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(54) Safety pressure switch for domestic appliances such as washing machines, dishwashers or suchlike

(57) Safety pressure switch (10) for domestic appliances, such as washing machines, dishwashers or suchlike, provided with a box-like element (11) inside which a membrane (12) is arranged that defines a first zone (18) connected to the environment to be controlled and a second zone (19) at atmospheric pressure. Actuators (13) cooperating with the membrane (12) are provided in the first zone (19). The actuators (13) comprise at least two pistons (32, 33) axially autonomous and have a total area of contact (17) with the membrane (12). The total area of contact (17) comprises at least a central area (22) and a peripheral area (23) defined by the upper surfaces of the corresponding pistons (32, 33). The pistons (32, 33) are moved by the membrane (12) in order to activate relative switches (20, 21).

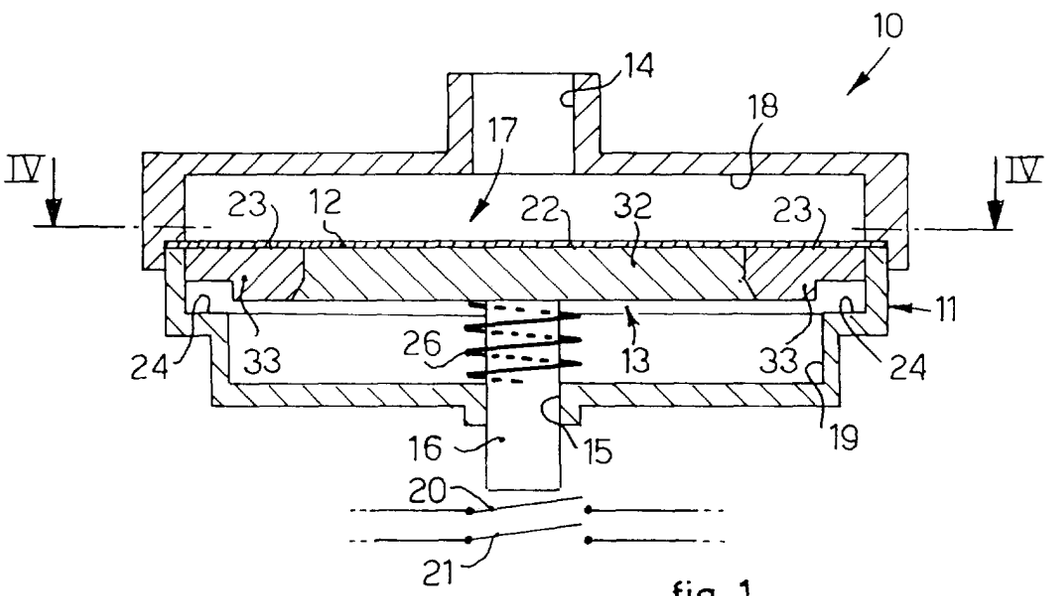


fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a safety pressure switch for domestic appliances such as washing machines, dishwashers or suchlike, able to authorize the command to activate any function, and also to function as a safety device.

BACKGROUND OF THE INVENTION

[0002] Pressure switches are known which are used in domestic appliances such as washing machines, dishwashers or suchlike, provided with a membrane which separates a box-like element transversely, so as to define a first upper zone at working pressure, and a second lower zone at atmospheric pressure.

[0003] The membrane cooperates with the piston of an actuator arranged in the second zone so that, with every increase in pressure in the upper zone, there is a corresponding displacement of the actuator which goes to stress a relative switch.

[0004] Known pressure switches are used in washing machines and dishwashers in an operative function, that is, as elements that cause an event, such as for example the insertion of the resistance to heat the water.

[0005] US-A-4,939,321 discloses a pressure switch wherein a plurality of diaphragms, parallel and coaxial to each other, are arranged inside a single cylindrical compartment of a container, in order to detect variations in pressure inside the compartment itself. This known device is particularly complex to make and costly, however.

[0006] US-A-5,452,613 discloses a pressure switch that comprises a single diaphragm arranged in correspondence with an aperture of a cylindrical compartment, inside which a piston is movable. A generic pressure transducer is associated with the diaphragm. This known device however does not allow to detect in a simple manner the presence of two different and determinate pressure values.

[0007] Applicant has devised and embodied the present invention to overcome the shortcomings of the state of the art and to obtain other advantages.

SUMMARY OF THE INVENTION

[0008] The present invention is set forth and characterized in the main claim, while the dependent claims describe other characteristics of the invention.

