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(54) Method and device for locking the drum of a top-loading washing machine in a suitable position.

(57) A method for locking in a suitable position the drum of a top-loading washing machine comprising a housing (2) provided with an upper door (3), a tub (4) provided with a loading aperture (10) to which access is prevented by said door (3) and containing a rotary drum (5) also provided with a door (11) for access to its interior, said position being such that the aperture (10) of the tub (4) corresponds with the door (11) of the rotary drum (5), said washing machine also comprising an electric motor (6) preferably of direct current permanent magnet type which via a usual transmission member (8) drives the drum (5) such that it rotates within the tub (4), said method comprising a succession of stages in which:

a) at any moment during a wash cycle or at its termination the electric motor (6) is operated at low speed for a predetermined time period;

b) during this motor low-speed operation stage sensors sense the presence of a mobile element (19) rigid with the transmission member (8) which transmits the movement of the motor (6) to the drum (5);

c) when said mobile element (19) is sensed, the motor (6) is short-circuited so as to block its rotation either during or on termination of the low-speed stage, so blocking the rotation of the drum (5) within the tub (4).

Said method is implemented by a device applied to the washing machine of the aforesaid type, comprising means (15) for causing the motor to operate at low speed, presence sensing means (17) comprising a fixed part (18) and a mobile part (19) rigid with the member (8) which transmits motion from the electric motor (6) to the drum (5), and means (46) arranged to short-circuit the motor (6) so halting its rotation during said stage of low speed operation.

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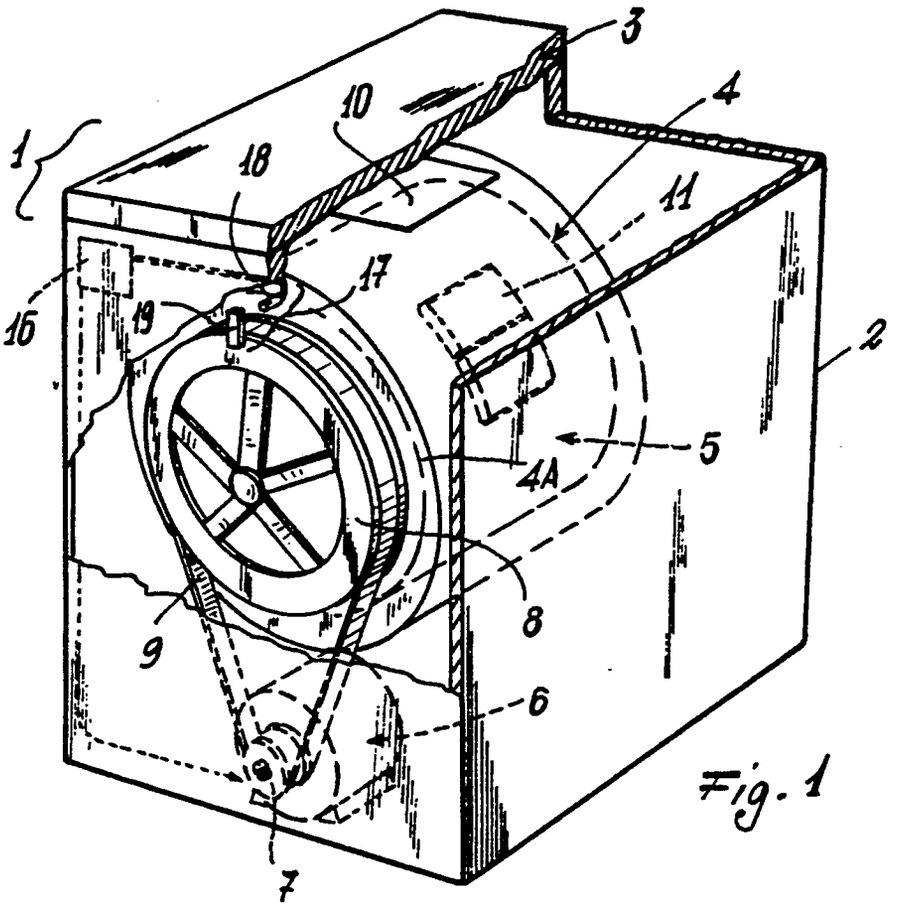

Fig. 1

This invention relates to a top-loading washing machine comprising a housing provided with a top door, a tub provided with a loading aperture to which access is prevented by said door and containing a rotary drum also provided with a door for access to its interior, an electric motor preferably of direct current (d.c.) permanent magnet type, arranged to operate said drum so as to cause it to rotate within the tub, and a programmer for controlling the various preset operating stages of the washing machine. Said machine is also provided with a timed delay means which prevents the housing door being opened for a determined time after the washing machine has stopped at the end of the selected wash cycle or after the washing machine has been halted by the user during this cycle.

