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(54) Control arrangement for washing machines.

(57) Control arrangement for washing machines comprising an electronic programme control device, an electric motor for driving the clothes holding drum, said motor being associated with two relays (15, 16) and controllable through a Triac (19), as well as comprising various electrically operating functional component parts (8, 9, 10) provided to perform the different duty steps of each washing programme selected.

Arrangement in which each relay is provided, apart from the respective movable electric contact (17b, 18a) for the energization of the electric windings (6, 7) of the drive motor (5), also with an additional respective movable electric contact (17a, 18b) which is separated from and actuatable at the same time as the other movable contact, for selectively switching on and off, ie. energizing and de-energizing, each functional component part (8, 9, 10) through a respective additional Triac (20).

The number of such expensive components as the Triacs used to control the various functional parts of the machine is in this way reduced to a minimum, while the electric circuit of the machine is at the same time simplified considerably.

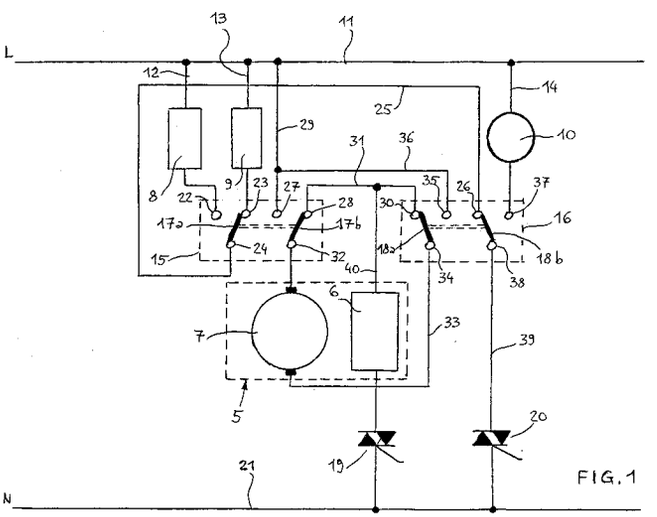

FIG.1

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The present invention relates to a control arrangement for washing machines, which is very simple in its construction and is capable of selectively switching on and off various functional component parts of said machines, while making use of a reduced number of semiconductor switching means, such as Triacs or the like, for this purpose.

Washing machines, such as in particular clothes washing machines or combined clothes washing and drying machines equipped with electronic programme control means, are currently provided with a respective semiconductor switching means (Triac or the like) included in the electrical circuit of each power-assisted functional component part of the machine (ie. the electromagnetic water inlet valves for hot and cold water fill, the drum driving motor, etc.), so as to switch on and off each one of said component parts at the right time, or according to an appropriate sequence, when any selected washing cycle is being performed.

Furthermore, in order to cause the drum driving motor to reverse its direction of rotation during the clothes washing phases of the cycle, the above cited washing machines are usually provided with at least a relay with electrical contacts of the break-before-make type, which are electrically connected with the electric windings of the drum driving motorin such a way as to reverse said direction of rotation of the motor according to traditional principles (for instance, by reversing the flow of the electric current through said motor windings).

However, while it certainly ensures a quite satsfactory operation of the various functional component parts of the machine, this construction of the electronic programme control arrangement proves on the other hand to be expensive, intricate and complicated owing to the presence of a plurality of such actuating members as said semiconductor switching means in combination with said control relays.

It is therefore desirable, and it at the same time is the purpose of the present invention, to provide a control arrangement for washing machines with a reduced number of actuating means of the above cited kind for causing the various functional component parts of the machine to be switched on and off in the way as is required to enable each washing cycle selected by the user to be satisfactorily performed by the machine.

Now, this control arrangement according to the invention 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:

- Figures 1, 2, 3 and 4 are schematics showing the electrical wiring diagram of the control arrangement for washing machines according to this invention, as illustrated for four different operation states.

