

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

0 518 147 A1

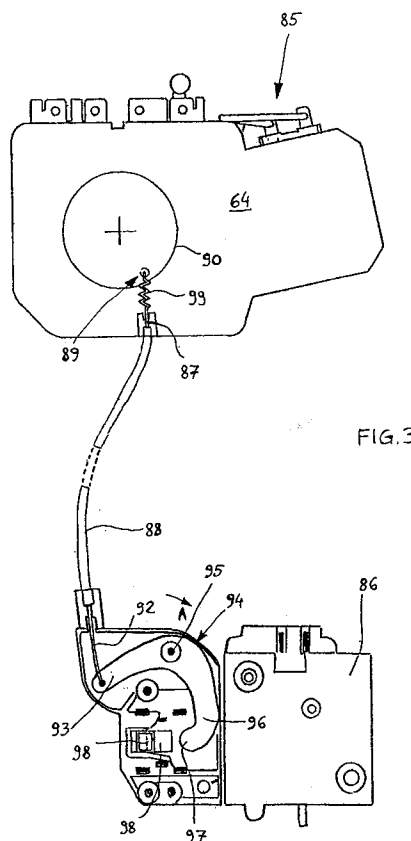
(12)

EUROPEAN PATENT APPLICATION(21) Application number: **92109161.7**(51) Int. Cl.⁵: **D06F 37/42**(22) Date of filing: **30.05.92**(30) Priority: **13.06.91 IT PN910035**(43) Date of publication of application:
16.12.92 Bulletin 92/51(84) Designated Contracting States:
DE ES FR GB IT(71) Applicant: **Zanussi Elettrodomestici S.p.A.**
Via Giardini Cattaneo, 3, C.P. 147
I-33170 Pordenone(IT)(72) Inventor: **Frucco, Giuseppe**
via Tiro a Segno 25**I-33170 Pordenone(IT)**Inventor: **Russo, Fernando****via Spallanzani 22****I-33170 Pordenone(IT)**Inventor: **Filoso, Antonio****via Candiani 14****I-33170 Pordenone(IT)**(74) Representative: **Giugni, Valter et al**
PROPRIA Protezione Proprietà Industriale
S.r.L. Via Mazzini 13
I-33170 Pordenone(IT)(54) **Door interlock device for clothes washing and/or drying machines.**

(57) Door interlock device for clothes washing and/or drying machines, comprising a traditional-type electromechanical actuator (4) with a bimetallic element for the delayed release of the lock (86) of the loading door of the machine, a plurality of functional parts (14, 15, 16, 17) and an electronic microprocessor arrangement (8) incorporating safety means adapted to enable the door lock to be released for opening only when pre-set values are reached as far as the temperature of the wash liquor (or the drying air, as the case may be), the level of the wash liquor and the rotation speed of the clothes holding drum are concerned.

Device further provided with an electric push-button switch (5) connected with said microprocessor arrangement (8) and adapted to enable, under the control of said microprocessor arrangement, the door to be actuated for opening through a cam (90) of a rotary selector means (64), which actuates a string (87) connected to a lever (94) having its fulcrum in the lock (86) and acting on the door latch (98) so as to release and open it when said rotary selector means (64) is actuated accordingly.

Device of simple and reliable construction, adapted to be used particularly in those machines that are not provided with a door handle.



The present invention relates to a door interlock device for clothes washing and/or drying machines and the like, which is adapted to enable the locked door of said machines to be opened at the end or during each selected washing and/or drying cycle upon reaching a certain safety level of operating conditions inside the machines themselves.

Clothes washing and/or drying machines of the current type are provided with a door interlock device which is adapted to keep the loading door of said machines locked in its shut position throughout the duration of each selected washing and/or drying cycle, thereby preventing said loading door of the machines from being accidentally opened as long as operating conditions prevail inside the machine which may prove dangerous or risky for the user, said dangerous conditions being for instance brought about by a high temperature of the wash liquor, the drum rotating at high speed rates or, in the case of drying machines, a high temperature of the air blown into the drum for drying the clothes.

