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72 Inventor: **Fumagalli, Silvano**
Via Grigna, 2
I-20052 Monza,
(Milano) (IT)

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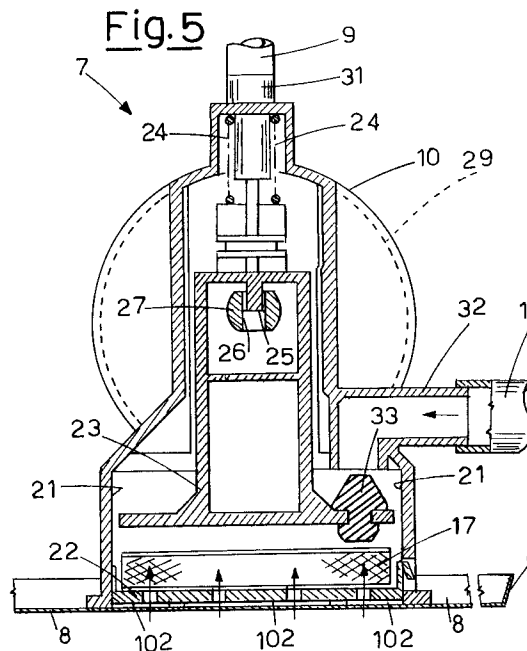
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74 Representative: **Mittler, Enrico et al**
c/o Marchi & Mittler s.r.l.
Viale Lombardia, 20
I-20131 Milano (IT)

71 Applicant: **CANDY S.p.A.**
Via Missori, 8
I-20052 Monza (Milano) (IT)

54 **Pneumatic sensor for safety device for blocking the water feed circuit of dishwashers, washing machines and the like.**

57 A safety device for blocking the water feed circuit of an electrical household appliance (1) comprises a water feed pipe (5), which can be connected at one end to a respective feed solenoid valve (100) of an internal water circuit (101) of the electrical household appliance (1), and where to a respective safety valve (2), which can be actuated pneumatically, is connected and placed between the opposite end of said feed pipe (5) and a water supply point (4), a collection base (8), positioned below the electrical household appliance (1), whereon a pneumatic sensor (7) is placed and which comprises expandable water-sensitive devices (17), housed in an expansion chamber (21), which command actuation of means of compression (28-30) of a fluid contained in a drum (9) connected to the safety valve (2); the expansion chamber (21) of the pneumatic sensor is provided with an inlet (32) which can be connected to a drain conduit (11) of an anti-overflow device (13) of a washing drum (12) of the electrical household appliance (1), and gate valve means (33) for closing said inlet (32) following expansion of said water-sensitive means (17).



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The present invention relates to a pneumatic sensor for a safety device for blocking the water feed circuit of dishwashers, washing machines and the like.

It is known that safety block devices are available commercially with the function of interrupting the flow of water inside the internal water circuit of dishwashers or washing machines in the absence of control by valve devices (feed solenoid valve) whereof said machines are provided, or in the event of bursting or perforation of the water feed pipe; otherwise leaks of water occur which lead to damaging floods.

The above devices are characterised in that, following their triggering, they can only be de-actuated by specialist technical staff; thus subsequent start-up of the electrical household appliance is subject to elimination of the fault which has caused triggering of the safety devices themselves. The latter are also able to detect even small overflows of water inside the machines which, although they do not lead to flooding, cause premature deterioration of the electrical household appliance.

A known safety device consists of a safety valve placed between the pipe coupling for attachment to a tap and the water feed pipe, a spiralled pipe which acts as a sheath for the feed pipe, and a pneumatic sensor, housed in a water collection base placed below the electrical household appliance, fitted with an expander whereto a drum containing air is connected and passed inside the spiralled pipe and, at the opposite end, connected to the safety valve to cause triggering thereof. The sensitive element of the pneumatic sensor is represented by a highly compressed spongy element which expands when it comes into contact with water, causing the sliding of a piston inside a chamber whereto the drum containing air is connected.

The collection base collects any leaks of water which may result from the overflow (through an anti-overflow drain system normally provided) from the washing drum of the dishwasher or washing machine following non-intervention by the aforementioned valve devices, or from perforation of the feed pipe, and conveys them to the pneumatic sensor which, in the presence of water, compresses the air inside the drum thus causing triggering of the safety valve, which blocks the water supply of the machine, even with the tap open.

The degree of protection provided by a safety device such as the one described above greatly depends on the triggering time of the pneumatic sensor: the collection base has in fact a limited capacity, due to the fact that the space normally available between the floor and the base of washing machines, and above all dishwashers, is very small. Therefore, before the pneumatic sensor

commands closure of the safety valve, the volume of water which has overflowed from the washing drum or leaked from the feed pipe and been conveyed by the spiralled pipe to the collection base may be sufficient for causing an overflow of the latter, and hence flooding.

