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(54) **Improvement in the control arrangement of a clothes washing machine**

Steuerungsvorrichtung einer Waschmaschine

Dispositif de commande d'une machine à laver

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(73) Proprietor: **Electrolux Zanussi S.p.A.**
33170 Pordenone (IT)

(72) Inventors:
• **Frucco, Giuseppe**
I-33170 Pordenone (IT)

• **Russo, Fernando**
I-33170 Pordenone (IT)

(74) Representative: **Giugni, Valter et al**
PROPRIA
Protezione Proprietà Industriale S.r.L.
Via Mazzini 13
33170 Pordenone (IT)

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Description

The present invention refers to a household-type clothes washing machine comprising a programme sequence control switch to control the actuation of the various process cycles to be performed by the machine, and a number of control devices provided to ensure correct operation of the same machine according to pre-set process parameters.

Clothes washing machines are generally known to be equipped with a safety interlock arrangement provided to prevent the loading door from being able to be opened when the machine is operating.

A first type of such door interlock arrangement is generally adapted to enable the loading door to only be opened, upon conclusion of a process cycle, after a certain delay time has elapsed so as to allow the user to reach into the drum under conditions of greater safety.

Such an arrangement generally consists of some electromechanical device comprising mainly a catch or similar contrivance which is adapted to lock the loading door in its closed position under the action of a moving arm associated to a delaying element of the positive temperature coefficient (PTC) type, as this is described for instance in the patent specification GB-A-2 128 283.

Such a PTC-type element is energized electrically, so as to command the safety arrangement accordingly, through appropriately provided controlled-type switches which undesirably complicate the overall control system of the machine. As a matter of fact, such switches may consist of appropriately provided contacts of the programme sequence control switch (in electromechanical solutions) or relays and/or Triacs (in electronic solutions), with corresponding driving and filter circuits associated thereto, which not only add to the overall costs of the product, but also reduce the reliability of the machine owing to the increased number of component parts subject to possible failure or breakdown.

Another type of door interlock arrangement is defined as "instantaneous" due to the fact that the loading door can be opened immediately upon actuation of an electric control element, whereas the opening of the door will in any case only be allowed if the drum is not rotating any longer, the level of the water is below the lower edge of the door and the temperature of the water is below a given value (for instance, 40°C).

Clothes washing machines are also generally known to be provided with a water flow distributing arrangement which, when directed by the programme sequence control switch to do so, diverts the flow of incoming water into the various compartments provided in the detergent dispenser to hold the detergents and the various additives and rinsing aids required to perform the washing process. The systems that have been used up to now to correctly shift or direct the water flow distributor in correspondence of the required compartment are based on logical position codings capable of being implemented and carried out in a variety of manners. An-

yway, all such systems call for a number of lines of the microprocessor associated to the programme sequence control switch to be occupied, as well as the use of low-voltage powered reading elements, the reliability of which is going to decrease with the time owing to problems deriving for instance from an oxidation of their electrical contacts. A solution of this kind is disclosed in the patent specifications EP 0 253 710 and EP 0 504 545.

It would therefore be desirable, and it is actually a main purpose of the present invention, that the part count of control and adjustment arrangements of clothes washing machines be reduced to a minimum, while simplifying the overall circuitry and boosting the reliability and safety of the component parts thereof.

The solution according to the present invention, as this is recited in the appended claims, substantially proposes the use of the electronic switch, ie. the Triac, which is normally present in the clothes washing machine to control the motor driving the rotating drum, as a general element controlling various critical component parts of the machine, such as the PTC element of the door interlock arrangement and position contacts provided to control the distribution of the inlet water flow and identify the individual operating phases of the washing cycles which the machine is going through.

