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(54) **Cleaning equipment, particularly for domestic use**

(57) Cleaning equipment (1) comprises a casing (2), a cleaning nozzle body (3) and a flexible hose (4) connecting the nozzle body and the casing (2) for conveying a fluid between the casing (2) and the nozzle body (3). The equipment (1) enables its user to actuate electrical

switches (9, 10) housed in the casing (2) directly from a handgrip (21) on the nozzle body (3) by mechanical transmission means (13, 17) without danger of electric shock.

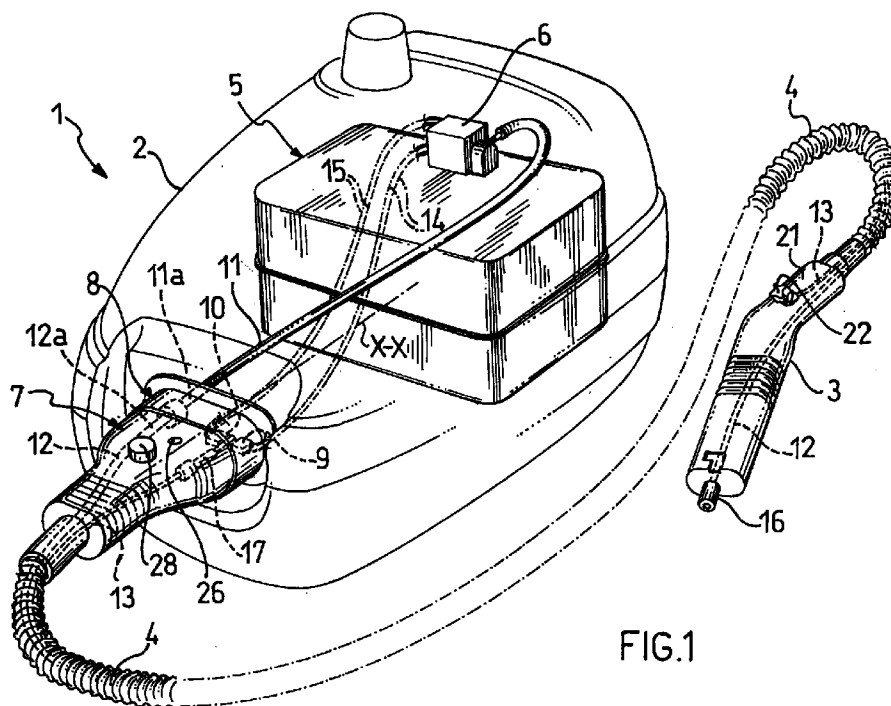


FIG.1

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Description

The present invention relates to cleaning equipment, particularly for domestic use, of the type including a casing, at least one switch for actuating electrical components of the equipment, a nozzle body for cleaning operations and a flexible hose connecting the nozzle body connector and the casing for conveying a fluid between the casing and the nozzle body.

Steam cleaning equipment is known which houses a boiler within the casing for producing steam and a solenoid valve which controls the outlet of steam from the boiler. The steam emitted is conveyed through the flexible hose to the nozzle body which, in this case, is a nozzle body for supplying the steam. Currently used steam cleaning equipment has an electrical switch for operating the solenoid valve located on a hand-grip of the body of the steam supply nozzle. This enables the user of the equipment to control the supply of steam from the boiler directly from the handgrip of the nozzle body.

This switch location, although being optimum from the point of view of ease and convenience of operation, is however not very safe for the user. In fact the switch is connected in an electrical circuit which controls the solenoid valve with an operating voltage equal to that of the mains to which the equipment is connected, this generally being greater than 200 volts. Consequently there is a danger that the user of the machine will receive an electric shock while operating the switch if his hands are not perfectly dry which is quite probable since such machines are used for cleaning rooms, an activity which involves the frequent use of water or other liquids.

Furthermore, consideration needs to be given to the danger to the user of receiving an electric shock in moving the nozzle body close to wet surfaces or in the event of liquid being accidentally spilt on the nozzle body while the machine is live.

The solution of using a reduction transformer to reduce the voltage in the solenoid valve control circuit to about ten volts has not been fully satisfactory. In fact the high temperatures which are reached within the casing of the equipment during operation make it necessary to use an armoured transformer, the high cost of which militates against this solution. One must also remember that, in order to ensure that the inner parts of the equipment are protected, it is not possible to use an effective forced ventilation system for cooling the transformer.

