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(71) Applicant: **Annovi & Reverberi S.r.l.**
41100 Modena (IT)

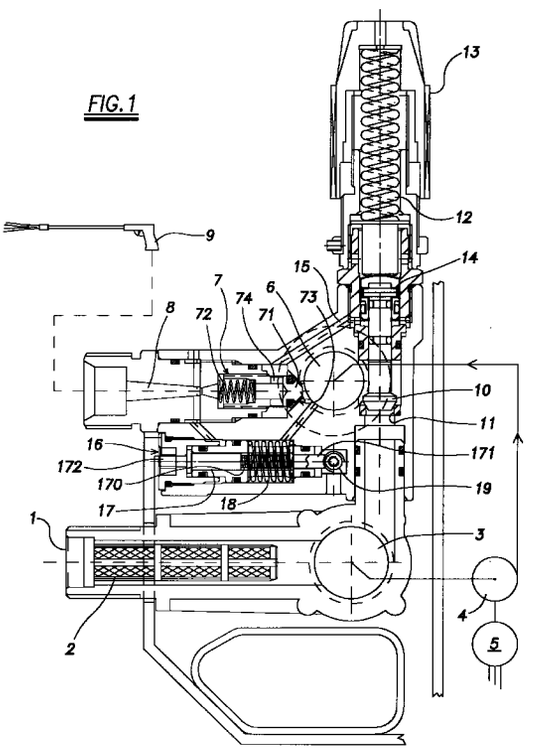
(72) Inventor: **Magri, Maurizio**
41100 Modena (IT)

(74) Representative: **Corradini, Corrado et al**
Studio Ing. C. CORRADINI & C. S.r.l.
4, Via Dante Alighieri
42100 Reggio Emilia (IT)

(54) Device for causing motor stoppage on the basis of liquid delivery in jet washers

(57) The device comprises a piston (17) sensitive to the pressure difference between the upstream and downstream side of the valving element for the pressurized water flow to the delivery lance.
Said piston (17) is connected, in series therewith, into a low voltage electrical circuit which is closed and respectively opened by the movements of said piston, said movements bringing it into contact with, and respectively withdrawing it from, an electrode (19), an electronic circuit (260) being provided which, in response to contact between the piston (17) and the electrode (19) energizes an electrical switch to open the power circuit of the jet washer electric motor.

FIG. 1



EP 0 805 470 A2

Description

This patent concerns machines known as jet washers, which comprise a high pressure pump operated by an electric motor, and feeding a pressurized water delivery lance.

The delivery lance is provided with its own means for opening and closing the water flow, which act generally in combination with a bypass which recycles the water to the pump intake when the water delivery is interrupted.

Simultaneously with water delivery interruption, controlled by a valve located on the delivery lance, it is advisable to also stop the pump, not only for energy saving but also to safeguard the state of the system and reduce its wear.

For this purpose control means for the pump drive motor are known, which are operated by the overpressure (water hammer) caused by the stoppage of water delivery, and in response to this overpressure stop the electric motor.

On reopening the water delivery said means act in the opposite sense.

In particular, devices are known which, in parallel with the valving element of the delivery conduit connected to the lance, comprise a piston controlled by the pressure difference between the upstream and downstream sides of said valving element.

When the pressure downstream of the valving element exceeds the pump delivery pressure because of water hammer consequent on closing the delivery lance, the piston moves against a spring to mechanically operate a switch located in the power line to the electric motor.

The known devices of this type have a series of drawbacks which greatly limit their operability.

A first drawback derives from the fact that said microswitch is connected into the medium voltage line, generally at 220 V, which powers the electric motor, this not always being allowable for safety reasons.

A further but no less serious drawback is due to the fact that the response time of the piston, which to operate the microswitch must undergo a certain travel, is not always compatible with the very short and practically instantaneous time for which the water hammer phenomenon persists.

A further drawback derives from the fact that the microswitch is located in a very moist environment, often in the presence of considerable condensate, which within a short time compromises its operability.

Lastly the known devices cannot permanently interrupt the electric motor power circuit in the case of accidental current interruption.

It hence happens that if the mains current should fail and the jet washer stops, when the current returns the jet washer automatically operates, possibly in the absence of the operator, to create a situation of potential danger.

The object of the present invention is to eliminate the aforesaid drawbacks within the framework of a simple and economical solution.

