



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.05.2012 Bulletin 2012/20

(51) Int Cl.:
D06F 33/02 (2006.01) **D06F 37/42** (2006.01)
A47L 15/42 (2006.01)

(21) Application number: **11187978.9**

(22) Date of filing: **04.11.2011**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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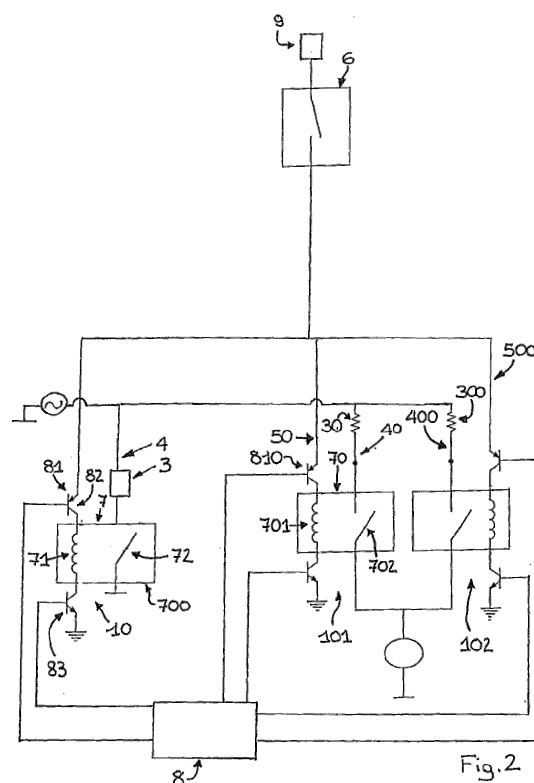
(30) Priority: **11.11.2010 IT RN20100071**

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(54) **Household appliance for carrying out a treatment on articles**

(57) An electrical household appliance for carrying out a treatment on articles comprises:

- a product treatment compartment (2);
- a door (20) providing access to the treatment compartment (2), the door (20) being openable by a user even during the product treatment;
- a first power line (4) which supplies power to a first electrical load (3);
- a first electrical control line (5) for controlling the first electrical load (3);
- a door open/door closed switch (6) operatively connected to the first electrical control line (5);
- control means (10) for the first electrical load (3) which in turn comprise a first electro-mechanical switch (7) comprising an electrical component (71) inserted along the first electrical control line (5) and a mechanical component (72) located along the first power line (4) and able to move between a first and a second position in which it respectively prevents or allows the passage of current along the first power line (4).



Description

[0001] This invention relates to an electrical household appliance for carrying out a treatment on articles.

[0002] There are prior art tumble dryers comprising:

- a compartment for the treatment of articles;
- a door providing access to the treatment compartment, allowing at least insertion of the articles before the treatment and removal of the articles after the treatment, the door being openable by a user even during treatment of the articles;
- an electric motor;
- a power line which supplies power to the electric motor;
- a door open/door closed switch located on the power line; door closing causing closure of the door switch, and door opening causing opening of the door switch. Consequently, opening the door is a sufficient condition to interrupt the power supply to the electric motor. That is extremely advantageously, since it increases the safety of the electrical household appliance, minimising the risk that, after opening the door, the user may be injured by accidental contact with the rotating drum. In particular, that increase in safety is also achieved in the absence of a device which locks the door and absolutely prevents the door from being opened during the drying cycle. Indeed, such a locking device, as well as adding to the cost, would prevent door opening from the inside of the treatment compartment (something which, in contrast, is important to prevent incidents involving children or animals which may get into the treatment compartment while the electrical household appliance is switched off).

[0003] However, such construction solutions are not without disadvantages linked to the cost of the door open/door closed switch located along the power supply line of the electric motor.

[0004] In this context, the technical purpose which forms the basis of this invention is to propose an electrical household appliance that overcomes the above mentioned disadvantages of the prior art.

[0005] The aim of this invention is to provide an electrical household appliance which can optimise its components.

[0006] In particular, the aim of this invention is to provide an electrical household appliance which can optimise its components while simultaneously optimising operating safety.

[0007] The technical purpose indicated and the aims specified are substantially achieved by an electrical household appliance comprising the technical features described in one or more of the appended claims.