It is entirely clear that these problems could also be present in other types of cleaning equipment intended to operate in damp environments such as, for example, liquid suction cleaners. Indeed for such equipment the possibility of controlling a motor of the suction cleaner directly from a handgrip on the nozzle body would be extremely advantageous to the user if there were not these problems.

The problem at the root of the present invention is that of devising equipment of the type specified which has structural and functional characteristics such as to

overcome the problems indicated above with reference to the prior art.

This problem is solved by cleaning equipment of the type specified which is characterised in that the at least one switch is housed within the casing and in that a control member is provided on the nozzle body and mechanical transmission means connect the control member to the at least one switch for operating the switch from the nozzle body.

In order to provide an understanding of the invention and its advantageous aspects, a detailed description is given below of several embodiments purely by way of non-limitative example, with reference to the appended drawings, in which:

Figure 1 is a perspective view of cleaning equipment according to the present invention;

Figure 2 is a perspective view of a detail of the equipment of Figure 1;

Figure 3 is a sectioned perspective view of a second detail of the equipment of Figure 1;

Figures 4 and 5 are sectional views of the detail of Figure 3 in two different phases of operation;

Figure 6 is a perspective view of cleaning equipment according to a variant of the present invention;

Figure 7 is a perspective view of a detail of the equipment of Figure 6;

Figure 8 is a sectioned perspective view of a second detail of the equipment of Figure 6, and

Figures 9 and 10 are sections of a detail of the equipment of Figure 6 in two different phases of operation.

With reference to Figures 1, 2 and 3, domestic steam-cleaning equipment is generally indicated 1.

The equipment 1 includes a rectangular-box-shaped casing 2, a nozzle body 3 for supplying the steam and a flexible hose 4 connecting the casing 2 to the nozzle body 3.

The nozzle body 3 includes, on a handgrip 21 thereof, a control member constituted by a rotatable knob 22 supported on the nozzle body 3.

The casing 2 houses a boiler 5 for producing the steam and a solenoid valve 6 for supplying the steam generated in the boiler 5. The solenoid valve 6 is located on the boiler 5.

To the casing 2 is fixed a female connector 8 in which a cooperating male connector 7 fixed to one end of the flexible hose 4 is inserted along a direction X-X perpendicular to the casing 2. In a preferred embodiment, the male connector 7 has a known device for connecting it to the female connector 8 controlled by a push button 28.

The female connector 8 supports two switches constituted, to advantage, by box-shaped microswitches 9 and 10. The microswitches 9 and 10 are connected in respective electrical circuits 14 and 15, each of which, in a preferred embodiment, is able independently to control the opening of the solenoid valve 6. The microswitches 9 and 10 close and open the electrical circuits 14 and 15 by means of respective control rods 9a and 10a. The

microswitches extend in the direction X-X with the rods 9a and 10a facing each other at a predetermined distance apart to define an interspace 29 in the said direction.

The female connector 8 also supports an end 11a of a tube 11 connected to the solenoid valve 6.

A tube 12 for conveying steam and a flexible cable 13 which is torsionally rigid extend within the flexible hose 4 and the nozzle body 3. The cable 13 is preferably constituted by four helically-wound steel wires.

A first end 12a of the tube 12 is carried by the male connector 7 and is connected with a pressure-tight seal to the end 11a of the tube 11. A second end of the tube 12 is connected to a steam outlet nozzle 16 of the nozzle body 3.

The male connector 7 houses a support constituted by a box-shaped base 18 which extends in the direction X-X and two tubular elements 19 and 20 which project therefrom perpendicular to the direction X-X. A through-hole is formed in the base 18 with its axis parallel to the direction X-X and communicating with the hollow interiors of the tubular elements 19 and 20.

A central portion of a shaft 17, preferably of plastics material, is rotatably supported in the through-hole in the base 18.

One end of the cable 13 is fixed for rotation with the knob 22 while its opposite end is inserted axially and clamped in a first end 17a of the shaft 17. A second end 17b of the shaft 17 is of rectangular section and is inserted in the interspace 29 between the two microswitches 9 and 10.

A ball 23 is inserted in the tubular element 20 and is urged by a helical spring 30 to exert a pressure on a corresponding square-section portion 17c of the shaft 17. The faces of the portion 17c are parallel to those of the end 17b and each has a concave recess 27 engageable by the ball 23.

A peg 24 is slidable in the tubular element 19 and is acted upon by a helical spring 25 so that a first end thereof bears on a corresponding portion 17d of the shaft 17. The section of the portion 17d is rectangular and the same as that of the end 17b but rotated through 90° relative thereto about the axis of the shaft 17. The portion 17d constitutes a cam for the peg 24.