This is attained according to the invention in that said piston controlled by the pressure difference between the downstream and upstream sides of the valving element of the device, instead of mechanically operating a microswitch carrying high voltage, simply creates a contact within a low voltage circuit, of the order of 10 V, to generate a signal which when suitably processed interrupts the motor feed current via a relay.

Preferably the contact is made between the flat end of a rod coaxial with the piston and connected to this latter by a spring, and a helical expansion of pointed section formed on an electrode, such as to prevent condensate droplets remaining trapped between the contacting surfaces, to the advantage of connection stability.

Said electrode is fixed in an electrically isolated manner, breakage due to impacts transmitted in the axial direction by the piston being prevented by the interposing of said rod and the relative spring.

Moreover according to the invention, the means for processing the signal generated by the contact between the piston and electrode comprise automatic zeroing means in the case of even accidental interruption of the mains supply, to prevent accidental re-operation of the jet washer when the current returns.

The merits and the operational and constructional characteristics of the invention will be apparent from the detailed description thereof given hereinafter with reference to the figures of the accompanying drawings, which show a preferred embodiment thereof by way of non-limiting example.

Figure 1 is a partly sectional side view of the invention.

Figure 2 is a front view thereof.

Figure 3 is an enlarged detail of Figure 2.

Figure 4 shows the control panel.

Figure 5 is a sectional side view thereof.

Figure 6 shows the circuit of the electronic card.

From said figures it can be seen that the hydraulic circuit, shown partly schematically, of the jet washer comprises a connector 1 to be connected to the water main and leading via a usual filter 2 to a conduit 3 connected to the suction conduit of the high pressure pump 4. The pump 4 is operated by the electric motor 5.

The delivery conduit of the high pressure pump 4 leads to a conduit 6 which, via a valving element 7 of piston type and a Venturi tube 8, communicates with the delivery lance 9.

The valving element 7 comprises a cup-shaped hollow piston 71, which maintains the seat 73 communicating with the conduit 6 closed by the spring 72.

The lateral surface of the piston comprises two radial channels 74 which, when the piston 71 withdraws under the action of the pumping pressure, connect the conduit 6 to the Venturi tube 8. The conduit 6 is connected to the pump suction conduit 3 via an adjustable valve the valve body 10 of which closes the valve seat 11 under the action of the spring 12.

The action of the spring can be adjusted by screwing down or unscrewing the the cap 13 on the spring.

The valve body 10 is rigid with a control piston 14, which causes it to rise by the pressure of the liquid existing upstream of the piston 71, transmitted via the conduit 15.

In practice the adjustment of the spring 12 enables the delivery pressure of the jet washer to be regulated, in that when said pressure exceeds the desired value the piston 14 raises the valve body 10, to bypass the pumped liquid to the suction side.

In this manner an equilibrium situation is created at the desired pressure.

In parallel with the valving element 7 there is positioned the control device 16 which causes the electric motor 5 to stop when the delivery of the lance 9 is shut off.

The device 16 comprises a piston 17 maintained towards the left in Figure 21 by the spring 18.

The piston 17 is in contact via a spring 170 with a rod 171 which, when the piston 17 moves towards the right overcoming the action of the spring 18, makes contact with the electrode 19.

As is apparent from the enlarged detail of Figure 3, the electrode 19 is supported by the body of the device by a collar 20 of dielectric material and comprises on the outside of the device means 21 for fixing a cable 22 which feeds its signals to the processing card 260.

The cylindrical body of the electrode 19 intended to make contact with the rod 171 is provided with an expansion 191 of triangular section, by which contact with the rod 171 occurs at a succession of discrete points.

In an opposite position to the spring 170, the piston 17 is rigid with a rod 172 which is accessible from the outside to manually release the piston 17 if necessary.

Figures 4 to 6 show the jet washer control panel 200, comprising a switch-on pushbutton 27, a switch-off pushbutton 28 and a series of three light-emitting diodes, namely a red diode 23 which lights when the pushbutton 21 is pressed, a green diode 24 which is lit when the pump is in operation, and a yellow diode 25 which is lit when the pump is at rest in the stand-by condition.

Said pushbuttons and diodes are connected to the card 260 shown in Figure 6.

Figure 4 and Figure 5 also show the power cable 26 and the connection cable 22 to the electrode 19.

The card 260 can be understood by the expert of the art with the aid of the following table showing the card components.

