

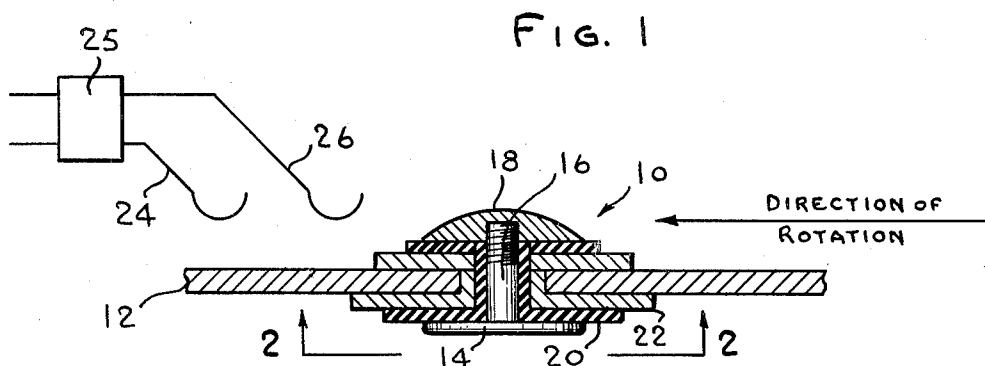
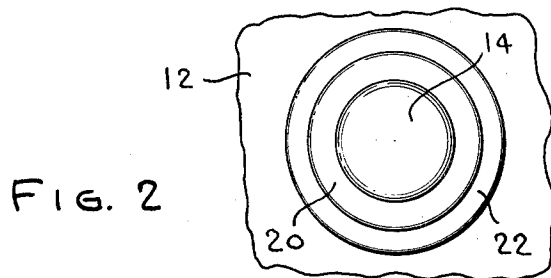
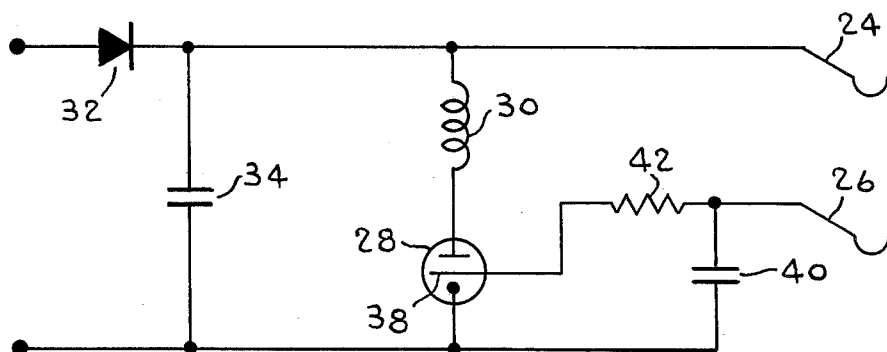
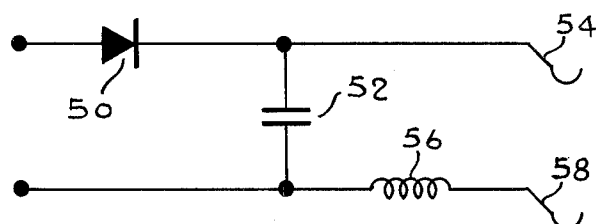
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DRYER SENSING DEVICE

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1

3,222,798

DRYER SENSING DEVICE

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This invention relates to dryer controls of the type which are operative to establish a drying cycle based on moisture content.

An object of this invention is to provide a simplified and effective arrangement for sensing moisture content.

In accordance with this invention it is proposed to provide an electrically conductive member which is supported on and exposed to the interior of the dryer drum. The electrical conducting member is insulated from the grounded drum to eliminate any direct path to ground and to provide a gap the leakage resistance of which varies in accordance with the moisture content of the clothing, or other articles, being dried. An electrical charge is applied to the electrically conductive member and after a preselected amount of rotation of the drum the residual charge on the electrically conductive member is removed and transmitted to control means which is operative to translate an electrical charge of predetermined magnitude into an operational dryer function.

Other objects and advantages will be pointed out in, or be apparent from, the specification and claims, as will obvious modifications of the embodiments shown in the drawings, in which:

FIG. 1 is a semi-schematic illustration of a preferred embodiment;

FIG. 2 is a view generally along lines 2—2 of FIG. 1;

FIG. 3 is a circuit diagram of a preferred embodiment; and

FIG. 4 is a circuit diagram of an alternative embodiment.

With particular reference to the drawings, electrical charge receiving means 10 is connected to and rotatable with a dryer drum 12 and includes a sensor 14 exposed to the interior of the drum. Sensor 14 includes a threaded portion 16 extending exteriorly of the drum for engagement with a conductive button or anchor 18. An insert 20, of suitable electrical insulating material, is positioned between an electrically conductive insert 22, which engages grounded drum 12, and sensor 14, its threaded extension 16 and button 18. Insert 20 electrically isolates the charge receiving means from ground and provides a gap between sensor 14 and insert 22 the resistance of which varies with the moisture content of the clothing being dried so that the leakage of current between sensor 14 and insert 22 gives a measure of moisture content.

