(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 245 870 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **11.09.91**

(51) Int. Cl.5: **D06F 39/10**, D06F 58/22, D06F 39/08

(21) Application number: **87107068.6**

(22) Date of filing: **15.05.87**

(54) **Filter monitoring device for an electric household appliance.**

(30) Priority: **16.05.86 IT 4572686**

(43) Date of publication of application:
19.11.87 Bulletin 87/47

(45) Publication of the grant of the patent:
11.09.91 Bulletin 91/37

(84) Designated Contracting States:
DE ES FR GB IT

(56) References cited:
EP-A- 0 028 067
EP-A- 0 028 067
DE-A- 2 135 932
US-A- 2 903 799
US-A- 2 950 539

PATENT ABSTRACTS OF JAPAN, vol. 2, no. 83 (M-78), 6th July 1978, page 2308 M 78; & JP-A-53 53 166 (HITACHI SEISAKUSHO K.K.) 15-05-1978

(73) Proprietor: **INDUSTRIE ZANUSSI S.p.A.**
Via Giardini Cattaneo 3
I-33170 Pordenone(IT)

(72) Inventor: **Grandin, Graziello**
Via Vecchia di Corva 17
I-33170 Pordenone(IT)
Inventor: **Mori, Maurizio**
Via Carducci 44/2
I-33074 Fontanafredda Pordenone(IT)
Inventor: **Frucco, Giuseppe**
Via Tiro A Segno 25
I-33170 Pordenone(IT)
Inventor: **Babuin, Piero**
Via S. Vito 28/1 I-33070 San Giovanni di Casarsa
Pordenone(IT)

(74) Representative: **Patentanwälte Grünecker, Kinkeldey, Stockmair & Partner**
Maximilianstrasse 58
W-8000 München 22(DE)

EP 0 245 870 B1

Description

The invention relates to a household appliance, such as a washing machine or a laundry dryer, having a filter and an indicator means to indicate the obstructed state of the filter, a sensing device, sensing on a parameter, which during operation of the appliance obtains an abnormal value, when the filter is obstructed, the sensing device being connected to the indicator means in series by a switch for switching it on as soon as it determines that the filter is obstructed, whereby the indicator means is connected to the main power supply, so that it remains switched on even if any other parts of the appliance, due to the obstructed state of the filter are switched off.

Known laundry washers and laundry dryers are usually equipped with filters for retaining particulate impurities and/or solid bodies entrained in the washing liquid, or for retaining loose fibers and fluff, respectively, entrained by the drying air flow circulating through the dryer. During operation of the respective machines, the associated filter is progressively obturated by the particulate impurities or solid bodies, or by loose fibers and fluff, respectively, until it is finally completely clogged, so that an effective filtering action is no longer obtained, resulting in unsatisfactory operation of the respective machine. For avoiding these disadvantageous effects, the known machines are provided with suitable monitoring devices associated with the respective filter for giving timely indication of the clogged state of the filter and thus of its need of being cleaned.

In particular, a known filter monitoring device for a laundry dryer comprises a thermostat disposed downstream of the filter with respect to the direction of circulation of the drying air and operatively connected to an indicator lamp visible at the control panel of the machine and adapted to indicate the operative state of the filter. The thermostat senses the temperature of the drying air circulating downstream of the filter, and is calibrated to control the energization of the indicator lamp in the presence of excessively high air temperatures resulting from the reduction of the air flow caused by the complete obturation of the filter by loose fibers and fluff.

This monitoring device suffers from the disadvantage, however, that it is automatically deenergized as soon as the machine itself is deenergized at the end of the laundry drying cycle or in response to faulty operation eventually necessitating maintenance operations to be carried out on the machine. Under these circumstances the indicator lamp of the known monitoring device is thus likewise deenergized, so that the indication of the operative state of the filter is not maintained operative to advise the user that suitable action should be taken. It would therefore be desirable, to provide a filter monitoring device for a laundry washer or laundry dryer capable of indicating the operative state of the filter irrespective of whether or not the respective machine is in operation.