[0009] The purpose of the invention is to achieve a safety pressure switch for domestic appliances, such as washing machines, dishwashers or suchlike, able to be used inside limited tolerances in several ranges of pressure values.

[0010] In accordance with this purpose, a safety pressure switch for domestic appliances according to the present invention comprises a box-like element inside which membrane means are arranged which define a first zone connected to the environment to be controlled, and a second zone at atmospheric pressure.

[0011] In the zone at atmospheric pressure, there are actuating means that cooperate with the membrane means and, in known manner, drive one or more switches. The actuating means have a supporting surface for the membrane means, are moved by the membrane means and are able to activate the switching means.

[0012] According to one characteristic of the present invention, the overall supporting area defined by the actuating means, in contact with the membrane means, is characterized by two or more substantially concentric areas of contact, of which one represents the central area and the others represent the peripheral areas.

[0013] Each of the areas of contact is defined by a surface of a corresponding piston means movable axially in autonomous manner.

[0014] Each of the areas of contact, central or peripheral, characterizes a specific range of pressure values to be detected, increasing from the most peripheral area towards the central one, and is associated to the drive of a specific switch.

[0015] According to a first form of embodiment of the present invention, the central area is substantially rectangular or square in shape and the peripheral areas each have the shape of a frame, concentric to the central area.

[0016] According to a variant, the central area is circular and the peripheral areas each have an annular shape, concentric to the central area.

[0017] Each specific piston means is enabled to make a determinate axial travel sufficient to activate the specific switch.

[0018] Increasing the pressure, the membrane means progressively displace first all the piston means, then the more central ones, one after the other, until they drive only the central piston means.

[0019] Stopping means, or means which limit the travel, cooperate with specific piston means.

[0020] The safety pressure switch according to the present invention can therefore be correctly used in several ranges of pressure values, since as the pressure varies the value of the area of contact which cooperates with the portion of membrane means that can move axially is also modified. In fact, when the travel of the first specific piston means, which is normally the outermost one, is stopped by the stopping means, the other specific piston means can freely continue their axial movement, following the expansion of the membrane means. The other specific piston means in fact define specific areas of contact which cooperate with progressively lower surfaces of the membrane means with respect to the starting surface. The surfaces of the membrane means and the areas of contact are coherent with specific ranges of pressure values.

[0021] In this way, the safety pressure switch accord-

ing to the present invention can work in several ranges of pressures and in every range of pressure inside limited intervals of tolerance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example, with reference to the attached drawings wherein:

- fig. 1 is a transverse section of a safety pressure switch according to the present invention, in this case, with two pressure intervals;
- fig. 2 shows the safety pressure switch of fig. 1, in a first operating step;
- fig. 3 shows the safety pressure switch of fig. 1, in a second operating step;
- fig. 4 is a section on a reduced scale from IV to IV in fig. 1;
- fig. 5 is a section on a reduced scale of a variant of the safety pressure switch in fig. 1;
- fig. 6 shows an enlarged detail of fig. 1;
- fig. 7 shows a first variant of the detail in fig. 3;
- fig. 8 shows a second variant of the detail in fig. 3;
- fig. 9 shows a further variant of the safety pressure switch in fig. 1.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT OF THE INVENTION

[0023] With reference to fig. 1, a safety pressure switch 10 according to the present invention comprises a box-like element 11 inside which a membrane 12 and an actuator 13 are arranged.

[0024] The box-like element 11 is provided at the upper part with an aperture 14 able to put into communication the inside of the box-like element 11 with the working environment, whose pressure is to be monitored, and at the lower part with a through hole 15 able to allow a rod 16 of the actuator 13 to protrude. All this is generally known in the state of the art.

[0025] The safety pressure switch 10 is applied inside a washing machine or a dishwasher, not shown in the drawings, and the aperture 14 puts in communication the inner part of the box-like element 11 with the washing compartment of a washing machine or of a dishwasher, so as to measure the pressure inside the washing compartment on each occasion.

[0026] The membrane 12 defines a first upper compartment 18 inside which, by means of the aperture 14, the pressure corresponds to the pressure in the washing compartment on each occasion, and a second lower compartment 19 at atmospheric pressure. In this way, if the pressure inside the washing compartment is greater than the atmospheric pressure, the membrane 12 tends to bend towards the lower compartment 19 at atmospheric pressure (figs. 2 and 3).