A second end 24a of the peg 24 projects from the tubular element 19 and is inserted in a hole 26 in one wall of the male connector 7.

With reference to Figures 1 to 4, the operation of the steam-cleaning equipment 1 is described below with reference to an initial condition in which the equipment 1 is switched on, the boiler 5 contains steam under pressure and the solenoid valve 6 is closed. As will be clear from the drawings, the end 17b of the shaft 17 is inserted in the interspace 29 between the two microswitches 9 and 10 but does not contact the control rods 9a and 10a of the microswitches 9 and 10. In this configuration, the peg 24 is housed entirely within the male connector 7.

The knob 22 is rotated in one of its two senses so that the cable 13 transmits torque to the shaft 17 and

urges it to rotate about its axis, while the pressure exerted by the ball 23 on the portion 17c opposes the rotation of the shaft 17. When the torque transmitted by the cable 13 to the shaft 17 is sufficient to overcome the pressure exerted by the ball 23, the shaft 17 snap-rotates through 90° round its axis. In its new position (Figure 5), the end 17b of the shaft 17 acts on the control rods 9a and 10a of the microswitches 9 and 10 to close the electrical circuits 14 and 15 and open the solenoid valve 6. Steam thus escapes from the boiler 5 through the solenoid valve 6 and flows through the tubes 11 and 12 to the steam outlet nozzle 16.

If the knob 22 is again rotated in one of the two senses, the shaft 17 returns to its initial angular position (Figure 4) and the supply of steam from the steam outlet nozzle 16 is stopped.

When the shaft is in its angular position in which its end 17b is able to operate the control rods 9a and 10a of the microswitches, the peg 24 (Figure 5) is in such a position that its end 24a projects from the hole 26 in the male connector 7. It should be noted that this occurs whether or not the male connector 7 is inserted in the female connector 8.

The projection of the peg 24 from the male connector 7 indicates that the shaft 17 is in the angular position in which its end 17b acts on the control rods 9a and 10a of the microswitches 9 and 10. It is in fact appropriate to avoid inserting the male connector 7 in the female connector 8 when the shaft 17 is in its angular position causing the opening of the solenoid valve 6 in order to avoid steam escaping from the steam outlet nozzle 16 before the nozzle body 3 has been gripped correctly by the user.

The cleaning equipment according to the present invention is exceptionally advantageous and safe for the user. In fact, it allows a switch housed within the casing of the equipment to be operated directly from the hand-grip of a nozzle body without the disadvantages of the prior art. In particular, since the nozzle body is isolated from the electrical parts of the equipment, it is clear there would be no risk of electric shock from the equipment of the present invention even if the nozzle body were to be immersed in a liquid.

The equipment according to the present invention enables the use of armoured transformers to be avoided.

Furthermore the present invention makes it particularly easy to manufacture cleaning equipment with a completely closed casing so as to ensure that the electrical parts contained therein are completely protected.

Moreover, the equipment according to the present invention is easy to use.

With reference to Figures 7 to 10, domestic steam-cleaning equipment according to the invention is generally indicated 101. Parts of the equipment 101 which are structurally and functionally equivalent to corresponding parts of the equipment 1 are indicated by the same reference numerals and are not described below in order not to burden unnecessarily the present description.

The male connector 7 houses an actuator device 102 for actuating the microswitches 9 and 10 comprising

a prismatic guide 103 fixed to the male connector 7 and extending in the direction X-X and an actuator rod 104 slidable in the guide 103 but fixed against rotation and movable between a withdrawn position (Figure 9) and an advanced position (Figure 10). In its advanced position, an end portion 105 of the actuator rod 104 projects from the prismatic guide 103 to actuate the control rods 9a and 10a of the microswitches 9 and 10 when the male connector 7 is inserted in the female connector 8 as will become clearer in the description below.

A shaft 106 extends in alignment with the actuator rod 104 and is supported by the male connector 7 for pivoting movement while being axially fixed. The shaft 106 is connected at one end to the cable 13 so as to be fixed for rotation therewith, while its opposite end is connected to the other end of the actuator rod 104 by a screw coupling 107.

Since the shaft 106 is fixed axially relative to the male connector 7 while the actuator rod 104 may slide but not rotate within the prismatic guide 103, it is clear that rotation of the shaft 106 causes a corresponding sliding movement of the actuator rod 104 in the prismatic guide 103, the magnitude of which depends on the pitch of the threading of the screw coupling 107.