The above cited Figures are schematics showing the electric wiring diagram of the control arrangement according to the present invention, such as it is installed in a washing machine, particularly a clothes washing machine or a combined clothes washing and drying machine with an electronic programme control means, comprising a wash tub containing a rotating clothes holding drum that is rotatably driven, in both of its directions of alternate rotation, by an electric motor of a traditional type (none of the above cited component parts is shown).

Referring now in particular to Figure 1, it can be noticed that is shows a condition in which the control arrangement according to the invention is set in its rest state and is electrically connected with a series of power-assisted functional component parts of the machine, which in this case include the electric driving motor 5 comprising an electric winding of the stator 6 and an electric winding of the rotor 7, as well as two electromagnetic water inlet valves 8 and 9 that are separated from each other and are provided to ensure cold and hot water supply to the machine, respectively, and an outlet or drain pump 10 for emptying the wash tub of the machine upon completion of the various pre-wash, main wash and rinse phases of the selected washing cycle, said electromagnetic water inlet valves 8 and 9 and said drain pump 10 being connected with the main conductor 11 of the electric power supply circuit of the machine through respective electrical conductors 12, 13 and 14.

The afore cited control arrangement according to the invention essentially includes two relay-type actuators 15 and 16 that are associated with the electric windings of the stator 6 and the rotor 7, respectively, to cause the electric driving motor 5 to be driven in its two alternate directions of rotation by the reversal of the flow of the electric current through said windings, said relay-type actuators being provided with a respective pair of electric contacts 17a, 17b and 18a, 18b which are movable and concurrently switchable to either of two different operational positions in the way and for the purposes that will be further described hereinafter.

The control arrangement according to the present invention further comprises a series of traditional-type semiconductor switching means to energize and de-energize in the due sequence the various functional component parts of the machine,

which in this case include two Triacs 19 and 20 or similar devices that are electrically associated with said relay-type actuators 15 and 16 and are so arranged as to be supplied across the main conductors 11 and 21 of the electric power supply circuit of the machine in the way and for the purposes that will be described hereinafter.

In particular, the moving contact 17a of the relay-type actuator means 15 is switchable to either one of the fixed contacts 22 and 23, which are in turn connected with the respective electromagnetic water inlet valves 8 and 9 through the conductors 12 and 13, whereas the remaining fixed contact portion 24 of said moving contact 17a is connected through an electric conductor 25 with a fixed contact 26 of the other relay-type actuator means 16.

Furthermore, the remaining movable contact 17b of said relay-type actuator means 15 is switchable to either one of the fixed contacts 27 and 28, which are in turn connected with the main conductor 11 through a conductor 29 and with a further fixed contact 30 of said relay-type actuator means 16 through a conductor 31, respectively, whereas the remaining fixed contact portion 32 of said movable contact 17b is connected through a conductor 33, which is in series with the winding of the rotor 7 of said electric drive motor 5, with a further fixed contact 34 of said relay-type actuator means 16.

The movable contact 18a of said relay-type actuator means 16 is in turn connected with the fixed contact 34 and is switchable to either one of its other fixed contacts 30 and 35, the latter being further connected through a conductor 36 with the afore described conductor 29.

Furthermore, the remaining movable contact 18b of said relay-type actuator means 16 is switchable to either one of the fixed contacts 26 and 37, the latter of which being connected with the drain pump 10 through the conductor 14, whereas the remaining fixed contact portion 38 of said movable contact 18b is connected with the main conductor 21 through a conductor 39, wherein the semiconductor switching means 20 is installed.

Finally, the winding of the stator 6 of said electric drive motor 5 is connected in series with the other semiconductor switching means 19 through a conductor 40 which is connected between the conductor 31 and the main conductor 21.

In the above decsribed resting state of the control arrangement according to the invention, the electronic programme sequence control device (not shown) of the machine is switched off, so that it keeps all the afore cited functional component parts of the machine de-energized, while the washing cycle to be performed is not allowed to start or progress.