In the specific case of dishwashers, the abovementioned problem is aggravated by the fact that, in some washing programs, the water may be fed with the spraying rotors actuated. This means that the volume of water in the washing drum has to be added to the volume of water circulating in the circuit of the rotors and in suspension (a volume which can even reach a few litres). A fault in the feed solenoid valve which occurs during such a feed phase in any case risks causing a flood, even if the triggering time of the pneumatic sensor is short since, when the dishwasher is stopped, the water in circulation and in suspension is added to that already contained in the washing drum which has caused the overflow, flows into the collection base and flows out therefrom onto the floor.

In order to avoid this problem a second type of safety device, also known, can be used and which, in place of the pneumatic sensor described, uses a float connected to a microswitch which commands actuation of the drain pump of the electrical household appliance: as soon as the level of water in the collection base raises the float, the microswitch actuates the drain pump which drains all the water contained in the washing drum.

A safety device of this type is however more costly than the previous one, also because a protection device is required for the drain pump to protect it in the event of continuous operation.

Moreover not even a safety device of the second kind is able to prevent the occurrence of flooding for whatsoever type of machine; in fact, again in the specific case of dishwashers, the special anti-overflow system of the washing drum can render the safety device described ineffectual. It is in fact known that dishwashers are sold on the market in whose washing drum a siphon is mounted which triggers when the level of the water in the drum exceeds a predefined safety level in order to transfer the water to the collection base. This siphon has hysteresis whereby it de-triggers when the level of water in the drum falls below a level lower than this safety level. The value of said hysteresis is generally such that the volume of water transferred by the siphon to the collection base is greater than the capacity of the latter, which therefore does not hold all the surplus water transferred by the siphon and causes flooding. Actuation of the drain pump also has a limited effect.

This latter problem can be solved by using a third type of safety device, which comprises a pneumatic block device acting directly on the feed

solenoid valve when the level of water in the drum exceeds a predetermined value.

However this third type of safety device is also expensive.

In view of the state of the art described, the object of the present invention is that of providing a pneumatic sensor for a safety block device of the first kind described above which allows the problems mentioned to be solved simply and economically, and which can be used in electrical household appliances already available on the market.

In accordance with the present invention, this object is achieved thanks to a pneumatic sensor for a safety device for blocking the water feed circuit of an electrical household appliance, said safety device comprising a water feed pipe, which can be connected at one end to a respective inlet solenoid valve of a water circuit inside the electrical household appliance, and whereto a respective safety valve, which can be actuated pneumatically, is connected and placed between the opposite end of said feed pipe and a water supply point, a collection base, placed below the electrical household appliance, whereon said pneumatic sensor is placed which comprises expandable water-sensitive means, housed in an expansion chamber, which command actuation of means for compressing a fluid contained in a drum connected to the safety valve, characterised in that said expansion chamber is provided with an inlet which can be connected to a drain conduit of an anti-overflow device of a washing drum of the electrical household appliance, and with gate valve means for closing said inlet following expansion of said water-sensitive means.

Thanks to the present invention it is possible to produce a safety block with a very short trigger time, since the surplus water in the washing drum of the washing machine or dishwasher is sent directly from the anti-overflow device to the spongy element of the pneumatic sensor, instead of onto the collection base. Since also the drain conduit of the anti-overflow device of the washing drum is closed after the sensor has been actuated, the surplus water in the washing drum is not transferred completely onto the collection base, wherefrom it would overflow, causing a flood, but instead remains in the washing drum, wherefrom it can later be removed following actuation of the drain pump. The safety device obtained in this way is thus very economical.

These and other features of the present invention will be made clearer by the following detailed description of one of its embodiments, illustrated by way of a non-limiting example in the accompanying drawings, in which:

Figure 1 shows an electrical household appliance fitted with a safety block device with a pneumatic sensor according to the invention;

Figure 2 shows in partial axial section said pneumatic sensor in a first operative condition;

Figure 3 shows in partial axial section said pneumatic sensor in a second operative condition;

Figure 4 shows a part of a washing drum of the electrical household appliance, with an anti-overflow drain device;

Figure 5 is a section along line V-V of Figure 2;

Figure 6 is a section along line VI-VI of Figure 3.