TABLE

COMPONENT	TYPE
C2, C5 capacitor	0.1/50
RR2 resistive network	1K*4
R6 resistor	1M
D3 signal diode	1N4007
D6, D7 signal diode	1N4148
R7 resistor	4K7
C3, C4 electrolytic capacitor	10/50
RR1 resistive network	10K*4
D2 zener diode	12V/1/2W
MOV1 varistor	22 zal
R3 resistor	100K
R1 resistor	680/1/2W
C1 electrolytic capacitor	1000/16
U1 quad Smith nand SGS-THOMSON	4093
TR1 npn transistor	BC 337
PTR1 diode bridge 1a/400vac	BRIDGE w104
F2, F3, JP4, JP5, JP6, JP7	fastons
F1 fuse in c.s.	FUSE 50 mA
D4 green LED 5 mm	GREEN LED
JP1, JP2, JP3	jumper
K1, K2 FEME relay	MZPS 100-43-16
D1 red LED 5 mm	RED LED
Sw1, sw2 ALPS PUSHBUTTONS	SW PUSHBUTTON
T1 ISOLATED TRANSFORMER	TR.220/9VAC 3W
D5 yellow LED	YELLOW LED

For a better understanding, the circuit of Figure 6 carries the reference numerals which appear in Figures 4 and 5.

It should be noted by the reader that the card logic is equipped with a delay circuit (R7, R6, D6, C4) which prevents stoppage of the motor 5 if the delivery lance 9 is opened and closed with a frequency of less than 4 to 5 seconds.

This prevents absorption peaks which inter alia could cause overheating of the domestic circuit breaker.

Moreover, as stated, the card 260 comprises a minimum voltage relay which prevents subsequent undesired motor re-start after mains voltage failure.

Claims

1. A device for causing stoppage of the electric operating motor of a jet washer, comprising a piston (17) sensitive to the pressure difference between the upstream and downstream side of the valving element for the pressurized water flow to the delivery lance, characterised in that said piston (17) is connected, in series therewith, into a low voltage electrical circuit which is closed and respectively opened by the movements of said piston, said movements bringing it into contact with, and respectively withdrawing it from, an electrode (19), an electronic circuit (260) being provided which, in response to contact between the piston (17) and the electrode (19), energizes an electrical switch to open the power circuit of the jet washer electric motor.

2. A device as claimed in claim 1, characterised in that that lateral surface of the electrode (19) which makes contact with the piston is provided with a helical expansion (191) of pointed section.

3. A device as claimed in claim 1, characterised in that the electrode (19) is fixed to the device body via a dielectric element (20).

