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(54) **Clothes drying or similar machine provided with conductometric moisture control**

(57) The machine is provided with a conductometric control system comprising a pair of electrodes (4) adapted to contact the clothes being dried and to correspondingly drive a programme sequence control unit (6) with a signal that is indicative of the residual moisture contents of the clothes. The electrodes (4) drive said pro-

gramme sequence control unit (6) through a radio-frequency transceiver comprising a transmitter (7) of said signal, which is arranged in correspondence of the drum (2) and is electrically connected to the electrodes (4), and a receiver (12) of said signal, which is arranged in a stationary position on the outer casing (1) of the machine.

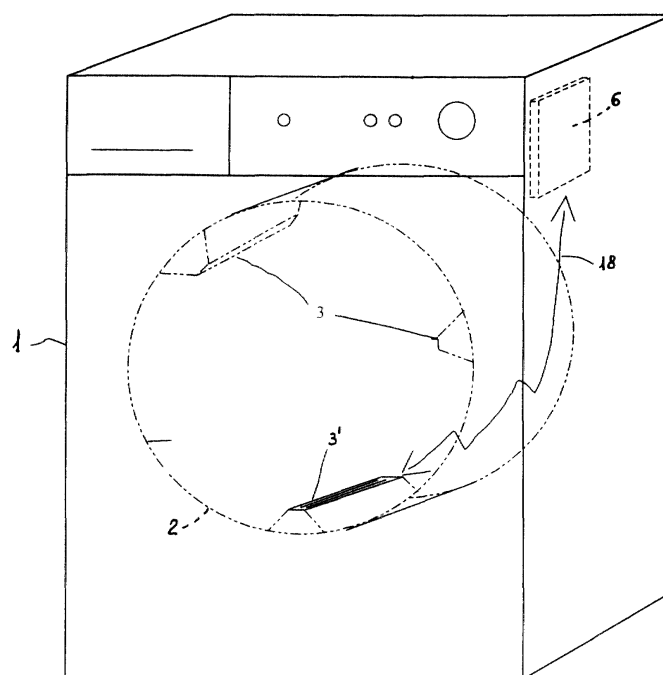


Fig. 1

EP 1 148 169 A2

Description

DESCRIPTION

[0001] The present invention refers to a clothes drying machine, or a combined clothes washing and drying machine, provided with a conductometric type of control of the residual moisture contents of the clothes being handled.

[0002] Clothes drying machines with conductometric control are usually of the rotating drum or tumbling type, and comprise a control system that is adapted to measure the residual moisture contents of the clothes via sensor electrodes which the same clothes enter into contact with. The conductance of the clothes is in fact used as a parameter for measuring the degree of dryness reached by the clothes, in such a manner as to be able to control the operation of the machine accordingly.

[0003] In particular, the sensors are arranged to drive a signal processing circuit which is generally mounted in a stationary position in the outer casing of the machine, outside of the rotating drum.

[0004] The sensors can be made and implemented in any of a number of possible manners. For instance, they may comprise electrically conductive plaques arranged inside the drum, in correspondence of the ribs provided there in view of promoting the agitation of the clothes. As an alternative thereto, as this is described for instance in EP-A-0 106 283, the sensor electrodes are constituted by respective portions of the drum which are electrically isolated from each other.

[0005] In any case, in order to connect the sensors to the signal processing circuit the need arises for at least a wiping electric contact to be used and this gives rise to reliability problems, especially in the case in which the machine is combined washing a drying machine, ie. a so-called washerdrier, and is therefore provided with a drum that rotates at high revolution speeds during spin-extraction cycles.

[0006] As a result, in the case of combined clothes washing a drying machines a solution is preferably adopted which calls for the sensors to be arranged in a stationary position, in correspondence of the loading door of the machine, for instance as described in EP-A-0 080 048. This solution, however, proves to be operationally unreliable, since it fails to ensure an effective electric contact in the case of reduced loads of clothes to be dried.

