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(54) **Leak prevention device for water supply conduits of electrical household appliances**

(57) The invention refers to a leak prevention device (1) for water supply conduits of electrical household appliances, such as washing machines and dishwashers. The device comprises a supply hose (2), a second hose (3) surrounding the supply hose (2) so as to form a chamber (4) between the supply hose (2) and said second hose (3) and a safety valve mechanism having a valve body unit (19) moveable from an open position to a closed position for closing the supply hose (2) and a valve body unit (19) actuating mechanism (26) for at least magnetically triggering the movement of the valve body unit (19) and being in fluid communication with the chamber (4). The valve body unit (19) actuating mechanism (26) comprises at least one magnet (31,32) which is moveable from a first to a second position, when the at least one magnet (31,32) of the valve body unit (19) actuating mechanism (26) in said second position triggers movement of the valve body unit (19) into the closed position. The valve body unit (19) actuating mechanism (26) comprises a fluid-driven plunger (27) in fluid connection with the chamber (4) and the least one magnet (31,32) is attached to said fluid-driven plunger (27) for a sliding movement together with said fluid-driven plunger (27) from said first to said second position.

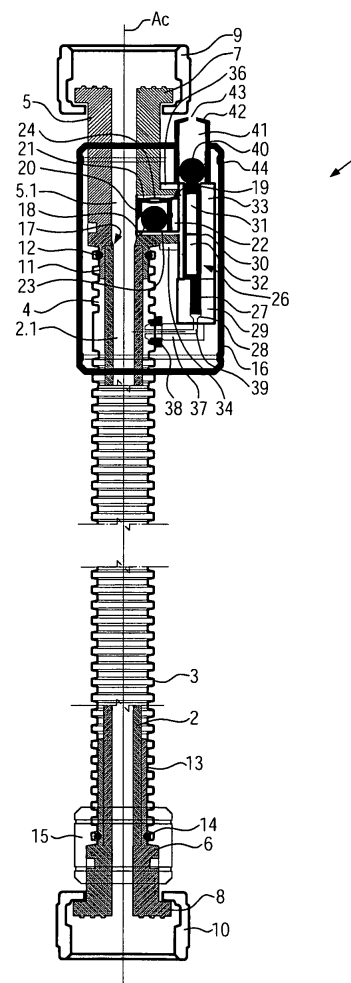


FIG. 1

Description

[0001] The present invention relates to leak prevention devices for water supply conduits of electrical household appliances, such as washing machines and dishwashers. The device comprises a supply hose, a second hose surrounding the supply hose so as to form a chamber between the supply hose and the second hose and a safety valve mechanism having a valve body unit moveable from an open position to a closed position for closing the supply hose and a valve body unit actuating mechanism for at least magnetically triggering the movement of the valve body unit and being in fluid communication with the chamber, the valve body unit actuating mechanism comprises at least one magnet which is moveable from a first to a second position, wherein the at least one magnet of the valve body unit actuating mechanism in said second position triggers movement of the valve body unit into the closed position.

[0002] Such a device is, for example, known from EP 0 984 093 A1. This known device comprises a closing valve, which is held by an actuating magnet in an open position. The valve is located within the flow channel of the supply hose, so that in the open position an annular flow-through is formed. The actuating magnet, which faces the valve magnet with the same polarity, holds the valve body in the open position. The actuating magnet is rotatably mounted and held in the open position of the valve in place by a moveable holder, which is biased by a compression spring in its holding position. Located at the opposite side of the holder is a dry sponge material, which upon contact with leaking water due to rupture of the supply hose will expand and then push the holder in its retracted position, so that the rotational movement of the actuating magnet is released. The actuating magnet will then no longer magnetically act on the valve magnet so that the valve closes. As usual, the leaking water comes from the chamber created between the supply hose and the second hose surrounding the supply hose. The second hose is in most of the cases, a corrugated hose. This mechanism prevents water from leaking out of the device and shut-down the household appliance, especially, a dishwasher or a washing machine.

[0003] A similar device using a magnetic actuating mechanism is known from DE 198 25 222 C1 as well as from EP 0 609 842 A1 and EP 0 555 679 A1.

[0004] All of these actuating mechanisms have the disadvantage that they have to rely on the quality of a sponge or similar material. It has to be taken into consideration that the device has to properly function only once which could be several years after the first use. During normal use, the valve has to be always in the open position. A further disadvantage is, that a large valve opening is required, so that only a minimum of pressure drop is present.

[0005] A further leak prevention device for water supply conduits is known from WO 2007/044346 A2. This device uses a plunger-driven valve. The pressure side

of the plunger is in fluid communication with the chamber formed between the supply hose and the outer second hose, so that upon leakage of water into the chamber and pressure build-up, the plunger is driven from a first position, in which the valve is open, to a second position, in which the valve is closed. In most of the embodiments, the plunger moves perpendicularly to the centre line of the supply hose, which afford large housings for the rupture control mechanism. In the second embodiment, the plunger moves coaxially to the supply conduit, which affords a special design of the valve seat. A disadvantage in this system is that the seals used around the valve opening have to function properly over a long period of time although the plunger will, in normal operation of the system, not move at all and will only move once upon rupture of the supply hose.

[0006] The object of the present invention is to design a more reliable device, which will also function properly after a long period of time.

