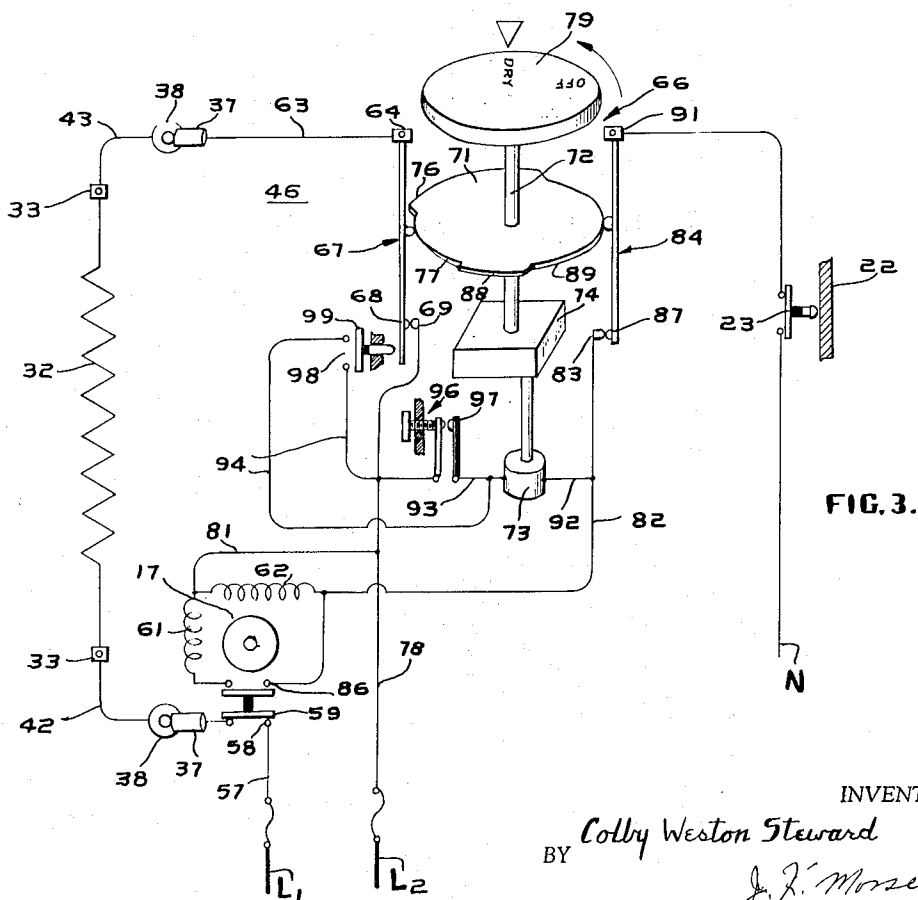
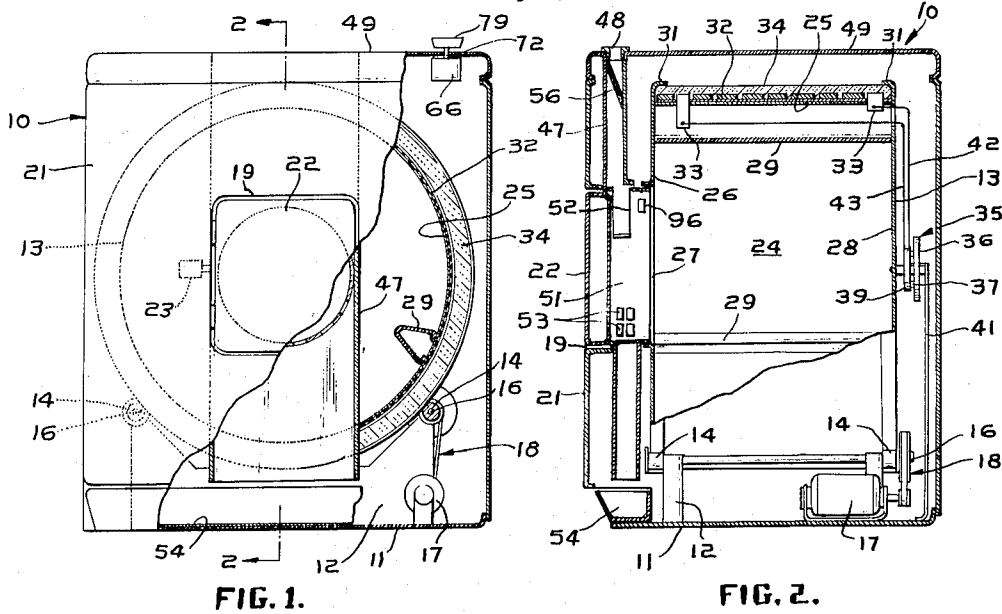