[0008] Further features and advantages of the invention are more apparent in the non-limiting description which follows of a preferred non-limiting embodiment of

an electrical household appliance illustrated in the accompanying drawings, in which:

- Figure 1 is a schematic view of an electrical household appliance according to this invention;
- Figure 2 is a portion of a wiring diagram integrated in the electrical household appliance according to this invention.

[0009] With reference to the accompanying drawings, the numeral 1 denotes an electrical household appliance for carrying out a treatment on products. Typically, the electrical household appliance 1 is a tumble dryer or a laundry washing machine or a dishwasher or an oven or a food refrigerator device such as a fridge, a freezer, a combined fridge - freezer structure.

[0010] The electrical household appliance 1 comprises:

- a product treatment compartment 2 (based on what is indicated above, said treatment could be washing, drying, refrigerating, cooking);
- a door 20 providing access to the treatment compartment 2, allowing at least insertion of the products before the treatment and removal of the products after the treatment. The door 20 can be opened by a user even during the execution of the product treatment (for example, in the case of a tumble dryer the door 20 can even be opened during rotation of a rotary drum containing the clothing to be dried, although, as is explained below, opening the door 20 interrupts rotation of the drum) or during the execution of a subphase of said treatment (typical situation for a laundry washing machine).

[0011] The electrical household appliance 1 comprises a first electrical load 3 (as illustrated in more detail below, the first electrical load 3 could be an electric motor, a resistance, etc.). Typically, the first load 3 is a resistance which is critical for safe operation of the electrical household appliance 1.

[0012] The electrical household appliance comprises a first power line 4 which supplies power to the first electrical load 3.

[0013] The electrical household appliance 1 also comprises:

- a first electrical control line 5 for controlling the first electrical load 3. As shown by way of example in the accompanying drawing, the first electrical control line 5 is separate from the power line 4;
- a door open/door closed switch 6 operatively (normally electrically) connected to the first electrical control line 5. With the door 20 open, the door open/door closed switch 6 is in a first configuration in which it prevents current from passing through the first electrical control line 5, with the door 20 closed, the switch is in a second configuration in which it does

not prevent current from passing through the first electrical control line 5 (in the second configuration the switch 6 allows, in the absence of other constraints such as further switches, the passage of current through the first electrical control line 5). In the first configuration, the door open/door closed switch 6 is open, in the second configuration it is closed. Appropriately, the switch 6, if in the second configuration, has direct current flowing through it. Advantageously, the switch 6 is sized to withstand voltages and currents which are less than those present along the first power line 4;

- control means 10 for the first electrical load 3 which in turn comprise a first electro-mechanical switch 7 comprising an electrical component 71 inserted along the first electrical control line 5 and a mechanical component 72 located along the first power line 4 and able to move between a first and a second position in which it respectively prevents or does not prevent the passage of current along the first power line 4, the mechanical component 72 of the first electro-mechanical switch 7 being controlled by the electrical component 71 of the first electro-mechanical switch 7. In the second position the mechanical component 72, in the absence of other constraints, allows the passage of current along the first power line 4. Appropriately, the failure of current to pass through the electrical component 71 of the first electro-mechanical switch 7 causes the mechanical component 72 of the first electro-mechanical switch 7 to adopt the first position. The mechanical component 72 of the first electro-mechanical switch 7 is in series with the first load 3. The electrical component 71 and the mechanical component 72 of the first electro-mechanical switch 7 are functionally interposed between the door open/door closed switch 6 and the first load 3. Appropriately, the first electro-mechanical switch 7 is a relay 700. In the preferred embodiment, the electrical component 71 of the first electro-mechanical switch 7 is a coil and the mechanical component 72 of the first electro-mechanical switch 7 is a contact comprising a metal reed. If current flows through the coil, it generates a magnetic field which attracts the reed, placing the contact in an operating configuration. If there is no electric current flowing through the coil, the reed and the contact adopt a home (non-operating) configuration.

[0014] Typically, the relay 700 is a type which experts in the field call "normally open" (that is to say, the relay contact is open if no current is passing through the coil which controls the relay). In a non-limiting example embodiment, between the door open/door closed switch 6 and the first load 3 there are no operatively interposed relays with coils through which alternating current flows.

[0015] Opening the door 20 is a sufficient condition to cut the power supply to the first electrical load 3 (and, if present, also to the second and/or third load 30, 300, as

explained in more detail below).

