à 5, dans laquelle chaque premier canal laminaire rétrofléchi (28) a un écoulement biconique, avec une zone conique dans sa partie médiane.

7. Soupape selon l'une quelconque des revendications précédentes 1 à 6, dans laquelle la partie la plus proche (26') de chaque canal externe est conique ou moins profonde que le reste.

8. Soupape selon l'une quelconque des revendications précédentes 1 à 7, dans laquelle chaque canal externe comporte au moins une déviation (26") pour augmenter sa longueur.

9. Soupape selon l'une quelconque des revendications précédentes, dans laquelle chaque ramification interne (27) a une profondeur et/ou largeur qui diminue alors qu'elle court du canal interne (25) jusqu'à la zone du piston ou du vérin (14).

10. Soupape selon l'une quelconque des revendications précédentes, constituée également d'un second canal laminaire rétrofléchi entre un canal interne (25) et un canal externe parallèle, ledit second canal rétrofléchi comportant une section transversale plus petite que celle du premier canal rétrofléchi (28).

11. Soupape selon la revendication 10, dans laquelle ledit premier canal laminaire rétrofléchi comporte une section transversale au moins égale à la somme des sections transversales du second canal laminaire rétrofléchi et à la partie la plus proche (26') du canal externe.

12. Soupape selon l'une quelconque des revendications précédentes, dans laquelle chaque canal latéral de la zone du bouchon a une profondeur au moins 30 % inférieure au reste du même canal.

13. Procédé d'évacuation d'air et de gaz des matrices de moulage sous pression et de diminution de la vitesse d'écoulement du métal fondu comprenant les étapes suivantes :

- fourniture d'une soupape d'aspiration selon la revendication 1 ;
- entrée d'un écoulement de métal fondu dans la soupape via un orifice d'entrée (21) ;
- passage forcé dudit écoulement de métal fondu dans les canaux internes (25) ;
- passage forcé dudit écoulement de métal depuis lesdits canaux internes (25) dans les ramifications internes (27) jusqu'à un piston ou un vérin (14) pour la fermeture de la soupape ;
- passage forcé dudit écoulement de métal depuis lesdits canaux internes (25) dans un ou deux canal/canaux laminaire(s) rétrofléchi(s) (28, 29) jusqu'aux canaux externes (26) et, via lesdits canaux externes (26), jusqu'à un bouchon (13) pour l'évacuation du gaz et de l'air, ledit métal étant refroidi au fur et à mesure qu'il s'écoule dans lesdits canaux internes et externes.