[0007] According to the present invention, the above object is achieved by a leak prevention device according to claim 1. In addition to the features of the preamble of claim 1, the leak prevention device is **characterized in that** the valve body actuating mechanism comprises a fluid-driven plunger in fluid connection with the chamber and at least one magnet is attached to said plunger for a sliding movement together with said plunger from said first to said second position. Such a design allows a reliable actuating mechanism, which is a combination of a fluid-driven plunger and a magnetic means. This combination allows for a valve body actuation, which does not afford, that the magnetic means of the actuating mechanism comes into direct contact with the fluid. The magnetic field from the magnets also acts through non-magnetic materials so that at least one magnet of the plunger can be located in a place, which is easily separated from the fluid stream. Also, the fluid-driven plunger only comes into contact with the fluid upon rupture of the supply hose and the spilling out of fluid into the chamber. Due to the fact that it usually takes a long period of time until the supply hose ruptures, also the plunger only comes into contact with the fluid in case of failure of the supply hose, so that the function is also not influenced by other problematic elements, like chalk. Chalk could, after a certain time, prevent the plunger from moving. Such a problem could occur in the design of WO 2007/044346 A2, where part of the plunger is always located within and comes into contact with the fluid stream. This new combination also does not have a material problem like in the sponge-driven devices, since the mechanism is much more simplified and more reliable but still uses a magnetic-driven system for moving the valve body unit. Such a magnetic-driven system does not afford additional seals, since triggering of the movement of the valve body unit is also possible through a closed non-magnetic wall.

[0008] The term "fluid" is used interchangeably herein with the terms "liquid", "gas" and/or "vapour" and is applicable in both singular and plural senses.

[0009] In order to decrease the size of the device in the radial direction, an embodiment is provided, wherein the supply hose has a centre line in the straight state and the plunger as well as the at least one magnet move along a line of travel from the first to the second position which is substantially parallel to the centre line in the straight state of the supply hose or within a range of $\pm 45^\circ$ from the centre line of supply hose. Due to the combination of the magnetic triggering of the movement of the valve body unit and the fluid-driven plunger of the actuating mechanism, there is absolutely no need, that the plunger intersects the supply or the second hose, so that these can be positioned side by side. Usually, the supply and the second hose are flexible, so that in this regard, the straight state is defined to get a proper definition.

[0010] Although the at least one magnet of the actuating mechanism may trigger some other kind of mechanism, the most simplified structure is according to a further embodiment that the valve body unit comprises at least one magnet and the at least one magnet of the valve body unit actuating mechanism, in said first position, magnetically acts on the at least one magnet of the valve body unit so that the valve body is held in the open position. The easiest solution should be when both magnets attract each other. However, the valve body unit could also be held in the open position if the magnet of the actuating mechanism and the valve body unit repel each other.

[0011] It is a further advantage, if additionally, at least one magnet of the valve body unit actuating mechanism, in said second position, magnetically acts on at least one magnet of the valve body unit so that the valve body is magnetically released to move into the closed position.

[0012] Especially, if the polarity of the facing magnets of the actuating mechanism and the valve body unit is the same, then in additional, a repel force is created, which enhances the movement of the valve body unit into the closed position.

[0013] In a further embodiment, the actuating mechanism comprises two magnets arranged in series along the line of travel of the plunger, and the two magnets face the valve body unit with different polarity in the first and second position, respectively. This is a rather simplified construction where in series, two similar or identical magnets can be used which, however, are inversely polarized. The distance of the two magnets correlates to the path where the plunger moves from the first to the second position.

[0014] The at least one magnet of the valve body unit could also face one of the two magnets of the valve body unit actuating mechanism with a different polarity in the first position and the other magnet with the same polarity in the second position. With such an arrangement in the most simplified way, only one magnet is required for the valve body unit, which has a respective polarity, so that it is attracted in the open position and repelled in the closed position.

[0015] In one further embodiment, the valve body unit comprises a moveable cage. The at least one magnet is attached to the cage and in the open position of the valve body unit, the valve body is positioned in the cage. Such a construction allows the use of valve bodies, which are not of magnetic material and which are not influenced by the magnets. In addition, the cage can be designed so as to enhance movability, whereas the valve body can be optimized, to properly close the supply hose upon rupture of it.

[0016] In addition, the moveable cage may have a first lateral opening which cross-sectional size is larger than the cross-sectional size of the valve body. The first lateral opening is covered in the open position of the valve body unit and is open in the closed position of the valve body unit so that the valve body is moveable laterally out of the cage. Thus, the cage properly holds the valve body in place in the closed position but releases the valve body in the open position. This also means that the direction of movement of the cage and the direction of movement of the valve body to close the supply hose, at least after a certain range differ from each other.

[0017] To enhance operation in one further embodiment, the moveable cage may have a second lateral opening which is located substantially opposite of the first lateral opening, both lateral openings in the closed position of the valve body unit are in substantial alignment with the through-channel of the supply hose. Through this construction, the fluid stream through the supply hose also enters the cage from the second lateral opening and thus, "blows" out the valve body through the first lateral opening. The size and shape of the second lateral opening may also have influence on how fast this function will work.

