

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 1 570 930 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

07.09.2005 Bulletin 2005/36(51) Int Cl.7: **B22D 18/04, B22D 41/00**(21) Application number: **04004683.1**(22) Date of filing: **01.03.2004**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PL PT RO SE SI SK TR**

Designated Extension States:

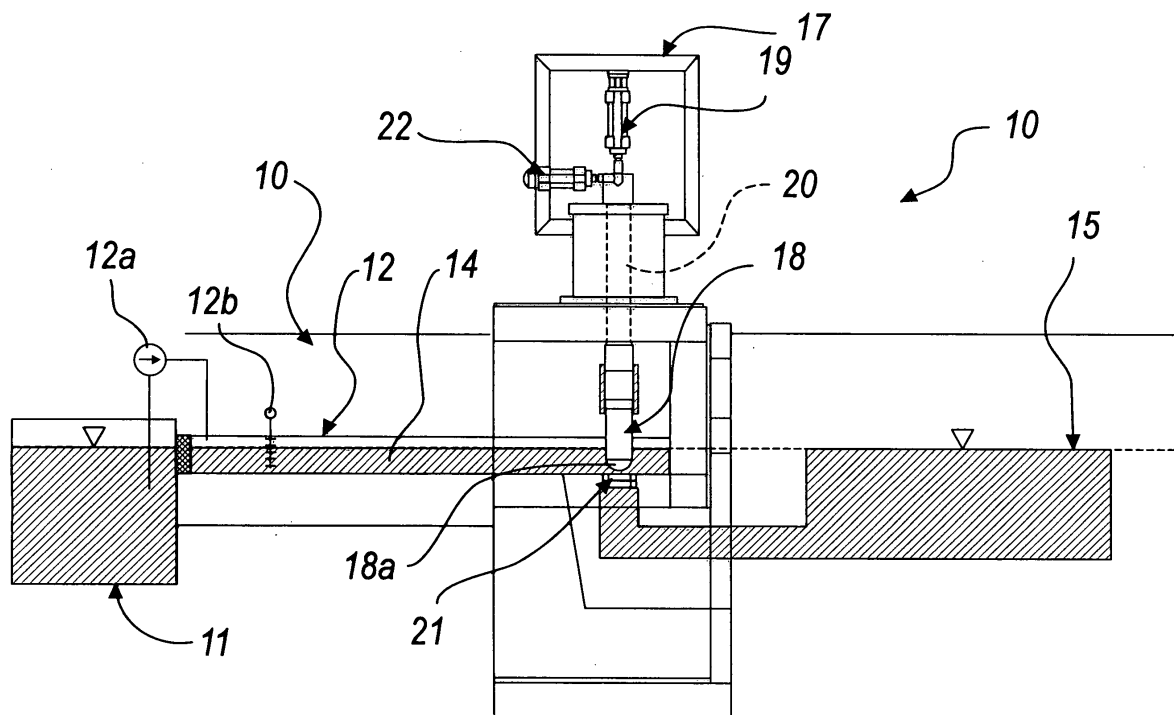
AL LT LV MK• **TEKSID ALUMINIUM S.p.A****10022 Carmagnola (Prov. of Torino) (IT)**(72) Inventor: **Garabello, Giuseppe****10041 Carignano (TO) (IT)**

(71) Applicants:

• **IDRA CASTING MACHINES S.p.A.**
20122 Milano (IT)(74) Representative: **Modiano, Guido et al****Modiano & Associati,
Via Meravigli, 16
20123 Milano (IT)**(54) **Casting apparatus where molten material is fed from a melting area to a holding area, particularly using a low-pressure apparatus**

(57) An apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, comprising at least one heated channel (12) for feeding molten material from a melting furnace (11)

to a pressurizable holding furnace (15). The pressurizable holding furnace is associable by way of casting means with a die; the apparatus further comprises a valve (17) for closing the feed between the channel and the holding furnace (15).

**Fig. 1****EP 1 570 930 A1**

Description

[0001] The present invention relates to an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process.

[0002] Apparatuses that use melting furnaces connected by means of closed channels to unpressurized holding furnaces are known among the various types of apparatus for die-casting metal by melting it and subsequently pressure-casting the molten metal inside the die.

