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(54) Feed safety device for dishwasher machine and relative method of operation

(57) A pneumatic safety device for the feeding of water of a dishwasher machine, characterised in that it comprises: a chamber (3) hermetically sealed by a flexible membrane (21); an air trap (15) placed in the tub of the machine for washing and connected pneumatically to said chamber, said air trap being capable of bending said membrane according to the value of the air pressure inside said chamber determined by the level of feed water in the tub which closes said air trap; a microswitch (23) with pushbutton (25) for actuating the microswitch, said microswitch tripping to emit an alarm signal at a water feed alarm level; and an elastic actuator (27) of the microswitch actuation pushbutton, said elastic actuator being placed between said membrane and said pushbutton and which can be actuated to cause tripping of the microswitch.

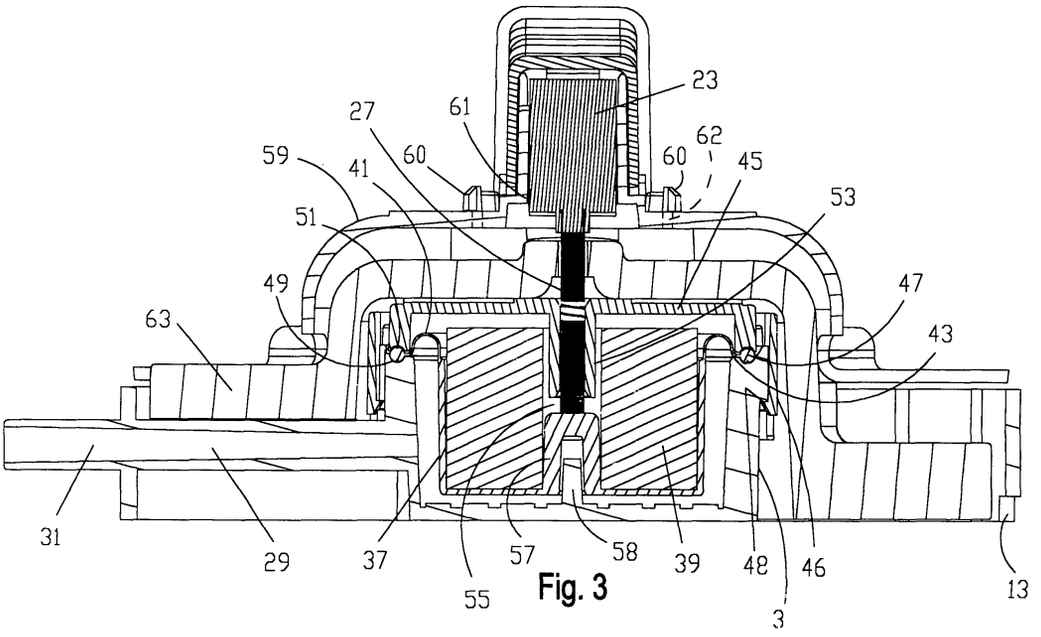

Fig. 3

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Description

[0001] The present invention relates to a safety device for the water feed of a dishwasher machine and the relative method of use.

[0002] The use of a safety pressure switch, placed in the tub of the dishwasher to detect a safety level of the feed water, has been known for some time. When this safety level is reached the dishwasher blocks feeding of water and enables the drain pump for emptying of the tub so as to avoid the possibility of overflow.

[0003] A complementary or alternative solution for detecting a safety level of the feed water has also been known for some time and which provides a device comprising a chamber sealed hermetically by a flexible membrane. The chamber is connected pneumatically to an air trap placed in the washing tub of the dishwasher machine, which membrane bends on closure of the air trap and on the reaching of an alarm level the bending of the membrane is sufficient for actuating the pushbutton of a microswitch by means of a small rigid actuator rod placed axially between the membrane and the pushbutton of the switch so as to generate an electrical alarm signal.

[0004] It is essential that a safety device of this type does not only trip at a specific feed water alarm level but has an adequate differential of water feed level for the de-energising of the alarm device since, when the abnormal feed level is indicated, the dishwasher machine must immediately start up the drain pump. When the drain pump is started up, there is a sudden lowering of the feed level and a safety device without an adequate level differential would be disabled with the risk of cycling, i.e. of enabling rapid and repeated cycles of priming and actuating of the drain pump with negative effects on the components and on the functioning of the same safety device.