[0018] In a further embodiment, a longitudinal extension of the supply hose has a lateral channel in which the moveable cage and the valve body of the valve body unit are substantially completely located in the open position, so that the flow channel of the hose is completely open, and in the closed position, the moveable cage and the valve body are moved a substantial distance out of the lateral channel so that the valve body is released out of the cage through the first lateral opening, whereby the flow channel is closed by the released valve body. Due to the fact that the valve body unit can be substantially completely retracted into a lateral channel, the valve body unit does not project into the fluid channel of the supply hose, so that the full cross-sectional area of the supply hose is used during normal operation of the device. This means, that the valve does not create an annular or even more complicated, and in most cases, restricted through-flow, through a valve opening. Thus, pressure drop and flow resistance are minimized. Upon triggering the movement of the valve body unit, it moves out of the channel and at least partially into the fluid channel of the supply hose and releases the valve body, which then closes the supply hose. The function of the lateral channel is to guide the cage together with the valve, so that the magnet may

not rotate and the first and second lateral opening are properly positioned. However, there is absolutely no need for a small or tiny space or distance between the cage and the channel, which may be disadvantageous with regard to chalk or other substances in the fluid after several years of use. Due to the fact that a substantial space or distance is allowed, the functionality of such a design is guaranteed over a long period of time.

[0019] Advantageously, the valve body may be a ball of preferably resilient material. A ball does not need any further guidance because it can be pressed on the valve seat in any position. If it is made from resilient material, it additionally has a proper sealing function and equalizes production tolerances.

[0020] In order to prevent malfunction upon pressure increase in the chamber due to temperature increase or other influences, which do however not result from the rupture of the supply hose, in one further embodiment, a retention means is provided which holds the plunger in the first position until a predetermined fluid pressure exerts onto the plunger. As a result, the plunger can only move if a certain pressure threshold is exceeded, which is also good if the device is used upside down. In the majority of cases, it is only necessary to slightly hold the plunger in place so that only a minor pressure increase is sufficient to move the plunger. Some simple tests will show how to set the proper threshold to prevent malfunction on the one hand and to ensure proper safety function upon rupture of the supply hose.

[0021] Additionally, the plunger has a first end for exerting full pressure and a second end, whereby the second end may be in contact with an indicator for moving the indicator, and the indicator is moved in the second position of the plunger out of a recess position into an exposed position. Thus, the device does not only shut down the supply hose and prevents further flow of fluid through it, but also indicates that such an instance has occurred. In this simplified form, the plunger also moves the indicator from a barely visible to an exposed position.

[0022] In addition to that, an indicator may be a ball which is moveable in a tube, whereby the tube having a hidden portion in a recess of a housing and an exposed portion extending from said housing, the exposed portion having an end with a holder which prevents movement of the ball out of the tube and which forms a venting aperture, the retention means being located in the tube and in the first position, the ball is held by the retention means in the hidden portion of the tube so that also the plunger is held in the first position. According to this design, the plunger is indirectly held in the first position via the indicator ball. The venting aperture is important for movement of the ball together with the plunger within the tube. In addition, at the end of travel in the second position, the indicator ball may also seal the venting aperture so that the whole system is closed and no fluid may leak out of the device. The exposed portion of the tube may be made transparent.

[0023] Further characteristics and advantages of the

present invention will become more apparent hereinafter from the following detailed disclosure of a specific embodiment by reference of the following Figures, where:

5 Fig. 1 is a schematic longitudinal cross-sectional view illustrating a leak prevention device shown in an open position, and

10 Fig. 2 illustrates a schematically longitudinal cross-sectional view of the device of Fig. 1 in the closed position.

[0024] Referring now to the drawings, a leak prevention device according to an embodiment of the present invention is shown in Figs. 1 and 2. The leak prevention device 1 includes an inner supply hose 2 and coaxially thereto an outer corrugated hose 3. A chamber 4 is formed between the supply hose 2 and the corrugated hose 3, which extends along the length of hoses 2 and 3. To form chamber 4, the inside diameter of the supply hose 2 is slightly greater than the outside diameter of the supply hose 2. The device 1 further includes at the end of the hoses 2 and 3, tubular hose extensions (flanch connectors) 5 and 6 each of which is provided at its outer end with a connecting flange 7 and 8, respectively. The flanges 7 and 8 interact with respective fittings 9 and 10 in order to connect the leak prevention device to a water tap (not shown) and to a household appliance, such as a dishwasher or a washing machine (not shown), respectively. At the opposite end of connecting flange 7, hose extension 5 comprises a tubular projection 11 having an inner diameter for closely fitting over the supply hose 2 and having an outer diameter for being closely fitted into the inner diameter of the corrugated hose 3. An additional O-ring 12 enhances the sealing tightness of this connection.

[0025] Hose extension 6 comprises a similar tubular projection 13 which is however slightly longer and which has the same inner and outer diameter to be connected to the hoses 2 and 3. An additional O-ring 14 also enhances the fluid tightness of this connection. The connecting area of hose extension 6 and the two hoses 2 and 3 is surrounded by a ring or clamp 15, which is injection moulded onto the connection area of the hose extension 6 after the hoses 2 and 3 have been fitted.

[0026] The connection area between hose extension 5 and the two hoses 2 and 3 is surrounded by a housing or casing 16 which can also be injection moulded around this area after fitting of all the elements contained in this area.

[0027] In the following, the elements contained within the housing 16, will be described in more detail.