[0003] In these apparatuses, the metal alloy is drawn from the holding furnaces, typically at atmospheric pressure, by means of cup-like containers that are dipped into the metal bath by means of an appropriately provided opening formed in the structure of the holding furnace, and is then injected into the die by means of injectors.

[0004] These types of apparatus have problems in terms of loss of temperature of the molten metal during collection and pouring with the cup-like containers, surface oxidation of the molten metal, regassing and foaming of the molten material during pouring.

[0005] Moreover, apparatuses are known which use pressurizable holding furnaces and are generally termed "low-pressure" apparatuses.

[0006] In these apparatuses, the holding furnace is in fact associated with a casting machine which, by means of the pressurization of the furnace, allows the molten metal to rise inside the solidification die, which is at a lower pressure.

[0007] This rise occurs by means of casting tubes that dip into the molten metal in a lower region and are connected to the die in an upper region.

[0008] Such machine, at each casting cycle, repeats the pressurization until the amount of molten material in the furnace is sufficient for casting.

[0009] These so-called "stand-alone" apparatuses have an inlet for loading the molten metal, which is closed by a hermetic door and is provided with a manual engagement system for the ladle for loading the holding furnace before it is pressurized.

[0010] Although these kinds of apparatus have been commercially available for some time and have been appreciated for their qualities, they are not free from drawbacks and further have aspects that can be improved.

[0011] In these apparatuses there are in fact many idle times for the filling of the holding furnace with the molten metal.

[0012] Every time the holding furnace is emptied by the succession of castings in order to fill the die, it is necessary to stop the pressurization machine and fill the furnace, wasting time and losing temperature in the dies.

[0013] Further, the operations for pouring and transferring the molten metal into the holding furnace cause regassing, foaming and oxidation of the molten material.

[0014] Moreover, these operations are rather dangerous.

[0015] The aim of the present invention is to provide an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, that solves the problems noted in known types of casting apparatus.

[0016] Within this aim, an object of the present invention is to provide an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, that allows to automate the operations of the casting process by using a holding furnace that can be pressurized.

[0017] Another object of the present invention is to provide an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, that solves the logistic problems linked to filling the holding furnaces.

[0018] Another object of the present invention is to provide an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, that eliminates the risks linked to operations for pouring and transferring the molten metal into the casting apparatuses.

[0019] Another object of the present invention is to provide an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, that maintains a constant level of molten metal in the holding furnace for each casting cycle.

[0020] Another object of the present invention is to provide an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, that can be manufactured with known systems and technologies.

[0021] This aim and these and other objects that will become better apparent hereinafter are achieved by an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, comprising at least one heated channel for feeding molten material from at least one melting furnace to at least one pressurizable holding furnace, said holding furnace being associable by way of casting means with at least one die, characterized in that it comprises at least one valve for closing the feed between said at least one channel and said at least one holding furnace.

[0022] Further characteristics and advantages of the present invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a schematic view of the apparatus according to the invention;

Figure 2 is a schematic sectional view of a portion of the apparatus according to the invention.

[0023] With reference to the figures, an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, according to the invention, is generally designated by the reference numeral 10.

[0024] Such apparatus 10 comprises at least one covered channel 12 for feeding molten metal from at least one melting furnace 11 to a pressurizable holding furnace 15.

[0025] The flow of molten metal 14 between the melting furnace 11 and the channel 12 occurs by means of a pump 12a.

[0026] First level sensors 12b are provided within the channels 12.

[0027] The channel 12 is heated by way of per se known heating means, which are not shown in the figures.

[0028] The pressurizable holding furnace 15 is associated, by way of casting means, for example casting tubes 16, with a die (not shown in the figures).

[0029] The casting tubes 16 have their inlet 16a immersed in the molten metal of the holding furnace 15.

[0030] A closure valve 17 is arranged between the heated channel 12 and the holding furnace 15.

[0031] Such closure valve 17 comprises a flow control element 18, which is associated with a translational actuator 19, which in this embodiment corresponds to a pneumatic cylinder and allows the flow control element 18 to perform a translational motion at right angles to the outflow section of the molten material 14 through said valve.