[0007] It should also be noticed in general that, according to currently applying standard regulations, clothes drying and similar machines shall feature an elevated insulation class between the drum (accessible by the user) and the power supply of the processing circuit, so that the latter must comprise electric switches of an undesirably complex and expensive type.

[0008] It therefore is a main purpose of the present invention to provide a clothes drying or similar machine equipped with a conductometric-type moisture control,

which is reliable and, at the same time, is capable of being manufactured in a simple and cost-effective manner on an industrial scale, in particular without requiring the use of wiping or sliding electric contacts.

[0009] In particular, it is a further purpose of the present invention to provide a clothes drying or similar machine of the above cited kind, which is capable of being assembled in a particularly convenient, rational and easy manner.

[0010] According to the present invention, these and further aims are reached in a clothes drying machine, or the like, provided with a conductometric-type moisture control, having the characteristics as recited in the appended claims.

[0011] Anyway, features and advantages of the present invention will be more readily understood from the description that is given below by way of nonlimiting example with reference to the accompanying drawings, in which:

- Figure 1 is a schematical view of a clothes drying machine according to the present invention;
- Figure 2 is an enlarged side view of a component part of the machine illustrated in Figure 1;
- Figure 3 is an enlarged cross-sectional schematical view of the component part illustrated in Figure 2; and
- Figure 4 is a basic schematical view of the circuit diagrams for the conductometric control of the residual moisture contents of the clothes in the machine illustrated in Figure 1.

[0012] With reference to the above listed Figures, the machine may be a clothes drying machine, or a combined clothes washing and drying machine, comprising an outer casing 1 which houses a rotating drum 2 that includes a plurality of clothes-agitating ribs 3 therewithin.

[0013] At least one (indicated at 3') of such ribs provided to improve the agitation of the clothes is preferably made as a separate component part extending, in correspondence of the inner surface of the cylindrical side wall of the drum 2, in a direction that is substantially parallel to the axis of rotation of the same drum. For instance, the rib 3' may have a tapering structure, with a substantially trapezoidal cross-section and a minor base in correspondence of which there is provided at least a pair of sensor electrodes 4.

[0014] In a per se known manner, when the drum 2 is operating, ie. rotating, the electrodes 4 are in contact with the clothes whose residual moisture contents is desirably to be measured by means of a conductometric-type control. In particular, the electrodes 4 are adapted to drive the programme sequence control unit 6 of the machine, which is arranged in a stationary position on

the outer casing 1, with a signal that is indicative of the residual moisture contents of the clothes.

[0015] According to a feature of the present invention, the electrodes 4 are adapted to drive the programme sequence control unit 6 via transceiver means or similar wireless signal transmission means, comprising a transmitter 7 of said signal, which is arranged in correspondence of the rotating drum 2 and is connected electrically to the electrodes 4. Said transceiver means further comprise a receiver 12 of said signal, which is on the contrary arranged in a stationary position, relatively far from the transmitter, and is preferably incorporated in the programme sequence control unit 6 itself.

[0016] In the rib 3', the transmitter 7 is preferably of the type operating on radio-frequency and is connected to an antenna 11 and respective circuitry 8-10. In particular, the electrodes 4 drive the transmitter 7 via a control circuit 8 and an amplifier 9. In a preferred manner, the antenna 11 is furthermore adapted to drive the control circuit 8, via a radio-frequency receiver 17, in the manner that shall be described in greater detail further on.

[0017] In the programme sequence control unit 6, the receiver 12 is preferably of the type operating on radio-frequency and is connected to an antenna 16 so as to drive a control circuit 13 with the above mentioned signal that is indicative of the residual moisture contents of the clothes being dried. In a per se known manner (not shown in the Figures), the programme sequence control unit 6 is adapted to control the operation of the main operative parts of the machine, in particular in view of determining, in accordance with said signal, the end of the selected drying cycle.