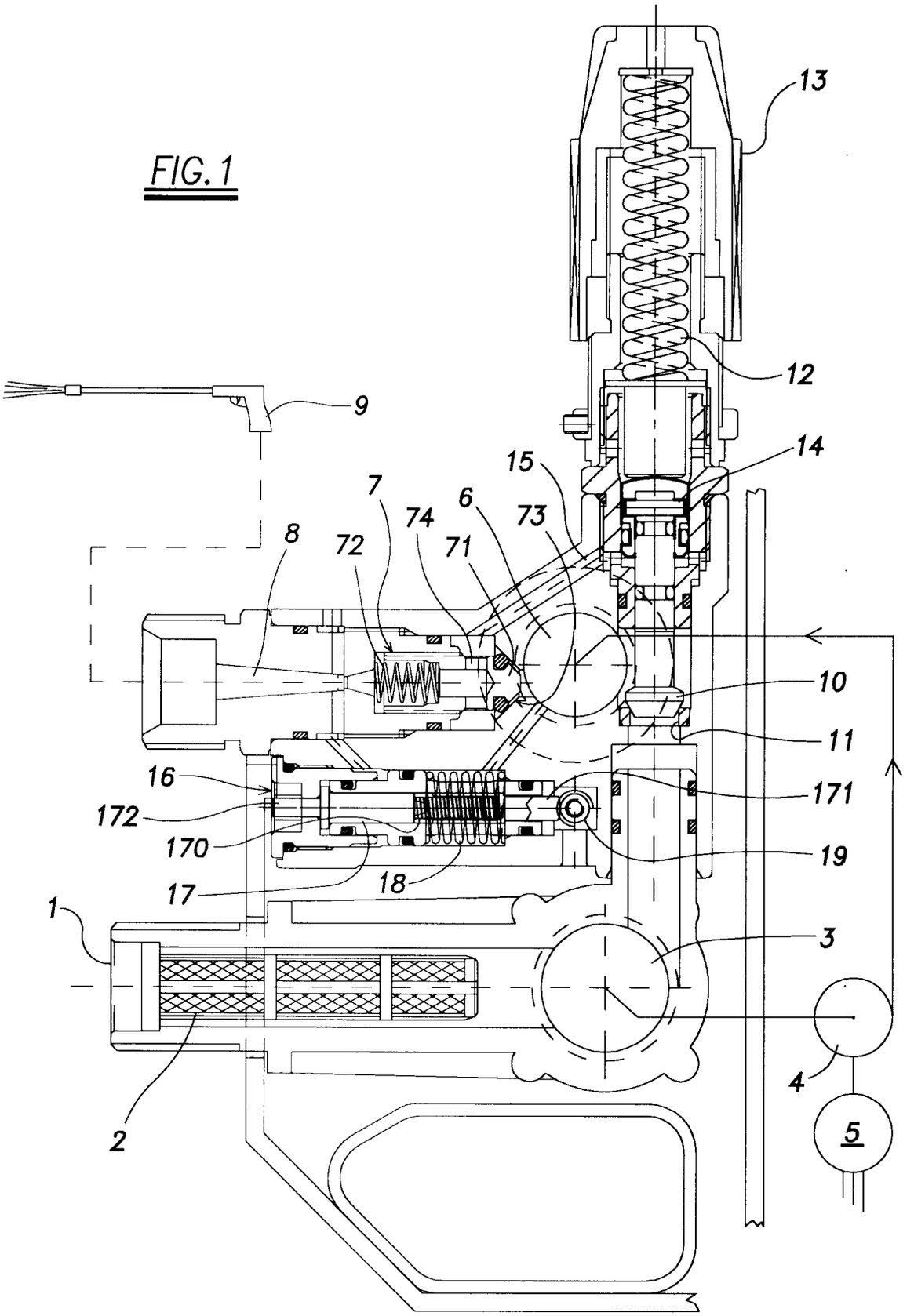
4. A device as claimed in the preceding claims, characterised in that the electronic circuit comprises means for permanently deenergizing the electrical switch if the electric current is interrupted.

5. A device as claimed in claim 1, characterised in that the electronic circuit is a printed card circuit positioned at a distance from the device.

6. A device as claimed in the preceding claims, characterised in that the contact between the piston (17) and the electrode (19) occurs via a rod (171) connected to the piston by a spring (170).

7. A device as claimed in the preceding claims, characterised in that in an opposite position to the spring (170) the piston (17) comprises a rod (172) which is accessible from the outside to manually release the piston (17).