[0028] The hose extension 5 has an inner passage 5.1 which has a slightly larger inner diameter than the inner diameter of an inner passage 2.1 of supply hose 2. Thus, in the transition region of the supply hose 2 and the hose extension 5, a valve seat 17 is formed. Slightly above the valve seat 17, the hose extension 5 is provided with a

radially outwardly extending channel 18. This channel 18 completely houses, in the position as shown in Fig. 1, a valve body unit 19 which includes a valve body 20 in the form of a rubber ball, a valve cage 21 for holding the valve body 20 in the shown position and a permanent magnet 22 attached to the valve cage 21. The axis of polarity of this permanent magnet 22 is perpendicular to the centre axis A_C of the supply hose 2 in the shown straight state. Thus, the plus pole is directed to the right and the minus pole is directed to the left (as in the drawing).

[0029] The valve cage 21 has a lower first lateral opening 23, which is big enough to allow release of the valve body 20 as will be explained in more detail below. On the opposite side of the valve cage 21, a second lateral opening is provided which is located nearly in the middle of the cage 21.

[0030] The leak prevention device 1 further comprises a body unit actuating mechanism 26, which includes a fluid-driven plunger 27 of preferably circular cross-section, which is guided in a cylindrical bore 28 of a plunger casing 29. The plunger 27 has a front extension 30, which holds two permanent magnets 31 and 32 in series. The polarity axes of these permanent magnets 31 and 32 are also perpendicular to the centre axis A_C of the supply hose 2. The first permanent magnet 31 has a minus pole on the left-hand side and a plus pole on the right-hand side, whereas the second permanent magnet 32 has a plus pole on the left-hand side and the minus pole on the right-hand side (as shown in the drawings). As a result, and as in the position as shown in Fig. 1, the first permanent magnet 31 attracts the permanent magnet 22 of the valve body unit 19 and holds the valve body unit 19 retracted in the channel 18. The front extension 30 together with the permanent magnets 31 and 32 is guided within a front extension 33 of the plunger casing 29. This front extension 33 has some lateral projections 34 and 35. The lateral projection 34 being fitted onto an outer tubular projection 36 of hose extension 5 and the second lateral projection 35 is of tubular form and is closely fitted within the channel 18 and guides valve body unit 19. Due to this construction, the front extension 33 of the plunger casing 29 completely closes the channel 18 in the hose extension 5, so that a wall is created between the permanent magnet 22 of the valve body unit 19 and permanent magnets 31 and 32 of the valve body unit actuating mechanism 26.

[0031] The cylindrical casing 29 is connected to the corrugated hose 3 through a fluid connector 37 and a sealing ring 38. The fluid connector 37 has fluid channel 39 which connects the chamber 4 with the cylindrical bore 28 of the plunger casing 29.

[0032] At the upper end of the front extension 33 of plunger 27, a coloured indicator ball 40 is provided, which is guided in an indicator tube 41. The lower part of the indicator tube 41 is recessed in housing 16 and the upper, transparent portion of the indicator tube 41 projects out of the housing 16. The upper end of indicator tube 41 is provided with an inwardly projecting holder 42 which pre-

vents the indicator ball 14 from moving out of the indicator tube 41 and which forms a venting aperture 43 so that movement of the plunger 27 together with the indicator ball 40 is not hindered by pressure build-up. Within the indicator tube 41 there is a slightly inwardly projecting retainer ring 44 which holds plunger 27 and the indicator ball 40 in the shown position (Fig. 1) so that a slight pressure build-up or an upside down assembly of the leak prevention device 1, does not lead to unwanted movement of the plunger 27. Only upon a predetermined threshold of pressure build-up in cylindrical bore 28, the plunger 27 could move the indicator ball 40 beyond the retainer ring 44.

[0033] The whole structure of the elements located within the boundaries of housing 16 is such, that the housing 16 might also be injection moulded onto these elements after assembly of these elements. Thus, especially the connection between the fluid connector 37 and the corrugated hose 3 as well as of the front extension 33 of cylindrical casing 29 and the hose extension 5 as well as the indicator tube 41 have to be sufficiently tight.

[0034] The materials used for most of the elements used in the leak prevention device are certain plastic materials which are well known for such purposes. The supply hose 2 has to be sufficiently pressure tight and sufficiently flexible. The same applies to the corrugated hose 3 although the material might be somewhat harder.

[0035] In the following, and by additional reference to Fig. 2, the function of the above-described leak prevention device 1 should be more clearly explained.

[0036] In Fig. 1, the plunger 27 is shown in a first position. Its first permanent magnet 31 holds the valve body unit 19 in an open position, so that the whole cross-sectional area of the inner passage 5.1 of the hose extension 5 is open. Due to this design, there is no flow restriction so that the complete circular cross-section can be used. In usual household appliances, such as washing machines and dishwashers, water will flow through the leak prevention device 1. Thus, the supply hose 2 has to be sufficient pressure resistant for such a use. In this regard, it should be noted that in the chamber 4 defined between the supply hose 2 and the corrugated hose 3, only air is contained. It might also be possible to fill this space with some other fluid, especially gas. However, the pressure of this fluid in chamber 4 is not sufficient, to move plunger 27, especially due to retainer ring 44. The interaction of retainer ring 44 and indicator ball 44 as well as plunger 27 has to be such, that also slight pressure increases due to, for example, temperature rise will not move the plunger 27.