In such washing machines of the state of the art it is not possible to easily gain access to the interior of the drum after termination of each wash cycle or following any stoppage of the machine. This is due to the fact that the drum often stops in a position in which its door does not correspond with the tub aperture. This means that the user has to manually rotate the drum, often with some force, until the positions of the tub aperture and the drum door correspond.

An object of the present invention is therefore to offer a method by which a user, after stoppage of the washing machine on termination of a wash cycle or during any stage thereof, can gain easy access to the interior of the washing machine drum without having to move the drum.

A further object of the present invention is to provide a washing machine having a device which enables the drum, after the machine has stopped, to halt in a position such that its door corresponds with the tub loading aperture.

These and further objects which will be apparent to the expert of the art are attained by a method for locking in a suitable position the drum of a top-loading washing machine comprising a housing provided with a top door, a tub provided with a loading aperture to which access is prevented by said door and containing a rotary drum also provided with a door for access to its interior, said position being such that the tub aperture corresponds with the door of the rotary drum, said washing machine also comprising an electric motor preferably of direct current permanent magnet type which via a normal transmission member drives the drum such that it rotates within the tub, said method comprising a succession of stages in which:

a) at any moment during a wash cycle or at its termination the electric motor is operated at low speed for a predetermined time period;

b) during this motor low-speed operation stage sensor means sense when the drum door substantially coincides with the tub aperture;

c) when substantial coincidence is sensed, the motor is short-circuited so as to block its rotation during or at the end of the low-speed stage, so blocking the rotation of the drum within the tub.

Said method is implemented by a device applied to the washing machine of the aforesaid type, comprising means for causing the motor to operate at low speed, presence sensing means comprising a fixed part and a mobile part associated rigidly with the drum, and means arranged to short-circuit the motor so halting its rotation during said stage of low speed operation.

The present invention will be more apparent from the accompanying drawing, which is provided by way of non-limiting example and in which:

Figure 1 is a cut-away perspective view of a top-loading washing machine;

Figure 2 is a simplified schematic diagram of an electrical circuit forming part of the washing machine of Figure 1, in which the electrical connections are shown by full lines whereas the non-electrical connections are shown by dashed lines.

In said figures the washing machine according to the present invention is indicated overall by the reference numeral 1 and comprises a housing 2 provided with a top door 3, a fixed tub 4 containing a rotary drum 5, and an electric motor 6, for example of the direct current (d.c) permanent magnet type, provided with an output or drive shaft 7. Said drive shaft 7 is arranged to rotate the drum via a pulley 8 connected to the drum and a usual transmission belt 9.

The tub 4 conventionally comprises a loading aperture 10, a usual door 11 also being provided on the drum 5.

The washing machine 1 (see Figure 2) is provided with a usual programmer or timer 12 and a usual timed delay means (represented by simplicity as a switch and indicated by 13 in said Figure 2) which in known manner keeps the door 3 locked against opening for a predetermined time after the washing machine has stopped at the end of the wash cycle or after it has been halted by the user during said cycle.

The programmer 12 and delay means 13 are connected into an operation command circuit 14 for the motor 6, which also comprises a command module 15 which in known manner controls the energisation mode of said motor during the various operating stages of the washing machine 1. The module 15 is controlled through a control line 15A by the timer or programmer 15 which can also form part of the command module.

According to the invention the washing machine, after any stoppage of its operation (either at the end of the wash cycle or during the cycle itself), provides for operating the motor 6 for a short time in order to bring the door 11 of the drum

5 into a position corresponding with the loading aperture 10 in the tub 4.

For this purpose, the command circuit 14 of the machine 1 is provided with a circuit part or control circuit 16 operationally connected to presence sensor means 17 disposed on the outside of the tub 4. Said sensor means 17 comprise (see Figure 1) a known presence sensor 18, for example an inductive proximity sensor, fixed in any known manner to a side 4A of the tub 4, and an element 19 such as a metal plate rigid with the pulley 8.