[0016] The door 20, when closed, mechanically operates the switch 6, causing it to adopt the second configuration. In particular, the door 20, when closed, operates the switch 6 by pressing it. Preferably, the door 20, when closed, pushes a contact element which in turn moves the switch 6, causing it to adopt the second configuration. Appropriately, if the door 20 is open, elastic means move the switch 6, causing it to adopt the first configuration. In that case, the contact element is not held by the door 20 in the position adopted in the switch 6 second configuration.

[0017] Appropriately, the electrical household appliance 1 comprises retaining means for retaining the door 20 in the closed position. The retaining means are partly made in the door 20 and partly made in the remaining parts of the electrical household appliance 1. For example, the retaining means comprise a hook made on the door 20 which engages in a corresponding ring made on an outer cabinet encompassing the functional components of the electrical household appliance. In an alternative embodiment the hook could be made on the cabinet, while the ring could be made on the door.

[0018] Appropriately, the electrical household appliance 1 comprises an actuator 22 for disengaging the retaining means, the actuator 22, if operated, disengaging the retaining means even during treatment of the products placed in the treatment compartment 2. The actuator 22 can be directly operated by the user and is located on the door 20 or in the remaining parts of the electrical household appliance 1 or partly on the door 20 and partly on the remaining parts of the electrical household appliance 1. For example, the actuator 22 is a handle or a push-button. By way of example, the actuator 22 is mechanically connected to the hook of the retaining means. Appropriately, operation of the actuator 22 is a sufficient condition for cutting the power supply to the first electrical load 3 (and, if present, also to the second and/or third load 30, 300, as explained in more detail below). Appropriately, the electrical household appliance 1 comprises a microcontroller 8. The control means 10 comprises a first current switch 81 controlled by the microcontroller 8 by means of an electrical control signal, the first current switch 81 being located along the first control line 5. Appropriately, the first current switch 81 is in series with the electrical component 71 of the first electro-mechanical switch 7. The first current switch 81 comprises two ports for transit of the electric current and one port for controlling the passage of electric current through the two transit ports. The electrical control signal causing a difference in voltage between the control port and one of the two transit ports, so as to allow the passage of electric current between the two transit ports. The control means 10 for the first load 3, appropriately in combination with the microcontroller 8, allow activation/deactivation of the first load 3 during treatment of the products placed in the treatment compartment 2 when the door open/door closed switch 6 is in the second configuration. The control means

10 therefore allow the first load 3 to be controlled for running a predetermined treatment programme for the products in the treatment compartment 2.

[0019] The first current switch 81 is a transistor 82. Appropriately, the electrical household appliance 1 comprises a pair of transistors 82, 83, in series with each other and in series with the electrical component 71 of the first electro-mechanical switch. That allows redundant control of the electrical component 71 of the first electro-mechanical switch 7 and therefore, indirectly, of the first load 3. The transistor 82 is one of the two transistors of the pair of transistors 82, 83.

[0020] As shown for example in Figure 2, the electrical household appliance 1 comprises:

- a second electrical load 30;
- a second power line 40 which supplies power to the second electrical load 30;
- a second electrical control line 50 which controls the second electrical load 30, the door open/door closed switch 6 being electrically in communication with the second electrical control line 50; the door open/door closed switch 6 being, when the door 20 is open, in a first configuration in which it prevents the passage of current through the second electrical control line 50, and the switch being, when the door 20 is closed, in a second configuration in which it does not prevent the passage of current through the second electrical control line 50;
- control means 101 for the second electrical load 30, comprising a second electro-mechanical switch 70 which comprises: an electrical component 701 inserted along the second electrical control line 50, a mechanical component 72 located along the second power line 40 and able to move between a first and a second position in which it respectively prevents or does not prevent the passage of current along the second power line 40, the mechanical component 702 of the second electro-mechanical switch 70 being controlled by the electrical component 701 of the second electro-mechanical switch 70. Appropriately, the failure of current to pass through the electrical component 701 of the second electro-mechanical switch 70 causes the mechanical component 702 of the second electro-mechanical switch 70 to adopt the first position. Appropriately, the second electro-mechanical switch 70 is a relay. In particular, the relay has one or more of the technical features described above with reference to the relay of the first electro-mechanical switch 7.