Characteristics and advantages of the present invention will be more clearly understood from the description that is given below by way of non-limiting example with reference to the accompanying drawings, in which

- Figure 1 is a view of a simplified wiring diagram for a clothes washing machine provided with a traditional type of PTC-based door interlock arrangement, as improved according to the present invention;
- Figure 2 is a view of a wiring diagram which is similar to the one shown in Figure 1, but intended for a clothes washing machine provided with a door interlock arrangement of the instantaneous type.

In Figure 1, the reference numeral 1 is used to indicate the main on/off switch of the clothes washing machine, the reference numeral 2 to indicate the electrical contact of the door interlock device, the reference numeral 3 to indicate the PTC element of the door interlock arrangement, the reference numeral 4 to indicate the electronic control module of the clothes washing machine, the reference numeral 5 to indicate the general relay of the machine, the reference numeral 6 to indicate a tachometer adapted to measure the revolutions per minute of the driving motor and, hence, of the rotating drum of the machine, the reference numeral 7 to indicate the stator of the motor rotatably driving the rotating drum of the machine, the reference numeral 8 to indicate the rotor of the same motor, the reference numeral 9 to indicate the electric portion of the programme sequence

control switch governing the operational elements of the clothes washing machine and, in particular, the inlet water flow distributing arrangement (not shown), the reference numeral 10 to indicate the power contacts of said programme sequence control switch, the reference numeral 11 to indicate the wiping contacts equipping the programme sequence control switch to control the positioning of the inlet water flow distributing arrangement, the reference numeral 12 to indicate an electrical RFI suppressing filter, the reference numeral 13 the driving motor of the programme sequence control switch, the reference numeral 14 to indicate the various connections of the programme sequence control switch with the functional elements of the machine (such as electromagnetic valves, pumps and the like), the reference numeral 15 to indicate the wiping contacts equipping the programme sequence control switch to control said functional elements of the machine, the reference numeral 16 to indicate the relay controlling the reversing action of the rotating drum, the reference numeral 17 to indicate the microprocessor included in the electronic control module 4 of the machine, the reference numeral 18 to indicate the electronic switch (Triac) of the motor driving the programme sequence control switch, and the reference numeral 19 to indicate the electronic switch (Triac) of the motor driving the rotating drum of the machine.

It should be noticed that, according to the present invention, the wiping contacts 11 are additionally used to identify, through counting, all of the electrical positions taken by the programme sequence control switch while going through the various cycles, as this will be explained in greater detail further on.

In Figure 2, which illustrates the electrical schematics of a clothes washing machine equipped with a door interlock arrangement of the instantaneous type, the only variant appearing as compared to Figure 1 is represented by the coil 22 (which replaces the PTC element 3) of the door interlock arrangement and the corresponding electrical connection with the electronic control module 4. All other component parts are identical to the ones appearing in Figure 1, so that they are indicated using the same reference numerals.

All such elements are normally provided and used in the control and regulation circuitry of an electronically controlled clothes washing machine.

According to the present invention, however, some of such elements are connected, in the two illustrated embodiments, in a new and original manner to reach the previously indicated aims and advantages.

In Figure 1, in fact, the PTC element 3 of the door interlock arrangement is connected to the Triac 19 via a connection terminal 24 of the electronic control module 4. The drum driving motor 7, 8, further to its normal connection with its corresponding Triac 19, via a contact 25 of the programme sequence control switch, and the reversing relay 16, is also connected, via said reversing relay 16, with the general relay 5 and the electric contact

2 of the door interlock arrangement, via a switch-over contact 26.

For the door to be effectively locked, it is necessary that the PTC element 3 be energized either continuously or intermittently, whereas in the latter case the interval shall however be shorter than its release time (usually ≤ 1.5 minutes). By taking advantage of this delay time, it is therefore possible to keep the door locked by simply letting the drum of the washing machine rotate according to an appropriately selected rhythm.