[0032] The flow control element 18 is connected to the translational actuator 19 by means of a cylindrical stem 20.

[0033] Said outflow section substantially coincides with the sealing seat 21 with which the flow control element 18 mates.

[0034] The sealing seat 21 has a circular cross-section that matches the transverse cross-section of the part 18a of the flow control element 18 that mates with the seat 21.

[0035] The flow control element 18 can perform a translational motion from a position that is substantially spaced from the sealing seat 21 to a position for mating with the seat 21; in any case, the flow control element 18 remains constantly in contact with the molten metal 14 both when the valve 17 is open and when it is closed.

[0036] The flow control element 18, moreover, is associated with an axial rotation actuator 22, which in this embodiment consists of a pneumatic cylinder that is arranged horizontally and is associated with kinematic means.

[0037] Such kinematic means are constituted, in this

embodiment, by spherical joints (not shown in the figures), which act between the cylinder and the flow control element and between the cylinder and the base structure to which it is coupled, and allow to convert the linear motion of the pneumatic cylinder into a circular motion.

[0038] The axial rotation actuator 22 allows the flow control element 18 to rotate about its own stem 20 when it is inserted in the sealing seat 21.

[0039] In this embodiment, both the flow control element 18 and the sealing seat 21 are made of ceramic material.

[0040] Means are also provided for the automated opening/closure of the valve 17.

[0041] Such automated opening/closure means are constituted by second level sensors (not shown in the figures) for detecting the level of the molten metal inside the holding furnace 15.

[0042] The second level sensors are functionally connected to an electronic control and actuation unit (not shown in the figures), which in turn is associated with the translational actuators 19 and with the rotational actuators 22.

[0043] The operation of the invention is as follows.

[0044] The molten material, typically a metal alloy, is fed or melted inside the melting furnace 11 and sent to the pressurizable holding furnace 15 along the heated channels 12 by means of the pump 12a, which is managed automatically by the first level sensors 12b.

[0045] When the valve 17 is open, the molten material that arrives from the melting furnace 11 feeds the holding furnace 15 by means of the heated channels 12.

[0046] In particular, the melting furnace 11 feeds the channel 12 by means of the pump 12a and keeps its level constant.

[0047] When the molten material reaches a preset level inside the holding furnace 15, this is reported by the second level sensors 15a to the electronic control and actuation unit, which closes the valve 17, mating with a slight pressure, thanks to the translational actuator 19, the flow control element 18 and the sealing seat 21 through which the molten material flows.

[0048] At this point, the flow control element orders the rotational actuator 22 to make the flow control element perform a plurality of partial rotations (for example rotations through approximately 45° alternated in clockwise/counterclockwise directions) while it is mated with the seat 21 with a slight pressure.

[0049] In this manner, the seat 21 is cleaned and the flow control element settles in an optimum manner on the seat 21.

[0050] The valve is then closed further by increasing the closure pressure of the flow control element 18 on the seat 21.

[0051] The holding furnace 15 is then pressurized and the molten material contained inside it can rise through the casting tubes 16 into the die, which is at a lower pressure, where solidification occurs.

[0052] After the molten material has risen through the tubes 16, the air or gas used to pressurize the furnace 15 is discharged and the valve 17 can be reopened.

[0053] In this manner, in accordance with the principle of communicating vessels, the molten material resumes flowing from the channel 12 toward the holding furnace 15, which is thus returned to the level for injection into the die.

[0054] The optimum level inside the channel 12 is maintained by means of the pump 12a and the first level sensors 12b.

[0055] It should be noted that the lower part of the flow control element 18 is always in contact with the molten material, so as to avoid thermal shocks.

[0056] In practice it has been found that the invention thus described solves the problems noted in known types of casting apparatus; in particular, the present invention provides an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, that reduces surface oxidation of the molten material that flows within the closed channels.

[0057] Moreover, the present invention provides an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, that ensures a constant temperature along the entire path of the molten material.

[0058] Further, the present invention provides an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, that allows to automate the operations for filling the pressurizable holding furnace, allowing a "continuous" feed and thus solving the logistic problems linked to the filling of holding furnaces.