A coil spring 119 mounted coaxially on the shaft 106 connects the shaft 106 to the prismatic guide 103 so as to oppose relative rotation of the two members.

A control member comprising a rack and pinion device 109 capable of transmitting rotation to the cable 13 is fitted to a handgrip 108 of the nozzle body 3. The device 109 comprises a hollow body 110 in which a key 111 carrying a rack 112 is slidable. The rack 112 meshes with a pinion 113 rotatably supported by the hollow body 110 and connected, in correspondence with its axis of rotation, to one end of the cable 13 so as to be fixed for rotation therewith. The device 109 includes resilient means, preferably constituted by torsion springs 114, which act on the key 111 to keep it in abutment with a projection 115 of the body 110 in an advanced travel-limit position (Figure 9) in which the key 111 projects from the body 110 by a predetermined distance L.

For reasons which will become clearer in the description below, when the key 111 is in its advanced travel-limit position, the rack 112 disengages from the pinion 113 so that the pinion 113 is free to rotate with the cable 13.

The nozzle body 3 further includes a handguard 117 on the handgrip 108 within which is a trigger lever 116 pivoted on the nozzle body 3 at one end and connected to the head 118 of the key 111 at the opposite end. By means of the trigger lever 116 it is possible to act on the key 111 to force it into the body 110 against the resilient action of the springs 114 until the key 111 itself is brought to bear against the end of the body 110 in a withdrawn travel-limit position (Figure 10).

With reference to Figures 6 to 10, the operation of the steam cleaning equipment 101 is described below with reference to an initial condition in which the equipment 1 is switched on, the boiler 5 contains steam under

pressure and the solenoid valve 6 is closed. As will be clear from the drawings, when the male connector 7 is inserted in the female connector 8, the end 105 of the actuator rod 104 is in alignment with the interspace 29 between the switches 9 and 10 but outside it. Delivery of steam is obtained by the user gripping the nozzle body 3 so as to insert his fingers in the handguard 117 and operate the trigger lever 116. Thus the key 111 and the rack 112 are moved against the action of the springs 114, causing the pinion 113, and consequently also the cable 13, to rotate. This rotation is transmitted to the shaft 106 which, as stated above, causes the actuator rod 104 to slide in the prismatic guide 103. This sliding brings the end portion 105 of the actuator rod 104 into a position in which it is inserted between the control rods 9a and 10a of the switches 9 and 10 to actuate them and cause the electrical circuits 14 and 15 to close and the solenoid valve 6 to open. Steam escapes from the boiler 5 through the solenoid valve 6 and through the tubes 11 and 12 to reach the steam outlet nozzle 16.

In order to stop the supply of steam from the steam outlet nozzle 16 it is sufficient to release the trigger lever 116 since the action of the springs 114 is sufficient to return the key 111 to its initial, advanced travel-limit position, rotating the cable 13 in the opposite sense from previously.

To advantage, the coil spring 119 cooperates with the springs 114 to cause the second rotation of the cable 13.

When the key 111 is in its advanced travel-limit position (Figure 9), any twisting of the flexible hose 4 will not cause accidental or undesirable opening of the solenoid valve 6 since the cable 13 and the pinion 113 are free to rotate relative to the rack 112.

In addition to having the advantages of the equipment 1, the equipment 101 has the advantage that the control member located on the handgrip of the nozzle body enables steam to be delivered from the steam outlet nozzle only when operated suitably by the user, this flow stopping automatically when the nozzle body is not gripped by the user. Thus, if the nozzle body is dropped accidentally, the danger of the user being hit by a jet of steam is avoided.

Furthermore, the pressure needed to operate the trigger lever may be distributed over several fingers which minimises the force which the user must exert to achieve the delivery of steam from the nozzle while using the equipment.