US-A-2 950 539 describes a laundry dryer with a signalling device indicating when the lint filter is clogged and needs to be removed for cleaning. This signalling device has a timer in connection with a cam and a holding relay, which is controlled by the timer. If the entire drying process takes an undue long time due to the obstructed filter, the timer energizes the relay which actuates a warning lamp to indicate that the filter is to be cleaned.

EP-A-1-028 067 describes a washing machine which includes a detector to indicate that the filter is obstructed. A low-level water sensor used during normal operation of the machine for normal control of the machine is monitored during the drainage operation and the controller is arranged to establish whether the water sensor has operated a predetermined time after the drain pump is started. If the switch does not change state, then it is assumed that the filter is blocked and, either immediately or at the end of the wash program a warning light is illuminated. This control, however, needs a complicated microprocessor circuit.

US-A-2 903 799 relates to a laundry dryer which includes a temperature sensitive switch in close thermal connection to the heater resistance. When the heater resistance obtains an undue high temperature, the temperature sensitive switch ignites a warning lamp to indicate that the filter is obstructed. This solution may deliver a very rapid response on an undue rise in the temperature of the heating unit which, however, may not necessarily be based on a clogged filter.

DE-A-21 35 932 refers to a laundry dryer with an indicator lamp which is switched on in case that the filter is clogged. For that purposes pressure sensors are provided upstream and downstream of the filter and the differential pressure switch is actuated as soon as the difference in pressures becomes undue high.

The invention as claimed intends to provide for a household appliance, such as a washing machine or a laundry dryer which has a simple and efficient monitoring device to indicate that the filter is obstructed. Furthermore, this monitoring device should also be in operation even when the machine has already been switched off by the program.

The characteristics of the invention will become more clearly evident from the following description, given by way of example with reference to the accompanying drawings, in which:

Fig 1 shows the electric circuit of a filter monitoring device in a washing machine, and

Fig 2 shows an electric circuit of another filter monitoring device in a laundry dryer.

With reference to Fig 1, there is shown a first embodiment of a filter monitoring device for use in a laundry washing machine of a conventional type, including a filter (not shown) associated with the discharge pump (not shown) and discharge pipe of the machine for retaining any foreign bodies entrained by the washing liquid.

The laundry washing machine further includes a pressure switch 7 or the like connected to the electric circuit of the machine for controlling the filling level of the washing liquid in the washing tub (not shown).

Pressure switch 7 includes a movable contact 8 connected to a supply conductor 9 of the machine and adapted to selectively close on fixed contacts 10 and 11 of the pressure switch, said fixed contacts being connected to conventional components (not shown) of the electric circuit of the machine.

In its first operative position movable contact 8 is caused to close on fixed contact 10 when the tub of the machine is empty or filled with a washing liquid to a level below that to which pressure switch 7 is calibrated.

In its second operative position movable contact 8 is caused to close on a fixed contact 11 when the tub is filled with the washing liquid to the level to which pressure switch 7 is calibrated.

The pressure switch 7 is connected between the supply conductors 9 and 12 of the electric circuit of the machine, with the interposition of an electric circuit breaker 13 being connected in series with an electric resistance 22 cooperating with a movable contact 23 of a manually resettable thermostat of conventional construction.

Movable contact 23 is adapted to close a circuit including an indicator lamp 16 for the indication of the operative state of the filter and connected between supply conductors 9 and 12 in parallel to the circuit including pressure switch 7, circuit breaker 13 and resistance 22.

Movable contact 23 is of the normally open type and adapted to be shifted to its closed state by its thermal expansion in response to the heating of resistance 22 when the latter is being energized by the closing of circuit breaker 13 with movable contact 8 of pressure switch 7 still closed an fixed contact 11. Closing of main switch 21 prepares the washing machine for carrying out a selected program under the control of the program control unit of the machine, and initiated by the admission of the washing liquid to the tub to the charging level determined by pressure switch 7, at which level movable contact 8 of pressure switch 7 is caused to close on fixed contact 11.