As shown in Figure 1, a safety device for blocking the water feed circuit of an electrical household appliance, for example a dishwasher 1, comprises: a safety valve 2 placed between a pipe coupling 3 for attachment to a tap 4 and a water feed pipe 5; a spiralled pipe 6 which acts as a sheath for the feed pipe 5; a pneumatic sensor 7, housed in a base 8 for collection of water, placed below the dishwasher 1, and fitted with an expander (which will be described in detail hereinbelow) whereto a drum 9, containing air, is connected and passed inside the spiralled pipe 6 and, at the opposite end, is connected to the safety valve 2 to bring about triggering thereof. The feed pipe 5 is connected to a feed solenoid valve 100 of the dishwasher 1 (Fig. 2), which is controlled by a programming device or timer (not shown) of the dishwasher 1 to feed water to an internal water circuit 101 of the dishwasher 1 itself. Opening of the safety valve 2 is subject to the position of a pushbutton 50, not accessible to the user but only to specialist technical staff.

As shown in Figure 2, the pneumatic sensor 7 consists of an external casing 10 in plastic material, hollow inside, whereto are connected the drum 9 and a conduit 11 connected in turn to an anti-overflow drain device whereof a washing drum 12 of the dishwasher 1 is provided. In the case in question, the anti-overflow device consists of a siphon 13 which extends from the base 14 of the washing drum 12 to inside the latter. As can be seen in detail in figure 4, the siphon 13 is made of a vertical pipe 15 having a mouth at a height L1 predefined in relation to the base 14, and a cap 16 which covers the mouth of the vertical pipe 15 and which surrounds for a section I of specific length the vertical pipe 15 itself, so that the lower opening of the cap 16 is at a height L2, lower than L1, in relation to the base 14. The vertical pipe 15 is connected below to the conduit 11, wherefrom a branch pipe 19 also starts, whereto a breather pipe 20 is connected.

The casing 10 of the pneumatic sensor 7 comprises internally an expansion chamber 21 for a spongy water-sensitive element 17 (Figs. 5 and 6).

The expansion chamber 21 is closed below by a perforated lid 22. The lid 22 is coupled to the casing 10 in such a way as to leave a gap 102 between it and the collection base 8, so that any layer of water which collects on the base 8 can wet the water-sensitive element 17. Inside the expansion chamber 21, above the water-sensitive element 17, a cursor 23 is housed, sliding vertically, and forced into a lower end-of-stroke position (shown in Figure 5) by a helicoidal spring 24. The cursor 23 is fitted with a pin 25 which, when the cursor is in the position of Figure 5, is inserted in a respective opening 26 made in a stem 27 of a piston 28 of a cylinder 29 also formed inside the casing 10 (Figs. 2 and 3). A helicoidal spring 30 elastically forces the piston 28 into the position shown in Figure 3. When however the pin 25 is inserted in the opening 26 of the stem 27, the sliding of the piston 28 is blocked, and the spring 30 compressed. The drum 9 is connected to a tubular appendage 31 in one piece with the casing 10 and which leads into the interior of the cylinder 29 (Fig. 3).

A tubular appendage 32, also in one piece with the casing 10, is connected to the interior of the expansion chamber 21 (Figs. 5 and 6); the conduit 11, coming from the siphon 13, is connected to said appendage. The cursor 23 carries a gate valve 33 which, when the water-sensitive element 17 has expanded and the cursor 23 is in the upper end-of-stroke position shown in Figure 6, closes the tubular appendage 32, from inside the expansion chamber 21, to prevent further flow of water from the siphon through the conduit 11.

On installing the safety device, the installer pushes it onto the stem 27 of the piston 28, so as to overcome the elastic stress force of the spring 30 in order to bring the piston 28 into the position of Figure 3. In this condition, the opening 26 is positioned exactly below the pin 25, which can therefore enter the opening 26 under the thrust of the spring 24 (Fig. 5). The piston 28 is thus blocked and "loaded", so to speak.

The safety device may be triggered by perforations of the feed pipe 5, or by faults in the feed solenoid valve 100 which do not allow adequate control by the programming device, and which lead to feeding of an excessive amount of water into the dishwasher 1.

In the case of perforation of the feed pipe 5, the spiralled pipe 6 conveys the water leaving the pipe 5 onto the collection base 8. When the level of water on the collection base 8 is such as to wet the water-sensitive element 17 (passing through the holes in the lid 22), the latter expands in the expansion chamber 21, thus causing the rise of the cursor 23 (compressing the spring 24). The pin 25 projects from the opening 26 of the stem 27 and,

since the elastic force of the spring 30 is no longer balanced, the piston 28 slides inside the cylinder 29, compressing the air inside the drum 9 and causing triggering of the safety valve 2. The flow of water from the tap 4 inside the feed pipe 5 is thus blocked.