Referring now to Figure 2, it can be noticed that it shows a condition reflecting a functional state of the machine in which the movable contacts 17a and 17b of the relay-type actuator means 15 are switched to establish a connection with the fixed contacts 23 and 28, respectively, whereas the movable contacts 18a and 18b of the relay-type actuator means 16 are switched to establish a connection with the fixed contacts 35 and 37, respectively, said electronic programme sequence control device of the machine being active in triggering both said semiconductor switching means 19 and 20.

Under these circumstances, said semiconductor switching means 19 causes then both electric windings of the rotor 7 and the stator 6 of said electric drive motor 5 to be connected in series and energized, so that they are therefore supplied with power by the main conductors 11 and 21 through the conductors 29 and 36, the movable contact 18a, the conductor 33, the movable contact 17b, the conductor 40 and said semiconductor switching means 19, with a resulting flow of the electric current in the direction indicated by the arrow A through said electric circuit, so that the rotor of said electric drive motor 5 is caused to rotate in a given direction.

As far as the electromagnetic water inlet valves 8 and 9 are concerned, neither of them is at this point energized, so that no further water quantity is let into the wash tub of the machine, in which the water needed for the washing phases of the selected cycle will have been filled previously, whereas the semiconductor switching means 20 is triggered so as to cause itself to be connected in series with the drain pump 10, across the two main conductors 11 and 21, through the conductor 14, the movable contact 18b of the relay-type actuator means 16 and the conductor 39, under resulting energization of this electric circuit, so that the drain phase to let out the water contained in the wash tub of the machine is started, said drain phase being then usually protracted until the water has been fully removed from said washing tub.

In order to let the rotor of said electric drive motor 5 be rotatably driven in the opposite direction as compared to the formerly described one, as this can in particular be seen in Figure 3, both relay-type actuator means 15 and 16 are switched over to their other operative position, in which the movable contacts 17a and 17b of the relay-type actuator means 15 are switched over to establish a connection with the fixed contacts 22 and 27, respectively, of said relay-type actuator means 15, whereas the movable contacts 18a and 18b of the other relay-type actuator means 16 are switched over to establish a connection with the fixed contacts 30 and 26, respectively, of said relay-type actuator means 16, while the electronic programme

sequence control device of the machine is active in keeping both semiconductor switching means 19 and 20 triggered.

Under the circumstances, then, said semiconductor switching means 19 causes both the electrical rotor and stator windings 7 and 6 of said electric drive motor 5 to be connected in series and energized accordingly, so that they are now supplied with power by the main conductors 11 and 21 through the conductor 29, the movable contact 17b of the relay-type actuator means 15, the conductor 33, the movable contact 18a of the relay-type actuator means 16, the conductor 40 and said semiconductor switching means 19. As a result, therefore, the electric current starts flowing in the direction shown by the arrow B through this electric circuit, so that the rotor of said electric drive motor is caused to rotate in the opposite direction as compared to the previous one.

The semiconductor switching means 20, in turn, no longer causes the drain pump 10 to be energized, as it did in the previous case. It on the contrary starts energizing the electromagnetic cold-water inlet valve 8 through the conductor 12, the movable contact 17a of the relay-type actuator means 15, the conductor 25, the movable contact 18b of the relay-type actuator means 16, the conductor 39 and said semiconductor switching means 20, so that cold water is filled from the mains into the washing tub of the machine until the pre-determined filling level of said water in said washing tub is reached.

Furthermore, under the above described conditions the electromagnetic hot-water inlet valve 9 is kept de-energized.

Referring now to Figure 4, it can be finally noticed that the relay-type actuator means 15 is switched over to its other operative condition as opposed to the operative condition illustrated in Figure 3, whereas the relay-type actuator means 16 is kept in the same operative condition as described for the previously illustrated case.