[0021] Appropriately, the electrical household appliance 1 comprises a second current switch 810 located along the second electrical control line 50 and controlled by the microcontroller 8 by means of an electrical control signal for allowing or preventing operation of the second electrical load 30.

[0022] In the preferred embodiment the first and sec-

ond control lines 5, 50 are parallel with each other. One end of the first control line 5 and/or of the second control line 50 is at the same potential as one end of the door open/door closed switch 6.

[0023] Appropriately, the electrical household appliance 1 could comprise:

- a third electrical load 300;
- a third power line 400 which supplies power to the third electrical load 300;
- a third electrical control line 500 which controls the third electrical load 300, the door open/door closed switch 6 being electrically in communication with the third electrical control line 500; the door open/door closed switch 6 being, when the door 20 is open, in a first configuration in which it prevents the passage of current through the third electrical control line 500, and the switch being, when the door 20 is closed, in a second configuration in which it does not prevent the passage of current through the third electrical control line 500;
- control means 102 for the third load 300.

[0024] The control means 102 for the third load 300 have one or more of the technical features described above with reference to the control means 10, 101 for the first or second load 3, 30 (obviously, transposed and applied for controlling the third load 300 and not the first or second load 3, 30). Appropriately, the electrical household appliance 1 comprises means 9 for generating a predetermined voltage applied to one end of the door open/door closed switch 6. That predetermined voltage is a direct current voltage. Appropriately, the generator means 9 comprise an AC/DC converter which converts the mains voltage to the predetermined voltage. Typically, the predetermined voltage is approximately 12 Volts. When the switch 6 is closed, that voltage is transferred to one end of the first control line (appropriately, also to one end of the second and/or third control line 50, 500).

[0025] Appropriately, if the switch 6 is open, the power supply to the first, second, third load 3, 30, 300 is cut, irrespective of the control signal supplied by the microcontroller 8.

[0026] In a first preferred embodiment, the electrical household appliance 1 is a tumble dryer comprising a rotating drum suitable for containing the products to be treated. The first electrical load 3 is an electric motor which drives the drum. The second electrical load 30 could be an electric heating resistance. Deactivation of the heating resistance is important to prevent overheating of the heating resistance itself. Indeed, when the door 20 is opened, the power supply to the electric motor which drives the drum is cut. Normally, the electric motor also drives the rotation of a cooling fan, but if the electric motor is stopped, the fan is also stopped, and it is for this reason that the heating resistance must be stopped so as to prevent problems with overheating. In the case of a tumble dryer, the third load 300 could be a further resistance,

for example designed to generate steam.

[0027] In a second preferred embodiment, the electrical household appliance 1 is a dishwasher comprising a pump for the washing liquid, the first electrical load 3 being an electric motor which drives the pump.

[0028] The invention described brings many advantages.

[0029] In particular, it allows the use of a door open/door closed switch in electrical contact with the first control line but not with the first power line 4 (basically, electrically connected on the control branch - electrical component 71 - of the relay 700 but not on the contact branch - mechanical component 72 - of the relay 700). Consequently, the door open/door closed switch 6 is subject to lower electrical loads and therefore a less expensive component can be used (on the first power line 4 there is an alternating current dictated by the external mains -220V-).

[0030] A further advantage is that if the door is opened, the power supply to one or more predetermined electrical loads is interrupted, so as to improve the operating safety of the electrical household appliance, but without requiring the use of a door lock which would prevent the door 20 from being opened while the electrical household appliance is operating.

[0031] It shall be understood that the invention described above may be modified and adapted in several ways without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by other technically equivalent elements. In practice, all the materials used, as well as the dimensions, may vary according to requirements.

Claims

1. An electrical household appliance for carrying out a treatment on products, comprising:

- a product treatment compartment (2);
- a door (20) providing access to the treatment compartment (2), allowing at least insertion of the products before the treatment and removal of the products after the treatment, the door (20) being openable by a user even during the product treatment;
- a first electrical load (3);
- a first power line (4) which supplies power to the first electrical load (3); **characterised in that** it comprises:
 - a first electrical control line (5) for controlling the first electrical load (3);
 - a door open/door closed switch (6) which is operatively connected to the first electrical control line (5), the door open/door closed switch (6) being, when the door (20) is open, in a first configuration in which it prevents the passage of current through the first electrical control line

(5), and the switch being, when the door (20) is closed, in a second configuration in which it does not prevent the passage of current through the first electrical control line (5);