[0018] In a preferred manner, the control circuit 13 is also adapted to drive the antenna 16, via an amplifier 14 and a radio-frequency transmitter 15, as this shall be described in greater detail further on.

[0019] It should be noticed that the control circuits 8 and 13 preferably comprise respective microcontrollers, for instance of the type Microchip PIC12C5XX and Motorola HC05B16, respectively.

[0020] The circuitry associated to the transmitter 7 obviously includes also power-supply means which, in the simplest and less expensive embodiment, are preferably provided in the form of a battery 10 that is housed in correspondence of the rib 3'. In this case, in view of increasing the operating autonomy of the entire electronic system 8-11 and 17, the transceiver 15, 17 is driven by the programme sequence control unit 6, in particular by the control circuit 13, so as to control the transmitter 7 and the related circuitry 8-11 and 17 between a stand-by state and a condition of regular power supply in accordance with the operating conditions of the machine, in a substantially per se known manner. As generally known by all those skilled in the art, in fact, in some phases of a drying cycle being performed on the clothes, the need arises for the programme sequence control unit 6 to receive information concerning the residual

moisture contents of the same clothes so as to be able to determine the end of the drying cycle itself. During these phases, therefore, the control circuit 13 is adapted to send to the circuit 8, via the transmitter 15, the antennas 16 and 11 and the receiver 17, a control signal that causes the entire electronic circuit 7-10 to switch over from the stand-by state to the regular power-supply state.

[0021] Under these regular power-supply conditions, the sensor electrodes 4 detect the residual moisture in the clothes and drive the control circuit 8 accordingly. The latter in turn generates the afore mentioned signal, which is amplified by the amplifier 9 and sent by the transmitter 7 to the receiver 12 via a radio-frequency link (shown schematically at 18 in Figure 1) which in an advantageous manner does not require any galvanic connection between the drum 2 and the programme sequence control unit 6.

[0022] Such an absence of any galvanic connection is not only effective in simplifying the structure of the drying machine, by making it needless for sliding or wiping electric contacts to be used in the construction, but also ensures an adequate electric insulation class thereof, so that the electronic circuits of the machine can make use of low-cost and low current-input switches (eg. Triacs).

[0023] In a preferred manner, the transmitter 7 and the related circuitry 8-10 and 17 are isolated in a sealed manner from the remaining part of the machine; for instance, they may be embedded in a mass of insulating resin inside the rib 3'.

[0024] In this connection, the rib 3' is preferably made in form of a separate sub-assembly that can advantageously be mounted on the rotating drum 2 upon having been pre-assembled and pre-tested jointly with the electrodes 4, the transmitter 7 and the related circuitry 7-11 and 17.

[0025] It will be appreciated that the above described clothes drying or similar machine may be the subject of a number of modifications without departing from the scope of the present invention.

[0026] For instance, the above described electronic circuits and/or the functional setting and arrangement thereof may be of any other different kind suiting the purpose, as long as they correspond to the characteristics set forth in the appended claims.

[0027] Furthermore, the programme sequence control unit 6, instead of being provided on the outer casing 1 of the machine as described, may be arranged in a different stationary position, for instance in correspondence of a central remote control unit provided separately from the machine itself.

Claims

1. Clothes drying or similar machine with an outer casing which houses a clothes-holding rotating drum,

the machine being provided with a conductometric-type control system comprising at least a pair of electrodes adapted to contact the clothes being dried and to correspondingly drive a programme sequence control unit of the machine with a signal that is indicative of the residual moisture contents of the clothes, **characterized in that** said electrodes (4) are adapted to drive said programme sequence control unit (6) via radio-frequency transceiver means, or similar wireless signal transmission means, comprising a transmitter (7) of said signal, which is arranged in correspondence of the rotating drum (2) and is electrically connected to the electrodes (4), said transceiver means further comprising a receiver (12) of said signal, which is arranged in a stationary position relatively far from said drum.