As a consequence of this switching state, both electric rotor and stator windings 7 and 6 of said electric drive motor 5 are de-energized along with the electromagnetic cold-water inlet valve 8 and the drain pump 10, whereas the electromagnetic hot-water inlet valve 9 is on the contrary energized through the conductor 13, the movable contact 17a of the relay-type actuator means 15, the conductor 25, the movable contact 18b of the relay-type actuator means 16, the conductor 39 and the semiconductor switching means 20, said electromagnetic hot-water inlet valve being then kept switched on by the microprocessor control means of the machine until the hot water filled into the washing tub of the machine has reached its pre-determined filling level.

In this way, each relay-type actuator means 15 and 16 has, apart from a respective movable contact 17b and 18a for energizing and de-energizing the windings of the electric drive motor, also at least a respective electric movable contact 17a and 18b for switching on and off one or more functional component parts of the machine, so that said relay-type actuator means actually perform a twofold function in controlling at the same time the switching state of both the windings of the electric drive motor of the machine, as it is currently the case, and one or more functional component parts of the same machine through a corresponding semiconductor switching means 20.

It will be therefore clearly appreciated that the control arrangement according to the present invention enables the number of control means (which are constituted by the semiconductor switching means 19 and 20) used to switch on and off the various functional component parts of the afore considered machines to be appreciably reduced owing substantially to the fact that a reduced number of such control means are used in combination with the electrical break-before-make contacts of the relay-type actuator means that are normally provided to control the energization and de-energization of the drive motor of the machines, thereby doing away with the need of using a special control means in connection with each one of the functional component parts to be switched on and off, as it is usually done in current machines, and providing an electrical circuit which is both simpler and less expensive in its construction.

Claims

1. Control arrangement for washing machines, in particular clothes washing machines or combined clothes washing and drying machines, comprising at least an electronic programme sequence control device to control the various washing programmes that may be selected, an electric motor to rotatably drive the clothes holding drum in either one of its directions of rotation, at least a first and a second electromechanical actuator means such as a relay or the like associated with the electric windings of the stator and the rotor, respectively, of said electric drive motor and provided with at least a respective movable electric contact adapted to electrically connect said windings with each other through at least a semiconductor switching means such as a Triac or similar switching device of a traditional type, as well as comprising a plurality of electrical functional component parts such as electromagnetic water inlet valves for hot and cold fill, drain pump, etc. arranged to be switched on and off under the

control of said electronic programme sequence control device as any selected washing programme is being performed, characterized in that said first and second electromechanical actuator means (15, 16) are provided with at least a further respective movable electric contact (17a, 18b) that is electrically separated from and actuatable at the same time as the corresponding respective movable electric contact (17b, 18a), said further movable electrical contacts (17a, 18b) being adapted to selectively energize each one of said functional electric component parts (8, 9, 10) of the machine separately from said electric windings of the stator (6) and the rotor (7) through at least a further semiconductor switching means (20) or similar switching device.

2. Control arrangement according to claim 1, characterized in that said further movable contact (17a) of said first electromechanical actuator means (15) is selectively switchable to electrically connect either one of said electromagnetic water-inlet valves (8, 9) for cold or hot water filling, and that said further movable contact (18b) of said second electromechanical actuator means (16) is selectively connectable with either said further movable contact (17a) or said drain pump (10).