For simplicity, the control circuit 16 is shown also incorporating the command module 15 connected in any manner to the presence sensor 18. This connection is shown by dashed lines 60 and 61 in Figure 2.

Specifically, the command circuit 14 comprises two circuit branches 20 and 21 carrying the two alternating mains voltage phases V_A. This voltage is made into d.c. voltage by a usual rectifier (not shown) before it reaches the terminals of the d.c. motor 6. The timer 12 is connected to said branches 20 and 21 (known hereinafter as the main lines) via the branches 12A and 12B.

Two mobile contacts 22 and 23 act on the main lines 20 and 21 under the control of a usual switch or pushbutton 24 positioned for example on the face of the washing machine housing 2. The various components of the command circuit 14 are powered by closing said mobile contacts 22 and 23, power being removed on opening them.

A relay 28 is connected to said lines 20 and 21, namely at nodes 26 and 27 thereof, whereas the module 15 is connected to nodes 29 and 30, and is also connected via branches 31 and 32 to the terminals of the d.c. motor 6.

Finally, the (door opening) delay means 13 which in known manner can be a catch operated by a bimetallic strip heated by an electrical resistance element, is connected to the line 21.

From a node 36 upstream of the mobile contact 23 in the line 21 there extends a line 37 comprising two mobile contacts 38A and 28A. The line 37 terminates within the command module 15.

Said module 15 also receives a line 42, comprising two mobile contacts 38B and 28B, which commences upstream of the mobile contact 22 at a node 43 located in the line 20 upstream of the mobile contact 22. The lines 37 and 42 will be known hereinafter as branch lines.

The mobile contacts 38A and 38B are operated by a relay 38 connected to the branch line 42 upstream of the mobile contact 38B via a branch 44, and to the line 21 via a branch 45. The branch 44 comprises one mobile contact 28D whereas the branch 45 comprises two mobile contacts 46A, of delayed opening, and 28C.

The first of these latter contacts is operated by a relay 46, and the second together with the contact 28D of the branch 44 is operated by the relay 28 which also operates the mobile contacts 28A and 28B. Specifically, the opening (or closure) of the mobile contact 28D is delayed with respect to the opening and closure of said contact 28C, the contacts 28A and 28B also advantageously being of delayed closure. A further self-maintaining contact 38C is connected into a branch 47 in parallel with the mobile contact 28C and is also operated by the relay 38.

The relay 46 is connected via branches 48 and 49 to the command module 15 from which it is powered when this latter is itself powered through the branch lines 37 and 42. Said relay 46 operates a mobile contact 46B provided in a branch 50 running parallel to the electric motor 6.

In particular, the branch 49 connects the relay 46 to a power line (not shown) connected to the presence sensor 18 which as stated is connected to the command module 15.

By means of a mobile contact (not shown) controlled by it, the presence sensor operates on the branch 49 to enable the relay 46 to be powered, as explained hereinafter, in order to arrest the movement of the motor 6 when desired.

It will now be assumed that a wash cycle is to be commenced. To do this the switch 24 of the command circuit 14 (which in Figure 2 is shown in the state in which the washing machine 1 is turned off, ie in the non-use position) is turned on to close the mobile contacts 23 and 24. As a result of this the relay 28 is energized and closes the mobile contacts 28C and 28D to open the mobile contacts 28A and 28B. In this manner the relay 38 is connected to the main lines 20 and 21 and is energized to close the mobile contacts 38A, 38B and 38C. With the closure of the contacts 22 and 23 the circuit 14 is powered and the machine can execute the desired wash program.

It will now be assumed that the drum 5 of the washing machine 1 is to be emptied after this latter has terminated the said wash cycle, or that further articles are to be placed in the drum for washing.

In either case, the user halts the operation of the washing machine by operating the switch 24 so as to open the mobile contacts 22 and 23. If the machine has reached the end of the wash cycle, this operation of the pushbutton can be advantageously done automatically in known manner by the timer 12.

Under such conditions the door 11 of the drum 5 can be in any position relative to the loading aperture 10 of the tub 4. It will be assumed that these positions do not correspond so that the user is unable to gain easy access to the interior of said drum. On opening the contacts 22 and 23 there is a consequent lack of power in the main lines 20

and 21 of the circuit 14.

As there is on power in the lines 20 and 21 downstream of the contacts 22 and 23, the relay 28 is de-energized and closes the mobile contacts 28A and 28B with a delay, whereas it opens the mobile contact 28C. The mobile contact 28D opens with delay while keeping the relay 38 energized by the power reaching it via the branches 44 and 47.