Several types of door interlock devices for washing and drying machines are known from the prior art, which comprise an electromechanical actuator such as a bimetallic element, and an interlock relay or similar element associated with the timer-programme sequence control switch of each machine and provided with a peg interacting with the door latch, said actuator being capable of being triggered into two different positions of operation by said timer-programme sequence control switch, ie. a first position of operation in which said actuator is inactive and causes said peg to be displaced into a resting position in which said peg does not interfere with said door latch, thereby enabling the same door to be either opened or closed by mechanically actuating an appropriately provided push-button located on the control panel of the corresponding machine and mechanically linked with said door latch through a system of articulated levers or connected therewith with a string, a tie rod or the like, and a second position of operation in which said actuator is activated and therefore causes said peg to be displaced into a working position in which said peg interferes with said door latch, thereby preventing the door to be opened through the actuation of said push-button.

These door interlock devices further comprise a traditional type of delay element associated with the electromechanical actuator and appropriately set or rated so as to allow said electromechanical actuator to be only actuated after a pre-determined delay time has elapsed from the end of the last spin-extraction or drying phase of the selected washing and/or drying cycle, in such a way as to enable the loading door of the machines to be only opened when the drum has safely stopped rotat-

ing and, as a result, any dangerous or risky situation that is likely to be of some harm to the user coming in contact with the drum is eliminated.

In particular, from the Italian patent application no. 45711-A/89 filed on February 21, 1989 by Industrie Zanussi SpA a door interlock device of the afore mentioned type is known which comprises a plurality of electronic comparators adapted to compare the actual measured value with a pre-determined reference value of such process parameters as the rotating speed, or rpm, of the drum, the temperature and the filling level of the water in the wash tub of washing machines (or the temperature of the drying air in the case of clothes washing machines), and connected with the door latch through a NOR logic gate, as well as with actuator means of the electromechanical type, so as to either prevent the loading door of the respective machine from being opened or enable it to be opened, through the actuation of a push-button that is mechanically connected with said door latch through a linkage system, strings, tie rods or the like, based on the outcome of each comparison made between the actual measured values and the pre-determined reference values of all afore cited process parameters, so that access to the drum is only made possible if absolutely safe operational conditions are prevailing inside the machine and any danger or risk for the user is therefore excluded.

It is the purpose of the present invention to provide a door interlock device of the afore illustrated type, which is operated through a corresponding control element which is capable of being actuated in a simple way, without exerting any mechanical force upon it, and is therefore capable of being included in the electric circuitry of machines that are provided with electronic systems to control their clothes washing and/or drying programmes.

This door interlock device is embodied with such construction and operating features and characteristics as essentially described with particular reference to the appended claims.

For a better understanding, the invention will at any rate be further described by way of non-limiting example with reference to the accompanying drawings in which:

- Figure 1 is a schematical view of the electric wiring diagram of the door interlock device according to the invention;
- Figure 2 is a view showing a structural detail of the electric circuit of the door interlock device according to the invention;
- Figure 3 is a view showing a structural detail of the mechanical part of the door interlock device according to the invention.

The above cited figures are therefore views

illustrating schematically the door interlock device according to the present invention, as applicable to clothes washing and/or drying machines, which is adapted to keep the loading door (not shown) of said machines locked in its shut position, barring the access to the rotating drum (not shown, either), in such a way as to prevent any undesirable opening of said loading door from occurring when the machine is going through any selected washing and/or drying cycle, so as to safely protect the user from any injury either upon entering into contact with those internal parts of said machines which are subject to high temperatures owing to the high temperature of the wash liquor or the drying air, as the case may be, or upon entering into contact with the drum rotating at a high speed rate.

As it may in particular be seen in Figure 1, the above cited door interlock device according to the present invention substantially comprises an electromechanical actuator 4 of a traditional type, which is associated with the peg (not shown) interacting with the latch (not shown) of the door of each machine so as to keep or not to keep said door locked in its shut position, and further comprises an electric push-button 5 for enabling the operation of the actuator 4 according to criteria as described in the following, said push-button being connected with the ground 6 of the device and arranged to be closed for connection to a pre-determined reference potential V_{cc} that is applied through a conductor 7 to the electronic microprocessor 8 of the machine, which is provided in the same machine so as to control the carrying out of the different washing and/or drying cycles thereof.