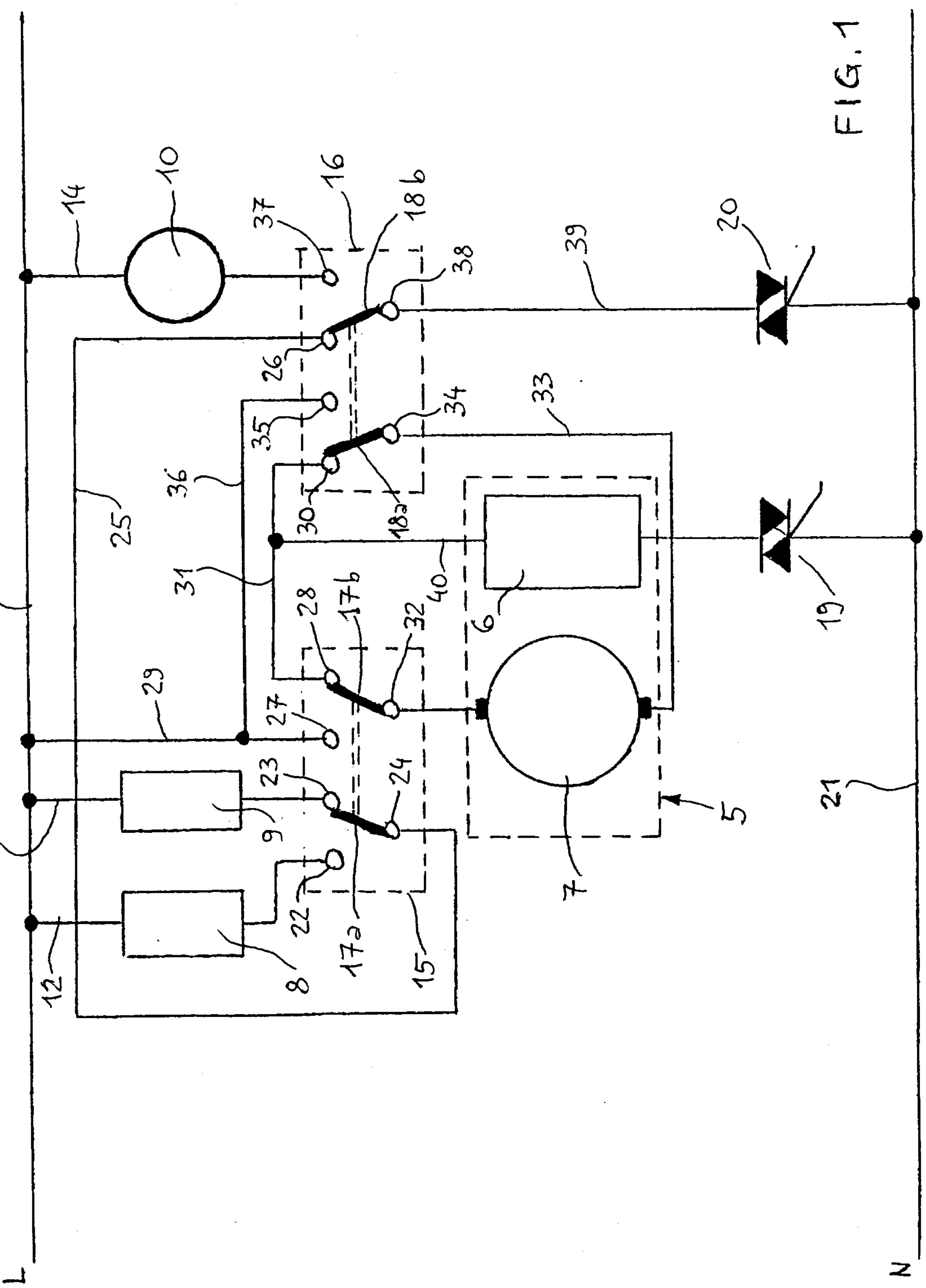
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FIG. 1