The delay in the closure of the mobile contacts 28A and 28B is chosen advantageously such as to enable the motor 6 to stop completely (so that the drum 5 also stops) when the switch 24 is opened during a usual wash cycle of the washing machine.

As the contacts 38A and 38B are already closed, the closure of the mobile contacts 28B and 28A causes the command module to receive power via the branch lines 37 and 42. The module 15 acts on the motor 6 to rotate it slowly. As a result of this, the motor 6 rotates the pulley 8 by means of the belt 9. This rotation of the pulley 8 (and thus of the drum 5) takes place at a (low) speed substantially close to that of the wash stage.

Because of the rotation of the pulley 8, at a certain point the element 19 passes in front of the presence sensor 18 which as a result of this "presence sensing" feeds a signal to the module 15 and thus, for the aforesaid reasons, to the relay 46 via the branch 49. It should be noted that the "presence sensing" takes place only during this low-speed rotation of the pulley 8 and does not take place during any other stage of operation of the washing machine 1.

The relay 46 is therefore powered via the branch 49 and branch 48 from the module 15. This relay therefore opens the mobile contact 46A with a delay and, importantly, more or less instantaneously closes the mobile contact 46B in the branch 50 in parallel with the motor 6, so short-circuiting it. This short-circuiting substantially instantaneously nullifies the counter-electromotive force of the motor in the presence of a magnetic field generated by the permanent magnets of the motor 6 itself, so blocking the motor and consequently the rotation of the pulley 8 and drum 5.

As the element 19 is disposed on the pulley 8 substantially in a position corresponding with the position of the door 11 on the drum 5 whereas the position sensor 18 is disposed on the tub 4 in a position substantially corresponding with the loading aperture 10 in the tub, the practically instantaneous blockage of the motor 6 due to the presence of said element 19 in front of the sensor 18 causes the drum 5 to stop in a position such that its door 11 corresponds with the loading aperture 10 in the tub 4.

Finally, with the delayed opening of the mobile contact 46A the relay 38 is de-energized to open the contacts 38A and 38B and thus interrupt the power supply to the module. It should be noted that the delay with which the contact 46A opens is less than the time during which the door opening delay means 13 prevents access to the washing machine tub. Furthermore, the delayed opening of the contact 46A can take place either simultaneously with or before the delayed opening of the contact 28D, which advantageously opens before the door opening delay means 13 allows the user to gain access to the tub.

Advantageously, the delay-operated contact 28D is not operated by the relay 28 but by the door opening delay means 13 itself. In this manner, when this allows the washing machine door to be opened it opens the contact 28D so that no member is electrically live.

However, according to a modification of the circuit 14, the mobile contact 28D is not of delayed opening but instead is operated by the relay 28 in such a manner as to open instantaneously with the contact 28C. In this modification the branch 44 connecting the contact 28D to the relay 38 is connected to the branch line 42 at two separate points, one upstream and one downstream of the mobile contact 38B.

On opening the switch 24 the relay 28 is de-energized to immediately open the mobile contact 28D. However, the relay 38 remains energized because it is connected (as already described) to the main line 21 through the branch 45 and to the main line 20 through that part of the line 42 comprising the mobile contact 38B (closed), and the branch 44. In this manner current can flow along the branch lines 37 and 42 to power the module 15 with the aforesaid consequences.

Because of the movement of the drum 2 within the tub 4 the user can easily gain access to the interior of the drum when the door 3 is released.

If the washing machine 1 is halted during a wash cycle for the purpose of placing further articles into its drum 5 for washing, the user having done this closes the door 11 of the drum 5 and then closes the door 3, after which he operates the switch 24 to return power to the main lines 20 and 21 of the circuit 14. In this manner the washing machine returns to operation to complete the wash cycle. It should be noted that after the motor 6 has stopped and the contacts 38A and 38B have opened the relay is de-energized. Consequently the mobile contact 46B is open to remove the short-circuit from the motor 6 and allow it to re-operate. The method according to the invention and a washing machine 1 constructed in accordance with the present invention obviate the aforesaid drawbacks of top-loading washing machines of the state of the art.