[0027] Inside the lower compartment 19 the actuator 13 is arranged, which comprises an overall area of contact 17 constantly in contact with the membrane 12, so that the flexion of the latter causes a downward movement of the actuator 13.

[0028] The actuator 13, in this case, comprises a first piston 32 solid with the rod 16 and arranged in an axially central position with respect to the overall area of contact 17. The rod 16 is able to drive, according to the displacement of the membrane 12, respective switches 20 and 21. The first piston 32, on its upper part, has an area 22 that constitutes the central area of the overall area of contact 17. The central area 22 has a rectangular (fig. 4), or circular (fig. 5) shape. It is clear that the central area 22 can have any other shape other than rectangular or circular (for example ellipsoidal, trapezoid, etc.).

[0029] The actuator 13 also comprises a second piston 33 (figs. 1, 2, 3), coaxial and external with respect to the first piston 32 and having on its upper part an area 23 that constitutes the peripheral area of the overall area of contact 17. The peripheral area 23 is concentric to the central area 22 and has a shape mating with that of the central area 22, so that it has the shape of a rectangular frame, when the central area 22 is rectangular (fig. 7), while it has an annular shape when the central area 22 is circular (fig. 8).

[0030] The outer piston 33 has a limited travel with respect to the inner piston 32, since the box-like element 11 has inside a stopping surface 24 on which the outer piston 33 is able to stop.

[0031] In this way, the membrane 12 acts on progressively smaller surfaces, as the pressure inside the washing machine increases; for example the whole surface of the area of contact 17 is exploited for normal ranges of pressure in a washing machine in use, whereas, in the event that the pressure inside the washing machine were to increase to emergency levels, a reduced surface is exploited, consisting only of the central area 22, which guarantees a greater precision in the range of values.

[0032] Therefore, by exploiting the switches 20 and 21 the pressure switch 10 can be installed in the washing machine so that, for example, when the pressure inside the washing machine is normal, the rod 16 drives the switch 20 which authorizes the command to activate a resistance to heat the water, while if the working pressure of the washing machine reaches emergency levels, the rod 16 drives the switch 21 which activates the safety circuit in order to discharge the excess water.

[0033] The actuator 13 cooperates with spring means 26 which keep the area of contact 17 in contact with the membrane 12.

[0034] The two pistons 32 and 33 are provided with reciprocal guide walls 25 (figs. 6, 7, 8) which keep them connected together, to allow them to move together, at least until the outer piston 33 stops on the corresponding stopping surface 24. The guide walls 25 also have the

function of keeping the inner piston 32 centered with respect to the outer piston 33 when the latter rises towards the starting position.

[0035] As shown in fig. 6, in this case, the guide walls 25 of the two pistons 32 and 33 have reciprocal bevels 27 and 28 at the lower part, which, during the descent step, allow them to move simultaneously and, during the ascent, to prevent the inner piston 32 from jamming on the outer piston 33.

[0036] Fig. 7 shows a variant of the embodiment in fig. 6, wherein the guide walls 25 comprise reciprocal bevels 127 and 128 extending along the whole thickness of the outer piston 33, while below the inner piston 32 a supporting foot 29 is made in one piece therewith, able to support the outer piston 33.

[0037] In the variant shown in fig. 8, the guide walls 25 have the beveled corners 227 and 228, respectively, lower in the outer piston 33, and upper in the inner piston 32. As in the previous variant, below the inner piston 32 a supporting foot 29 is made in one piece therewith.

[0038] According to the variant shown in fig. 9, there are two or more elastic elements 30 provided, such as for example biconical or omega-shaped springs or suchlike, arranged below the two pistons 32 and 33 so as to connect them together elastically.

[0039] The action of the elastic elements 30 allows hysteresis of the pressure switch 10, that is, it allows to delay the return movement of the two pistons 32 and 33 to their initial position with respect to the variation of pressure in the upper compartment 18. In this way we obtain an optimum functioning of the actuator 13 in its entirety and of the switches 20, 21 associated therewith. In this way a bistable movement is created instead of a linear one.

[0040] According to a variant, not shown in the drawings, this movement could also become polystable, if there were more than two pistons associated with the membrane 12 and movable with respect to each other.

[0041] It is clear, however, that modifications and/or additions of parts can be made to the pressure switch 10 as described heretofore, without departing from the field and scope of the present invention.

[0042] It is also clear that, although the present invention has been described with reference to specific examples, a person of skill in the art shall be able to achive many other equivalent forms of pressure switch for domestic appliances, such as washing machines, dishwashers or suchlike, all of which shall come within the field and scope of the present invention.