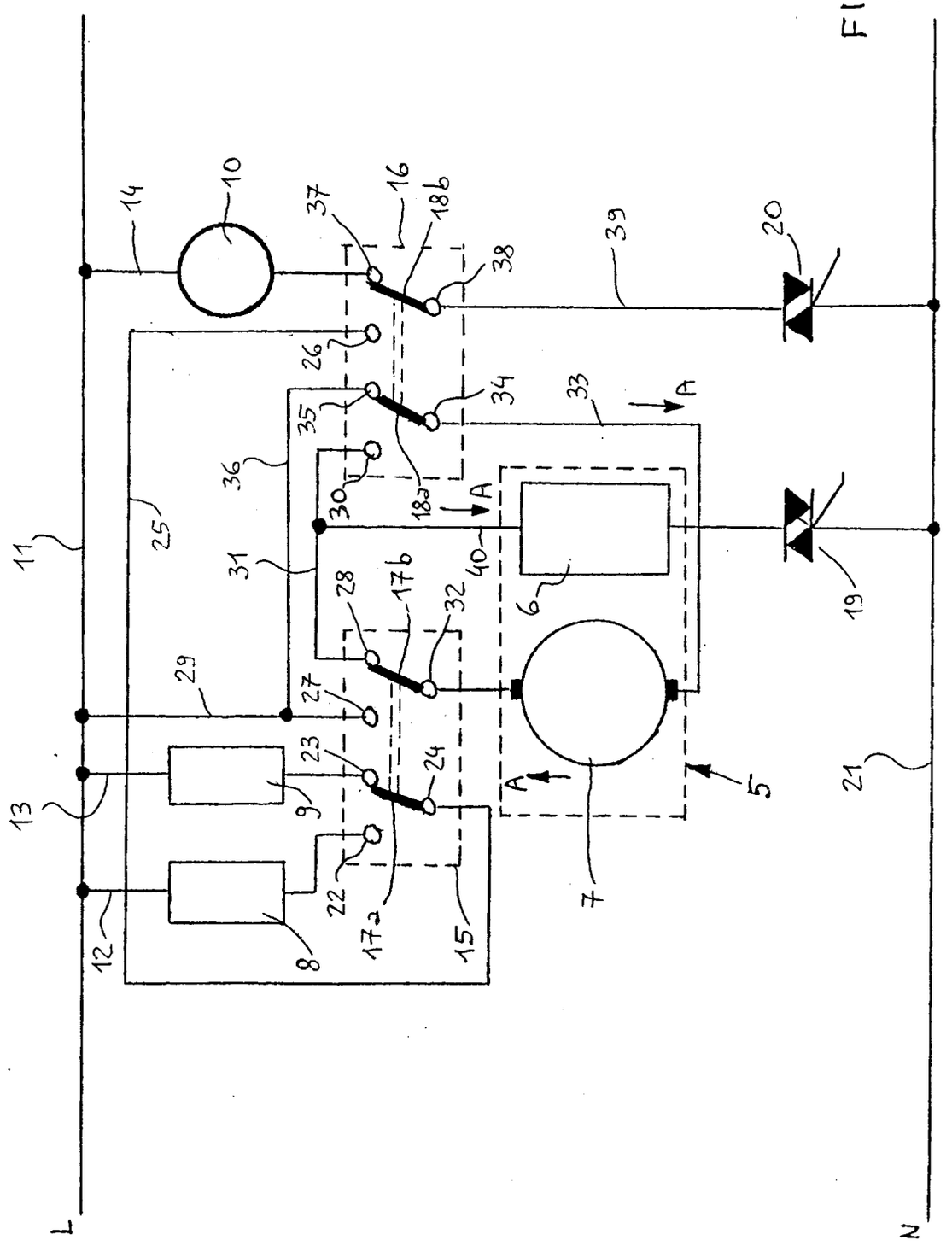
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