At the end of the selected program the washing liquid is discharged from the tub by means of the discharge pump causing it to pass through the filter and the discharge pipe (none of these components being shown in the drawing).

As long as the filter is not obstructed by any foreign bodies and/or loose fibers of the laundry entrained by the washing liquid, the discharge operation is carried out within a relatively short time, while requiring a noticeably longer period of time when the filter is obstructed.

In practice, movable contact 8 of pressure switch 7, which at the beginning of the discharge operation is still closed on fixed contact 11, will be caused to close on fixed contact 10 after a predetermined period of time during which the tub of the machine has been emptied to a lower liquid level, provided that the filter is not obstructed.

If on the other hand the filter is in fact obstructed, movable contact 8 will be caused to close on fixed contact 10 after a period of time which is longer than that specified above.

According to the invention, the respective cam of the program control unit of the machine operates to close electric circuit breaker 13 of the filter monitoring device at the end of the above specified short period of time.

If the filter is obstructed, movable contact 23 remains in its closed state, causing indicator lamp 16 to light up even after the machine has been switched off by the program control unit, or in the case of faulty operation necessitating maintenance operations to be carried out.

The movable contact can only be returned to its open state to extinguish indicator lamp 16 by manually resetting the thermostat after the filter has been cleaned or replaced.

According to the invention, indicator lamp 16 may be supplemented or replaced by other indicator devices of conventional type, for instance by an acoustic warning device connected to the electric circuit in the same manner as described. The thus constructed monitoring device is adapted to have a voltage applied thereto in response to the closing of a main switch 21 of the machine connected to the above described supply conductors 9 and 12.

The device shown in Fig 2 on its part is composed of the same electric components as the device of Fig 1, which are therefore designated by the sane reference numerals, with the exception of the pressure switch, which in this case is replaced by a thermostat 42, disposed downstream of the filter in the flow direction of the circulating drying air.

The thermostat 42 has a movable contact 43 of the normally open type, which remains in its open position as long as the filter is not obstructed. When the filter is obstructed, resistance 22 obtains an undue high temperature and then closes mov-

able contact 23 which switches an the indicator lamp 16. Switch 23 as in the embodiment of Fig 1 can only be reset manually.

Claims

1. Household appliance, such as a washing machine or a laundry dryer, having a filter and an indicator means (16) to indicate the obstructed state of the filter, a sensing device (7,13,22;42,22), sensing on a parameter, which during operation of the appliance obtains an abnormal value, when the filter is obstructed, the sensing device being connected to the indicator means (16) in series by a switch (22) for switching it on as soon as it determines that the filter is obstructed, whereby the indicator means is connected to the main power supply (9,12), so that it remains switched on even if any other parts of the appliance, due to the obstructed state of the filter are switched off,
characterized in that, the sensing device includes a switch (7,13;42) in series to a resistor (22) which is heated up abnormally in the obstructed state of the filter and that the switch (23) in series with the indicator means (16) is a temperature sensitive switch being in thermal connection with the resistor (22) to switch on the indicator means (16) when the resistor (22) obtains an abnormal temperature.

2. Washing machine according to claim 1 having a program switch (13) in series with a pressure switch (7) which senses the level of water in the machine,

characterised in that,

the resistor (22) is connected in series with the program switch (13) and the pressure switch (7) to be energized when both the program switch (13) and the pressure switch (7) are closed and to obtain an abnormal temperature, when the time period between starting the pump to empty the machine by the program switch (13) and opening of the pressure switch (when the water level has fallen beyond a predetermined value) is excessively long.