[0005] So as to avoid this disadvantage the state of the art provides for a siphon which overflow-trips the air trap in such a way as to delay emptying of the air trap when the feed level lowers.

[0006] Clearly manufacture of the siphon requires special processes of moulding and welding, and limited design dimension choices due to the reduced availability of space in the dishwasher.

[0007] The limitation of the size of the siphon also does not allow the achievement of appreciable extensions of the feed water level differential for de-energising the safety device.

[0008] The safety device which uses the siphon is therefore complicated and at times not always reliable and effective.

[0009] The object of the present invention is that of avoiding the disadvantages suffered by traditional feed safety devices for a dishwasher machine and is achieved by a feed safety device for a dishwasher machine in accordance with claim 1.

[0010] The advantages of the safety device in accordance with the present invention lie in eliminating the siphon which allows a lower overall cost of the dishwasher machine, greater reliability and repeatability of the feed safety device.

[0011] An outstanding feature of the present invention is the providing of an elastic actuator of the pneumatic safety device which can guarantee a significant increase in the force and stroke differential whereto the membrane has to be subjected so as to cause tripping of the microswitch in relation to the case wherein this actuator is rigid. In this way the feed water level differential measured between the reset point and the tripping point of the microswitch becomes sufficient for avoiding the use of a siphon as occurs instead in traditional pneumatic safety devices.

[0012] An integrated system composed of such a pneumatic safety device and a float safety device placed in the base of the dishwasher machine can advantageously substitute the adoption of a pressure switch as primary safety system.

[0013] Alternatively the safety system can have the pneumatic safety device alone.

[0014] Finally the provision of an elastic instead of a rigid actuator for the pneumatic safety device allows greater speed of tripping of the microswitch with greater force of closure of the contacts of the microswitch and this in turn enables the microswitch to sustain an advantageously greater electrical current.

[0015] These and other advantages will be made clearer by the following description of a preferred embodiment of the present invention, to be read purely by way of a non-limiting example of the more general principle claimed.

[0016] The description refers to the accompanying drawings in which:

Figure 1 is a schematic view of the feed safety system in the drum (sectioned) of the dishwasher machine in accordance with the present invention; and
Figures 2 and 3 are transversely sectioned views in detail of the safety system of Figure 1.

[0017] Referring to the drawings, the safety system formed by the integration of a first pneumatic safety device and a second float safety device defines a vertical axis L-L and is positioned with the lower side on the base of the dishwasher machine.

[0018] The safety system comprises a support body 1 common to the two devices, formed by an internal chamber 3, axially extending and open above, and by an enclosure element 5 of the chamber 3 connected thereto by means of bridges 7 which define angular segments, open above and below, of the support body 1.

[0019] Preferably, as shown, the chamber 3 has a cylindrical lateral surface and a flat and circular lower base, and the enclosure element 5 also has an annular shape.

[0020] The enclosure element 5 has members 9 for

attachment to the base 11 of the dishwasher machine and defines openings 13 for the passage of the water from the exterior of the support body 1 to the open angular segments defined inside the support body 1.

[0021] The pneumatic safety device comprises an air trap 15 situated in the sump 17 of the tub 19 of the dishwasher (lower point for collection of the water in the tub of the dishwasher) or in any other point of the tub 19 of the dishwasher, a deformable membrane 21 in rubber, attached for hermetic sealing of the open upper side of the chamber 3, a pneumatic connection between the air trap 15 and the chamber 3, a microswitch 23 with actuation pushbutton 25 for processing an electrical alarm signal, and an actuator 27 of the microswitch 23 placed between the deformable membrane 21 and the pushbutton 25 of the microswitch 23.

[0022] The pneumatic connection between the air trap 15 and the chamber 3 is formed by a tubular conduit 29 which opens in the chamber 3 and extends through the enclosure element 5, projecting for a section 31 outside thereof.