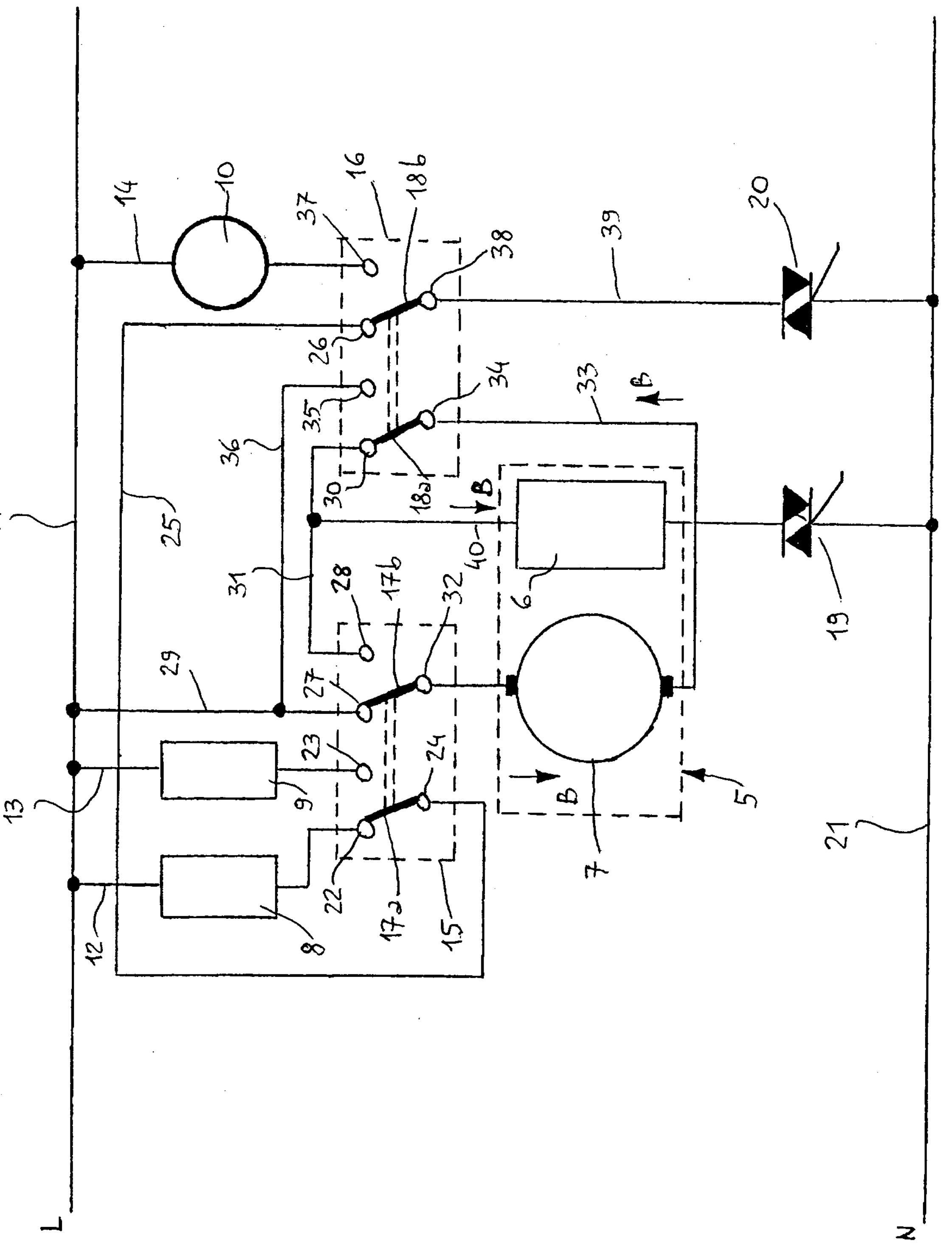
FIG. 2