Claims

1. A method for locking in a suitable position the drum of a top-loading washing machine comprising a housing (2) provided with an upper door (3), a tub (4) provided with a loading aperture (10) to which access is prevented by said door (3) and containing a rotary drum (5) also provided with a door (11) for access to its interior, said position being such that the aperture (10) of the tub (4) corresponds with the door (11) of the rotary drum (5), said washing machine also comprising an electric motor (6) preferably of direct current permanent magnet type which via a usual transmission member (8) drives the drum (5) such that it rotates within the tub (4), said method being characterised by comprising a succession of stages in which:

a) at any moment during a wash cycle or at its termination the electric motor (6) is operated at low speed for a predetermined time period;

b) during this motor low-speed operation stage, sensors (17) sense when the door (11) of the drum (5) substantially coincides with the aperture (10) of the tub (4);

c) when substantial coincidence is sensed, the motor (6) is short-circuited so as to block its rotation either during or on termination of the low-speed stage, so blocking the rotation of the drum (5) within the tub (4).

2. A device for implementing the method claimed in claim 1 applied to a top-loading washing machine (1) comprising a housing (2) provided with an upper door (3), a tub (4) provided with a loading aperture (10) to which access is prevented by said door (3) and containing a rotary drum (5) also provided with a door (11) for access to its interior, an electric motor (6) preferably of direct current permanent magnet type which via a usual transmission member (8) drives the drum (5) such that it rotates within the tub (4), a programmer (12) and a timed delay means (13) arranged to prevent access to the tub (4) for a predetermined time after stoppage of the machine (1), characterised by comprising means (15) for causing the electric motor (6) to operate at low speed, presence sensing means (17) comprising a fixed part (18) and a mobile part (19) rigid with the member (8) which transmits motion from the electric motor (6) to the drum (5), and means (46) arranged to short-circuit the motor (6) so halting its rotation during said stage of low speed operation.

3. A device as claimed in claim 2, characterised in that the means (46) arranged to short-circuit the electric motor (6) are connected into a control circuit (16), the presence sensor means (17) being connected to said circuit.

4. A device as claimed in claim 2, characterised in that the means for causing the electric motor (6) to operate at low speed are a pre-programmed command module (15).

5. A device as claimed in claim 4, characterised in that the command module (15) for the electric motor (6) is controlled by the programmer (12) via a command line (15A).

6. A device as claimed in claim 3, characterised in that the means arranged to short-circuit the electric motor (6) are a relay (46) acting on a mobile contact (46B) provided in a branch (50) in parallel with the electric motor (6).

7. A device as claimed in claims 2 and 6, characterised in that the relay (46) is connected to the command module (15) of the electric motor (6) and to the presence sensor (17), and is powered via said module, the sensor means (17) acting on one of the branches (49) carrying said power so that said power is either present or absent.

8. A device as claimed in claim 2, characterised in that the sensor means (17) comprise a fixed position sensor (18) disposed in a side (4A) of the tub (4) and cooperating with a mobile element (19) rigid with the member (8) which transmits motion from the electric motor (6) to the drum (5), said position sensor (18) being fixed to the tub (4) in a position corresponding to that of the loading aperture (10) of said tub (4), and said mobile element (19) being disposed on the transmission member (8) in a position corresponding with that of the door (11) of the drum (5).

9. A device as claimed in claim 3, characterised in that the control circuit (16) is connected to an operation command circuit (14) for the washing machine motor (6) which comprises the programmer (12) and the timed delay means (13), said control circuit (16) comprising branch lines (37, 42) for powering the operation command means (15) for the electric motor (6), said lines (37, 42) carrying voltage to said command circuit (14).

10. A device as claimed in claims 3, 6 and 9, characterised in that the control circuit (16) comprises a relay (28) connected to the main lines (20, 21) powering the command circuit (14) and a relay (38) operating mobile contacts (38B, 38A) which enable the branch lines (37, 42) to be connected to the mains when the main lines (20, 21) are interrupted by the operation of mobile contacts (22, 23) by a pushbutton (24) positioned on the housing (2) of the washing machine (1) or directly by the programmer (12).

11. A device as claimed in claim 10, characterised in that the relay (28) connected to the main powering lines (20, 21) is disposed downstream of the mobile contacts (22, 23) operable by the pushbutton (24), and operates delayed-closure contacts (28A, 28B) connected into the branch lines (37, 42) and a mobile contact (28C) connected into a branch (45) terminating at the relay (38) which

operates the mobile contacts (38A, 38B) connected into the branch lines (37, 42), this latter relay being connected by a branch (44) to one of said branch lines (42).