[0023] A small flexible tube 33 is then attached to join the section 31 of the tubular conduit 29 and the outlet 35 of the air trap 15.

[0024] The deformable membrane 21 is preferably formed by a cylindrical cap provided with a flap 41 and a cylindrical dome 37 for containing a weight 39, also preferably cylindrical, which cap 21 can be attached, upside down, for hermetic sealing of the upper open side of the chamber 3.

[0025] The upper edge 43 of the chamber 3 forms a shoulder for support of the peripheral edge 41 of the membrane 21.

[0026] The chamber 3 is covered above by a first small cover 45, open centrally, whose lower edge adapts to the upper edge of the chamber 3, placing the peripheral edge of the membrane 21 in between.

[0027] More specifically the flap 41 of the membrane 21 has a rib 47 along its peripheral edge, while the upper edge 43 of the chamber 3 provides an indentation 49 for housing the lower portion of this rib 47 and the lower edge of the small cover 45 provides a further indentation 51 for housing the upper portion of this rib 47.

[0028] Outside of the small cover 45 small flexible teeth 46 extend downwards and can be coupled to a recess 48 of the external lateral wall of the chamber 3 to form removable snap-hooking of the small cover 45 to the chamber 3.

[0029] The snap-attachment of the first small cover 45 to the chamber 3 causes tightening of the rib 47 of the membrane 21 between the two relative lower 49 and upper 51 housing indentations in such a way as to form hermetic sealing of the chamber 3.

[0030] The first small cover 45 extends internally and centrally with an axial bush 53 inserted in an axial through cavity 55 of the weight 39 for the axial guiding of the actuator 27.

[0031] The dome of the membrane 21 comprises a hollow appendage 57 turned towards the interior of the dome 21 and engaged at the rear end of the through cavity 55 to maintain the weight 39 centred on the membrane 21.

[0032] From the centre of the base of the chamber 3 a pin 58 extends axially, inserted in the cavity of the appendage 57 of the membrane 21 so as to ensure also centring of the membrane 21 in relation to the chamber 3.

[0033] Above the first small cover 45 a second small cover 59 is attached. Attaching of the second small cover 59 is achieved by the removable snap-engaging of small flexible teeth 60 extending above the small cover 45 in corresponding through holes 62 formed in an eccentric position on the second small cover 59.

[0034] The second small cover 59 also has a central through opening 61 aligned with the bush 53 of the first small cover 45.

[0035] The microswitch 23 is mounted rotatingly on the external side of the second small cover 59 and has the axis of rotation removably snap-supported on the small cover 59.

[0036] The microswitch 23 is arranged in such a way as to insert the pushbutton 25 in the opening 61 of the second small cover 59.

[0037] The actuator 27 of the microswitch 23 is formed by an axially elastic member, preferably a cylindrical helical spring axially inserted through the bush 53 of the first small cover 45 and restrained between the pushbutton 25 of the microswitch 23 and the protuberance 57 of the membrane 21.

[0038] More specifically the elastic actuator 27 is formed by an intermediate section with distanced coils and by end sections with pack coils.

[0039] The microswitch 23 is preferably supported rotatingly in a vertical plane by the second small cover 59 with the possibility of blocking the angle of rotation via suitable cam means or regulation screws suitable for positioning at a precise height the pushbutton 25 of the microswitch 23 so as to allow fine regulation of the alarm level of the feed water which enables tripping of the safety system.

[0040] The float safety device comprises a float 63 placed between the first small cover 43 and the second small cover 59 and extending in the angular segments, open above and below, of the support body 1.

[0041] The float 62 has an axial ridge 65 aligned with the pushbutton 25 of the microswitch 23, which ridge 65 defines a second actuator for the pushbutton 25 and has an axial through hole 67 for the passage of the elastic actuator 27 of the pneumatic safety device.

[0042] The float 63 is freely mobile in an axial direction and in the lower axial position rests on the bridges 7 of the support body 1.

[0043] We shall now describe the functioning of the integrated safety system.