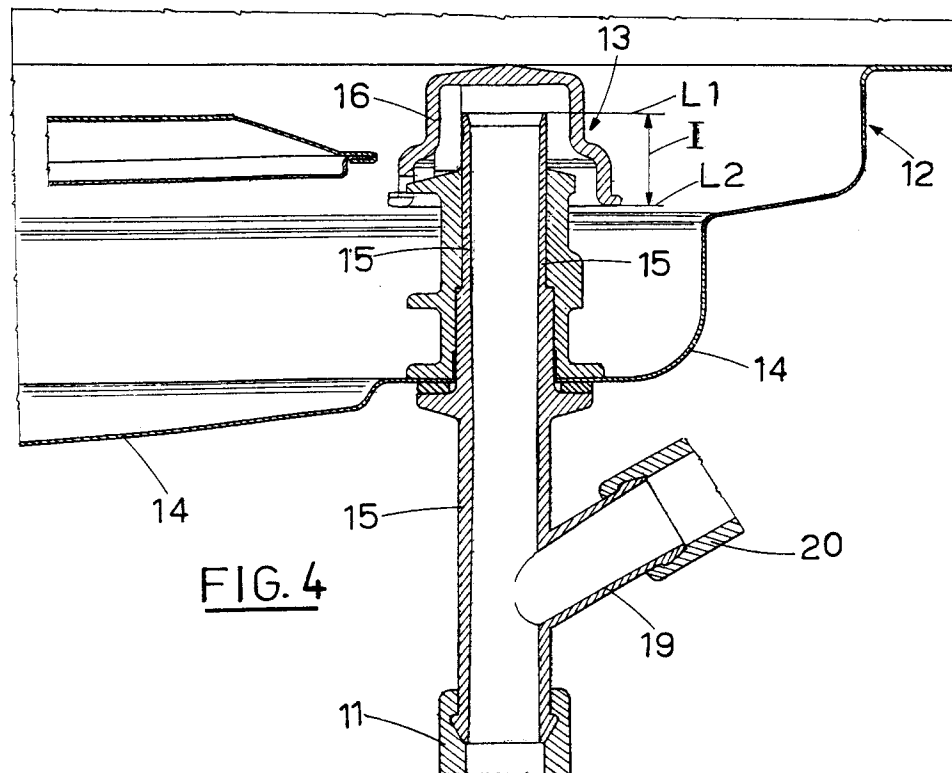
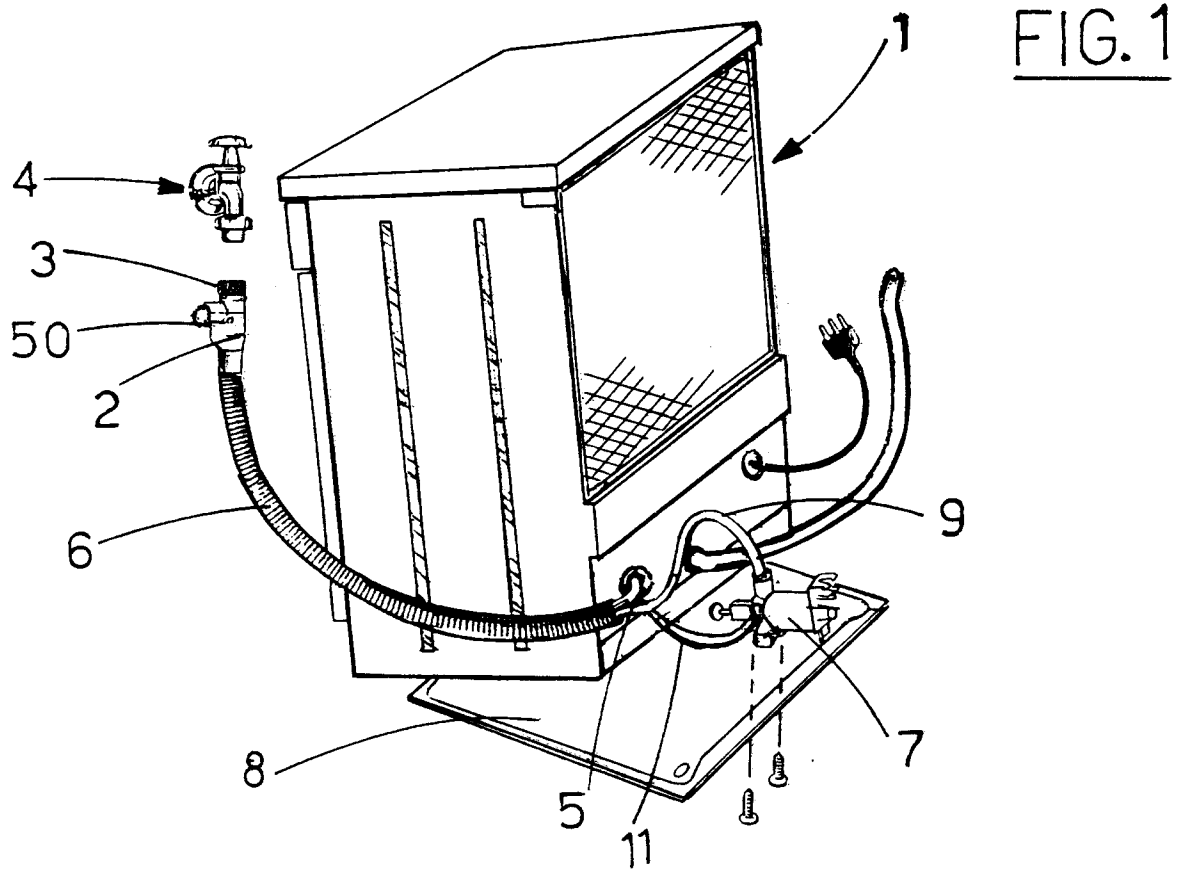
In the event of a fault in the feed solenoid valve 100, the level of water in the washing drum 12 rises until it reaches the level L1 of Figure 4, causing triggering of the siphon 13. The latter transfers water from the washing drum 12 to the conduit 11, and then directly inside the expansion chamber 21 of the pneumatic sensor 7. A small quantity of water is sufficient for causing expansion of the water-sensitive element 17 and therefore, wholly similarly to the previous case, blocking of the safety valve 2. For the very reason that the water is transferred directly inside the expansion chamber 21, the safety device triggers (i.e. the water-sensitive element 17 expands) very rapidly, greatly limiting the excess quantity of water which is fed into the washing drum 12 of the dishwasher 1. Since, following expansion of the water-sensitive element 17 and the consequent rise of the cursor 23, the gate valve 33 closes the tubular appendage 32, the siphon 13 cannot transfer further water, even if the de-triggering level L2 has not been reached. The surplus water therefore remains in the washing drum 12 without giving rise to overflows and consequent floods, and wherefrom it can then be eliminated by a drain pump (not shown).