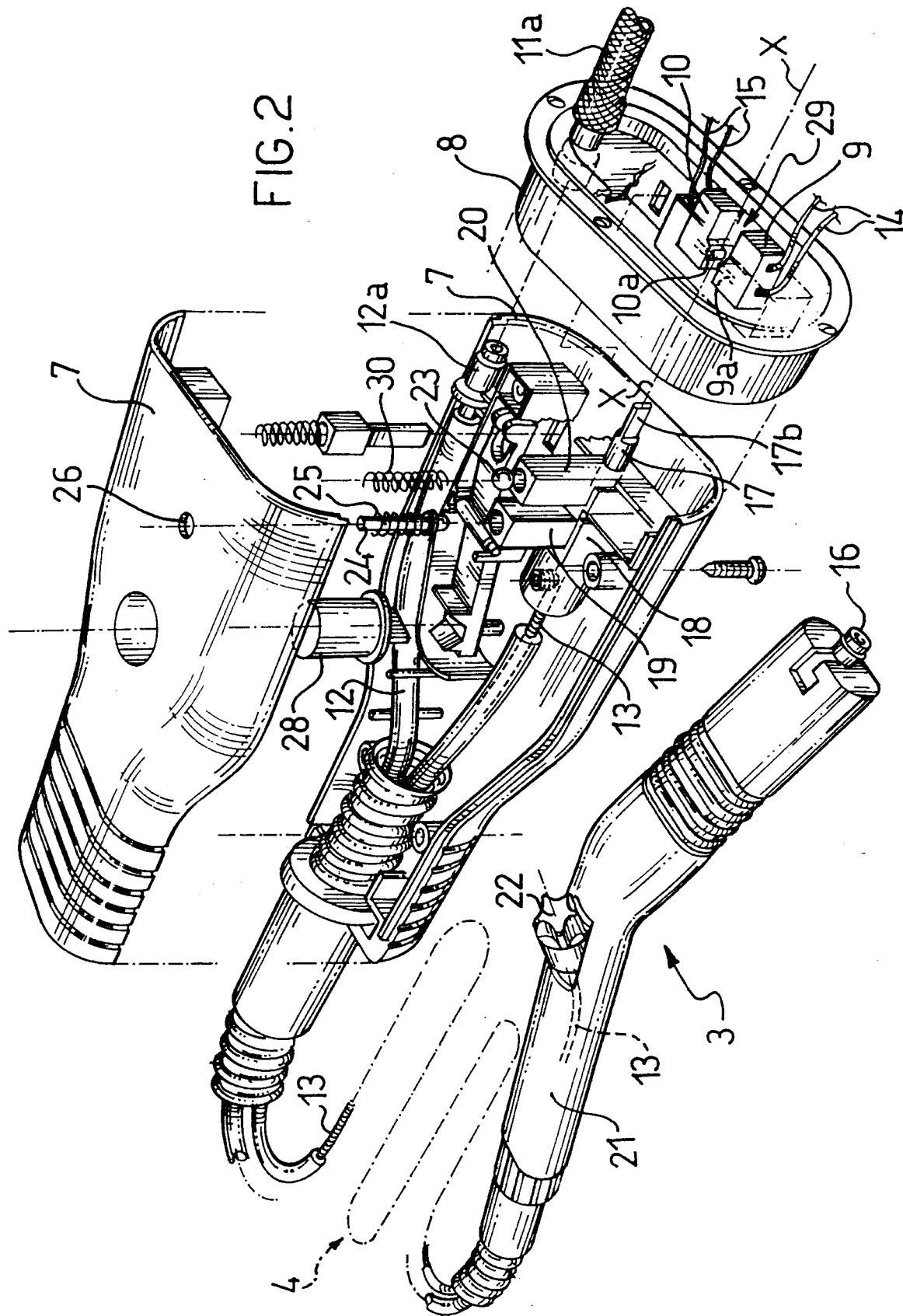
Obviously an expert in the art may make various modifications and adaptations to the equipments described above and may replace elements with functionally equivalent elements in order to satisfy specific requirements without thereby departing from the scope of protection of the invention as defined in the following claims.