[0044] Referring to the functioning of the pneumatic safety device, when the ordinary device for controlling

the feed level does not function, the feed valve of the dishwasher machine continues to feed until the level of water in the sump closes the inlet 16 of the air trap 15. The pressure signal which is created in the air trap 15 due to the water head present above the inlet 16 of the air trap 15 reaches the chamber 3 and raises the membrane 21 against the action of the weight 39.

[0045] The purpose of the weight 39 is that of predefining the feed water alarm level corresponding to tripping of the microswitch 23: by increasing the weight 39 the alarm level increases.

[0046] When the alarm level is reached in the tub the membrane has pushed the actuator 27 on the pushbutton 25 as far as the position of tripping of the microswitch 23 which in turn generates an electrical alarm signal which enables closure of the feed valve and the start-up of the drain pump of the dishwasher machine.

[0047] Referring now to the functioning of the float safety device, in the event of the feed water overflowing towards the base of the dishwasher machine, seeping through the openings 13 of the enclosure element of the common support body 1 of the integrated safety system, the float 63 is raised by the water which pushes the actuator 65 on the pushbutton 25 as far as the position of tripping of the microswitch 23 which in turn generates, once again, an electrical alarm signal which enables closure of the feed valve and start-up of the drain pump of the dishwasher machine.

[0048] Similarly the float safety device is useful for detecting leaks from seals or from the components used to contain and circulate the washing water.

[0049] The microswitch 23 is characterised by an intrinsic force and stroke tripping differential between the tripping point, defined by a tripping force and by a tripping stroke, that is to say the point wherein, while the pushbutton 25 is pressed down, closure of the contact of the microswitch 23 is obtained, and the reset point, defined by a reset force and by a reset stroke, that is to say the point wherein, while the pushbutton 25 is released, opening of the contact of the microswitch 23 is obtained.

[0050] Given the precision required of the safety system, which has to detect the alarm level of the water feed with tolerances of no more than a few millimetres, the microswitch 25 must have a low tripping force and this entails it having also an extremely low intrinsic tripping differential.

[0051] Providing a microswitch 23 with a low tripping force and a weight 39 attached on the membrane 21 serves to enable actuation of the pushbutton 25 of the microswitch 23 both by the actuator of the pneumatic safety device and by the actuator of the float safety device.

[0052] This provision represents in fact a compromise between a weak thrust of the actuator of the float safety device and a tendentially excessive force by the actuator of the pneumatic safety device.

[0053] One of the outstanding features of the invention consists in the fact that, for a safety system wherein the microswitch has a necessarily low intrinsic force and stroke differential in order to be able to detect with precision the alarm level of the feed water, in the pneumatic safety device an elastic actuator of the pushbutton of the microswitch is provided, capable of significantly expanding the feed water level differential measured between the reset point and the tripping point of the microswitch in relation to the case wherein this actuator is rigid. In this way the pneumatic safety device guarantees a sufficient feed water level differential for avoiding cycling of the safety system without the need to provide a siphon for the purpose.

Claims

1. A pneumatic safety device for the water feed of a dishwasher machine **characterised in that** it comprises:

   - a chamber (3) hermetically sealed by a flexible membrane (21);
   - an air trap (15) placed in the tub of the machine for washing, connected pneumatically to said chamber (3), said air trap (15) being capable of bending said membrane (21) according to the value of the pressure of the air inside said chamber (3) caused by the level of feed water in the tub which closes said air trap (15);
   - a microswitch (23) with pushbutton (25) for actuation of the microswitch (23), said microswitch (23) tripping for the emission of an alarm signal at a water feed alarm level; and
   - an elastic actuator (27) of the pushbutton (25) for actuation of the microswitch, said elastic actuator (27) being placed between said membrane (21) and said pushbutton (25) and which can be actuated, so as to cause tripping of the microswitch (23), by the bending of the membrane (21) at the water feed alarm level.

2. A water feed safety device of a dishwasher machine according to claim 1, **characterised in that** said actuator (27) is formed by a cylindrical helical spring acting axially between said pushbutton (25) of the microswitch (23) and said membrane (21).