The solution according to the present invention, however, enables the door to be kept locked even without the need for the drum to be driven. This is possible through the contact 26 being switched over so as to divert the power supply from the driving motor 7, 8 to the relay 5. In this particular situation, all other electric elements of the washing machine are de-energized, so that such a condition may be only brought about in well-determined phases of an operational cycle (for instance, in the "pre-soak" phase, in which the clothes, and in particular the delicate ones, have to be kept immersed in water for a certain period of time, without any rotation of the drum).

Should the Triac 19 of the drum driving motor 7, 8 suffer a short-circuit condition, the microprocessor 17 will activate the relay 5 by switching over the contact 26 so as to remove the power supply from the motor 7, 8. The door of the clothes washing machine will then be able to be opened after the inherent delay time of the PTC element 3 has been duly allowed to elapse. In other words, it can conclusively be said that when the relay 5 is de-energized (switch-over contact 26 in the position shown in Figure 1) and the Triac 19 is operating regularly, both the door interlock arrangement 2, 3 and all of the functional elements of the washing machine are activated. When on the contrary the relay 5 is energized (contact 26 switched over from the position shown in Figure 1) along with the Triac, the door interlock arrangement 2, 3 keeps being activated together with the driving motor 13 of the programme sequence control switch, while all other functional elements of the washing machine are however de-energized, ie. separated from the power supply.

In the embodiment illustrated in Figure 2, in which a door interlock arrangement of the so-called instantaneous type is used, the specific situations are different, but they anyway ensure the same function. In fact, if the Triac 19 suffers a short-circuit condition, the microprocessor 17 will detect such a condition on the basis of the signal delivered by the tachometer 6. Under the circumstances, the microprocessor 17 cannot energize the relay 5 and, as a consequence, de-energize the drum driving motor 7, 8, since the door could then be opened immediately. To switch off and stop the motor 7, 8, the microprocessor 17 will therefore energize the driving motor 13 of the programme sequence control switch until the contact 25 is brought to its opening position. The drum driving motor 7, 8 is in this way de-energized and,

upon the drum coming to a standstill, the microprocessor 17 will activate the relay 5 (by switching over the contact 26 from the position shown in Figure 2), thereby energizing the coil 22 that will open the switch 2 of the drum loading door.

Therefore, it can conclusively be said that when the relay 5 is energized (contact 26 switched over from the position shown in Figure 2) and the Triac 19 is not operating, the door interlock arrangement is energized, while the functional elements of the washing machine are separated from the power supply. When the relay 5 is on the contrary de-energized (contact 26 in the position shown in Figure 2) and the Triac is in any of its conditions, both the door interlock arrangement and the functional elements of the washing machine are energized.

The electric circuits appearing in Figures 1 and 2 emphasize a further innovatory feature which is capable of increasing both the simplicity and the reliability of the control arrangements of a clothes washing machine. As it can be noticed in the Figures, the wiping contacts 11 controlling the positioning of the inlet water flow distributor are connected to the electronic control module 4 and, as a consequence, the microprocessor 17, via two connection lines 20, 21 only.

Such a solution enables, through only two 220-volt signals coming from the contacts 11, various positions corresponding to the main phases of the operational cycles of the machine (ie. pre-wash/rinses, main wash, drying, etc.) to be recognized. Within each one of such phases there may be several positions of electrical actuation which the microprocessor 17 is able to recognize through a simple counting starting from the first one.

During a cycle, the microprocessor 17 is capable to recognize the starting position of a phase and can shift the corresponding actuator to the desired position; any subsequent shifting will be made forward and/or backward with respect to that position, using per se known means, based on said counting.

Should there be a power supply failure for any reason whatsoever, the microprocessor 17, after the power supply has been duly restored, will start from the current position and shift the inlet water flow distributor backward until a change of phase is read. This is needed by the microprocessor 17 in order to be able to identify the position in a univocal manner. A solution like this, which may for instance comprise a mechanical phase indicator means (flange), arranged coaxially with respect to the camshaft of the programme sequence control switch, and a clutch means being adapted to only act when the shaft is rotated clockwise, enables such an identification of position to be made without altering the associated phase indication.