Claims

1. Safety pressure switch for domestic appliances, such as washing machines, dishwashers or suchlike, comprising a box-like element (11) inside which membrane means (12) are arranged to define a first zone (18) connected to the environment to be controlled and a second zone (19) at atmospheric pressure, actuating means (13) being provided in said second zone (19) cooperating with said membrane means (12), said actuating means (13) having a determinate area of contact (17) able to contact said membrane means (12), and being able to be moved by said membrane means (12) in order to activate relative switching means (20, 21), **characterized in that** said area of contact (17) comprises a central area (22) associated with a first piston means (32) and at least a peripheral area (23) associated with a second piston means (33), **in that** said first and second piston means (32, 33) are axially movable autonomously with respect to said box-like element (11), and **in that** each of said areas, central (22) and peripheral (23), characterizes a specific range of values of pressure increasing from the most peripheral area (22) towards said central area (23).

2. Pressure switch as in claim 1, **characterized in that** said central area (22) has a substantially rectangular or square shape and said peripheral area (23) has the shape of a frame concentric to said central area (22).

3. Pressure switch as in claim 1, **characterized in that** said central area (22) is circular and said peripheral area (23) has an annular shape and is concentric to said central area (22).

4. Pressure switch as in claim 1, **characterized in that** each of said piston means (32, 33) is able to perform a determinate axial travel sufficient to activate a specific switching means (20, 21).

5. Pressure switch as in claim 4, **characterized in that** said box-like element (11) comprises stopping means (24) able to define said determinate axial travel of at least one of said piston means (32, 33).

6. Pressure switch as in claim 1, **characterized in that** each of said piston means (32, 33) comprises guide means (25) able to allow their autonomous and reciprocal axial movement in an operating direction, and to facilitate the repositioning thereof in the opposite direction.

7. Pressure switch as in claim 1, **characterized in that** it also comprises elastic means (26) able to keep each of said areas, central (22) and peripheral (23), associated with said membrane means (12).

8. Pressure switch as in claim 1, **characterized in that** said actuating means (13) comprise a rod (16) solid with said piston means (32, 33) and able to activate said switching means (20, 21).

9. Pressure switch as in claim 1, **characterized in**

that below said areas, central (22) and peripheral (23), a plurality of elastic elements (30) are provided, able to delay the return movement of said piston means (32, 33) with respect to the variation in pressure in said first zone (18) so as to create a substantially bistable movement instead of linear.