FIG.3



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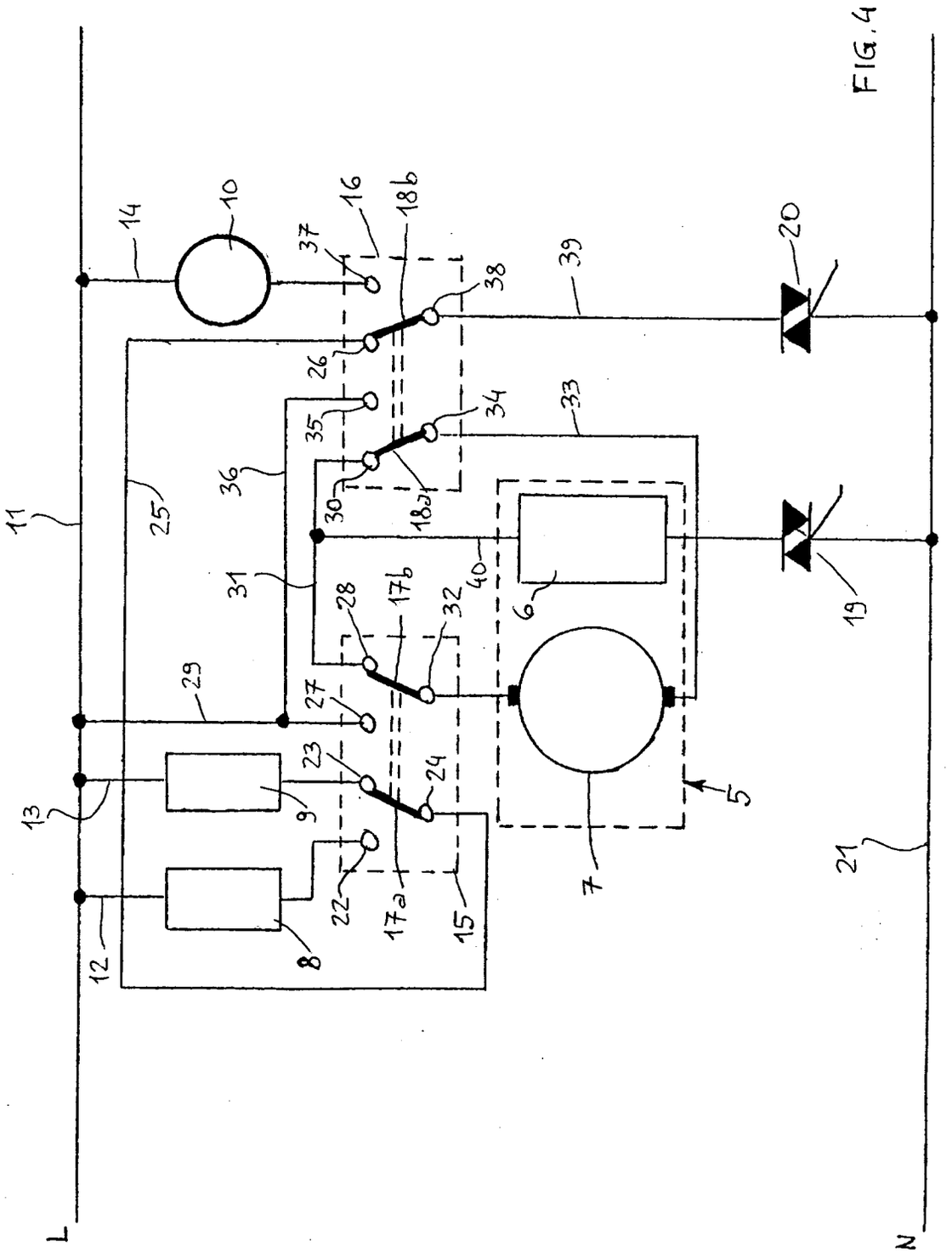
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FIG.4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 10 9789

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	EP-A-0 038 671 (SERVIS DOMESTIC APPLIANCES LIMITED) * page 13, line 19 - page 14, line 18; figure 3 *	1	D06F33/02
A	FR-A-1 555 955 (W. HOLZER) * claims; figure 2 *	1	
A	GB-A-944 048 (CONSTRUCTA-WERKE GMBH) * figure 1 *	1,2	
A	DE-A-1 815 705 (SIEMENS-ELECTROGERÄTE GMBH) * figure *	2	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	08 OCTOBER 1992	COURRIER G.L.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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