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CONTROL CIRCUIT FOR CLOTHES DRIER

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1 Claim. (Cl. 34—45)

The invention relates to clothes driers and more particularly to control means for clothes driers to provide improved operation.

Driers used for removing moisture from clothing must be provided with control means of some type to terminate the heating period near the end of the drying operation.

In accordance with the invention, a tumbler type clothes drier is provided with means for heating the clothing to evaporate the moisture therein, an adjustable thermostat positioned so as to be responsive above a predetermined temperature within the drier to energize a timer to open the heating element circuit, and thereafter the timer acts to shunt the thermostat to continue the tumbling operation for a predetermined length of time.

Accordingly, it is one of the objects of this invention to provide an automatic control arrangement for a tumbler type clothes drier utilizing a low capacity adjustable thermostat which is relatively simple in construction and operation.

It is another object of the invention to provide a tumbler type clothes drier with a control means which utilizes a low capacity thermostat connected in the timer circuit to provide for deenergization of the heating means.

It is still another object of the invention to provide an automatic control for a tumbler type clothes drier which shunts the controlling thermostat after energization of the timer motor to tumble the clothes for a predetermined length of time.

It is yet another object of the invention to provide a control for a tumbler type clothes drier which utilizes a timer to deenergize the heating means and a low capacity thermostat in the timer circuit to normally hold the timer inactive until a predetermined temperature has been reached within the drier, after which the thermostat is automatically shunted to continue tumbling of the clothes for a predetermined length of time.

Other objects, features, capabilities and advantages are comprehended by the invention as will later appear and as are inherently possessed thereby.

Referring to the drawings:

Figure 1 is a diagrammatic partial front plan view of a clothes drier with portions in section showing a clothes drier to which the improved control means may be applied;

Figure 2 is a partial vertical longitudinal sectional view of the clothes drier taken generally on the line 2—2 in Figure 1; and

Figure 3 is a schematic wiring diagram of the improved control means.

Referring now more in detail to the drawings for one form of clothes drier embodying the control features of the present invention, there is shown an outer cabinet or casing 10 secured to a base frame construction 11 for completely enclosing the operating parts of the clothes drier. Projecting upwardly from the base 11 are a pair of spaced ribs 12 which provide a support for a hollow clothes receiving rotatable tumbler or drum 13, mounted for rotation about its horizontal axis within a cradle

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formed by four spaced flanged friction rollers 14 carried on opposite ends of parallel spaced shafts 16. The drum 13 may be rotated by means of a pivotally mounted electric motor 17 through suitable speed reduction mechanism, such as, for example, a belt and pulley arrangement 18 which is operatively connected to one of the shafts and pair of rollers 14. When the motor is energized, the driven pulley rotates one of the shafts 16 and the friction between the engaging portions of the rollers and drum causes the same to rotate about its horizontal axis at a considerable speed reduction; i. e. between 35 and 50 R. P. M., while the opposite shaft carrying its pair of rollers 14 merely acts as a rolling support.

The surrounding cabinet has an access opening 19 provided in its front wall 21 disposed about the horizontal axis of the drum 13, and a door or closure 22 adjacent the opening 19 is adapted to be opened or closed by the operator to gain access to the drum or to seal the opening. Also, when the door is moved from one position to the other, it is adapted to engage a door switch 23 for a purpose to be hereinafter described.

The horizontally mounted drum 13 within the casing and defining the drying chamber 24 is a unitary structure and includes an imperforate cylindrical wall 25, a front end wall 26, having a single centrally located access opening 27 facing the access opening 19 in the front wall of the cabinet, and an imperforate vertical rear end wall 28 spaced in parallel relation to the front wall. A plurality of parallel lifting ribs or vanes 29 are secured to the inner periphery of the cylindrical wall 25 to tumble the clothes, and the end walls 26 and 28 are provided with circumferential flanges 31 which rest on the rollers 14 and constitute the sole support for the drum in its horizontal position.