- control means (10) for the first electrical load (3) which in turn comprise a first electro-mechanical switch (7) comprising an electrical component (71) inserted along the first electrical control line (5) and a mechanical component (72) located along the first power line (4) and able to move between a first and a second position in which it respectively prevents or does not prevent the passage of current along the first power line (4); positioning of the mechanical component (72) of the first electro-mechanical switch (7) in the first or the second position being controlled by the electrical component (71) of the first electro-mechanical switch (7), the failure of current to pass through the electrical component (71) of the first electro-mechanical switch (7) causing the mechanical component (72) of the first electro-mechanical switch (7) to adopt the first position.

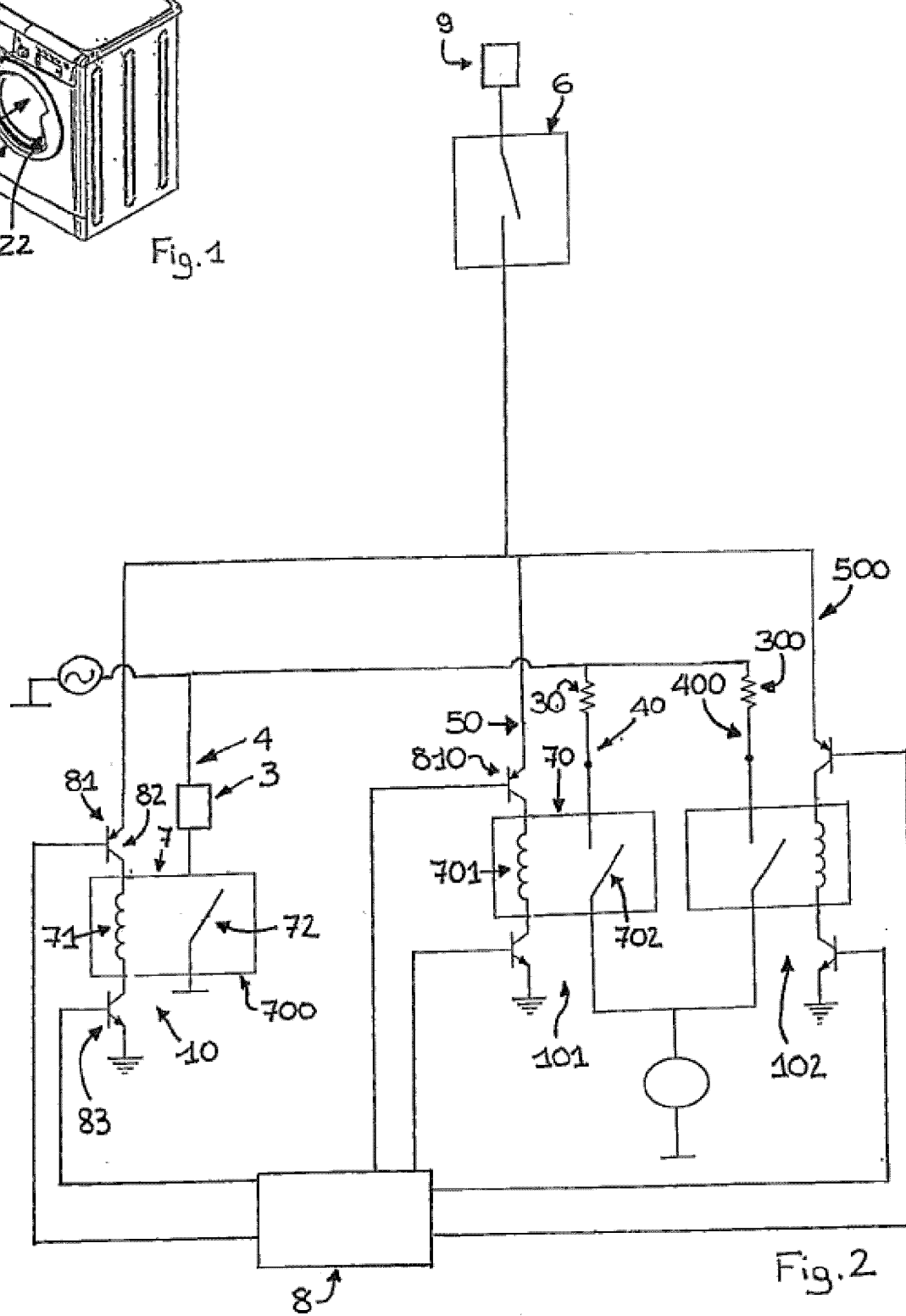
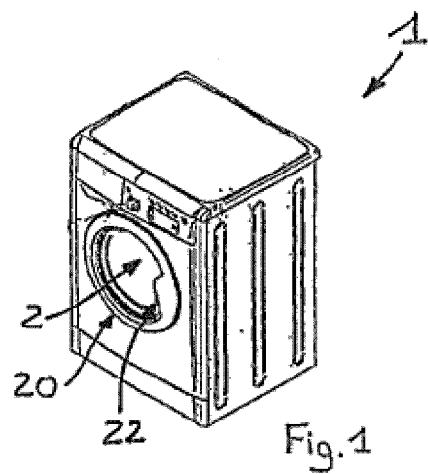
2. The electrical household appliance according to claim 1, **characterised in that** the door (20), when closed, mechanically operates the door open/door closed switch (6) by means of pressure, causing it to adopt the second configuration.