Conclusively, the described solution enables various positions (of the inlet water flow distributor, the current cycle phase being performed, the electric contacts of the various functional elements of the machine, and the like) to be recognized by only using two connection

lines to the microprocessor. Furthermore, the signals coming from the water flow distributor position contacts 11 are more reliable since the latter are energized with alternating current at 220 Volts reducing oxidation problems.

It will be appreciated that the described circuits may undergo any modification or variation as considered to be appropriate, without departing from the scope of the present invention as defined in the appended claims.

Claims

1. Clothes washing machine of the rotating-drum type, comprising at least an arrangement (2,3) adapted to lock the drum loading door, an inlet water flow distributor to direct selectively the water flow to the various compartments of the detergent dispenser, a motor (7,8) to rotatably drive the drum, an electromechanical programme sequence control switch (9), all said components being connected to an electronic control arrangement (4) comprising a main relay (5), a drum rotation reversing relay (16), a microprocessor (17) and an electronic motor-control switch (19), characterized in that the driving motor (13) of the programme sequence control switch (9) is controlled, via the microprocessor (17) and the main relay (5), by two position signals transmitted on two connection lines (20,21) coming from respective contacts (11) of the programme sequence control switch, as well as by the door interlock arrangement (2,3) and the electronic switch (19) of the motor (7,8).
2. Clothes washing machine according to claim 1, **characterized in that** the two position signals of the contacts (11), in combination with the counting performed by the microprocessor (17), further constitute the means for recognizing the phases of the operational cycle performed by the machine.
3. Clothes washing machine according to claim 1 or 2, **characterized in that** the two position signals, in combination with the counting performed by the microprocessor (17), are associated to the motion of the motor (13) to form the means for identifying the phase of the cycle in the case of the power supply to the washing machine being restored after a failure.
4. Clothes washing machine according to claim 1, wherein the door interlock arrangement is of the delayed type, **characterized in that** the door interlock arrangement (2, 3) and the drum driving motor (7, 8) are connected to the main relay (5) via a switch-over contact (26).
5. Clothes washing machine according to claim 1,

wherein the door interlock arrangement is of the instantaneous type, **characterized in that** the coil (22) of the door interlock arrangement is directly connected to the electronic switch (19) of the motor (7, 8) via a terminal (24) of the electronic control module (4), and is further connected to the main relay (5) via a switch-over contact (26).

Patentansprüche

1. Waschmaschine vom Drehtrommel-Typ, die mindestens eine zum Verschließen der Trommel-Beladetüre geeigneten Anordnung (2, 3), einen Einlaßwasserstrom-verteiler zum wahlweisen Lenken des Wasserstromes zu den verschiedenen Fächern des Detergentien-Abgebers, einen Motor (7, 8) zum Dreh-Antrieb der Trommel und einen elektromechanischen Programmfolge-Steuerschalter (9) umfaßt, welche Komponenten alle mit einer elektronischen Steueranordnung (4) mit einem Hauptrelais (5), einem Trommeldrehungs-Umschaltrelais (16), einem Mikroprozessor (17) und einem elektronischen Motorsteuerschalter (19) verbunden sind,
dadurch gekennzeichnet, daß der Antriebsmotor (13) des Programmfolge-Steuerschalters (9) über den Mikroprozessor (17) und das Hauptrelais (5) durch Zweipositions-Signale gesteuert wird, die an zwei Verbindungsleitungen (20, 21) übertragen werden, welche von jeweiligen Kontakten (11) des Programmfolge-Steuerschalters kommen, wie auch durch die Türverriegelungs-Anordnung (2, 3) und den elektronischen Schalter (19) des Motors (7, 8).
2. Waschmaschine nach Anspruch 1, **dadurch gekennzeichnet**, daß die Zweipositions-Signale der Kontakte (11) in Kombination mit dem durch den Mikroprozessor (17) ausgeführten Zählvorgang weiter das Mittel zum Erkennen der Phasen des durch die Maschine ausgeführten Betriebszyklus bilden.
3. Waschmaschine nach Anspruch 1 oder 2, **dadurch gekennzeichnet**, daß die Zweipositions-Signale in Kombination mit dem durch den Mikroprozessor (17) ausgeführten Zählvorgang der Bewegung des Motors (13) zugeordnet sind, um das Mittel zur Identifizierung der Phase des Zyklus zu bilden, falls die Stromversorgung der Waschmaschine nach einem Versagen wieder hergestellt ist.
4. Waschmaschine nach Anspruch 1, bei der die Türverriegelungs-Anordnung vom Verzögerungstyp ist, **dadurch gekennzeichnet**, daß die Türverriegelungs-Anordnung (2, 3) und der Trommel-Antriebsmotor (7, 8) mit dem Hauptrelais (5) über einen Umschalterkontakt (26) verbunden sind.