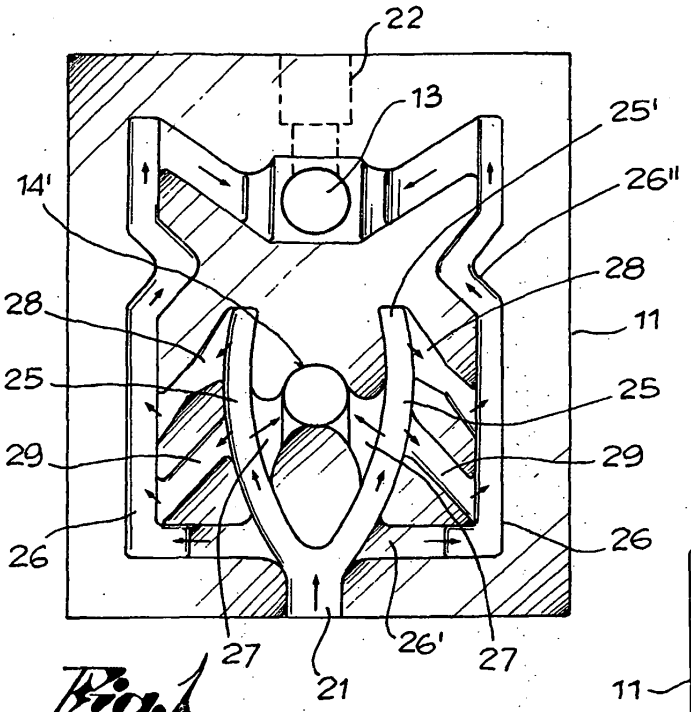


Fig.1

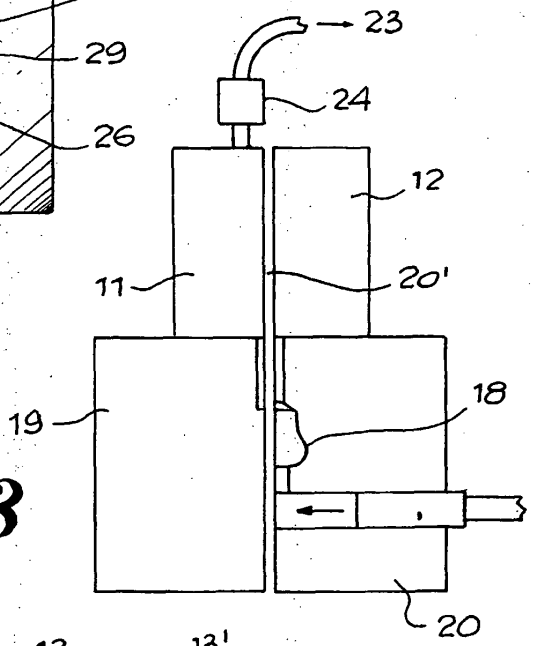


Fig.3

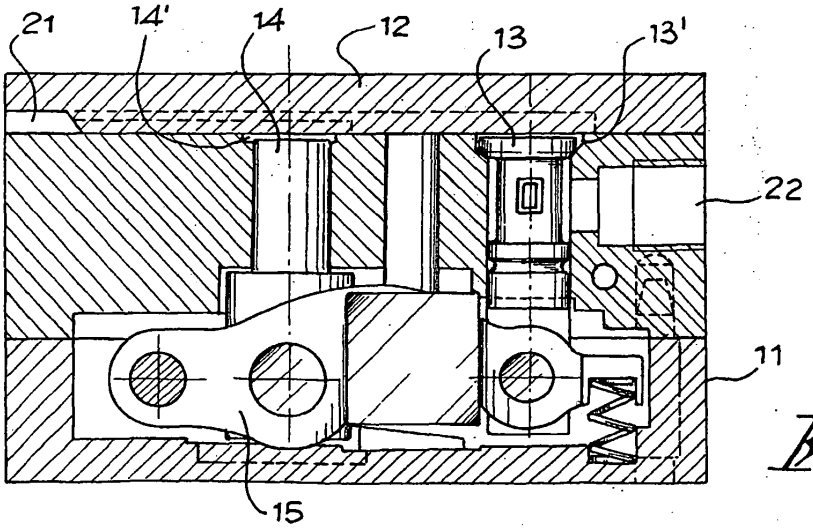


Fig.2

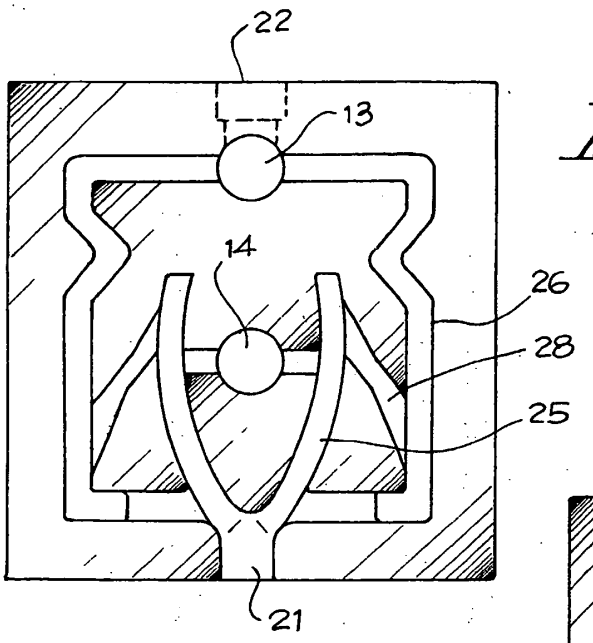


Fig.5

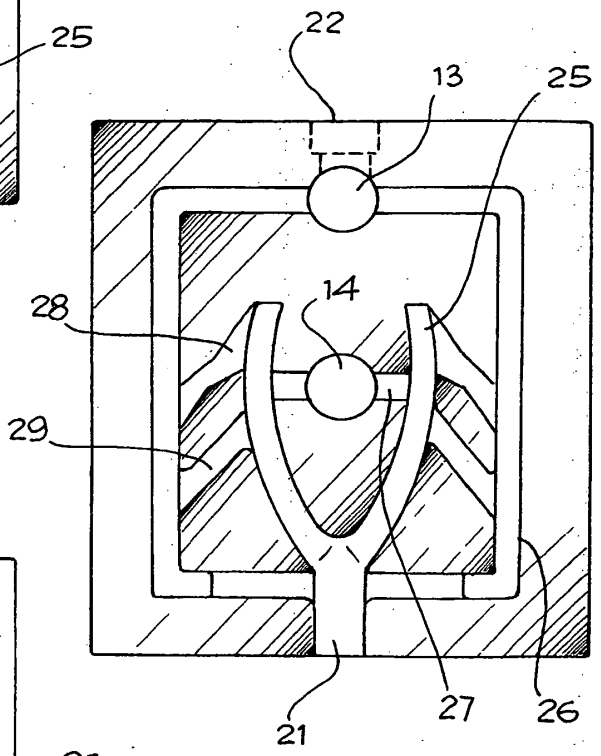


Fig.4

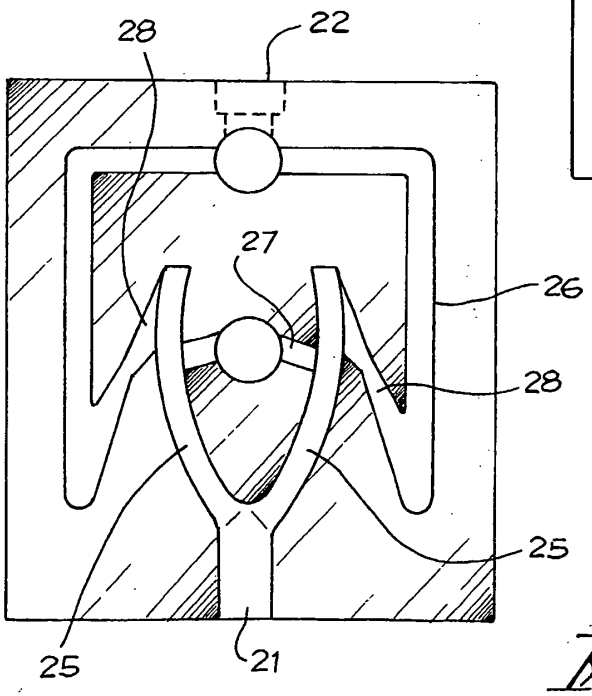


Fig.6