FIG. 1



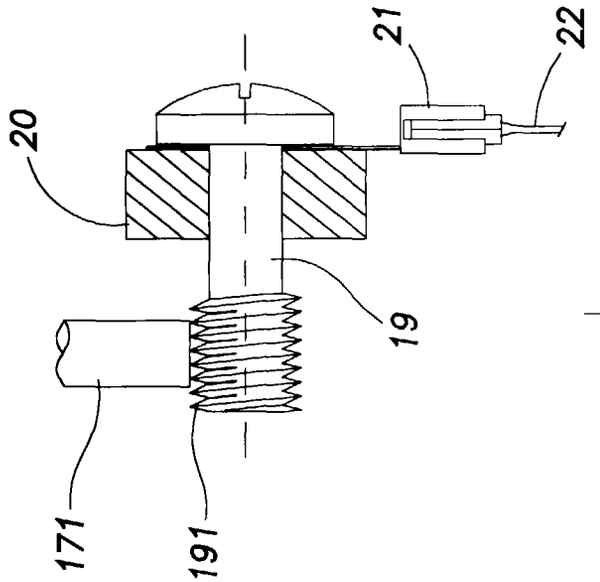


FIG.3

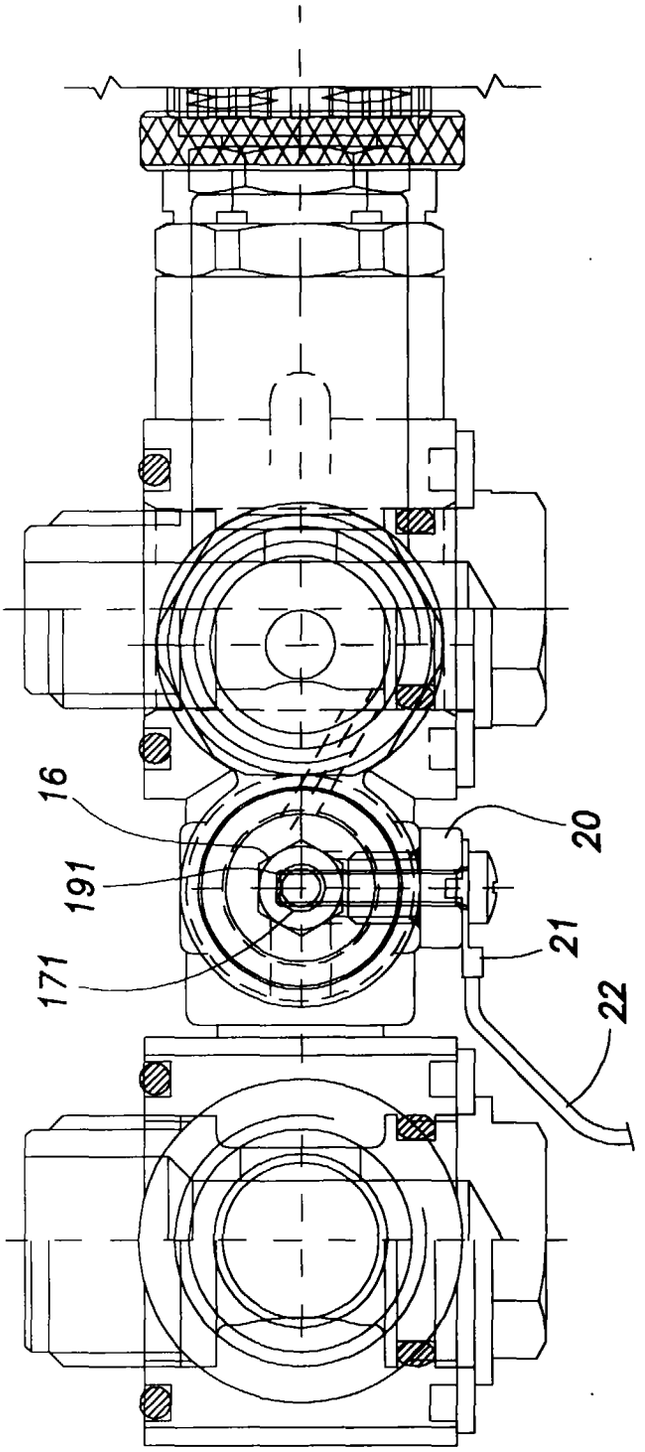