[0037] However, after several years of operation of the leak prevention device 1, or due to defects in the material, it might happen, that the supply hose 2 ruptures. In such a case, fluid, especially water, will leak from the supply hose 2 into the chamber 4, so that the chamber 4 will suddenly or slowly, fill with additional fluid. This leads to a pressure increase within the chamber 4 and also in the fluid channel 39 of fluid connector 37 and in cylindrical

bore 28. Upon exceeding a predetermined pressure threshold, the plunger 27 will move upwardly (as in Fig. 2) pushing the indicator ball 40 beyond the retainer ring 44 and also moving the first permanent magnet 31 out of interaction with permanent magnet 22. The second permanent magnet 32 is then moved into interaction with the permanent magnet 22, so that the same polarities face each other. In this second position of the plunger 27 (as shown in Fig. 2), the second permanent magnet 32 repels permanent magnets 22 of the valve body unit 19, so that the valve body unit 19 moves to the left (as in Fig. 2) and at least partially out of the channel 18. The valve cage 21 then restricts through-flow of the inner passage 2.1 and the fluid has to flow through lateral opening 24 and "blows" out valve body 20 out of the valve cage 21 through the lateral opening 23. The valve body 20, which is a rubber ball is then pressed onto the valve seat 17 and thus, shuts down the leak prevention device 1 and prevents further through-flow of fluid. At the same time, the front extension 30 of the plunger 27 extends out of the front extension 33 of plunger casing 29 and pushes the indicator ball 40 against holder 42. Also the indicator ball 40 is a rubber ball, which then closes the venting aperture 43 so that also no fluid may leak out of housing 16. In this second position of the plunger 27, the indicator ball 40 is clearly visible in the exposed transparent portion of the indicator tube 41 and clearly shows, that the valve body unit actuating mechanism 26 has triggered the valve body unit 19 so that it is in the closed position as shown in Fig. 2.

[0038] The above-described structure and function is rather reliable since the valve body unit actuating mechanism 26 will not come into contact with the fluid streaming through the supply hose 2 before rupture of the supply hose 2. In addition, the triggering of movement of the valve body unit 19 can be made through a closed wall due to magnetic interaction. No critical materials, such as sponge materials have to be used in this regard. Further, the valve body unit 19 has only to be guided within the channel 18 and the lateral projection 35 so that it keeps the correct orientation in the open and closed position and during movement from the open to the closed position. No tight guidance is needed, so that reasonable tolerances or play can be used which prevent the valve body unit 19 from sticking in its open position after a long period of operation of time of the leak prevention device 1, for example, through shock furring, etc. In addition, by use of rather strong permanent magnets 22, 31 and 32, the force which can be applied onto the valve body unit 19 for triggering the movement can be rather strong, especially it can be much larger than the force created by use of usual pressure similar area. (e.g., in household water conduits)

Claims

1. Leak prevention device (1) for water supply conduits

of electrical household appliances, comprising a supply hose (2), a second hose (3) surrounding the supply hose (2) so as to form a chamber (4) between the supply hose (2) and the second hose (3) and a safety valve mechanism having a valve body unit (19) moveable from an open position to a closed position for closing the supply hose (2) and a valve body unit actuating mechanism (26) for at least magnetically triggering the movement of the valve body unit (19) and being in fluid communication with the chamber (4), the valve body unit actuating mechanism (26) comprises at least one magnet (31, 32) which is moveable from a first to a second position, wherein the at least one magnet (31, 32) of the valve body unit actuating mechanism (26) in said second position triggers movement of the valve body unit (19) into the closed position, **characterized in that** the valve body unit actuating mechanism comprises a fluid-driven plunger (27) in fluid connection with the chamber (4) and the at least one magnet (31, 32) is attached to said plunger (27) for a sliding movement together with said plunger (27) from said first to said second position.

2. Leak prevention device (1) according to claim 1, **characterized in that** the supply hose (2), has a centre line (A_C) in the straight state and the plunger (27) as well as the at least one magnet (31, 32) move along a line of travel from the first to said second position which is substantially parallel to the centre line (A_C) in the straight state of the supply hose (2) or in a range of $\pm 45^\circ$ from the centre line (A_C) of the supply hose (2).
3. Leak prevention device (1) according to claim 1 or 2, **characterized in that** the valve body unit (19) comprises at least one magnet (22) and at least one magnet (31) of the valve body unit actuating mechanism (26) in said first position magnetically acts on at least one magnet (22) of the valve body unit (19) so that the valve body (20) is held in the open position.
4. Leak prevention device (1) according to claim 3, **characterized in that** at least one magnet (32) of the valve body unit actuating mechanism (26) in said second position magnetically acts on at least one magnet (22) of the valve body unit (19) so that the valve body unit (19) is magnetically released to move into the closed position.
5. Leak prevention device (1) according to one of claims 2 to 4, **characterized in that** the valve body unit actuating mechanism (26) comprises two magnets (31, 32) arranged in series along the line of travel of the plunger (27), the two magnets (31, 32) face the valve body unit (19) with different polarity in the first and second position, respectively.