As usual, said electromechanical actuator 4 is formed by a heater element of the PTC type in association with a bimetallic or similar element acting as a delay element for the opening of the door, as schematically illustrated to represent a single unit 9 which is supplied through a conductor 10 connected to the main phase conductor 11 of the machine, said unit being adapted to operate said peg into its two operational door locking and releasing positions, along with a movable electric contact 12 supplied through said main phase conductor 11 and connected with the different operational components of the machine which are included in the electric circuitry thereof and which, in this example, comprise the synchronous motor 13 of an appropriate rotary selector (not shown) that will be described in the following, the liquid-detergent dispensing pump 14 provided for extracting the liquid detergent contained in an appropriate reservoir (not shown) in the machine and delivering it into the wash tub, the recirculating pump 15 which is connected with the recirculation conduit (not shown) of washing machines arranged to perform the washing process by spraying the wash

liquor onto the clothes in the drum, the drain pump 16, and the water inlet electromagnetic valves 17 and 18 for letting cold and hot water into the wash tub of the machine, as well as further *per se* known components that are not shown in the Figure.

The above mentioned operational components of the machine are capable of being selectively energized through a plurality of micro-switches which, in the example described here, are constituted by the micro-switches 19, 20, 21 and 22, which are provided in a particularly advantageous way as component parts of a printed-circuit board included on an electronic module 23 and perform further a function of identifying, in the way that will be described in the following, the various operating positions taken each time by said synchronous motor 13 and corresponding to the various phases of the washing and/or drying cycle being performed by the machine as selected by its user.

In particular, said synchronous motor 13 is supplied by means of an electric conductor 24, which is inserted between said phase conductor 11 and the neutral conductor 25 of this electric circuit, through at least a traditional-type semiconductor switch such as a Triac 26 or similar bi-directionally conducting device driven through a driver 27 which is connected to the microprocessor 8 through the conductor 28, whereas all said micro-switches 19-22 are capable of being supplied in the manner as described hereinafter, between the two conductors 11 and 25, through at least a further semiconductor switching element such as a Triac 29 or similar bi-directionally conducting device connected between an electric conductor 30, which is common to all said micro-switches, and the neutral conductor 25, said Triac being driven through a driver 31 that is connected, through the conductor 32, with the output 33 of a NOR logic gate 34 comprised in the microprocessor 8, along with a series of further electronic components including three electronic comparators 35, 36 and 37 which have their respective outputs 38, 39 and 40 connected with the corresponding inputs 41, 42 and 43 of said NOR logic gate 34.

The respective first inputs 44, 45 and 46 of said electronic comparators 35, 36 and 37 are in turn connected, through corresponding measurement transducers 47, 48 and 49, with sensors (not shown) being installed inside the machine and provided to respectively detect the temperature of the wash liquor (or the drying air, as the case may be), the level of the wash liquor filled into the tub as well as the rotation speed of said rotating drum, whereas the respective second inputs 50, 51 and 52 of said electronic comparators 35, 36 and 37 are connected with predetermined electric reference voltages.

The above described electronic components

provide a safety arrangement as described in the Italian patent application no. 45711-A/89 filed on February 21, 1989 by Industrie Zanussi S.p.A., to which reference will therefore be made for a better understanding of the operational implications and peculiarities, said safety arrangement being adapted to prevent the loading door of the machine from being opened as long as the temperature of the wash liquor (or the drying air, as the case may be), the level of said wash liquor and the rotation speed of the rotating drum are at such values as to prove dangerous or risky for the user in the case that he or she would be capable of gaining access and getting into contact with the drum inside the machine.

Finally, said conductor 30 is further connected with the microprocessor 8 so as to enable said microprocessor to detect the related braking or making conditions of the various micro-switches 19-22 to the purposes that will be described hereinafter.

In particular, the micro-switch 19 is adapted to be closed for establishing a connection with the electromechanical actuator 4 through said conductors 10 and 30, the micro-switch 20 is adapted to be closed for establishing a connection with the liquid-detergent dispensing pump 14 through the conductors 24, 53 and 30, whereas the micro-switch 21 is adapted to be closed for establishing a connection with the recirculating pump 15 through the conductors 24, 54 and 30 and the micro-switch 22 is adapted to be closed for establishing a connection with both the drain pump 16, through the conductors 55, 56 and 30, and the break-before-make contact 57 of a relay switch 58 that is controllable through the microprocessor 8 of the machine.

The electromagnetic valves 17 and 18 are in turn selectively energizable by the same micro-switch 22 through a further relay switch 59 which is controllable through said microprocessor 8 of the machine and is provided with a break-before-make contact 60 adapted to be switched over to and from either one of the respective conductors 61 and 62 so as to establish a connection with and enable the energization of said electromagnetic valves 17 and 18, said contact being supplied through a further conductor 63 which is caused to communicate with the conductor 56 of the micro-switch 22 when said break-before-make contact 57 of said relay switch 58 is switched over to its other operational setting.