3. A water feed safety device of a dishwasher machine according to claim 2, **characterised in that** said chamber (3) defines an upper open side hermetically sealed by said membrane (21), above which membrane (21) the pushbutton (25) of the microswitch (23) is placed, and **in that** said (27) actuator is arranged vertically between said pushbutton (25) of the microswitch (23) and said membrane (21).

4. A water feed safety device of a dishwasher machine

according to claim 3, **characterised in that** a weight (39) sustained by said membrane (21) is provided, suitable for predefining the feed water alarm level which causes tripping of the microswitch (23).

5. A water feed safety device of a dishwasher machine according to claim 4, **characterised in that** said membrane(21) has a cap shape with a dome (37) for containing said weight and a flap (41), said dome (37) of the membrane (21) being turned towards the interior of said chamber (3).

6. A water feed safety device of a dishwasher machine according to claim 5, **characterised in that** a first small cover (45) of said chamber (3) is provided, with an opening for the passage of said actuator (27) and removably mounted above said chamber (3) with reciprocal snap-engaging means (46, 48).

7. A water feed safety device of a dishwasher machine according to claim 6, **characterised in that** the upper edge (43) of said chamber (3) is coupled to the lower edge of said first small cover (45) with the peripheral edge of said flap (41) of the membrane (21) placed in between.

8. A water feed safety device of a dishwasher machine according to claim 7, **characterised in that** said peripheral edge of said flap (41) of the membrane (21) is formed by a rib (47), and **in that** said upper edge (43) of said chamber (3) and respectively said lower edge of said first small cover (45) provide an indentation (51) for housing the lower and respectively upper portion of said rib (47) of the flap (41) of the membrane (21).

9. A water feed safety device of a dishwasher machine according to any one of claims 6 to 8, **characterised in that** said weight (39) has a vertical through cavity (55) and said first small cover (45) extends internally and vertically with a bush (53) which projects into said cavity (55) of said weight (39) so as to guide axially said actuator (27) in its interior.

10. A water feed safety device of a dishwasher machine according to claim 9, **characterised in that** the dome (37) of said membrane (21) comprises a protuberance (57) engaged at the lower end of said axial cavity (55) of said weight (39) so as to maintain centring between said membrane (21) and said weight (39).

11. A water feed safety device of a dishwasher machine according to any one of claims 6 to 10, **characterised in that** a second small cover (59) is provided with an opening for the passage of said actuator (27) and removably mounted outside said first small cover (45) with reciprocal snap-engaging means (60, 62), said second small cover (59) supporting at its external side said microswitch (23).

12. A water feed safety device of a dishwasher machine according to claim 11, **characterised in that** said microswitch (23) is mounted rotatingly on said second small cover (59).

13. A water feed safety device of a dishwasher machine according to claim 12, **characterised in that** said microswitch (23) has the axis of rotation removably snap-supported by said second small cover (59).

14. A water feed safety device according to any one of claims 12 and 13, **characterised in that** means are provided for blocking the angular position of the microswitch (23) for fine regulation of the water feed alarm level.

15. A water feed safety system of a dishwasher machine, **characterised in that** it comprises a pneumatic safety device in accordance with any one of claims 1 to 14 and an additional safety device integrated with said pneumatic safety device, said additional safety device having a float (63) for actuation of the pushbutton (25) of the microswitch (23) of the pneumatic safety device, said float (63) being placed on a reference plane, it being possible to raise said float (63) from the level of water present above the reference plane up to an emergency level of tripping of the microswitch (23) of the pneumatic safety device.

16. A water feed safety system of a dishwasher machine, **characterised in that** it comprises a pneumatic safety device in accordance with any one of claims 11 to 14 and an additional safety device integrated with the pneumatic safety device, said additional safety device having a float (63) for actuation of the pushbutton (25) of the microswitch (23) of the pneumatic safety device, said float (63) being rested on a reference plane and being arranged between said first (45) and said second (59) small cover of the first safety device, it being possible to raise said float (63) from the level of water present above the reference plane up to an emergency level of tripping of the microswitch (23) of the pneumatic safety device.

17. A water feed safety system of a dishwasher according to any one of claims 15 and 16, **characterised in that** said reference plane is the base of the dishwasher.