6. Leak prevention device (1) according to claim 5, **characterized in that** the at least one magnet (22) of the valve body unit (19) face one (31) of the two magnets of the valve body unit actuating mechanism (26) with a different polarity in the first position and the other magnet (32) with the same polarity in the second position.
7. Leak prevention device (1) according to one of claims 1 to 6, **characterized in that** the valve body unit (19) comprises a moveable cage (21), the at least one magnet (22) is attached to the cage (21) and in the open position of the valve body unit (19), the valve body (20) being positioned in the cage (21).
8. Leak prevention device (1) according to claim 7, **characterized in that** the moveable cage (21), has a first lateral opening (23) which cross-sectional size is larger than the cross-sectional size of the valve body (20), the first lateral opening (23) is covered in the open position of the valve body unit (19) and is open in the closed position of the valve body unit (19) so that the valve body (20) is moveable laterally out of the cage (21).
9. Leak prevention device (1) according to claim 8, **characterized in that** the moveable cage (21), has a second lateral opening (24) which is located substantially opposite of the first lateral opening (23) both lateral openings being in the closed position of the valve body unit (19) in substantial alignment with an inner passage (5.1) of the supply hose (2).
10. Leak prevention device (1) according to claims 8 or 9, **characterized in that** a longitudinal extension (5) of the supply hose (2) has a lateral channel (18) in which the moveable cage (21), and the valve body (20) of the valve body unit (19) are substantially completely located in the open position, so that the inner passage (2.1) of the supply hose (2) is completely open, and in the closed position the moveable cage (21) and the valve body (20) are moved a substantial distance out of the lateral channel (18) so that the valve body (20) is released out of the cage (21) through the first lateral opening (23), whereby the inner passage (2.1) is closed by the released valve body (20).
11. Leak prevention device (1) according to claim 10, **characterized in that** the extension (5) of the supply hose (2) is formed by a flange connector connected to the supply hose (2), the inner passage (5.1) of the flange connector has a cross-section which is slightly larger than the cross-section of the valve body (20), and the inner passage (2.1) of the supply hose (2) has a cross-section which is slightly smaller than the cross-section of the valve body (20) so that a valve seat (17) is formed by a transition area of the flange

connector and the supply hose (2).

12. Leak prevention device (1) according to one of claims 1 to 11, **characterized in that** the valve body (20) is a ball of preferably resilient material.
13. Leak prevention device (1) according to one of claims 1 to 12, **characterized in that** a retention means (44) is provided which has the plunger (27) in the first position until a predetermined fluid pressure exerts onto the plunger (27).
14. Leak prevention device (1) according to one of claims 1 to 13, **characterized in that** the plunger (27) has a first end for exerting fluid pressure onto it and a second end, this second end is in contact with an indicator (40) for moving the indicator (40), the indicator is moved in the second position of the plunger (27) out of a recessed position into an exposed position.
15. Leak prevention device (1) according to claim 14, **characterized in that** the indicator (40) is a ball moveable in a tube (41), the tube (41) having a hidden portion in a recess of a housing (16) and an exposed portion extending from said housing (16), the exposed portion having an end with a holder (42) which prevents movement of the ball out of the tube (41) and which forms a venting aperture (43), the retaining means (44) being located in the tube (41) and in the first position of the plunger (27) the ball is held by the retention means (44) in the hidden portion of the tube (41) so that also the plunger (27) is held in the first position.

Amended claims in accordance with Rule 137(2) EPC.

1. Leak prevention device (1) for water supply conduits of electrical household appliances, comprising a supply hose (2), a second hose (3) surrounding the supply hose (2) so as to form a chamber (4) between the supply hose (2) and the second hose (3) and a safety valve mechanism having a valve body unit (19) moveable from an open position to a closed position for closing the supply hose (2) and a valve body unit actuating mechanism (26) for at least magnetically triggering the movement of the valve body unit (19) and being in fluid communication with the chamber (4), wherein the valve body unit (19) comprises at least one magnet (22), the valve body unit actuating mechanism (26) comprises at least one magnet (31, 32) which is moveable from a first to a second position, the at least one magnet (31, 32) of the valve body unit actuating mechanism (26) in said second position triggers movement of the valve body unit (19) into the closed position, the valve body unit

actuating mechanism comprises a fluid-driven plunger (27) in fluid connection with the chamber (4), the at least one magnet (31, 32) is attached to said plunger (27) for a sliding movement together with said plunger (27) from said first to said second position, and at least one magnet (31) of the valve body unit actuating mechanism (26) in said first position magnetically acts on at least one magnet (22) of the valve body unit (19) so that the valve body (20) is held in the open position, **characterized in that** the valve body unit actuating mechanism (26) comprises two magnets (31, 32) arranged in series along with the line of travel of the plunger (27), the two magnets (31, 32) are movable by the plunger (27) to face the valve body unit (19) with different polarity in the first and second position, respectively.

2. Leak prevention device (1) according to claim 1, **characterized in that** the supply hose (2), has a centre line (A_c) in the straight state and the plunger (27) as well as the at least one magnet (31, 32) move along a line of travel from the first to said second position which is substantially parallel to the centre line (A_c) in the straight state of the supply hose (2) or in a range of $\pm 45^\circ$ from the centre line (A_c) of the supply hose (2).

3. Leak prevention device (1) according to claim 1 or 2, **characterized in that** at least one magnet (32) of the valve body unit actuating mechanism (26) in said second position magnetically acts on at least one magnet (22) of the valve body unit (19) so that the valve body unit (19) is magnetically released to move into the closed position.