[0059] In particular, it should be noted that the molten material is fed to the pressurizable furnace cyclically, without manual interventions, substantially by using the automatic system that actuates the valve that closes the feed between the channel and the holding furnace.

[0060] Not least, the present invention provides an apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, that eliminates the risks linked to the operations for pouring and transferring the molten metal in said apparatus.

[0061] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0062] In practice, the materials employed, so long as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

[0063] Where technical features mentioned in any claim are followed by reference signs, those reference

signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An apparatus for feeding molten material from the melting area to the holding area in casting apparatuses, particularly apparatuses using a low-pressure process, comprising at least one heated channel for feeding molten material from at least one melting furnace to at least one pressurizable holding furnace, said holding furnace being associable by way of casting means with at least one die, **characterized in that** it comprises at least one valve for closing the feed between said at least one channel and said at least one holding furnace.
2. The apparatus according to claim 1, **characterized in that** said closure valve comprises a flow control element that is associated with a translational actuator for moving said flow control element from a position in which it is spaced from its sealing seat to a position in which it is mated with said sealing seat, said sealing seat coinciding substantially with the section for the outflow of the molten material from said at least one channel to the feed channel of said at least one holding furnace.
3. The apparatus according to claim 2, **characterized in that** said flow control element can perform a translational motion at right angles to said outflow section and **in that** said sealing seat has a circular cross-section that corresponds to the transverse cross-section of the part of said flow control element that mates with said sealing seat.
4. The apparatus according to one or more of the preceding claims, **characterized in that** said flow control element is associated with an axial rotation actuator to allow said flow control element to rotate when it is inserted in its sealing seat.
5. The apparatus according to one or more of the preceding claims, **characterized in that** part of said flow control element is constantly in contact with the molten material both when said at least one valve is open and when it is closed.
6. The apparatus according to one or more of the preceding claims, **characterized in that** said translational actuator comprises a pneumatic cylinder.
7. The apparatus according to one or more of the pre-

ceding claims, **characterized in that** said rotational actuator comprises a pneumatic cylinder that is associated with kinematic means for converting the linear motion into circular motion.

5

8. The apparatus according to claim 7, **characterized in that** said kinematic means comprise spherical joints that act between said pneumatic cylinder and said flow control element and between said pneumatic cylinder and the base structure to which it is coupled. 10
9. The apparatus according to one or more of the preceding claims, **characterized in that** said flow control element is made of ceramic material. 15
10. The apparatus according to one or more of the preceding claims, **characterized in that** said sealing seat is made of ceramic material. 20
11. The apparatus according to one or more of the preceding claims, **characterized in that** the connection between said at least one melting furnace and said at least one channel occurs by means of a pump. 25
12. The apparatus according to one or more of the preceding claims, **characterized in that** at least one level sensor is provided inside said at least one channel. 30
13. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises automated opening/closure means for said valve. 35
14. The apparatus according to claim 13, **characterized in that** said means for the automated opening/closure of said at least one valve comprise at least one additional sensor for detecting the level of the molten material inside said at least one holding furnace. 40
15. The apparatus according to claim 14, **characterized in that** said at least one additional level sensor is functionally connected to an electronic control and actuation unit, which in turn is associated with said translational actuator and with said axial rotation actuator. 45