18. Dishwasher machine having a water feed safety device in accordance with any one of claims 1 to 14.

19. Dishwasher machine having a water feed safety

system in accordance with any one of claims 15 to 17.

20. Method for the control of the water feed of a dishwasher, **characterised in that** it uses a device in accordance with any one of claims 1 to 14.

21. Method for the control of the safety level of the feed water of a dishwasher, **characterised in that** it uses a system in accordance with any one of claims 15 to 17.

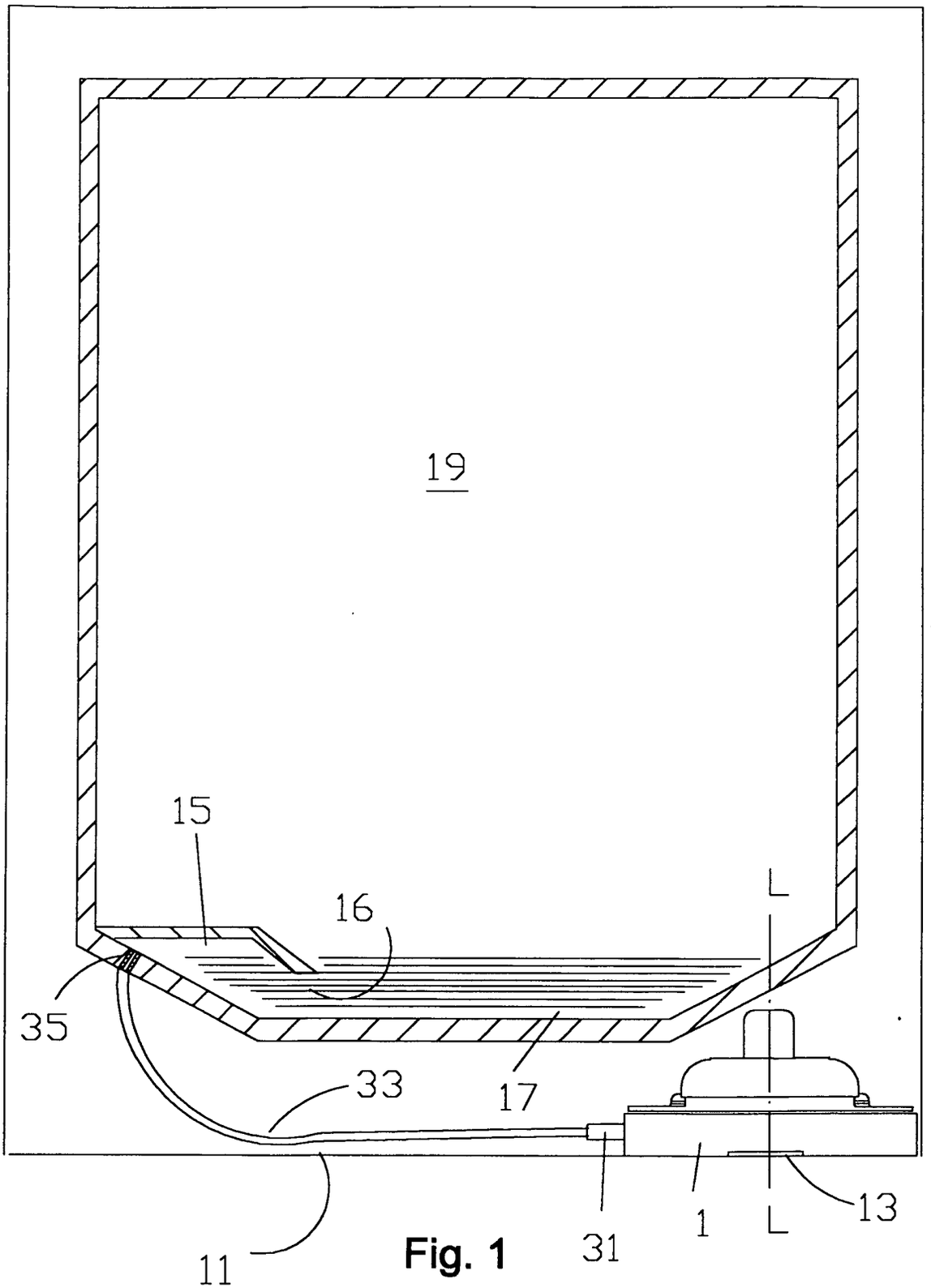

Fig. 1

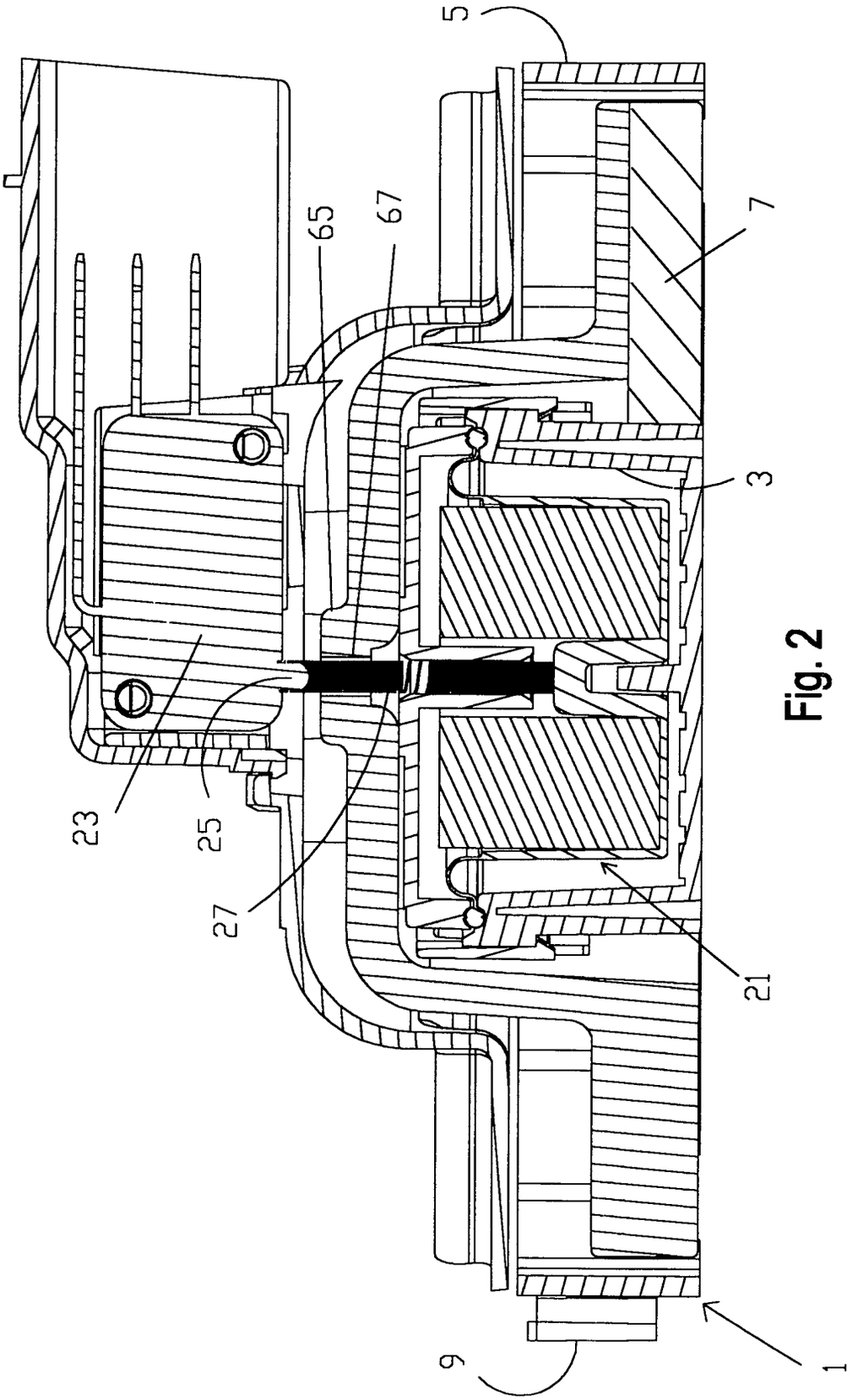

Fig. 2