Sensor 14 rotates with the dryer drum and a pair of brushes 24 and 26 are supported from a block 25 in fixed relation with the drum and arranged in relative spaced relation to sequentially engage button 18 upon rotation of the dryer drum. More particularly, the brushes are spaced apart in the direction of rotation of the drum as indicated by the arrow in FIG. 1 and brush 24 is connected to a source of electrical energy so that upon engagement with button 18 a charge will be applied to the charge receiving means. As the drum rotates the clothing being dried will bridge the gap between sensor 14 and insert 22 so that the charge applied by brush 24 leaks off to ground in accordance with the moisture content of the clothing. After a predetermined amount of drum rotation, brush 26 engages button 18 and removes the residual charge on the button. Brush 26 is electrically connected to control means which is operative to receive the

2

charge taken from the button and translate it into an electrical signal for effecting a particular dryer control function. It will be appreciated that the spacing between the brushes can be varied as desired, preferably they are arranged as illustrated in FIG. 1 so that a charge is applied by brush 24 and the residual charge removed after approximately a full revolution of the drum.

Although any one of a number of arrangements can be utilized to furnish electrical energy to brush 24 and also a number of controls are suitable for translating the residual charge into a usable signal, it is preferred to utilize a control circuit similar to that disclosed in the co-pending application of Otto R. Behrens, filed July 26, 1960, Serial No. 45329 and assigned to the assignee of this application. More particularly, the control includes a thyatron tube 28 which is connected in series with a relay 30. A combination rectifier 32 and capacitor 34 apply a filtered D.C. voltage to the thyatron 28 which is of a preselected value below the normal breakdown voltage of the thyatron. As a result, the thyatron is initially non-conductive and no current flows through relay 30 which remains in an unactuated state. Brush 26 is electrically connected to grid 38 of the thyatron so the charge taken from charge receiving means 10 is applied to the grid. When the charge is of predetermined magnitude it will render the thyatron conductive. Having rendered the thyatron conductive, current flows through and actuates relay 30 to effect a particular desired dryer control function, for example to terminate the dryer cycle or to activate a timer to provide a time-out operation of predetermined duration.

Means is also provided to minimize the possibility of the control circuit being prematurely activated due to a small and/or tumbling, momentarily suspended load and as a result of which the leakage of current would not be affected by the moisture content of the clothing so that the residual charge would not correspond to the moisture content of the load. Preferably a capacitor 40 is included in the grid circuit of the thyatron and is effective to store the charge taken from button 18 until it reaches a particular predetermined magnitude at which point the capacitor discharges and places the proper potential on grid 38 to render the thyatron conductive. It is also desirable to include a resistor 42 between capacitor 40 and the grid to limit the current delivered to the thyatron to a safe value.

It is recognized that with this invention it is also possible to eliminate the additional controls, such as the thyatron, and to effect the desired dryer control utilizing only the applied and residual charge. Such an arrangement is illustrated in FIG. 4, where rectifier 50 and capacitor 52 deliver an electrical charge to charge applying brush 54. A relay 56 is directly connected to charge measuring brush 58. The charge delivered to brush 54 is selected to be of sufficient magnitude to actuate relay 56 assuming no leakage of the charge to ground. Until the moisture content of the clothing reaches a desired point, sufficient leakage of the charge will occur so that the residual charge taken from the charge receiving means by brush 58 will not be adequate to actuate relay 56. This arrangement has given satisfactory results when used with larger loads and the arrangement described in connection with FIGS. 1-3 is preferred since its performance is satisfactory both with large and small loads; however, it is recognized that further experimentation and development may result in adequate performance of the embodiment of FIG. 4 even with smaller loads.

Although this invention has been illustrated and described in connection with particular embodiments thereof, it will be apparent to those skilled in the art that various changes and modifications may be made

therein without departing from the spirit of the invention or from the scope of the appended claims.

What we claim is:

1. In a dryer having a drum rotatable within a housing, an electrically conductive sensor insulated from and mounted on the drum for rotation therewith and having a sensing surface exposed to the drum interior and a contact surface lying within a small arc, means carried in the housing and periodically engaged by the contact surface of the sensor as the drum rotates to alternately impress a fixed charge on the sensor and to sense the residual charge on the sensor after the drum has rotated subsequent to impression of the charge to allow leakage from the sensor at a rate dependent upon the moisture content of the material being dried,
said sensor being mechanically and electrically isolated from said means during the interval between impressing and sensing the charge on the sensor, and means connected with said last-mentioned means and responsive to a sensed residual charge of predetermined value to effect a dryer control function.
2. In a dryer having a drum rotatable within a housing, an electrically conductive sensor insulated from and mounted on the drum for rotation therewith and having a sensing surface exposed to the drum interior and a contact surface lying within a small arc, means in the housing including wiper means periodically engageable by the contact surface of the sensor as the drum rotates to impress a fixed charge on the sensor and to subsequently sense the residual charge to effect a dryer control function in response to a residual charge of predetermined magnitude,
said drum rotating subsequent to impressing the charge and prior to sensing the residual charge so that representative materials in the drum contact the sensing surface of the sensor to leak the charge therefrom at a rate related to the moisture content of the materials.
3. In a dryer having a drum rotatable within a housing, an electrically conductive sensor insulated from and mounted on the drum for rotation therewith and having a sensing surface exposed to the drum interior and a contact surface lying within a small arc, first and second wipers mounted in the housing for sequential engagement by the contact surface as the drum rotates,
means including the first wiper for impressing an electric potential on the sensor when the contact surface thereof engages the first wiper during rotation of the drum, the impressed potential on the sensor leaking therefrom during continued rotation of the drum at a rate dependent upon the moisture content of the materials being dried in the drum, and means including the second wiper for sensing the residual potential on the sensor upon engagement of the contact surface thereof with the second wiper and being responsive to a predetermined residual potential to effect a dryer control function.
4. The combination of claim 3 wherein said means including said second wiper also includes a relay coil connected directly to said second wiper to have said residual potential impressed directly thereon.
5. In a dryer having a drum rotatable within a housing, an electrically conductive sensor insulated from and mounted on the drum for rotation therewith and having a sensing surface exposed to the drum interior and a contact surface lying within a small arc, first and second wipers mounted within the housing in circumferentially spaced positions with respect to the drum and in the path of rotation of said contact surface,
said contact surface engaging said wipers sequentially as the drum rotates,
means for impressing an electric potential on the first

- wiper to thereby impress a potential on the sensor as the contact surface engages the first wiper, and control means including the second wiper and responsive to a potential of predetermined magnitude on the second wiper as it is engaged by the contact surface to effect a dryer control function.
6. A dryer according to claim 5 in which the sensor contact surface is exposed to the exterior of the drum and the wipers are closely spaced with the sensor contact surface engaging the first wiper a few degrees of rotation after engaging the second wiper whereby the drum makes substantially a full revolution after having the potential impressed on the sensor before the residual potential is sensed.
7. In a dryer having a drum rotatable in a housing, an electrically conductive sensor insulated from and mounted in the wall of said drum and having a sensing surface exposed to the drum interior for engagement by the drum contents and a wiping surface exposed to the exterior of the drum, means in the housing for periodically engaging the sensor wiping surface as the drum rotates for impressing an electric charge on the sensor and subsequently sensing the residual charge on the sensor, and means connected with said last-mentioned means and responsive to a residual charge of predetermined value to effect a dryer control function.
8. In a dryer having a rotatable drum and control means operative in response to a predetermined electrical charge to effect a dryer control function, the combination of
an electrically conductive sensor insulated from and mounted on said drum for rotation therewith, said sensor including a contact surface characterized by a limited circumferential extension relative to said drum and a sensing surface exposed to the interior of said dryer for engagement with material being dried to permit electrical leakage from said sensor in accordance with moisture content of said material, first fixed electrical brush means supported adjacent said drum and connected to an electrical source, and second fixed electrical brush means supported adjacent said drum and connected to said control means,
said first and second brush means arranged relative to each other and said drum to sequentially engage said contact surface and said sensor being electrically isolated on said drum during rotation between said first and second brush means except for the leakage circuit through said material, said first brush means applying a predetermined electrical charge to said sensor and said second brush means receiving the residual charge on said sensor and transmitting said residual charge to said control means.
9. In a dryer having a rotatable drum and control means operative in response to a predetermined electrical charge to effect a dryer control function, the combination of
an electrically conductive sensor insulated from and rotatable with said drum, said sensor including a contact surface characterized by having a limited circumferential extension relative to said drum and a sensing surface exposed to the interior of said drum for engagement with material being dried with said material providing a leakage path between said sensor and said drum so that a charge on said sensor leaks off in accordance with the moisture content of said articles and so that said sensor is electrically isolated on said drum except for said leakage path,
a first fixed electrical brush supported in the path of and for engagement by said contact surface, said first electrical brush connected to an electrical source and operative, when engaged by said contact surface, to apply an electrical charge to said sensor, and a second fixed electrical brush supported in the

5

path of and for engagement by said contact surface, said second brush connected to said control means and spaced from said first electrical brush in the direction of rotation of said drum to engage said contact surface after a predetermined amount of rotation of said sensor subsequent to its engagement with said first electrical brush.

10. In a dryer having a rotatable drum and control means operative in response to a predetermined electrical charge to effect a dryer control function, the combination of

electrically isolated charge receiving means supported on and rotatable with said drum, said charge receiving means electrically insulated from said drum and being exposed to the interior thereof for engagement by material being dried with said material bridging between said charge receiving means and said drum to permit leakage of the charge to said drum in accordance with moisture content of said material, and being electrically isolated during rotation except for the leakage circuit established by said material,

first means fixed relative to said drum and arranged for momentary engagement by said charge receiving

6

means to apply an electrical charge to said charge receiving means, and second means fixed relative to said drum and arranged for momentary engagement by said charge receiving means after a predetermined amount of rotation of said drum subsequent to application of said charge, said second means connected to said control means and operative to transmit the charge remaining on said charge receiving means after said predetermined amount of rotation to said control means.

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