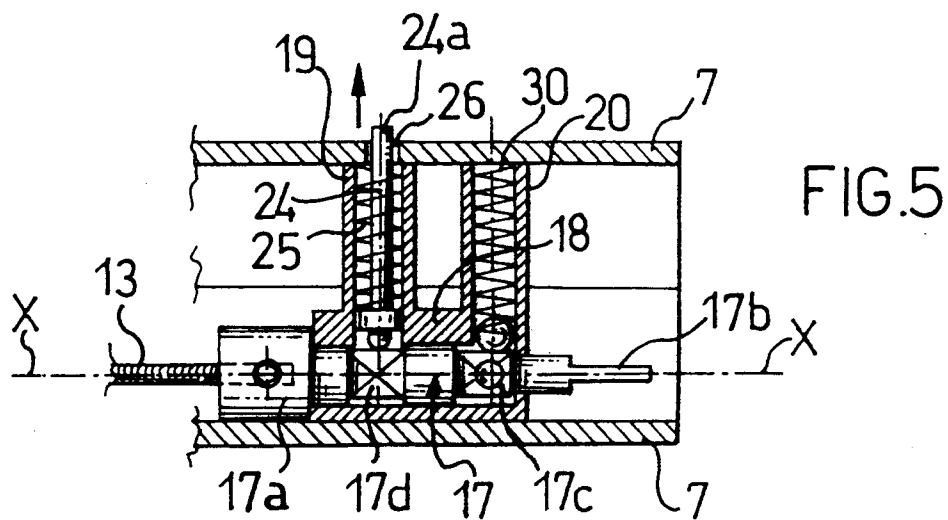
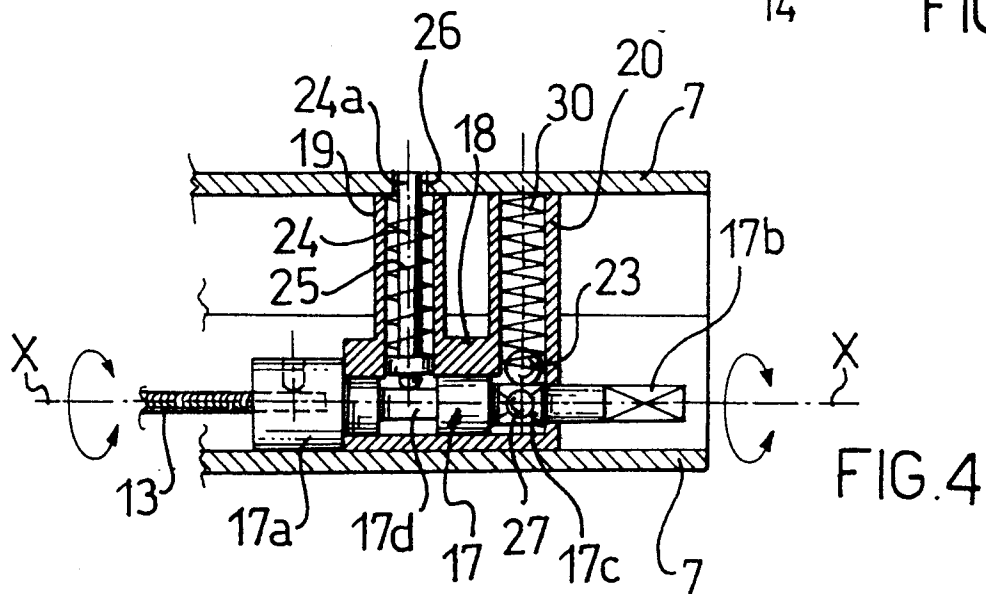
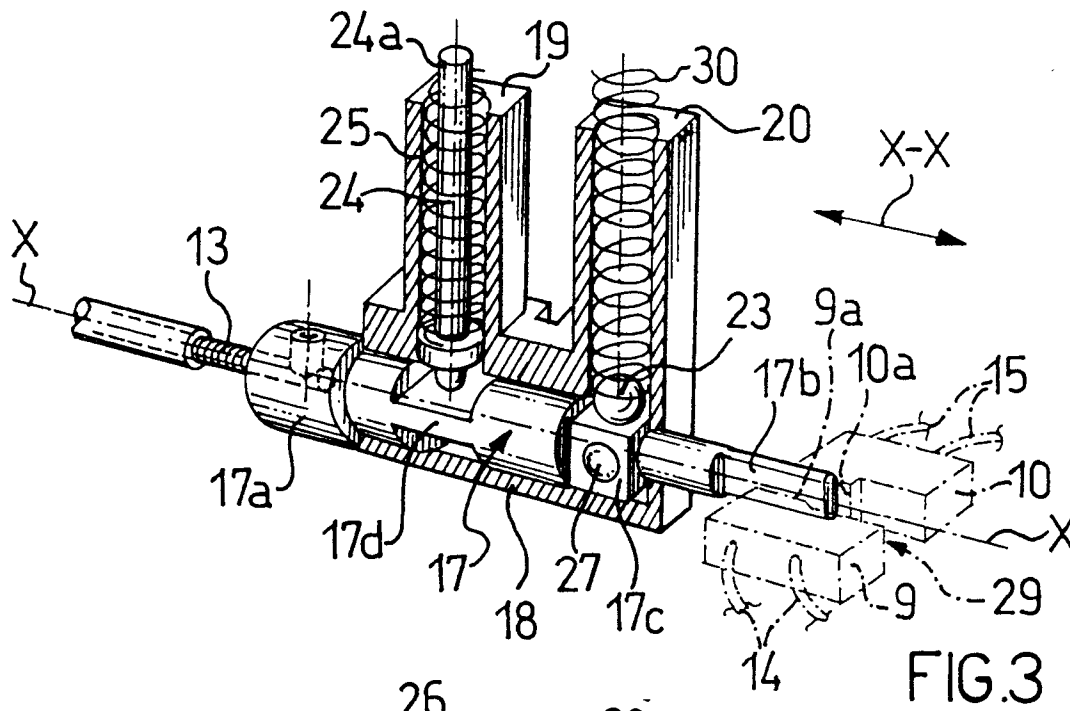
In particular, the number of switches and their arrangement within the body of the equipment may be varied in accordance with specific requirements, as may the type of switch used.