3. The electrical household appliance according to claim 1 or 2, **characterised in that** it comprises:

- retaining means for retaining the door (20) in the closed position, the retaining means being partly made in the door (20) and partly made in the remaining parts of the electrical household appliance (1);
- an actuator (22) for disengaging the retaining means, the actuator (22), if operated, disengaging the retaining means even during treatment of the products placed in the treatment compartment (2); the user being able to directly operate the actuator (22) located on the door (20) or in the remaining parts of the electrical household appliance (1) or partly on the door (20) and partly on the remaining parts of the electrical household appliance (1).

4. The electrical household appliance according to any of the foregoing claims, **characterised in that** it comprises a microcontroller (8) and **in that** the control means (10) for the first load (3) comprise a first current switch (81) controlled by the microcontroller (8) by means of an electrical control signal, the first current switch (81) being located along the first control line (5).

5. The electrical household appliance according to claim 4, **characterised in that** the first current switch (81) is a transistor (82).
6. The electrical household appliance according to any of the foregoing claims, **characterised in that** the first electro-mechanical switch (7) is a relay (700).
7. The electrical household appliance according to any of the foregoing claims, **characterised in that** the electrical household appliance (1) is a tumble dryer comprising a rotating drum suitable for containing the products to be treated, the first electrical load (3) being an electric motor which drives the drum.
8. The electrical household appliance according to any of the foregoing claims, **characterised in that** the electrical household appliance (1) is a dishwasher comprising a pump for the washing liquid, the first electrical load (3) being an electric motor which drives the pump.
9. The electrical household appliance according to any of the foregoing claims, **characterised in that** it comprises:
- a second electrical load (30);
 - a second power line (40) which supplies power to the second electrical load (30);
 - a second electrical control line (50) which controls the second electrical load (30), the door open/door closed switch (6) being electrically in communication with the second electrical control line (50); the door open/door closed switch (6) being, when the door (20) is open, in a first configuration in which it prevents the passage of current through the second electrical control line (50), and the switch being, when the door (20) is closed, in a second configuration in which it does not prevent the passage of current through the second electrical control line (50);
 - control means (101) for the second electrical load (30), comprising a second electro-mechanical switch (70) which comprises: an electrical component (701) inserted along the second electrical control line (50), a mechanical component (72) located along the second power line (40) and able to move between a first and a second position in which it respectively prevents or does not prevent the passage of current along the second power line (40), the mechanical component (702) of the second electro-mechanical switch (70) being controlled by the electrical component (701) of the second electro-mechanical switch (70), the failure of current to pass through the electrical component (701) of the second electro-mechanical switch (70) causing the mechanical component (702) of the second electro-mechanical switch (70) to adopt the first position.
10. The electrical household appliance according to claim 9 when it depends directly or indirectly on claim 4, **characterised in that** the control means (101) for the second load (30) comprise a second current switch (810) located along the second electrical control line (50) and controlled by the microcontroller (8) by means of an electrical control signal for allowing or preventing operation of the second electrical load (30).





EUROPEAN SEARCH REPORT

Application Number
EP 11 18 7978

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 March 2012	Examiner Clivio, Eugenio
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			

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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 18 7978

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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