2. Clothes drying or similar machine according to claim 1, in which the rotating drum comprises one or more ribs provided for enhancing the agitation of the clothes, **characterized in that** said electrodes (4), said transmitter (7) and the related circuitry (8-11) associated thereto are housed in correspondence of at least one (3') of said ribs (3).
3. Clothes drying or similar machine according to claim 2, **characterized in that** said transmitter (7) and the related circuitry (8-11) are isolated in a tightly sealed manner from the remaining part of the machine.
4. Clothes drying or similar machine according to claim 2, **characterized in that** said rib (3') is made in form of a separate sub-assembly that is mounted on the rotating drum (2) upon having been pre-assembled together with said electrodes (4), said transmitter (7) and the related circuitry (8-11).
5. Clothes drying or similar machine according to claim 2, **characterized in that** said transmitter (7) and said circuitry (8-11) are energized by battery means (10) housed in correspondence of the rib (3') that houses also the electrodes (4), the transmitter (7) and the related circuitry (8-11), in which further transceiver means (15, 17) are driven by the programme sequence control unit (6) of the machine and are adapted to control said transmitter (7) and the related circuitry (8-11) to enable them to switch over between a stand-by state and a regular power-supply state in accordance with the operating conditions of the machine.

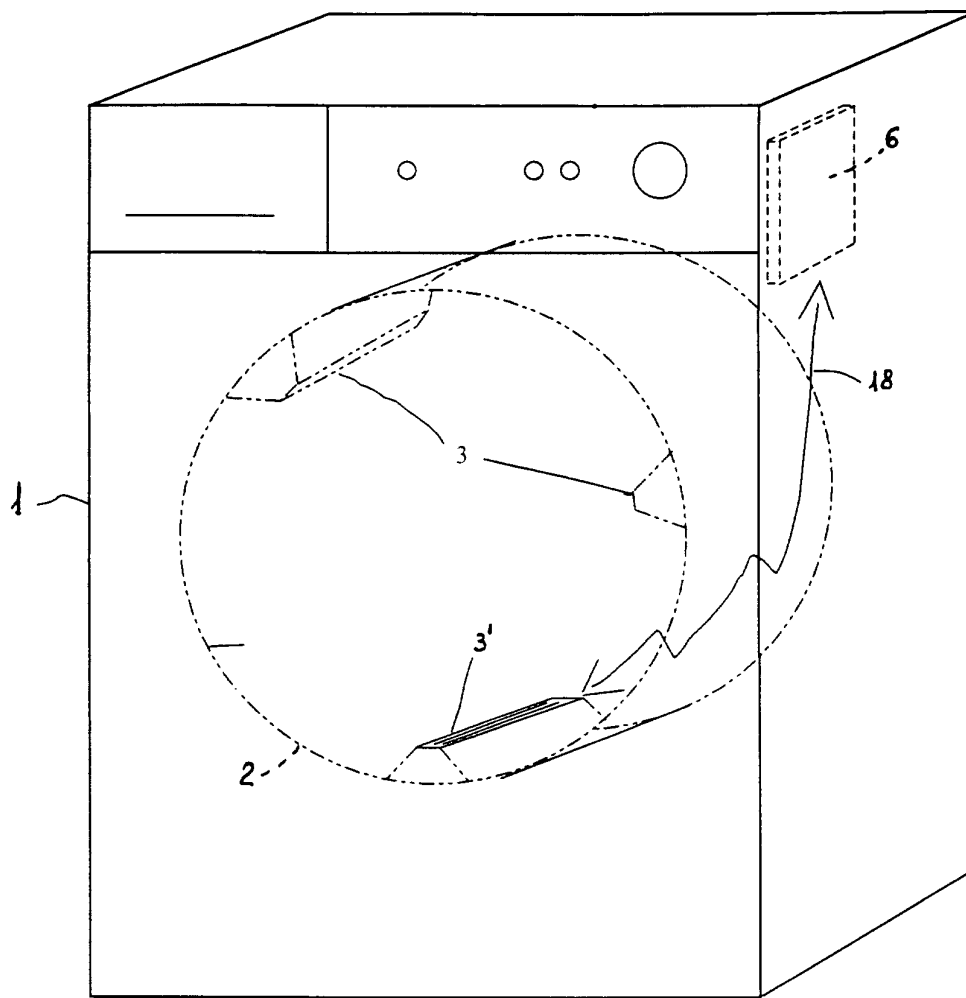


Fig. 1

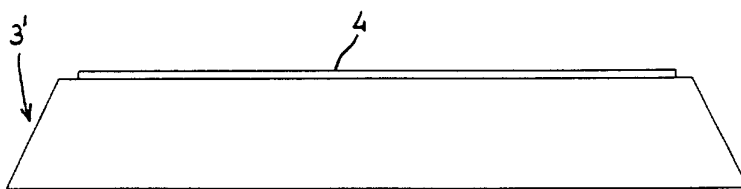


Fig. 2

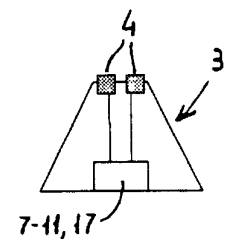


Fig. 3

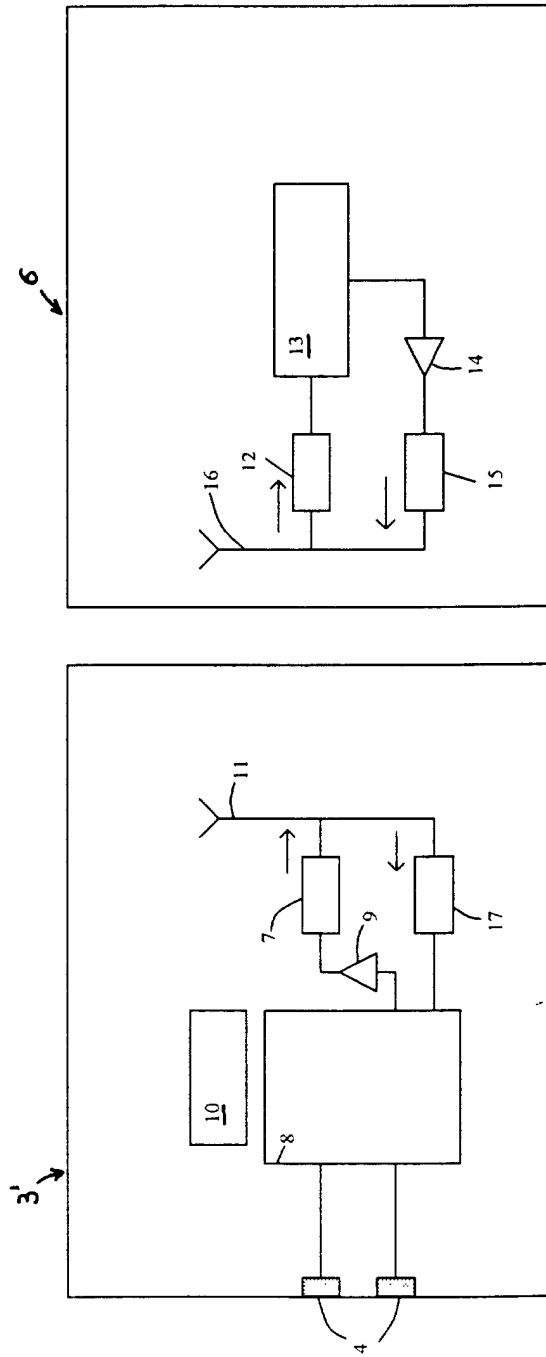


Fig 4