Even if the present invention has been described by referring to a dishwasher with a siphon anti-overflow device, it can clearly be used in dishwashers with spillway anti-overflow devices, comprising a hole in the washing drum, placed at a height determined by the base of the latter, whereto the conduit 11 is connected. A safety block device comprising a sensor according to the present invention can also be used in washing machines, in addition to dishwashers.

Claims

1. Pneumatic sensor for a safety device for blocking the water feed circuit of an electrical household appliance (1), said block device comprising a water feed pipe (5), which can be connected at one end to a respective feed solenoid valve (100) of an internal water circuit (101) of the electrical household appliance (1), and whereto a respective safety valve (2) is connected, which can be actuated pneumatically, and positioned between the opposite end of said feed pipe (5) and a water supply point (4), a collection base (8), placed below the electrical household appliance (1), whereon said pneumatic sensor (7) is placed and which

- comprises expandable water-sensitive means (17), housed in an expansion chamber (21), which command actuation of means (28-30) of compressing a fluid contained in a drum (9) connected to the safety valve (2), characterised in that said expansion chamber (21) is provided with an inlet (32) which can be connected to a drain conduit (11) of an anti-overflow device (13) of a washing drum (12) of the electrical household appliance (1), and gate valve means (33) for closing said inlet (32) following expansion of said water-sensitive means (17). 5 10
2. Pneumatic sensor according to claim 1, characterised in that said gate valve means comprise a gate valve (33) connected to a cursor (23) housed slidingly inside said expansion chamber (21) and forced elastically into a position of blocking of actuation of said compression means (28-30), and sliding following expansion of said water-sensitive means (17) into a position of enabling of actuation of said compression means (28-30). 15 20 25
3. Pneumatic sensor according to claim 2, characterised in that said compression means (28-30) comprise a cylinder (29), inside whereof a piston (28) is housed, sliding between a first and a second position, and means (30) of elastically forcing the piston (28) into said first position, corresponding to the condition of compression of the fluid contained in said drum (9). 30 35
4. Pneumatic sensor according to claim 3, characterised in that said cursor (23) is provided with a pin (25) which can be engaged in a respective opening (26) of a stem (27) of the piston (28) to block the latter in said second position. 40
5. Pneumatic sensor according to any one of the previous claims, characterised in that said water-sensitive means comprise a highly compressed spongy element (17). 45
6. Pneumatic sensor according to any one of the previous claims, characterised in that said anti-overflow device (13) comprises a siphon which is triggered when the water in the washing drum (12) reaches a first predefined level (L1) to transfer the water to said conduit (11), and de-triggers when the water falls again below a second predefined level (L2), lower than the first level (L1). 50 55