The afore described micro-switches 19-22 are in a particularly advantageous manner operated by a control device which is associated with the detergent dispensing arrangement of a type as traditionally used in washing machines, said device being substantially similar to the one described in the

Italian patent application PN91A000012 filed on February 27, 1991 by the same Applicant, and being such as to enable the breaking and/or making conditions of each micro-switch to be identified, along with the corresponding pre-determined operational phases of the washing cycle being each time performed by the machine according to user's selection, under utilization of a rotary selector means adapted to selectively let supply water into each compartments of said detergent dispenser and capable of being rotatably driven by a related synchronous motor in the way as described in the afore cited patent application.

By having now reference to Figure 2, it can be noticed that said rotary selector means 64 comprises, in a similar way as described for the selector means covered by the afore mentioned patent application, a plurality of concentrically running, electrically conductive strips which in this example of embodiment comprise the four circularly-shaped conductive strips 65, 66, 67 and 68, which are arranged on an insulating support board 69 so as to be separate from one another in a mutually independent way, and which are provided with respective angularly spaced fixed contacts 70, 71, 72 and 73 and are further connected with corresponding terminals 74, 75, 76 and 77 of a terminal block 78 that is associated with said rotary selector means 64, said terminals being respectively connected with the corresponding micro-switches 19, 20, 21 and 22, and said rotary selector means further comprising a wiping contact 79 that is in turn connected with a corresponding conductive strip 80 which is internally concentric with respect to the other conductive strips and which is supplied by the electric circuit of the machine, said wiping contact being rotatably driven by the rotation of said rotary selector means, as generated by the action of said synchronous motor 13, so as to be each time displaced to establish a connection with the different fixed contacts 70-73, thereby causing the corresponding micro-switches 19-22 to make and, therefore, the respective phases of the selected washing and/or drying cycle to be performed.

Said synchronous motor (not shown in the Figure) is in turn supplied through electrical conductors 81 and 82 that are connected to corresponding terminals 83 and 84 on the terminal block 78.

In this manner, it is therefore possible, according to the criteria and principles set forth in detail in the afore cited Italian patent application no. PN91A000012, to immediately and automatically identify each operational phase of any selected washing and/or drying cycle being performed by the machine during the making state of each said micro-switch as determined by the rotation of said rotary switch 64.

By referring now to Figure 3, it can be noticed that it shows a schematic view of the mechanical mechanism 85 which is built in the washing machine and is provided in view of causing the operation of the latch 86 of the door of said machine.

In the herein described exemplary embodiment, the above cited mechanism in a much usual way comprises a metal pulling string 87 sliding through a protective sheathing 88, an end of which (as marked by the numeral 89 in the drawing) is operable by the contour of an appropriately provided cam 90, which is arranged coaxially with respect to said rotary selector means 64 and is rotatably actuatable by the same selector means, and the other end of which (as marked by the numeral 92 in the Figure) is adapted to engage with the end portion of a first arm 93 of an arcuate spring-loaded lever 94 pivoting about a fulcrum 95 located on the door lock 86 thereunder. Said lever is further provided with a second arm 96, the rounded-off end portion 97 of which is adapted to interact with the latch 98 of said door lock, said latch being adapted to lock the door in its shut position or to release it therefrom so as it can be opened.

In particular, said metal pulling string 87 is capable of causing the lever 94 to be shifted, according to the position in which the string itself is shifted by the movement of said cam 90, into either one of two operational positions, ie. a first position as shown in Figure 3, in which said rounded-off end portion 97 of the arm 96 of said lever does not interfere with said latch 98, thereby allowing it to keep engaged with the door and, as a consequence, locking said door in its shut position, and a second position in which said lever is caused to pivot about its fulcrum 95 in the direction shown by the arrow A, wherein said rounded-off end portion of said lever arm 96 is brought to act against said latch 98, thereby disengaging it from the door and, as a consequence, enabling the door to be opened.

In particular, when said metal string 87 is pulled by the rotary movement of said cam 90, the synchronous motor 13 of the rotary selector means 64 being supplied in the manner as described hereinafter, also the lever 94 is shifted into its second operational position, whereas it only causes the latch 98 to be released and, therefore, enables the door to be opened when the electromechanical actuator 4 is de-energized during the cycle or at the end thereof, under the safety conditions and in the manner as described hereinafter.