5. Waschmaschine nach Anspruch 1, bei der die Türverriegelungs-Anordnung vom Momentantyp ist, **dadurch gekennzeichnet**, daß die Spule (22) der Türverriegelungs-Anordnung direkt mit dem Elektronikschalter (19) des Motors (7, 8) über eine Klemme (24) des elektronischen Steuermoduls (4) verbunden ist und weiter über einen Umschalterkontakt (26) mit dem Hauptrelais (5) verbunden ist.

Revendications

1. Machine à laver le linge du type à tambour rotatif, comprenant au moins un agencement (2, 3) adapté pour verrouiller la porte de chargement du tambour, un distributeur d'écoulement d'eau d'admission pour diriger, de manière sélective, l'écoulement d'eau vers les divers compartiments du distributeur de détergent, un moteur (7, 8) pour entraîner en rotation le tambour, un commutateur de commande de séquence de programme électromécanique (9), lesdits composants étant tous connectés à un agencement de commande électronique (4) comprenant un relais principal (5), un relais d'inversion de sens rotation de tambour (16), un microprocesseur (17) et un commutateur de commande de moteur électronique (19), caractérisée en ce que le moteur de commande (13) du commutateur de commande de séquence de programme (9) est commandé, via le microprocesseur (17) et le relais principal (5), par deux signaux de position transmis sur deux lignes de connexion (20, 21) provenant de contacts (11) respectifs du commutateur de commande de séquence de programme, ainsi que par l'agencement de verrouillage de porte (2, 3) et le commutateur électronique (19) du moteur (7, 8).
2. Machine à laver le linge selon la revendication 1, caractérisée en ce que les deux signaux de position des contacts (11), en combinaison avec le comptage effectué par le microprocesseur (17), constituent, de plus, les moyens destinés à reconnaître les phases du cycle de fonctionnement exécuté par la machine.
3. Machine à laver le linge selon la revendication 1 ou 2, caractérisée en ce que les deux signaux de position, en combinaison avec le comptage effectué par le microprocesseur (17), sont associés au mouvement du moteur (13) pour former les moyens destinés à identifier la phase du cycle dans le cas du rétablissement de l'alimentation de la machine à laver après une panne.
4. Machine à laver le linge selon la revendication 1, dans laquelle l'agencement de verrouillage de porte est du type à retard, caractérisée en ce que l'agencement de verrouillage de porte (2, 3) et le moteur

d'entraînement de tambour (7, 8) sont connectés au relais principal (5) via un contact de commutation (26).

5. Machine à laver le linge selon la revendication 1, dans laquelle l'agencement de verrouillage de porte est du type instantané, caractérisée en ce que la bobine (22) de l'agencement de verrouillage de porte est directement connectée au commutateur électronique (19) du moteur (7, 8) via une borne (24) du module de commande électronique (4) et est, de plus, connectée au relais principal (5) via un contact de commutation (26).