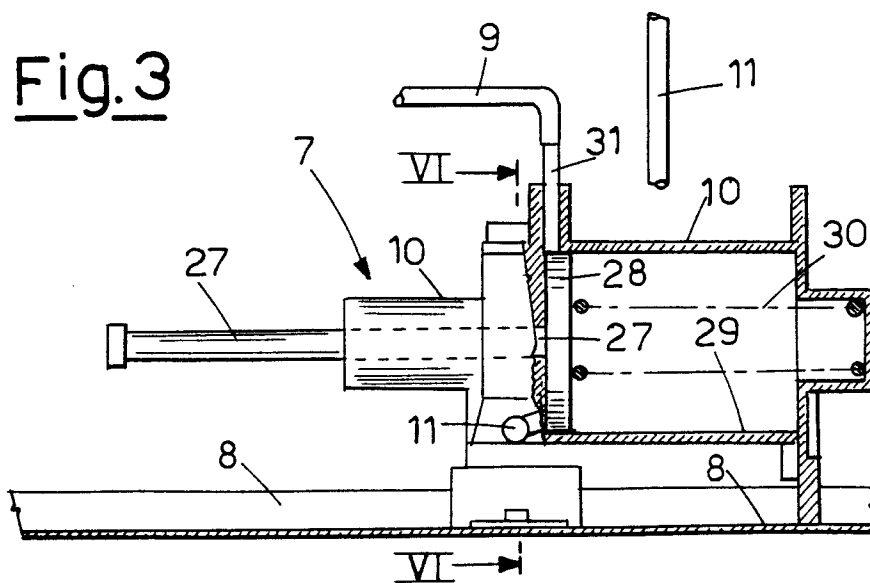
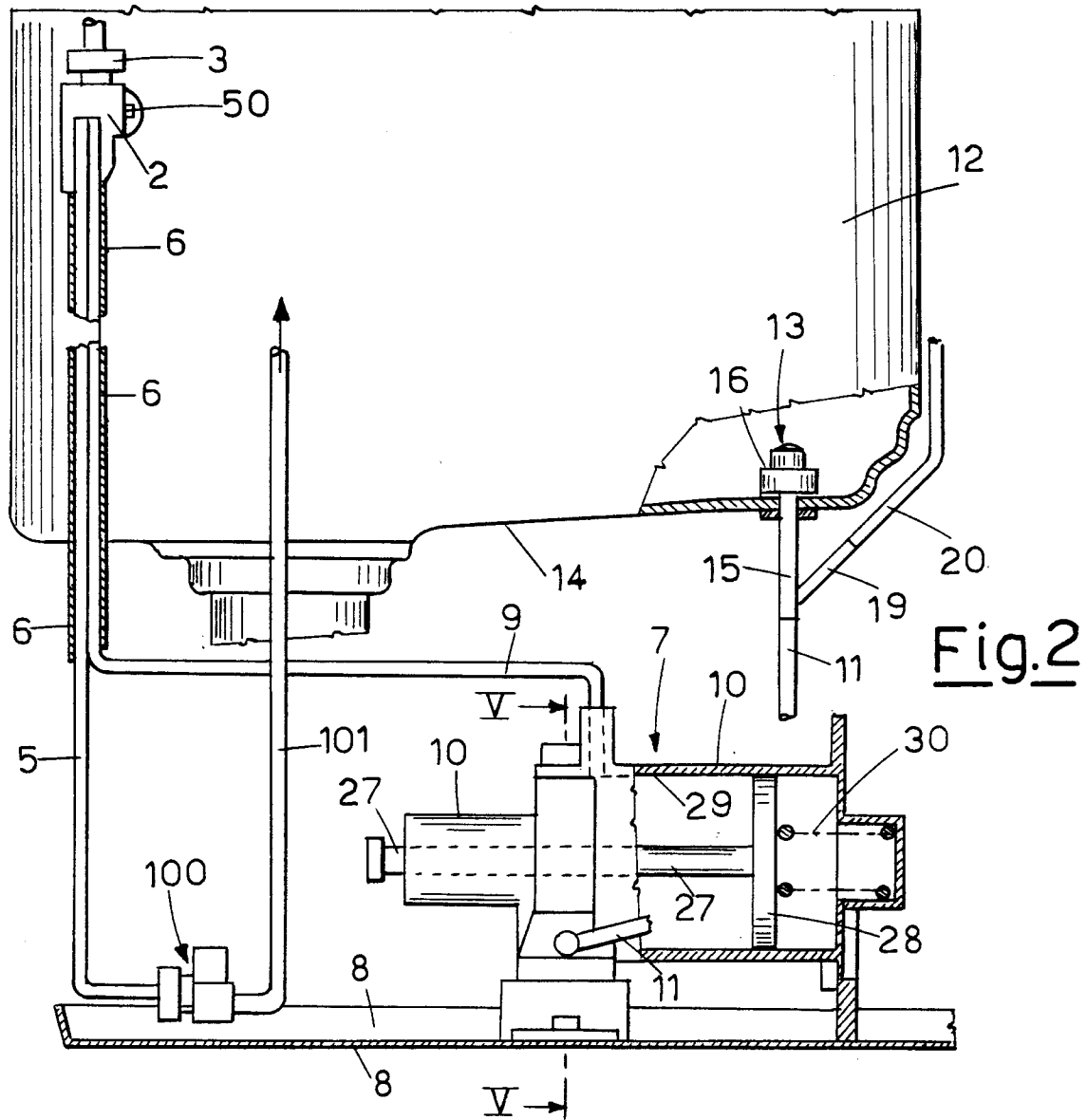