In order to enable the metal string 87 to be operable also under the above described conditions of the electromechanical actuator 4 being energized, at least one energy-absorbing element is provided, such as for instance a spring 99 that

may be appropriately arranged anywhere in the system, for example at the end portion 89 of said string.

The door interlock device provided in this way operates as follows: when the desired washing cycle has been selected and set on the machine and the door of the same machine has been properly shut after having loaded the dirty clothes in the drum, the electromechanical actuator 4 acts to drive the movable electrical contact 12 into making and the door is kept locked in this shut position by the latch 98 of the door lock 86, regardless of the position taken by the arcuate lever 94 being pulled by the string 87, as long as said electromechanical actuator 4 is energized.

As soon as the selected washing cycle is started, the electrical circuit of the machine is energized following the closing of said movable contact 12, while triggering of the Triac 26 causes the synchronous motor 13 of the rotary selector means 64 of the machine to be energized so as to switch said rotary selector means into its setting corresponding to the starting phase of said washing cycle. When the other Triac 29 is subsequently triggered, this causes the various functional components of the machine to be selectively energized and, as a consequence, the selected washing cycle starts being actually performed by the machine throughout its various phases.

As the washing cycle is performed in this way by the machine, said rotary selector means 64 is successively switched into its various control settings as driven by the action of the same synchronous motor 13 associated therewith and under the control of the microprocessor 8.

In this way, the various functional components of the machine are switched on and off in a selective manner, while the switching state of each micro-switch 19-22, as brought about by the rotation of the rotary selector means 64, is detected by the microprocessor 8 through the conductor 30, so that it is allowed to constantly monitor the progress of each operational phase of the washing cycle as it is carried through by the machine.

At the end of the washing cycle, the corresponding condition is detected by the microprocessor 8, while the unit 9, which comprises the PTC heating element and the bimetallic element, is de-energized, thereby causing the latch 98 of the door lock 86 to be released, and consequently enabling the door to be opened, with a certain delay.

This operation can be performed automatically, without any need for the electrical push-button switch 5 to be actuated into its closed setting, in the case that the cam 90 is rotated in such a setting as to cause the string 87 to be pulled and, as a consequence, the latch 98 to be released. If

this is not the case, said operation is performed automatically by actuating the push-button switch 5 into its closed setting, thereby making the circuit for the microprocessor 8 to be supplied with the reference voltage V_{cc} , which therefore provides said microprocessor with the information that there is a demand for the door to be opened, so that the same microprocessor is switched into its door release control mode as described hereinafter.

In the same way, when a washing and/or drying cycle is in progress, said microprocessor 8 is effective in signalling, through its built-in safety system as previously described, whether the temperature of the wash liquor (or the drying air, as the case may be), the level of the wash liquor in the tub and the rotation speed of the drum have decreased to pre-determined safety values that would therefore not imply any dangerous or risky situation upon opening of the door or touching internal parts of the machine by the user.

In the case that said pre-determined safety values are not reached by the above specified process parameters, the microprocessor 8 will by no means enable the door lock to be released, and the door to be opened, while signalling this condition through an appropriately provided visual or acoustic indicator (not shown) associated therewith.

Should on the contrary said process parameters have actually decreased to said safety values, the microprocessor 8 enables the door lock release procedure to be started, owing to the fact that it keeps the synchronous motor 13 continuously energized through the Triac 26. As a consequence, the cam 90 is caused to be rotatably actuated so that the string 87 is pulled until the cam itself causes in this way the lever 94 to be shifted into its other operational position, in which said lever 94 is pivoted about its fulcrum 95 in the direction shown by the arrow A and the arm 96 of the same lever is brought to act against the latch 98, thereby disengaging it from the door and enabling the same door to be opened.

The door interlock device provided according to the invention in the afore described way has a simple construction and enables the door to be opened automatically, even in the case that the door is not provided with a handle. Furthermore, owing to the fact that it does not require any mechanical action to operate the door, it is suitable for use even in clothes washing and/or drying machines equipped with electronic control circuits, thereby ensuring a very reliable operation of the same machines.