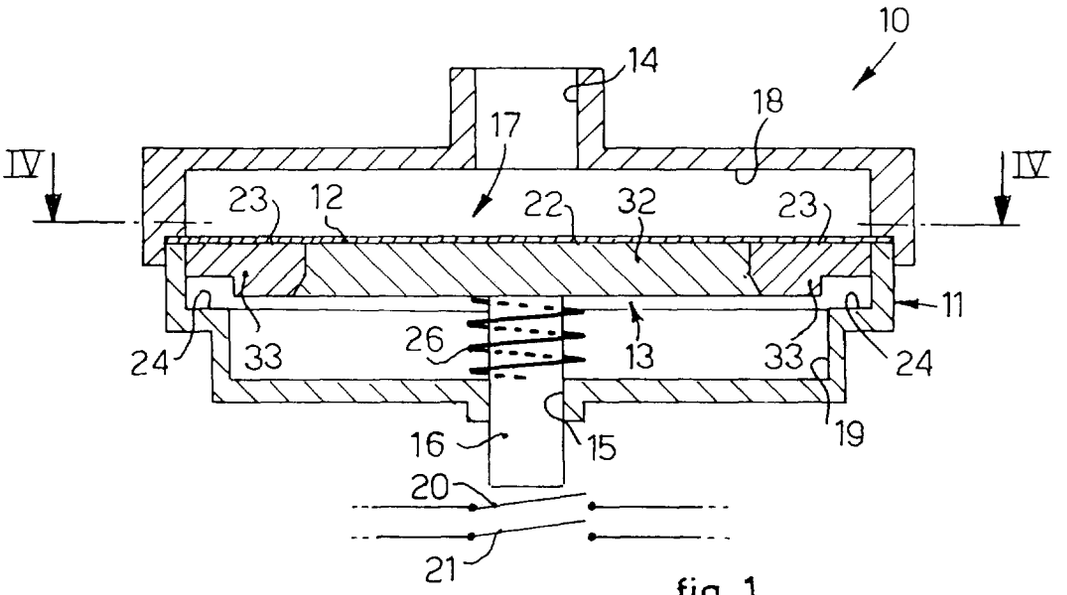

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fig. 1

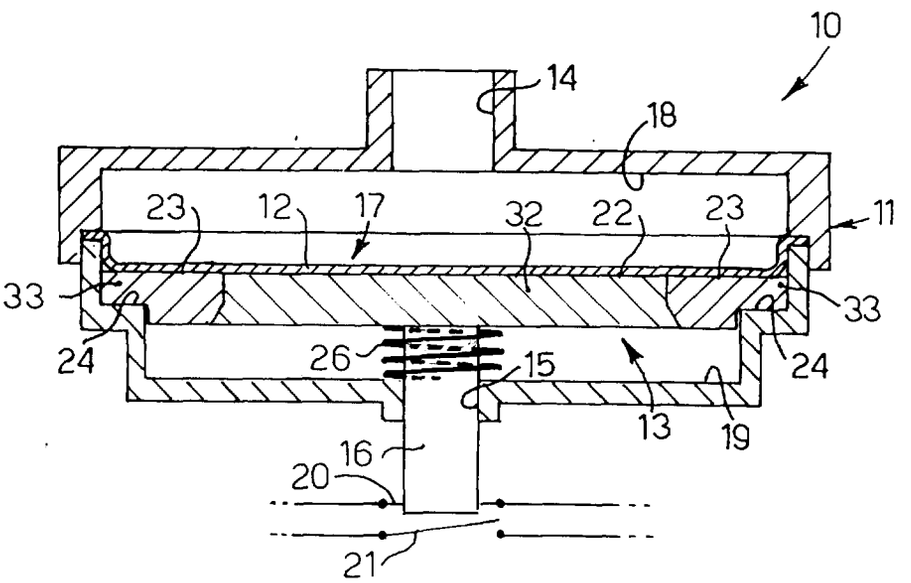

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fig. 2

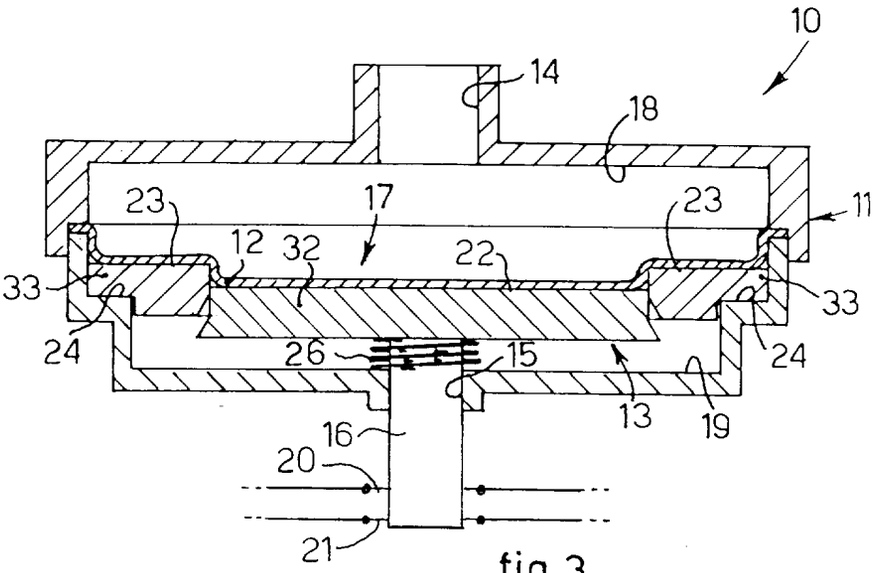


fig. 3

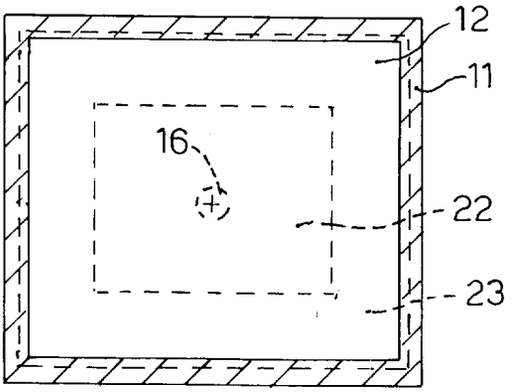


fig. 4

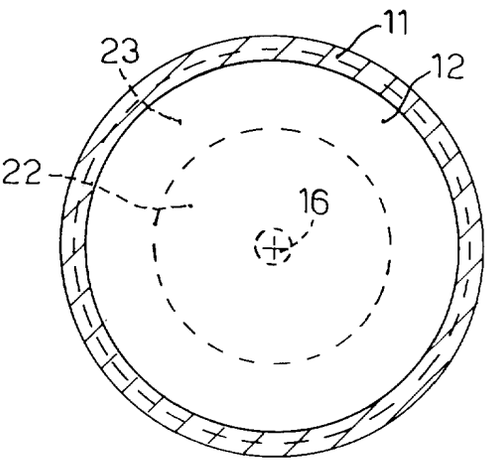


fig. 5

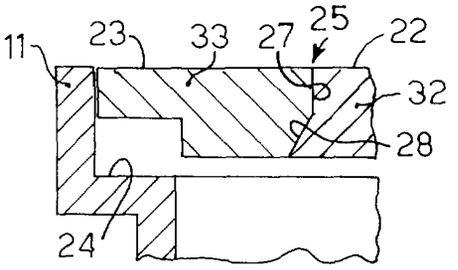


fig. 6

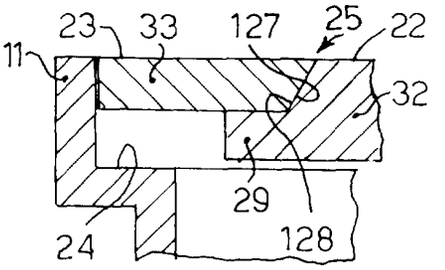


fig. 7

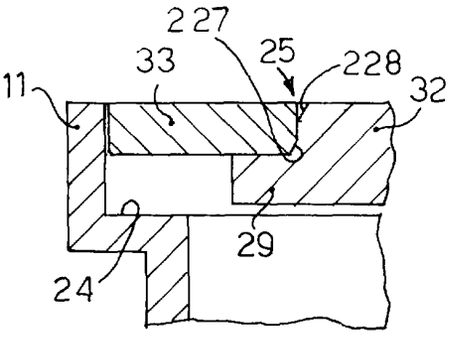


fig. 8

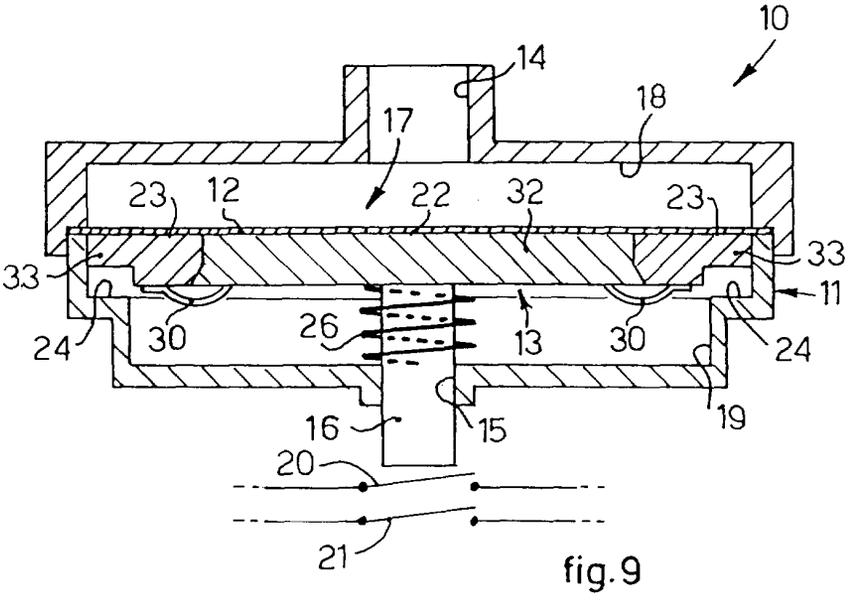


fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 03 10 4068

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	US 3 657 501 A (HOYT HAROLD R) 18 April 1972 (1972-04-18)	1-8	H01H35/26
Y	* the whole document *	9	

Y	US 4 469 923 A (CHARBONEAU THOMAS J) 4 September 1984 (1984-09-04) * column 5, line 61 - column 6, line 1; figure 1 *	9	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	29 November 2004	Mäki-Mantila, M

CATEGORY OF CITED DOCUMENTS

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29-11-2004

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