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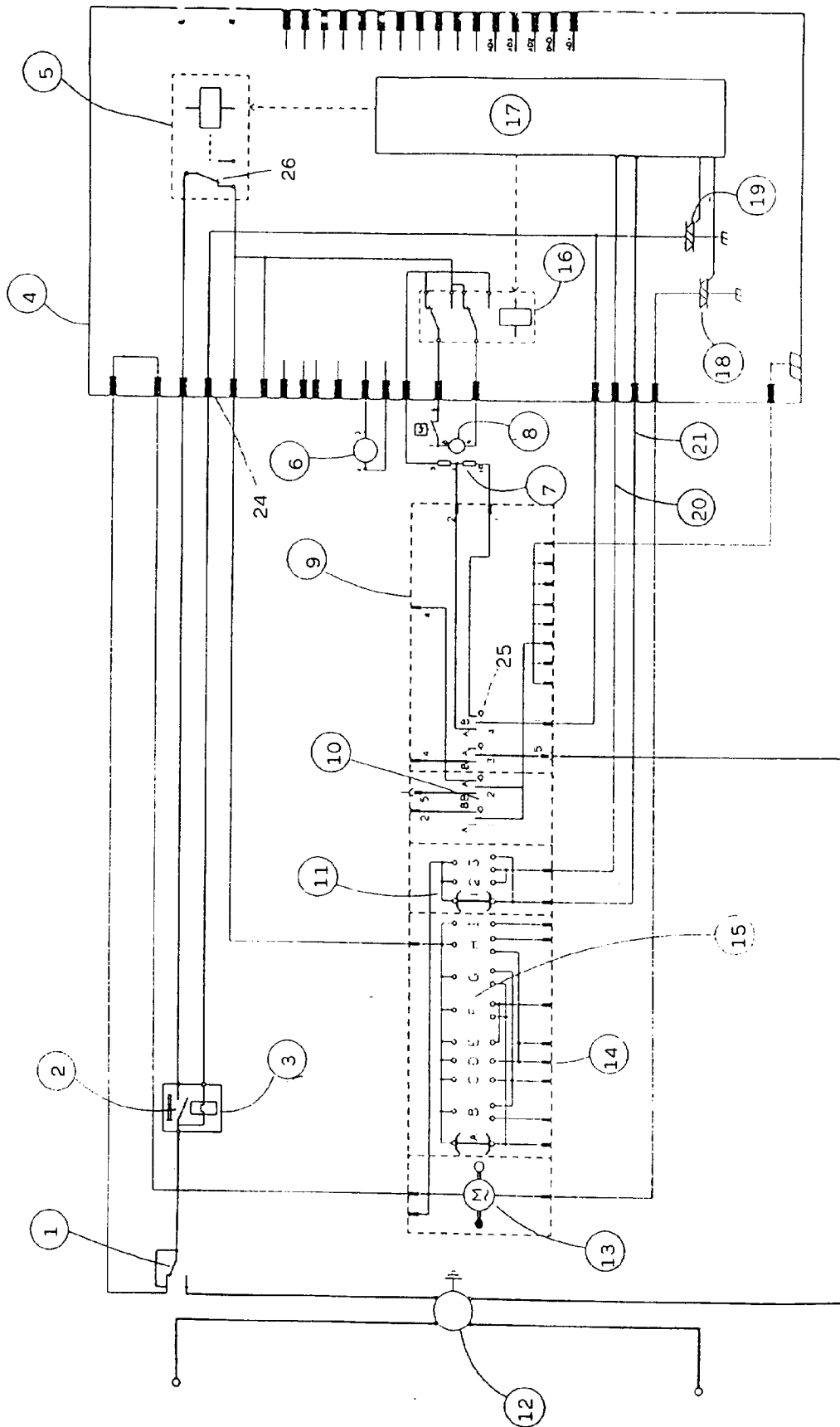