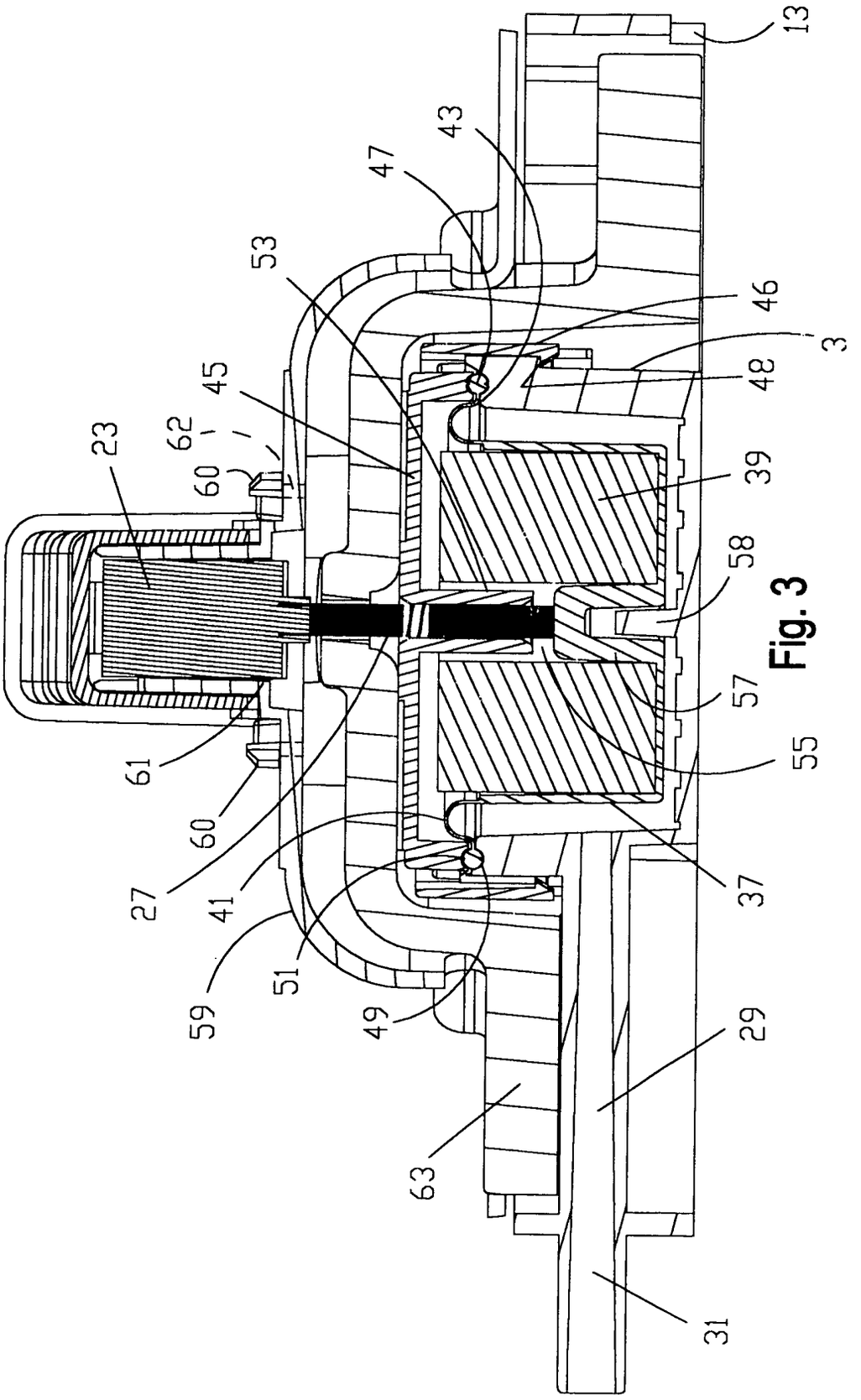
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Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 02 02 0596

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	28 November 2002	Laue, F

CATEGORY OF CITED DOCUMENTS

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