12. A device as claimed in claim 11, characterised in that the delayed-closure mobile contacts (28A, 28B) in the branch lines (37, 42) close with a delay exceeding the time period required for the motor (6) and drum (5) to completely come to rest after the washing machine (1) has been halted during any stage of the wash cycle.

13. A device as claimed in claim 11, characterised in that a delayed-operation mobile contact (28D) is connected into that branch (44) which connects the relay (38) operating the mobile contacts (38A, 38B) in the branch lines (37, 42) to one of said branch lines (42).

14. A device as claimed in claim 13, characterised in that said delayed-operation mobile contact is operated by the relay (28) connected to the main powering lines.

15. A device as claimed in claim 13, characterised in that the delayed-operation mobile contact is operated by timing means (13).

16. A device as claimed in claim 11, characterised in that a mobile contact (28D) operated by the relay (28) connected to the main powering lines is connected into that branch (44) which connects the relay (38) operating the mobile contacts (38A, 38B) in the branch lines (37, 42) to one of said branch lines (42).

17. A device as claimed in claim 16, characterised in that the branch (44) comprising the mobile contact (28D) is connected to the branch line (42) at two separate points situated upstream and downstream of one of the mobile contacts (38B) of the relay (38) in said branch line.

18. A device as claimed in claims 3 and 10, characterised in that the means (46) arranged to short-circuit the electric motor (6) operate a delayed-operation mobile contact (46A) connected into the branch (45) comprising the mobile contact (28C) operated by the relay (28) connected to the main powering lines.

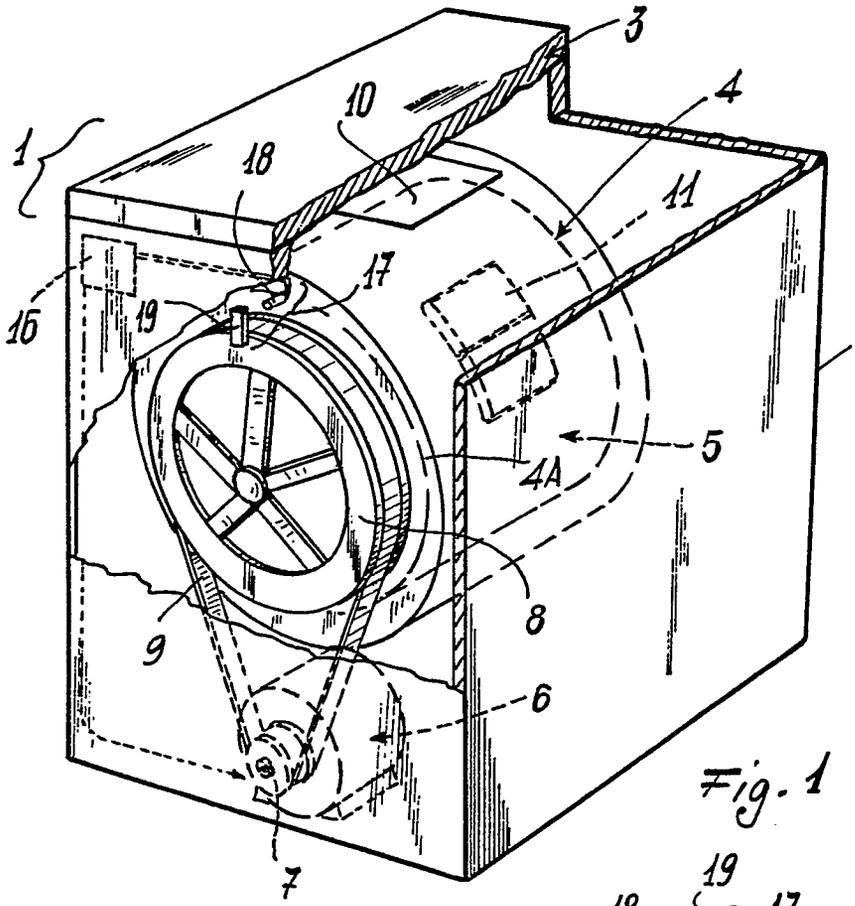
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Fig. 1