FIG.2

FIG.5

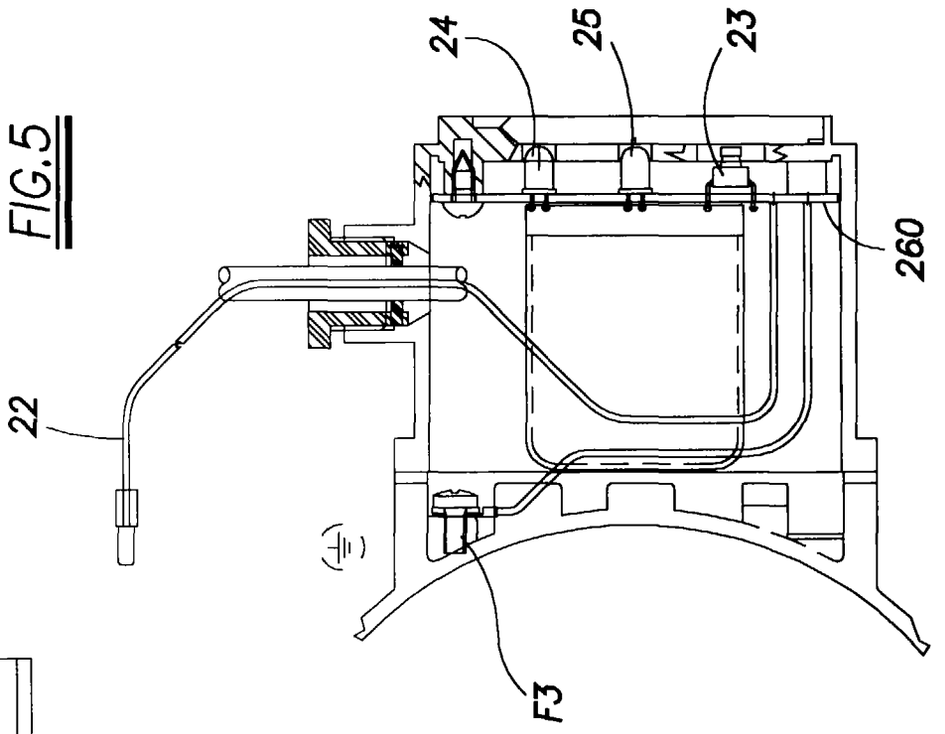
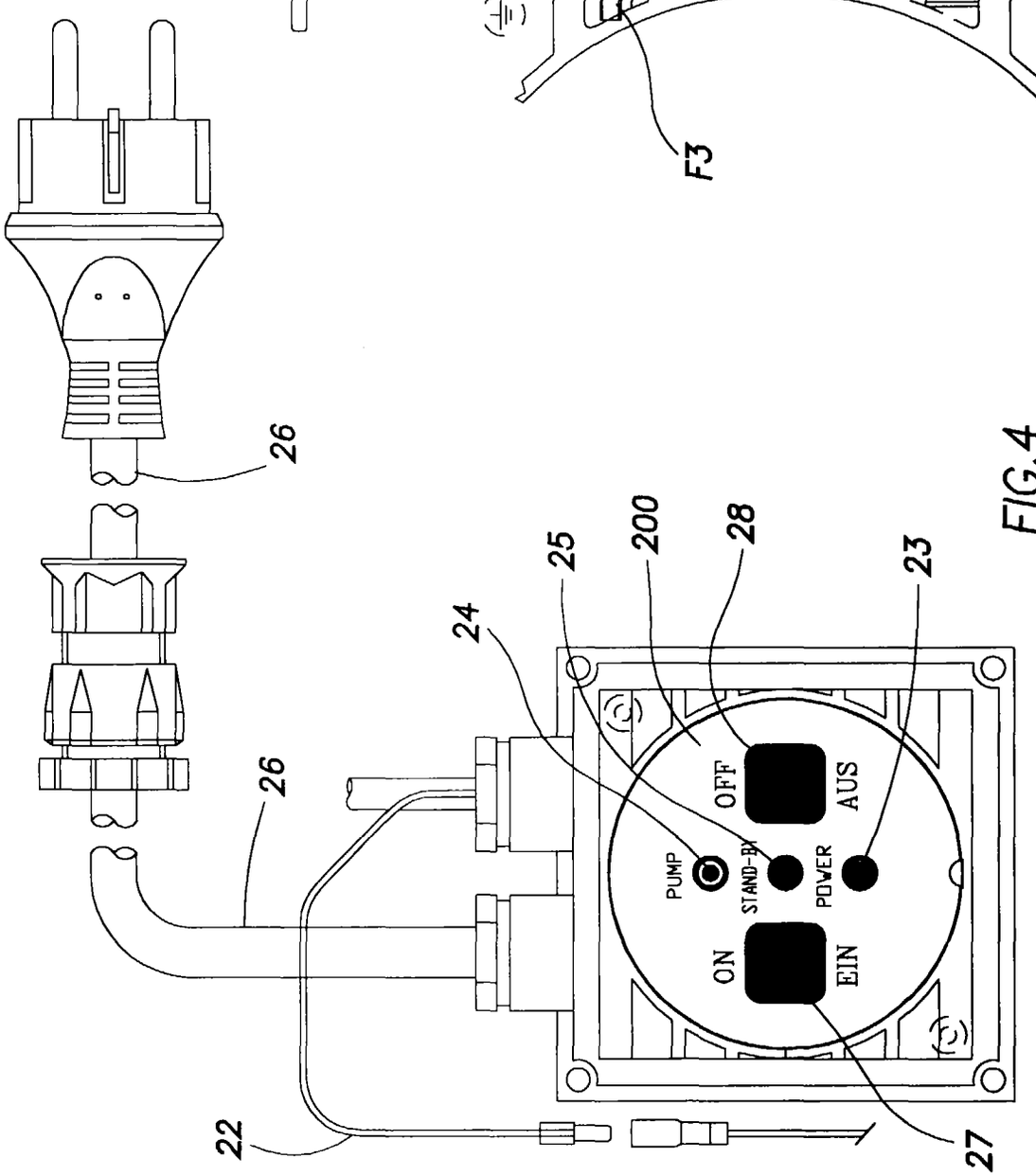