3. Laundry dryer, according to claim 1,

characterized in that,

the sensing device includes a temperature sensitive switch (42) located within a chamber downstream of the filter to sense the temperature of the circulating drying air, and being connected in series with the resistor (22) to energize this resistor (22) when the temperature of the drying air obtains an abnormal value.

Revendications

1. Appareil domestique, tel qu'une machine à laver ou un sèche-linge, ayant un filtre et des moyens d'indication (16) pour indiquer l'état de colmatage du filtre, un dispositif de détection (7,13,22;42,22), détectant un paramètre qui prend une valeur anormale pendant le fonctionnement de l'appareil lorsque le filtre est colmaté, le dispositif de détection étant relié en série aux moyens d'indication (16) par un interrupteur (23) pour mettre sous tension les moyens d'indication dès que le dispositif de détection détermine que le filtre est colmaté, les moyens d'indication étant reliés à l'alimentation électrique du réseau (9,12) de façon à rester sous tension même si tous les autres composants de l'appareil sont mis hors tension du fait de l'état de colmatage du filtre, caractérisé en ce que le dispositif de détection comporte un commutateur (7,13;42) monté en série avec une résistance (22) qui est chauffée anormalement lorsque le filtre est colmaté et en ce que l'interrupteur (23), monté en série avec les moyens d'indication (16), est un interrupteur thermosensible en liaison thermique avec la résistance (22) pour mettre sous tension les moyens d'indication (16) lorsque la résistance (22) atteint une température anormale.

2. Machine à laver selon la revendication 1, ayant un interrupteur programmé (13) en série avec un mano-contact (7) qui détecte le niveau de l'eau dans la machine, caractérisée en ce que la résistance (22) est montée en série avec l'interrupteur programmé (13)et avec le manocontact (7) pour être mise sous tension lorsque l'interrupteur programmé (13) et le manocontact (7) sont tous deux fermés et pour atteindre une température anormale lorsque l'intervalle de temps entre la mise en route de la pompe de vidange de la machine par l'interrupteur programmé (13) et l'ouverture du manocontact (lorsque le niveau de l'eau est tombé en dessous d'une valeur prédéterminée)est excessivement long.

3. Sèche-linge selon la revendication 1, caractérisé en ce que le dispositif de détection comporte un interrupteur thermosensible (42) disposé à l'intérieur d'une chambre en aval du filtre pour détecter la température de l'air de séchage en circulation, et monté en série avec la

résistance (22) pour mettre sous tension cette résistance (22) lorsque la température de l'air de séchage atteint une valeur anormale.

Patentansprüche

1. Haushaltsgerät, beispielsweise Waschmaschine oder Wäschetrockner, mit einem Filter und einer Anzeigevorrichtung (16) zum Anzeigen des verschmutzten Zustandes des Filters, einer Fühlereinrichtung (7, 13, 22; 42, 22), die einen Parameter beobachtet, welcher während des Betriebs des Geräts einen abnormalen Wert annimmt, wenn das Filter verschmutzt ist, wobei die Fühlereinrichtung an die Anzeigevorrichtung (16) in Reihe zu einem Schalter (22) geschaltet ist, der eingeschaltet wird, wenn festgestellt wird, daß das Filter verschmutzt ist, wobei die Anzeigevorrichtung an die Hauptstromversorgung (9, 12) angeschlossen ist, so daß sie auch dann eingeschaltet bleibt, wenn irgendwelche anderen Teile des Geräts wegen des verschmutzten Zustandes des Filters abgeschaltet sind, **dadurch gekennzeichnet,** daß die Fühlereinrichtung einen Schalter (7, 13; 42) aufweist, der in Reihe zu einem Widerstand (22) liegt, welcher im verschmutzten Zustand des Filters in abnormaler Weise aufgeheizt wird, und daß der Schalter (23), der in Reihe zu der Anzeigevorrichtung (16) liegt, ein temperaturabhängiger Schalter ist, der in Wärmekontakt mit dem Widerstand (22) steht, um die Anzeigevorrichtung (16) einzuschalten, wenn der Widerstand (22) einen abnormalen Temperaturwert erreicht.