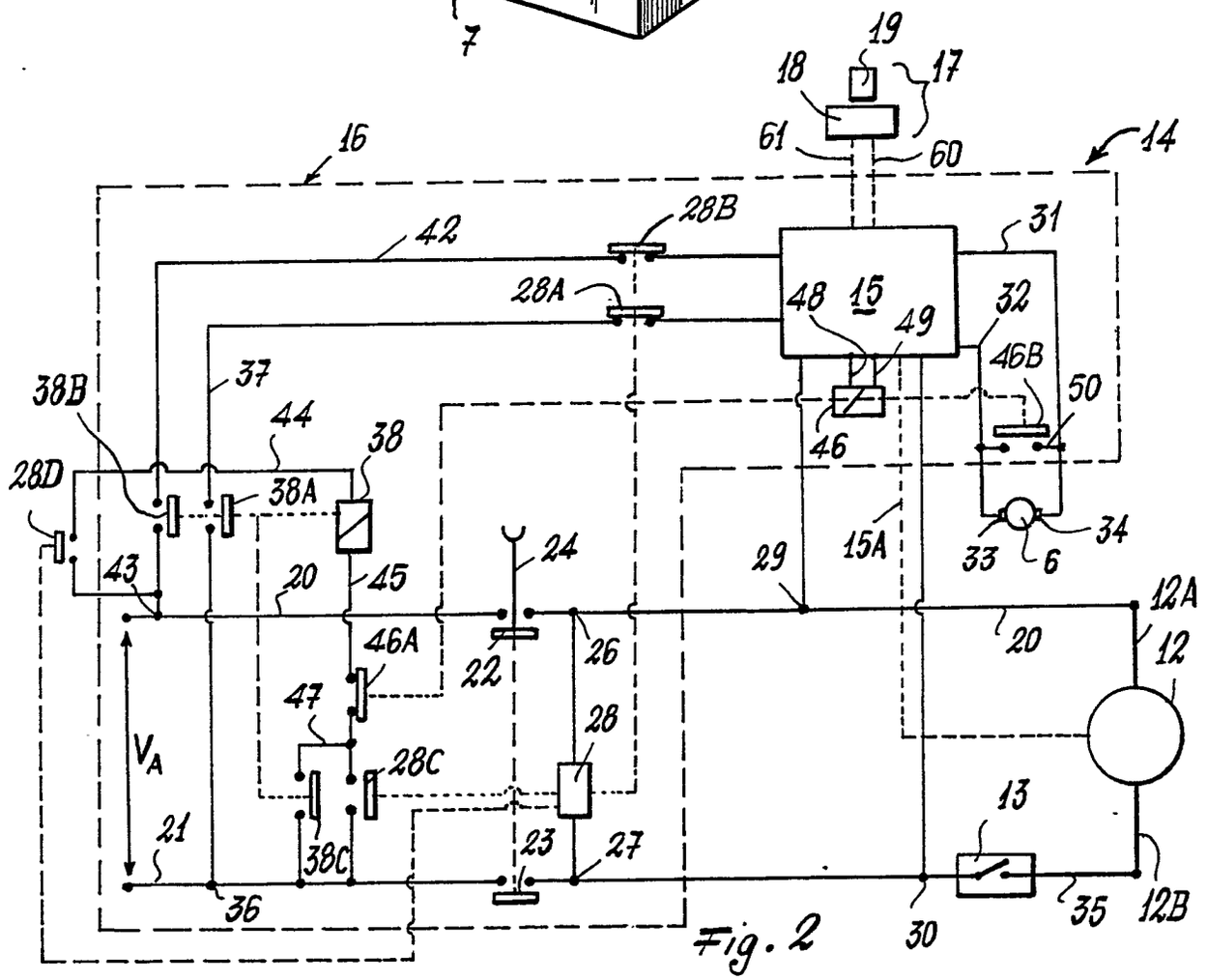
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Fig. 2

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EUROPEAN SEARCH REPORT

Application Number

EP 90 20 0527

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)
Y	FR-A-2522343 (THOMSON-BRANDT S.A.) * page 2, line 23 - page 4, line 23 *	1-3	D06F37/30
A		4, 5, 8	
Y	FR-A-2300837 (SOCIETE CHALECTRO S.A.) * page 1, line 1 - page 1, line 27 *	1-3	
A	* page 2, line 11 - page 2, line 23 *	6	
A	FR-A-2296719 (SOCIETE CHALECTRO S.A.)		

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	11 JUNE 1990	GOODALL C.J.

CATEGORY OF CITED DOCUMENTS

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