4. Leak prevention device (1) according to claim 2 or 3, **characterized in that** the at least one magnet (22) of the valve body unit (19) face one (31) of the two magnets of the valve body unit actuating mechanism (26) with a different polarity in the first position and the other magnet (32) with the same polarity in the second position.

5. Leak prevention device (1) according to one of claims 1 to 4, **characterized in that** the valve body unit (19) comprises a moveable cage (21), the at least one magnet (22) is attached to the cage (21) and in the open position of the valve body unit (19), the valve body (20) being positioned in the cage (21).

6. Leak prevention device (1) according to claim 5, **characterized in that** the moveable cage (21), has a first lateral opening (23) which cross-sectional size is larger than the cross-sectional size of the valve body (20), the first lateral opening (23) is covered in the open position of the valve body unit (19) and is open in the closed position of the valve body unit (19) so that the valve body (20) is moveable laterally

out of the cage (21).

7. Leak prevention device (1) according to claim 6, **characterized in that** the moveable cage (21), has a second lateral opening (24) which is located substantially opposite of the first lateral opening (23) both lateral openings being in the closed position of the valve body unit (19) in substantial alignment with an inner passage (5.1) of the supply hose (2).

8. Leak prevention device (1) according to claims 6 or 7, **characterized in that** a longitudinal extension (5) of the supply hose (2) has a lateral channel (18) in which the moveable cage (21), and the valve body (20) of the valve body unit (19) are substantially completely located in the open position, so that the inner passage (2.1) of the supply hose (2) is completely open, and in the closed position the moveable cage (21) and the valve body (20) are moved a substantial distance out of the lateral channel (18) so that the valve body (20) is released out of the cage (21) through the first lateral opening (23), whereby the inner passage (2.1) is closed by the released valve body (20).

9. Leak prevention device (1) according to claim 8, **characterized in that** the extension (5) of the supply hose (2) is formed by a flange connector connected to the supply hose (2), the inner passage (5.1) of the flange connector has a cross-section which is slightly larger than the cross-section of the valve body (20), and the inner passage (2.1) of the supply hose (2) has a cross-section which is slightly smaller than the cross-section of the valve body (20) so that a valve seat (17) is formed by a transition area of the flange connector and the supply hose (2).

10. Leak prevention device (1) according to one of claims 1 to 9, **characterized in that** the valve body (20) is a ball of preferably resilient material.

11. Leak prevention device (1) according to one of claims 1 to 10, **characterized in that** a retention means (44) is provided which has the plunger (27) in the first position until a predetermined fluid pressure exerts onto the plunger (27).

12. Leak prevention device (1) according to one of claims 1 to 11, **characterized in that** the plunger (27) has a first end for exerting fluid pressure onto it and a second end, this second end is in contact with an indicator (40) for moving the indicator (40), the indicator is moved in the second position of the plunger (27) out of a recessed position into an exposed position.

13. Leak prevention device (1) according to claim 12, **characterized in that** the indicator (40) is a ball

moveable in a tube (41), the tube (41) having a hidden portion in a recess of a housing (16) and an exposed portion extending from said housing (16), the exposed portion having an end with a holder (42) which prevents movement of the ball out of the tube (41) and which forms a venting aperture (43), the retaining means (44) being located in the tube (41) and in the first position of the plunger (27) the ball is held by the retention means (44) in the hidden portion of the tube (41) so that also the plunger (27) is held in the first position.

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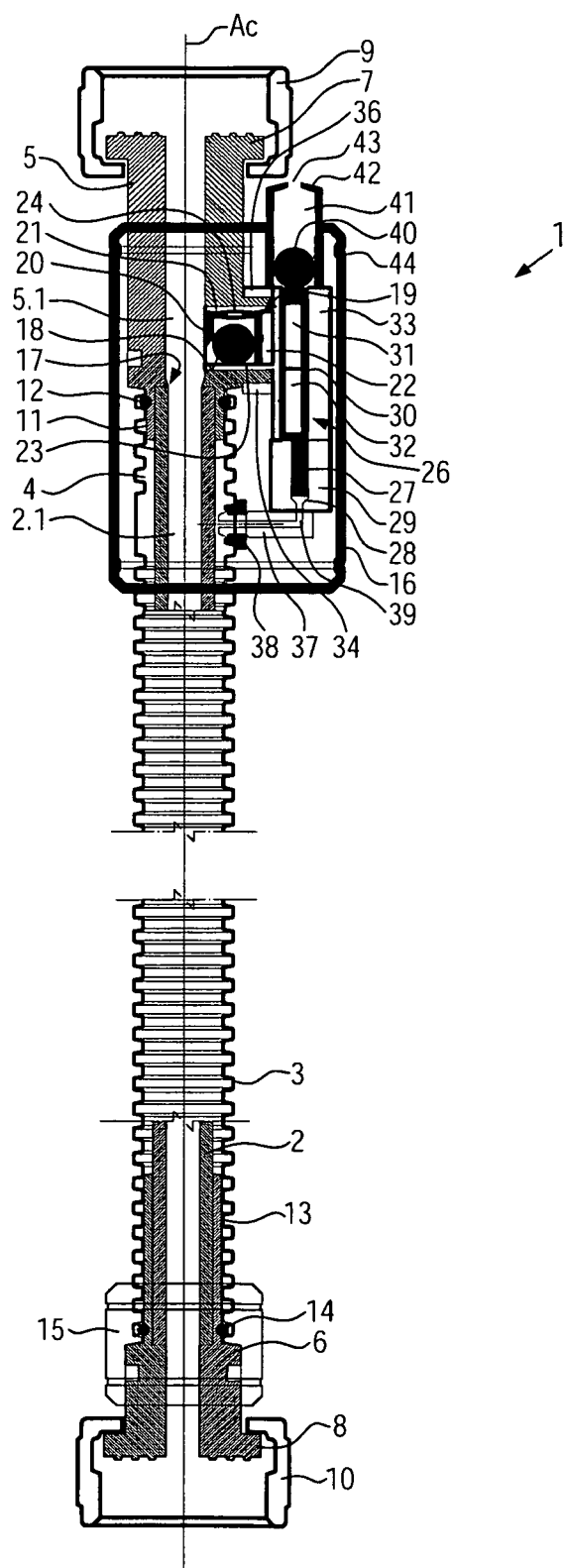