Claims

1. Door interlock device for clothes washing and/or drying machines comprising a wash tub

containing a rotating drum accessible through a loading door, a detergent dispenser provided with a rotary selector means capable of being rotated into various operational positions by at least a synchronous motor or similar means so as to cause the water from the water supply mains to be filled selectively through each one of the various compartments of said detergent dispenser, said rotary selector means being adapted to actuate a plurality of switching means so as to enable the various phases of each selected washing cycle to be identified, as well as comprising an electromechanical actuator means provided with at least a delay element of a *per se* known type for enabling the door to be opened with a pre-determined delay after the end of each related operation cycle of the machine, a plurality of functional components (such as pumps for dispensing liquid detergents, wash liquor re-circulating pump, drain pump, electromagnetic water inlet valves, etc.) included in the internal circuit of the machine along with said synchronous motor, said switching means and at least an electronic microprocessor means of a *per se* known type provided to control the progress of the various operation cycles by switching on and off in due sequence said functional components, said machine further comprising a door lock acting on said loading door so as to prevent it from being opened or enable it to be opened, said circuit finally comprising safety means of a *per se* known type that are provided in said microprocessor and adapted to enable said door to be opened, by means of at least an electric push-button switch for enabling said door lock to be actuated through said electromechanical actuator means, only when the temperature of the wash liquor (or the drying air, as the case may be), the level of the wash liquor and the rotation speed of said clothes holding drum have decreased to pre-determined safety values barring any dangerous or risky situation for the user, said door interlock device being **characterized in that** said electric push-button switch (5) is operatively connected with said microprocessor means (8) to enable said door lock (86) to be operated, and therefore said door to be opened, through actuation means (90, 87, 94) that are associated with said door lock (86) and are operable through said rotary selector means (64), under the control of said microprocessor means (8).

2. Door interlock device according to claim 1, **characterized in that** said actuation means comprise at least an appropriate cam (90) that

is coaxial with said rotary selector means (64) and rotatably actuatable by the latter, and comprise also a metal string (87) or similar means and an arcuate spring-loaded lever (94) pivotable about a fulcrum situated on said door lock (86), said string (87) being connected at an end (89) thereof with said cam (90) and, at the other end (92) thereof, with a first arm (93) of said lever (94), the second arm (96) of which is arranged to co-operate with the latch (98) of said door lock (86), said lever (94) being shiftable by the rotary movement of said cam (90) through said string (87), with the interposition of energy-absorbing means (99), so as to actuate said latch (98) to its door unlocking position.

3. Door interlock device according to claim 2, **characterized in that** said energy-absorbing means comprise at least a spring (99).