50

55

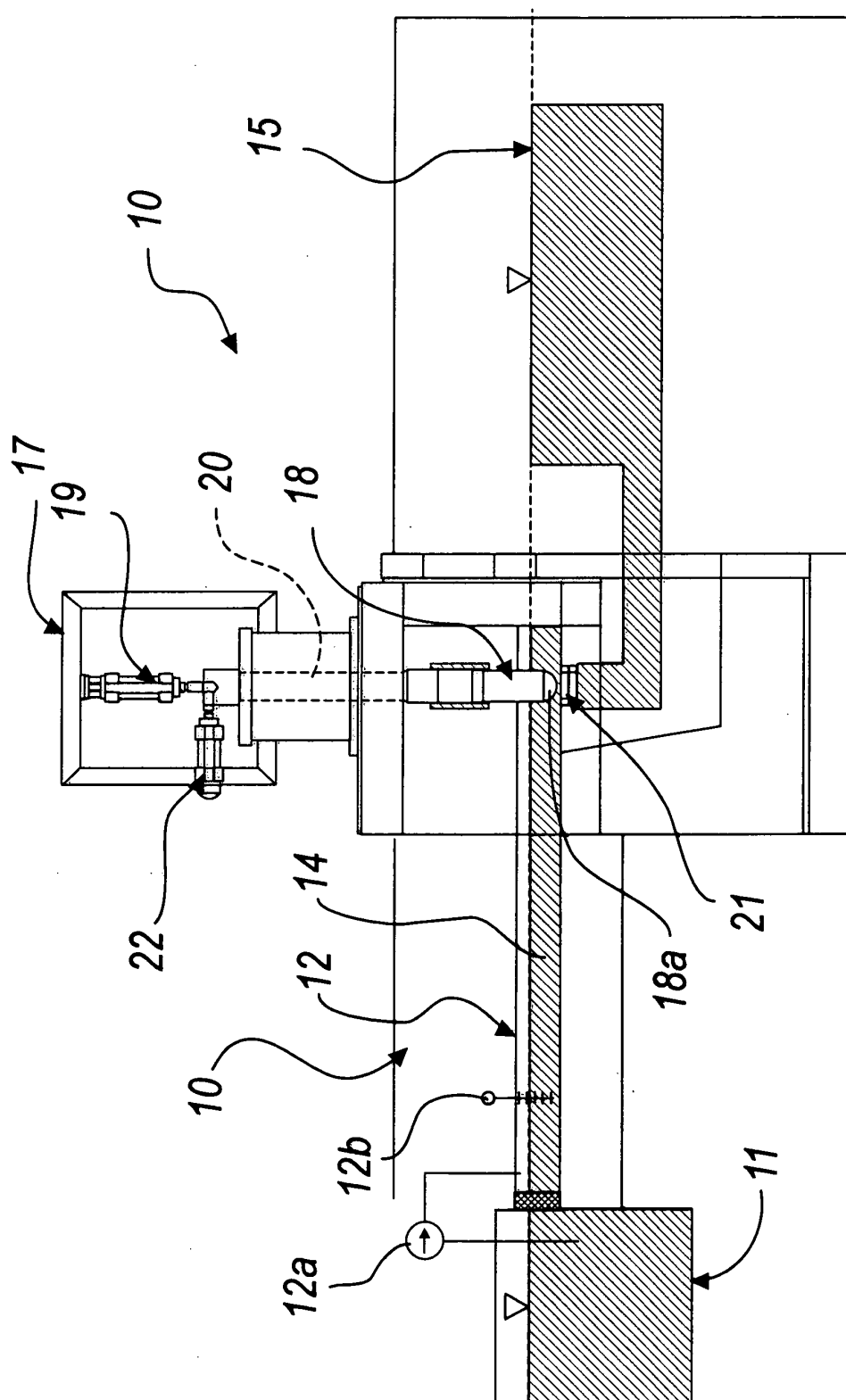


Fig. 1

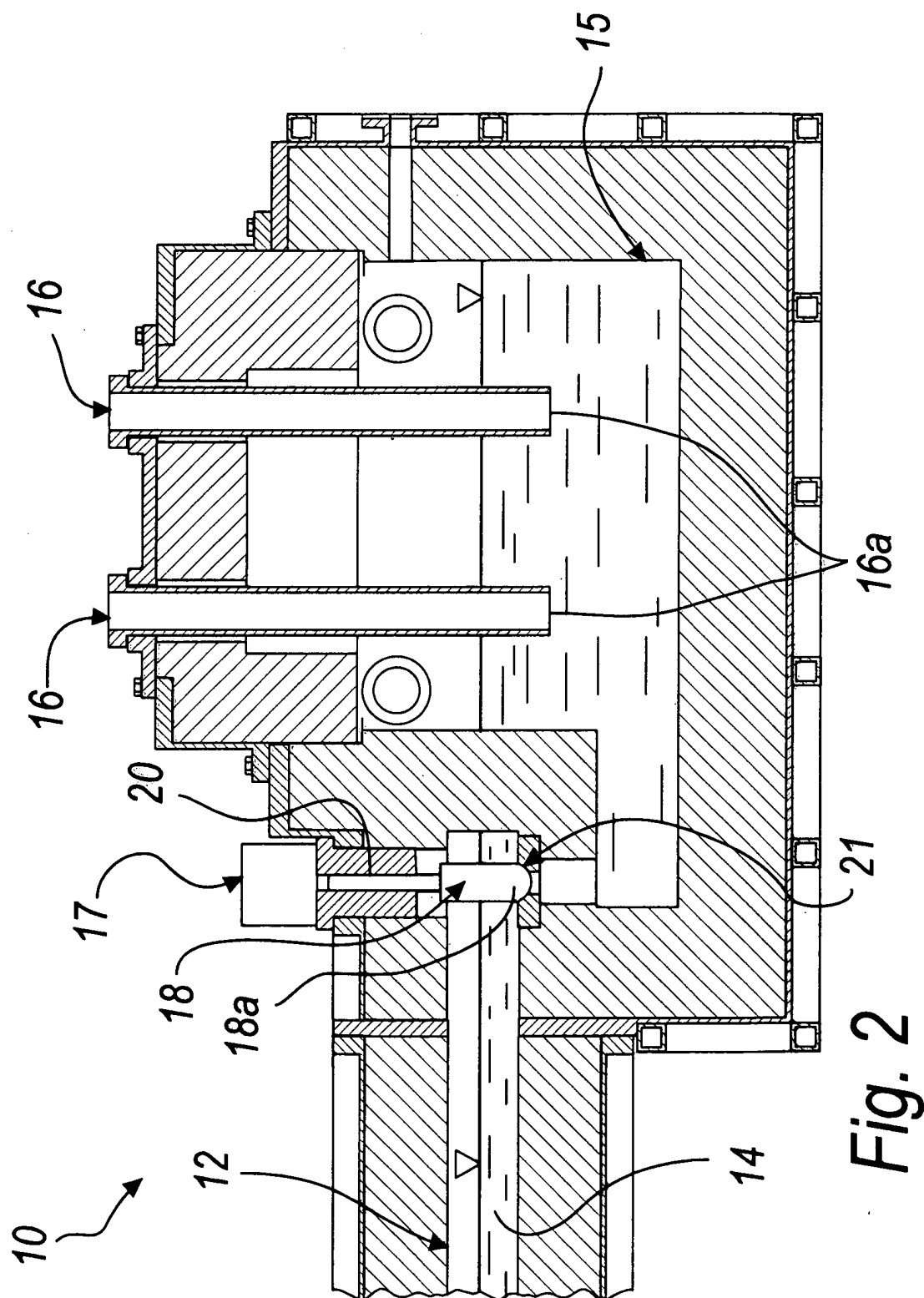


Fig. 2



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 00 4683

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 846 509 A (GEN MOTORS CORP) 10 June 1998 (1998-06-10) * abstract; figures *	1-15	B22D18/04 B22D41/00
X	----- PATENT ABSTRACTS OF JAPAN vol. 018, no. 472 (M-1667), 2 September 1994 (1994-09-02) -& JP 06 154992 A (KOBEL STEEL LTD), 3 June 1994 (1994-06-03) * abstract *	1	
X	----- PATENT ABSTRACTS OF JAPAN vol. 1995, no. 02, 31 March 1995 (1995-03-31) -& JP 06 328229 A (TOSHIBA MACH CO LTD), 29 November 1994 (1994-11-29) * abstract; figure 2 *	1	
X	----- PATENT ABSTRACTS OF JAPAN vol. 013, no. 500 (M-891), 10 November 1989 (1989-11-10) & JP 01 202343 A (KOMATSU LTD), 15 August 1989 (1989-08-15) * abstract *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B22D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		28 October 2004	Hodiamont, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

4
EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 00 4683

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

28-10-2004

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0846509	A	10-06-1998	EP 0846509 A1	10-06-1998
			US 5948352 A	07-09-1999

JP 06154992	A	03-06-1994	NONE	

JP 06328229	A	29-11-1994	JP 3252338 B2	04-02-2002

JP 01202343	A	15-08-1989	NONE	