FIG. 1

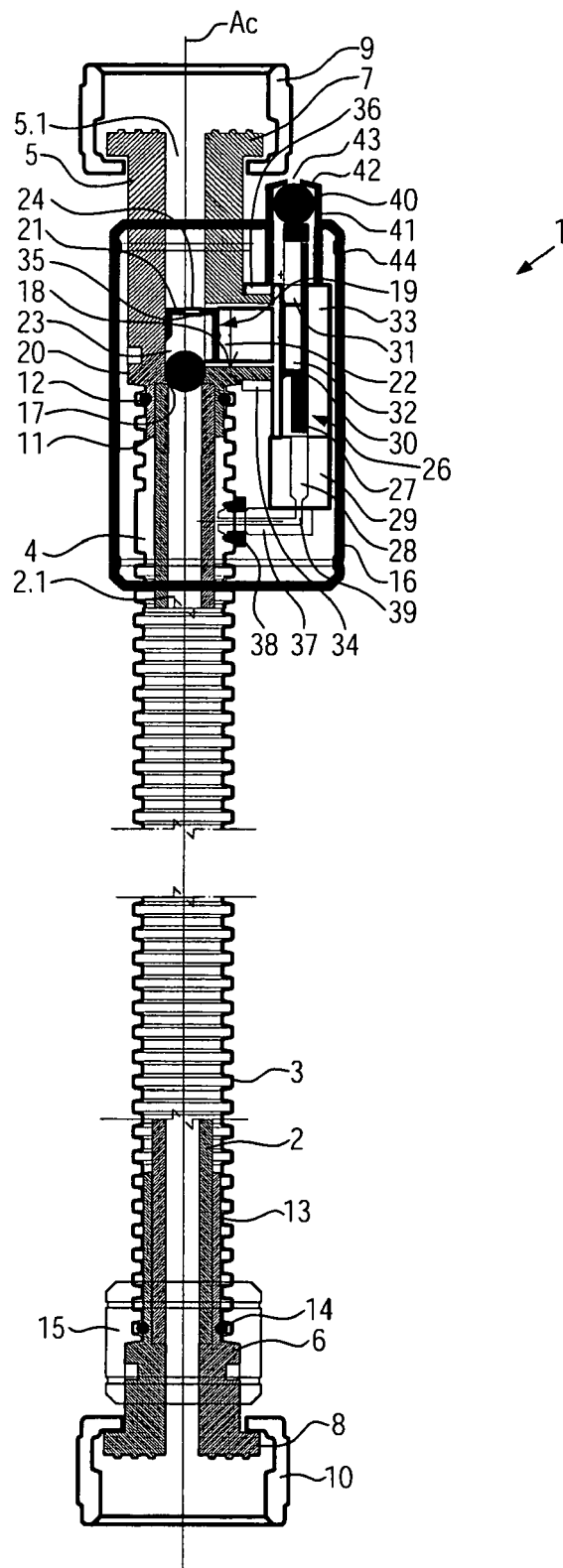


FIG. 2



EUROPEAN SEARCH REPORT

Application Number
EP 09 01 0829

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 84 05 924 U1 (LICENTIA PATENT-VERWALTUNGS-GMBH) 24 May 1984 (1984-05-24)	1-5	INV. D06F39/08 A47L15/42
A	* page 4, line 1 - page 5, line 10; claims; figures *	6-15	
A	DE 85 27 754 U1 (AWECO KUNSTSTOFFTECHNIK GERÄTEBAU GMBH) 12 February 1987 (1987-02-12)	1-15	
A	* page 5, line 13 - page 7, line 17; claims; figures *	1-15	
A	FR 2 596 130 A1 (SOCADO [FR]) 25 September 1987 (1987-09-25)	1-15	
A	* page 1, line 20 - page 2, line 32; figures *	1-15	
A	DE 34 25 588 A1 (BOSCH SIEMENS HAUSGERÄTE [DE]) 23 January 1986 (1986-01-23)	1-15	
	* page 6, line 4 - page 7, line 32 *		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			A47L D06F
Place of search		Date of completion of the search	Examiner
Munich		11 February 2010	Clivio, Eugenio
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			

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EP 09 01 0829

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11-02-2010

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