25

30

35

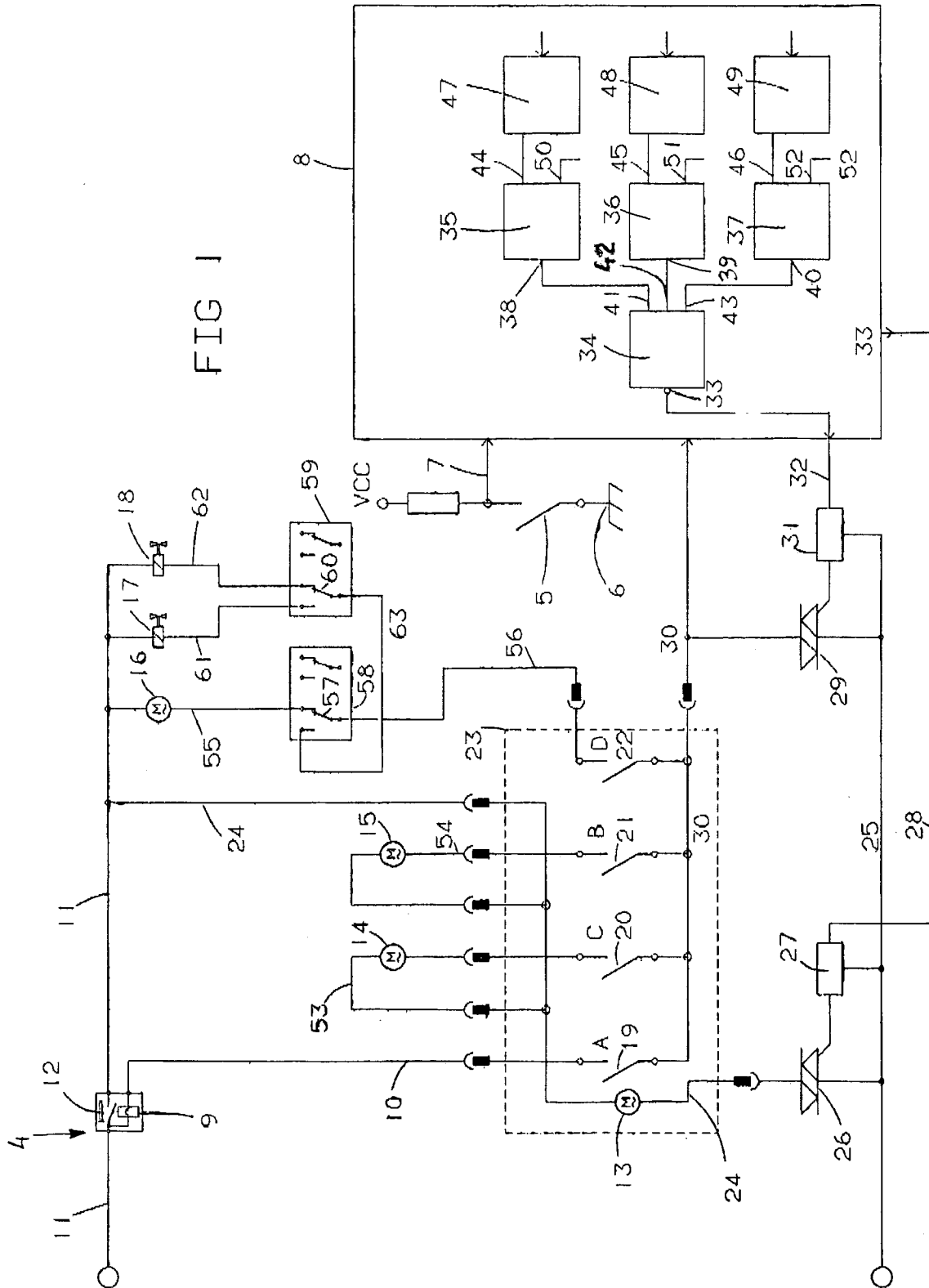
40

45

50

55

FIG 1



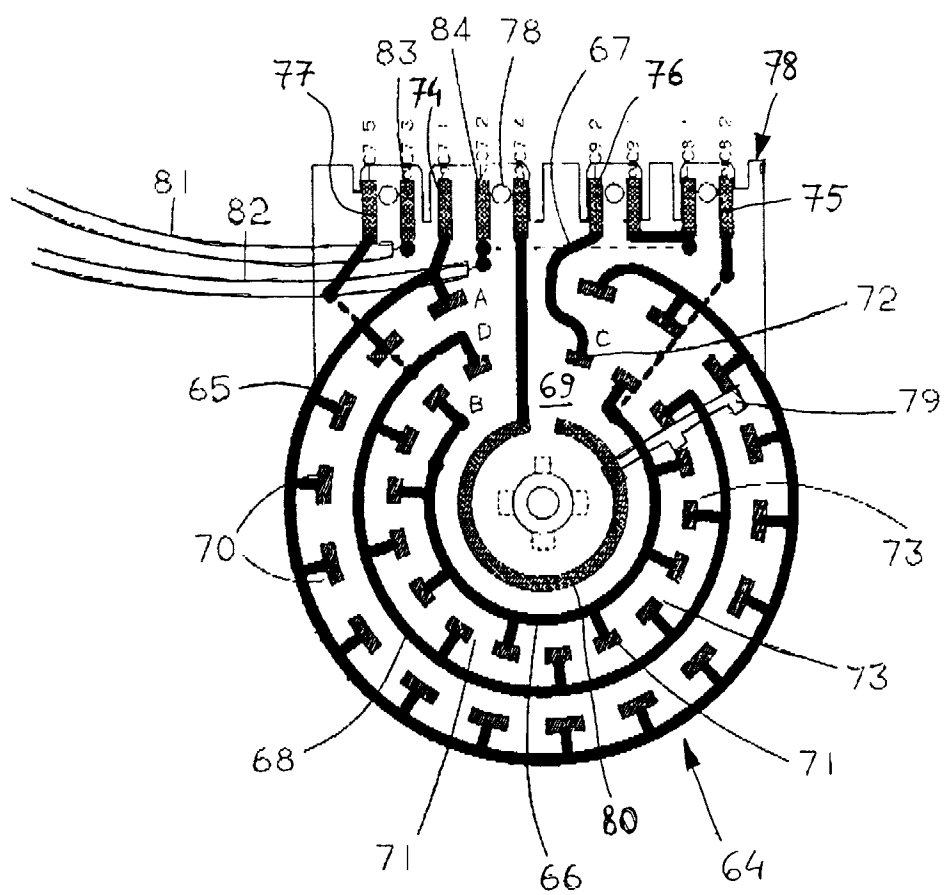
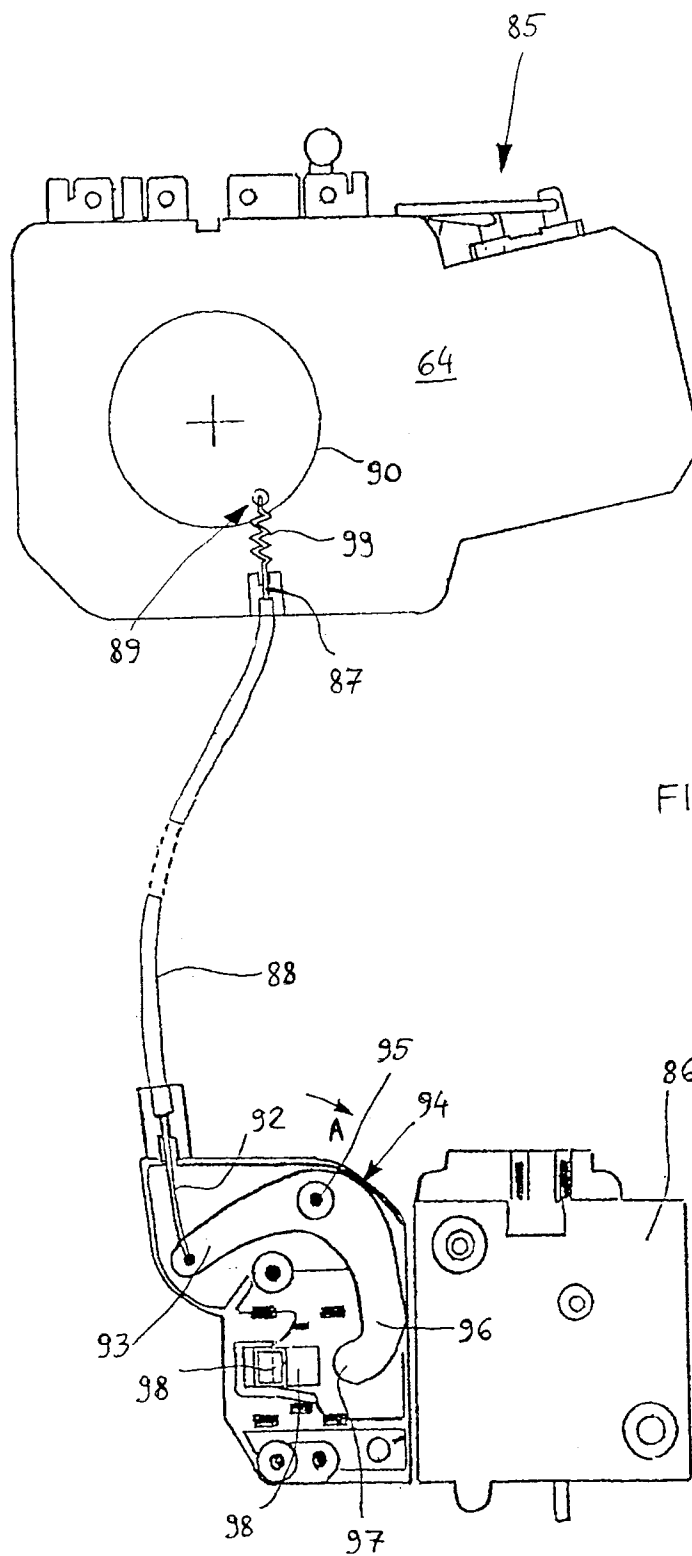


FIG 2





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 10 9161

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	FR-A-1 564 393 (INDUSTRIE A. ZANUSSI S.P.A.) * page 2, line 4 - page 3, line 18 * ---	1-3	D06F37/42
D,A	EP-A-0 384 148 (INDUSTRIE ZANUSSI S.P.A.) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			D06F A47L
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20 AUGUST 1992	Examiner GOODALL C. J.
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			