2. Waschmaschinen nach Anspruch 1 mit einem Programmschalter (13) in Reihe zu einem Druckschalter (7), welcher auf den Füllstand in der Maschine anspricht, **dadurch gekennzeichnet,** daß der Widerstand (22) in Reihe zu dem Programmschalter (13) und dem Druckschalter (7) geschaltet ist, um mit Energie versorgt zu werden, wenn sowohl der Programmschalter (13) als auch der Druckschalter (7) geschlossen sind, wodurch er eine abnormale Temperatur erreicht, wenn die Zeitdauer übermäßig lang wird, die zwischen dem Einschalten der Pumpe, die die Maschine entleert, durch den Programmschalter (13), und dem Öffnen des Druckschalters (wenn der Füllstand unter einen vorgegebenen Wert abgesunken ist), liegt.

3. Wäschetrockner nach Anspruch 1, **dadurch gekennzeichnet,** daß die Fühleinrichtung einen temperaturempfindlichen Schalter (42) aufweist, der innerhalb einer Kammer stromabwärts von dem Filter liegt, um die Temperatur der zirkulierenden, trocknenden Luft zu prüfen und daß der Schalter (42) in Reihe mit dem Widerstand (22) geschaltet ist, um diesen Widerstand (22) mit Energie zu versorgen, wenn die Temperatur der trocknenden Luft einen abnormalen Wert annimmt.