Fig. 6

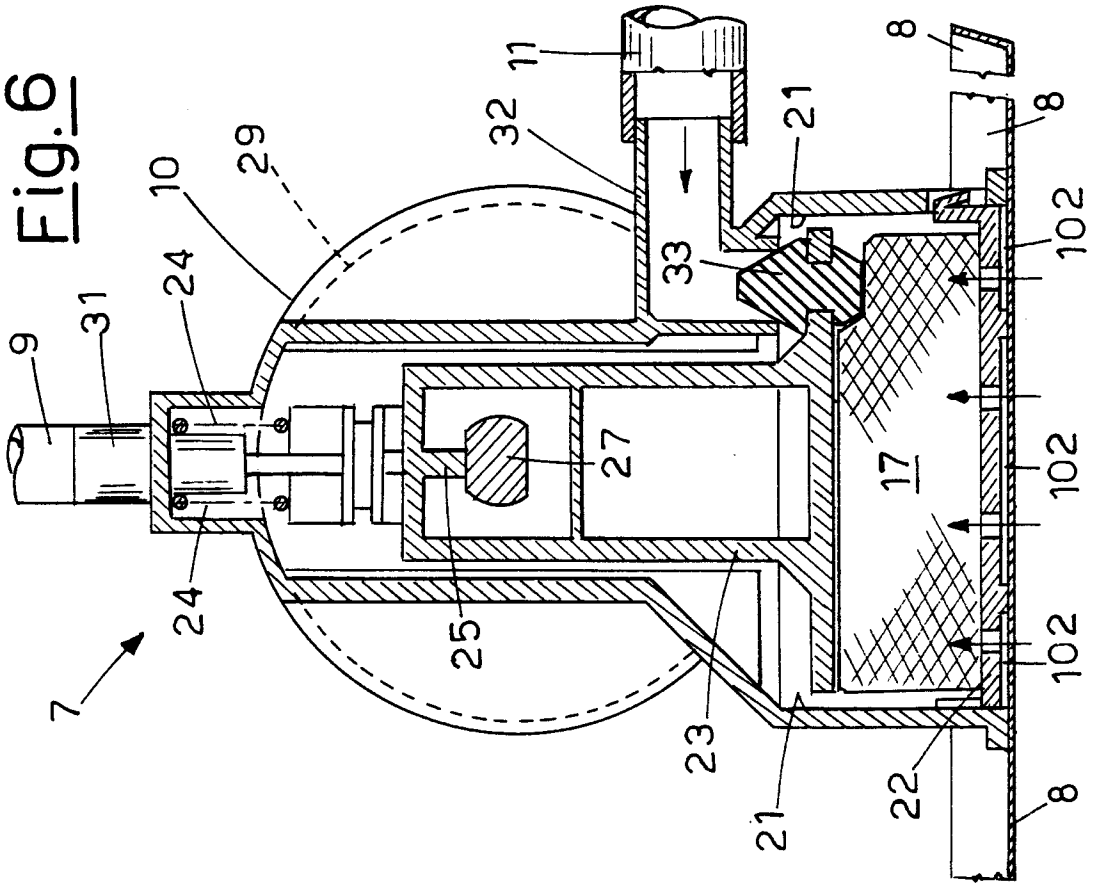
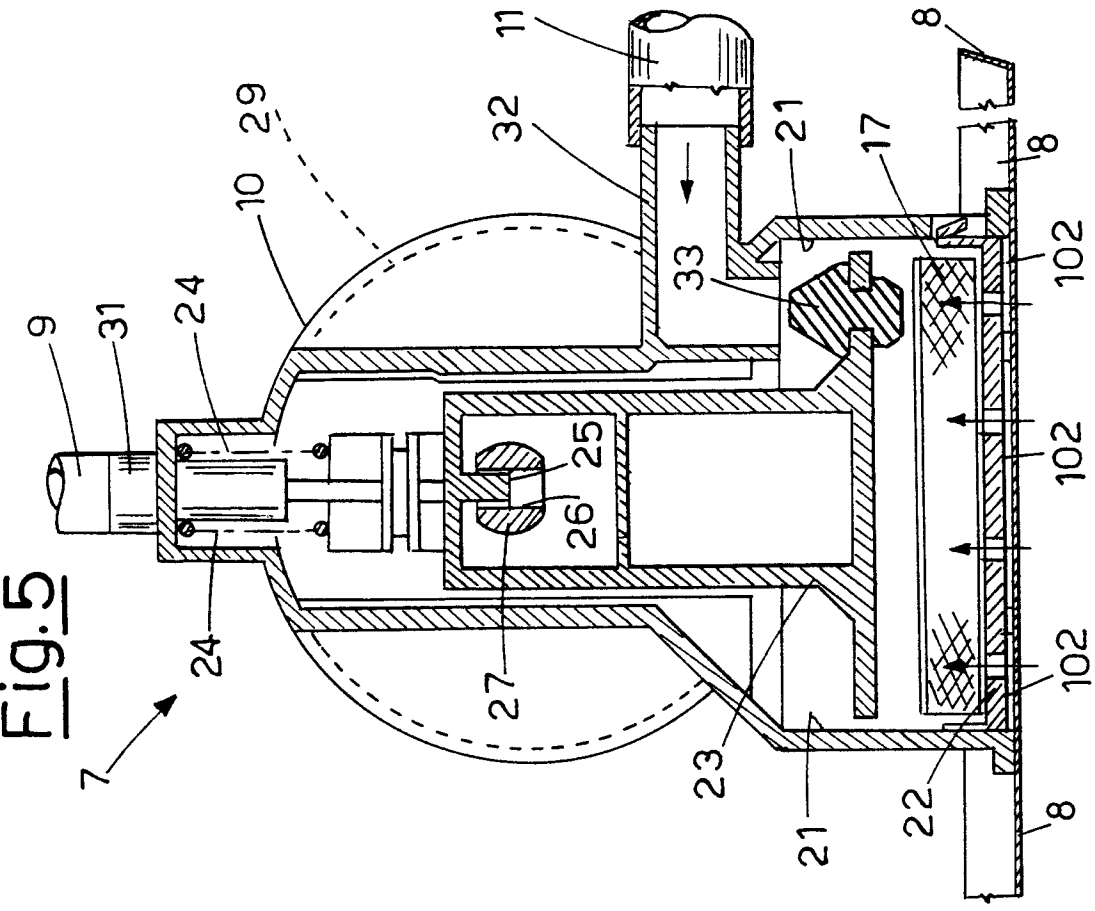


Fig. 5





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.6)
P,Y	DE-A-44 02 502 (ELTEK S.P.A.) * column 3, line 49 - column 5, line 65; claim 1; figures 3-5 *	1	D06F39/08
A	---	3,5	
Y	DE-U-84 20 779 (BOSCH-SIEMENS HAUSGERÄTE GMBH) * the whole document *	1	
A	---	6	
A	EP-A-0 555 679 (RE-FLEX S.R.L.) * column 2, line 19 - column 3, line 16; claims 1,5; figures 1,2 *	1	
A	DE-A-37 18 080 (ELTEK S.P.A.) * column 3, line 49 - column 4, line 29; claim 1; figures 2,4,5 *	1,5	
A	PATENT ABSTRACTS OF JAPAN vol. 13 no. 35 (P-818) ,26 January 1989 & JP-A-63 233343 (SANYO ELECTRIC CO LTD) 29 September 1988, * abstract *		TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D06F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 13 September 1995	Examiner Munzer, E
CATEGORY OF CITED DOCUMENTS		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	
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			