In the case of a liquid suction cleaner, the switch from the nozzle body may control a motor of a suction fan.

Claims

1. Cleaning equipment (1; 101), particularly for domestic use, of the type comprising a casing (2), at least one switch (9, 10) for actuating electrical components (6) of the equipment, a nozzle body (3) for cleaning operations and a flexible hose (4) connecting the nozzle body (3) and the casing (2) for conveying a fluid between the casing (2) and the nozzle body (3), characterised in that the at least one switch (9, 10) is housed within the casing (2) and in that a control member (22; 109, 116) is provided on the nozzle body (3) and mechanical transmission means (13, 17; 103, 104, 106) are provided for connecting the control member (22; 109, 116) to the at least one switch (9, 10) for actuating the switch (9, 10) from the nozzle body (3). 5
2. Equipment (1; 101) according to Claim 1 for steam cleaning, in which a boiler (5) is provided within the casing (2) for producing steam and a solenoid valve (6) controls the outlet of steam from the boiler (5) and in which the nozzle body is a nozzle (3) for supplying steam produced in the boiler (5) and conveyed in the flexible hose (4), the solenoid valve (6) being controlled by the switch (9, 10). 10
3. Equipment (1) according to Claim 2, in which there are two switches (9, 10) and in which the mechanical transmission means comprise a torsionally-rigid, flexible cable (13) and a shaft (17), part (17b) of which is rotatably inserted between control rods (9a, 10a) of the switches (9, 10), the shaft (17) being fixed for rotation with a first end of the cable (13). 15
4. Equipment (1) according to Claim 3, in which the control member comprises a knob (22) rotatably supported by the nozzle body (3) and operable from the exterior, the knob (22) being fixed for rotation with a second end of the cable (13) to rotate it. 20
5. Equipment (1) according to Claim 3 or Claim 4, in which the shaft (17) is pivotable between, and snap-engageable in, respective angular positions in which the part (17b) of the shaft interferes and does not interfere respectively with the control rods (9a, 10a) of the switches (9, 10). 25
6. Equipment (1) according to Claim 5, in which a second part (17d) of the shaft (17) further includes a cam which acts on a peg (24) extending in a direction perpendicular to the shaft and along which the peg (24) is slidable, supported by a support (18, 20) fixed to an end connector (7) of the flexible hose (4). 30
7. Equipment (1; 101) according to Claim 2, in which the mechanical transmission means comprise a torsionally-rigid, flexible cable (13) having one end connected to the control member (22; 109, 116) and its other end connected to an actuator device (17, 18; 103, 104, 106) of the at least one switch (9, 10). 35
8. Equipment (101) according to Claim 7, in which the control member (109, 116) rotates the cable (13) and in which the actuator device (103, 104, 106) comprises an actuator rod (104) movable linearly relative to an end connector (7) of the flexible hose (4) to actuate a control rod (9a, 10a) of the at least one switch (9, 10), and mechanical means (106) for converting the rotary motion of the cable (13) into linear motion of the actuator rod (104). 40
9. Equipment (101) according to Claim 8, in which the actuator rod (104) is fixed for rotation with the end connector (7) of the flexible hose (4) and in which the mechanical means comprise a second shaft (106) extending in alignment with the actuator rod (104), fixed axially to the end connector (7) of the flexible hose (4) and fixed for rotation with the cable (13), the second shaft (106) and the actuator rod (104) being connected by a screw-threaded coupling (107). 45
10. Equipment (101) according to Claim 9, including a spring (119) which acts on the second shaft (106) to oppose its rotation. 50
11. Equipment (101) according to Claim 7 or Claim 8, in which the control member comprises a device (109) with a rack (112) and a pinion (113), the pinion (113) being fixed for rotation with the cable (13). 55
12. Equipment (101) according to Claim 10, in which the rack (112) is slidable between two travel-limit positions and in which resilient means (114) act on the device (109) to urge the rack (112) into one travel-limit position.
13. Equipment (101) according to Claim 12, including a trigger lever (116) hinged to the nozzle body (3) to operate the rack (112) against the action of the resilient means (114).
14. Equipment (1; 101) according to Claim 3 or Claim 7, in which the cable (13) is of steel.