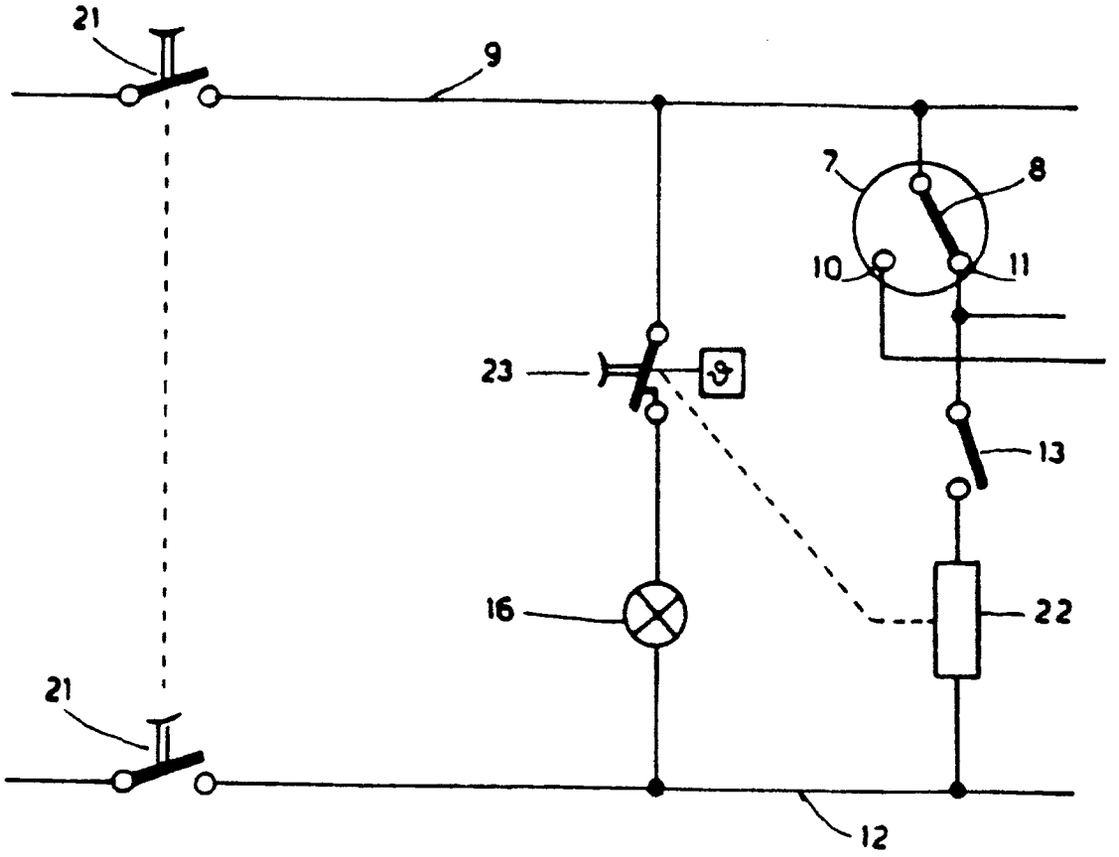

FIG. 1

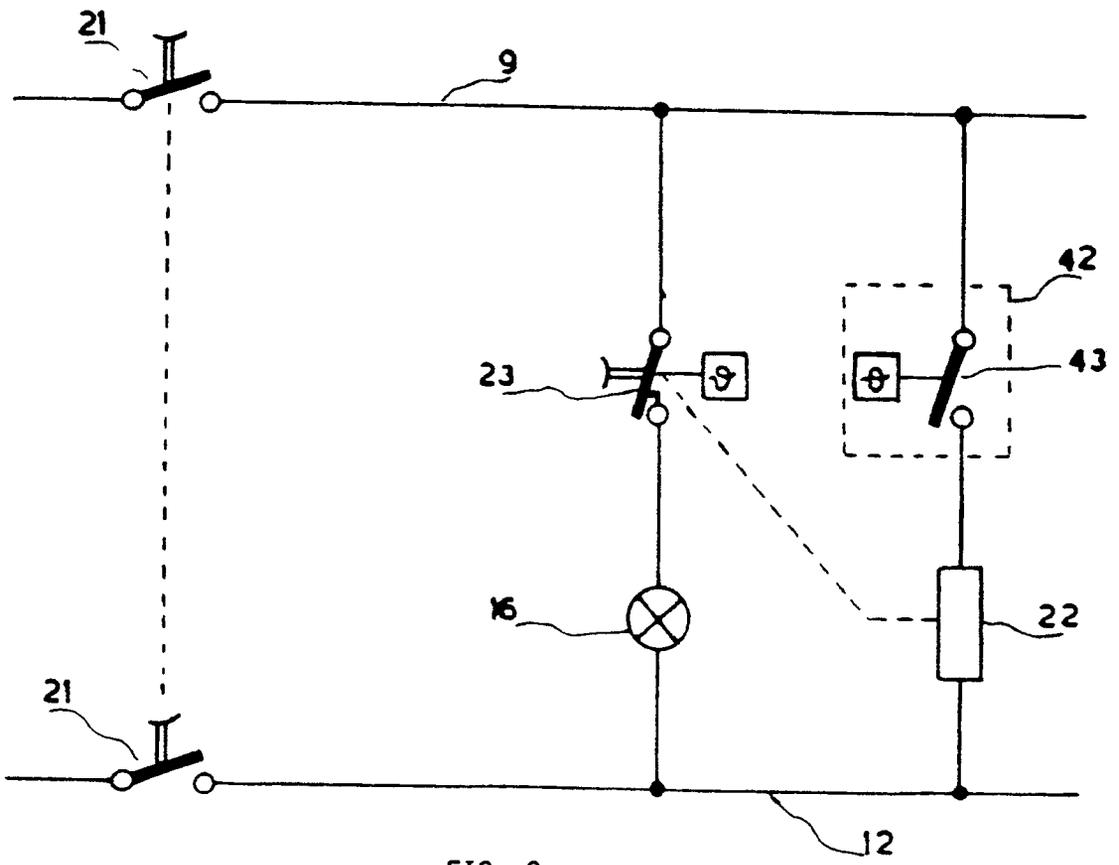

FIG. 2