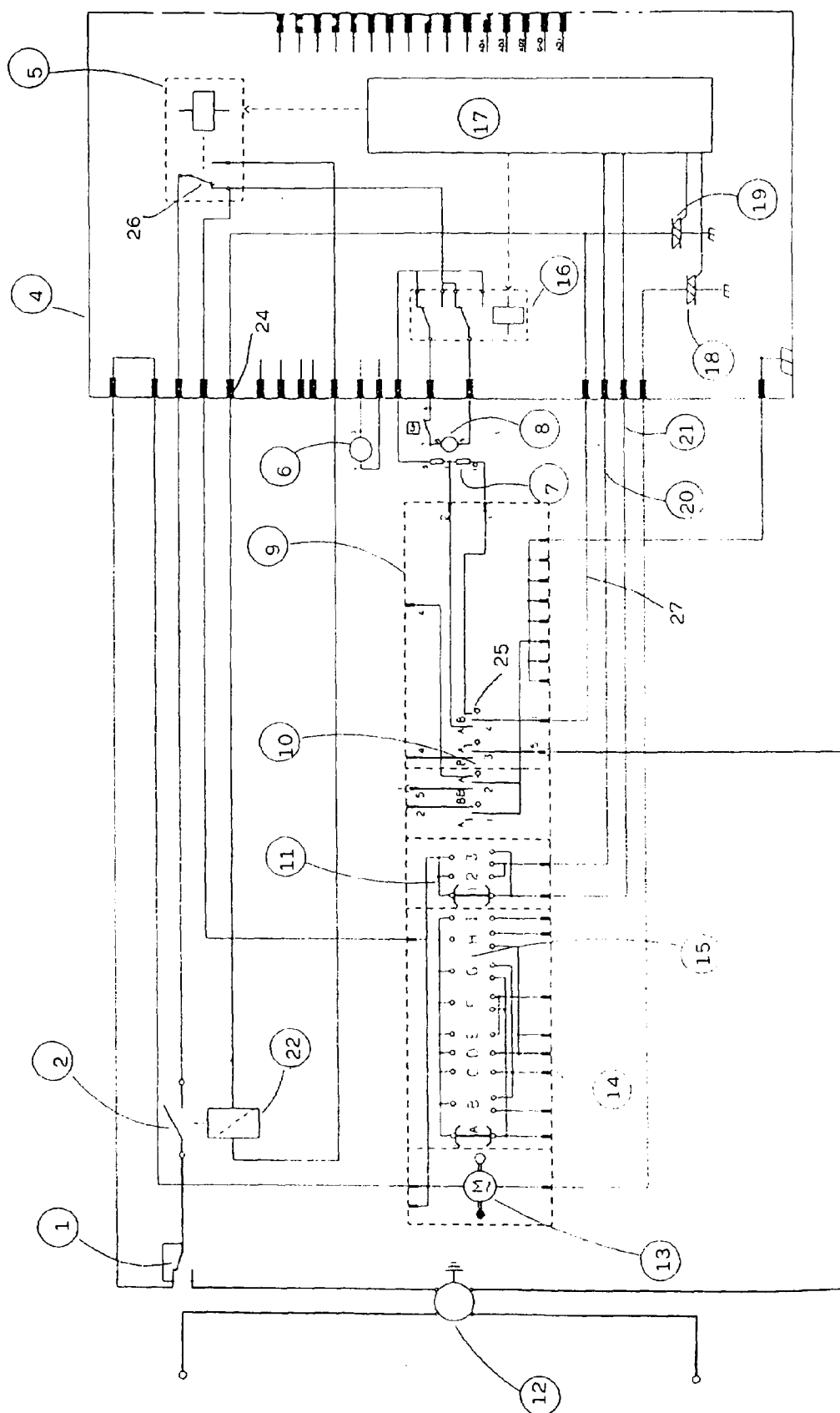


FIG. 1



FIC. 2