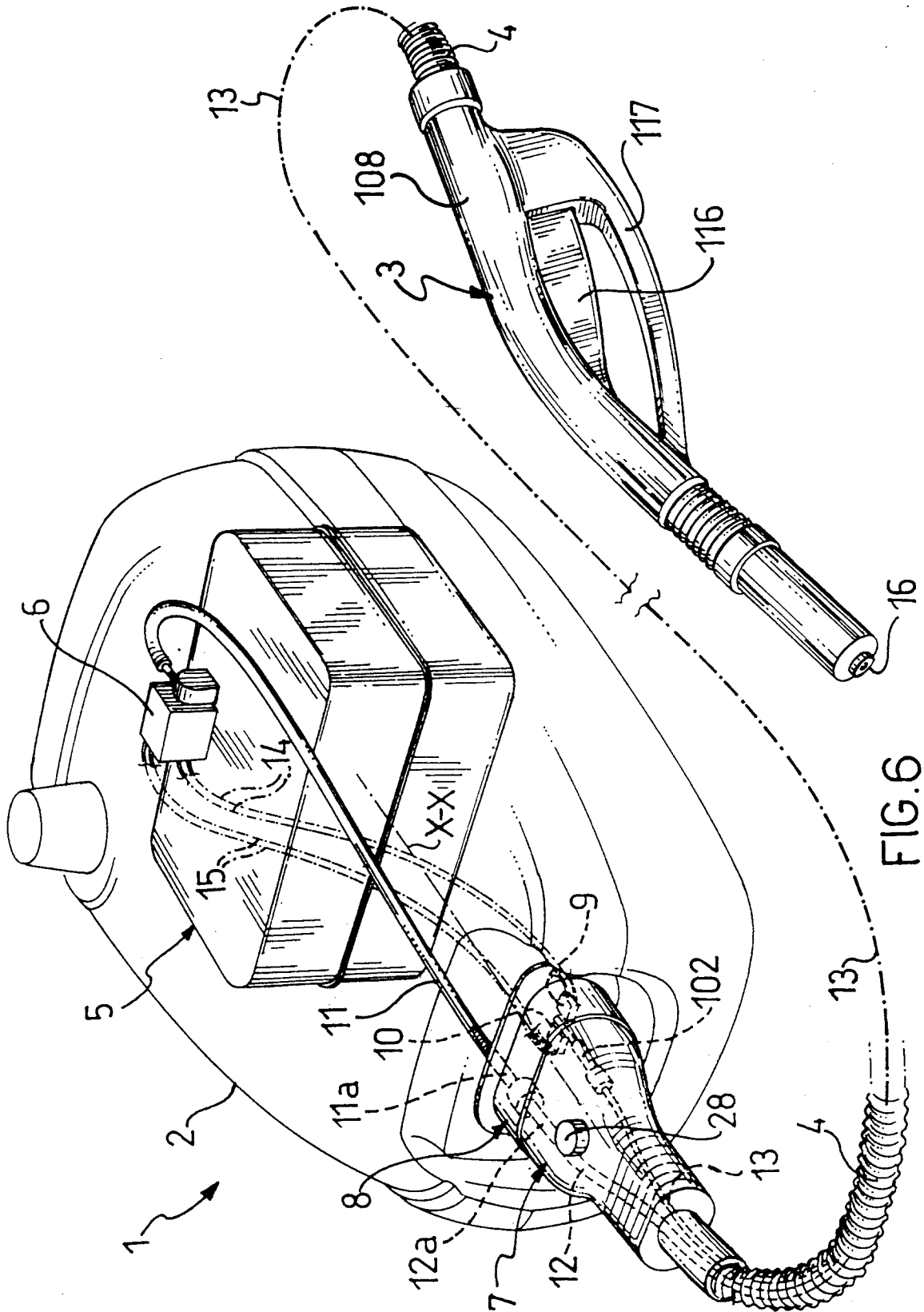


FIG. 7