24
25
23
260
22
F3

FIG.4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200
28
24
23
OFF
AUS
PUMP
STAND-BY
POWER
ON
EIN
26
22
27

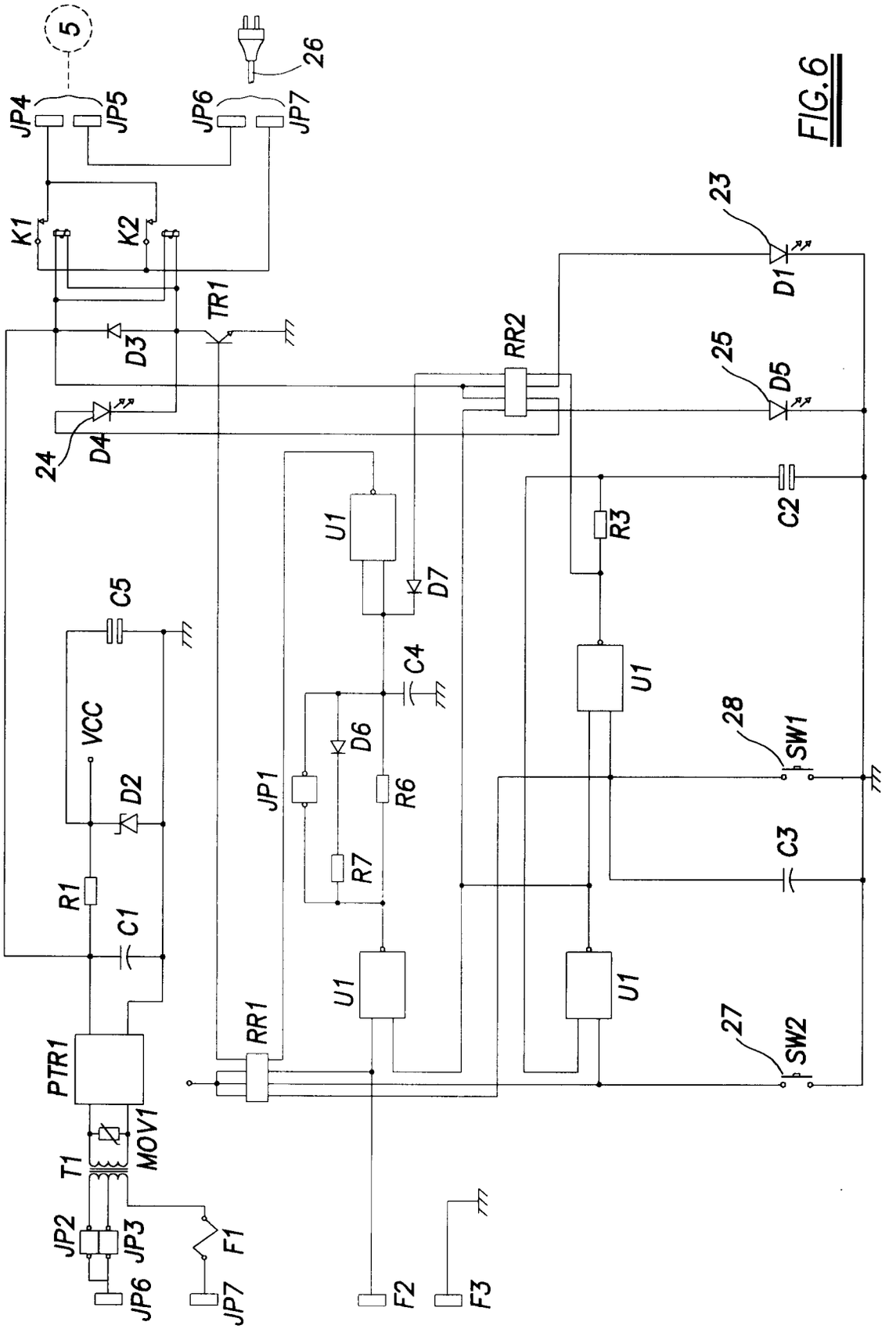
5
JP4
JP5
JP6
JP7
26
K1
K2
TR1
D3
D4
24
RR2
23
D1
25
D5
C2
R3
U1
D7
C4
D6
JP1
R6
R7
C5
VCC
D2
R1
C1
PTR1
MOV1
T1
JP2
JP3
JP6
JP7
F1
RR1
F2
F3
28
SW1
C3
27
SW2

FIG.6