In order to evaporate the moisture in the clothing within the drum 13, heat must be applied thereto. One such means for heating the drum is in the form of an electrical heating element 32 formed from a single, flat, long, thin and relatively wide strip of stainless steel, or other material having somewhat similar characteristics. This particular type heating element is preferably tightly wound over a thin strip of electrical insulation to cover substantially the entire outer periphery of the imperforate cylindrical wall 25 of the drum, and its opposite ends are secured to suitable terminal posts 33 disposed within the recess provided by one of the elevating vanes 29. A heating element of this type uniformly heats the entire periphery of the drum, which, of course, heats the clothing in the drying chamber to evaporate the moisture or a high percentage thereof, and the overall temperature of the entire heating element is reduced considerably. Also, to improve the overall efficiency of the drier, the outer surfaces of the drum may be enclosed by heat insulating material 34.

While various means may be employed for supplying energy to the heating element 32, there is diagrammatically disclosed a collector ring assembly 35 mounted on the back portion of the rear wall 28 at the approximate axis of rotation of the drum. This collector ring assembly includes a relatively stationary non-metallic support 36 carrying the usual carbon brushes 37 held in engagement with a pair of spaced concentric collector rings 38 mounted on the outer face of a generally disc-shaped rotatable insulating block 39 which is in turn anchored or secured to the rear wall 28 of the drum and, of course, rotates therewith. The stationary support 36 is held against rotational movement by means of a flexible holding arm 41 whose lower end is anchored to the base 11. Electrical conductors 42 and 43 extend from their respective collector rings radially outwardly along the back of the drum and are directly connected to the opposite ends of the heating element 32 at the terminal blocks 33 in

any suitable manner. Electrical energy is supplied to the heating element 32 from any suitable source of supply L₁ and L₂ under control of control mechanism generally referred to at 46 (Figure 3) to be hereinafter described.

Referring now more particularly to Figure 2, it can be seen that the front wall 26 on the drum 13 is spaced from the front wall 21 of the cabinet 10 to provide room for an open-ended vertical fluid conducting rectangular duct or conduit 47. The upper open end of the duct 47 communicates with the ambient atmosphere through a grilled opening 48 provided in the top wall 49 of the cabinet, and its lower open end is disposed adjacent the base 11 and in direct communication with the relatively cold air thereat. Intermediate the lower and upper ends of the duct and in alignment with the aligned access openings 19 and 27 in the cabinet and front wall of the drum, respectively, the duct is provided with a suitable horizontal cylindrical passage 51 of approximately the same size as the access opening in the drum. This passage permits access to the interior of the drum for inserting or removing the clothing.

In order to provide means for connecting the drying chamber 24 with the ambient atmosphere and to allow the vapor evaporated from the clothing to escape, the upper portion of the cylindrical passage 51 has a relatively large slot 52 directly communicating with the upper portion of the duct. Also, the lower portion of the cylindrical passage is provided with a series of relatively large openings or perforations 53 which directly communicate with the lower portion of the duct. While during the drying operation the major portion of the air entering the lower open end of the vertical duct flows upwardly through the perforations 53, they also provide the means for permitting heavy lint thrown through the opening and the vapor condensed in the duct to pass therethrough and fall downward through its open end, to be collected in a spaced combination heavy lint and moisture collecting tray 54 disposed directly therebelow. While the heavy lint will fall downwardly into the collecting tray, the light airborne lint will travel with the vapor and heated air upwardly through the duct; therefore, a detachable lint trap 56 of any suitable type is mounted in the upper portion of the vertical duct to filter the vapor and heated air and trap the lint moving therewith.

Referring now to Figure 3 for a detailed description of the improved control means which may be applied to a drier of the type described, there is shown a pair of leads or conductors L₁ and L₂ having a 230 volt potential between the two and a neutral N having a 115 volt potential between either one of the conductors L₁ and L₂.

Energization of the heating element 32 is from the line L₁ through a conductor 57 connected to one of the brushes 37 on the drum and it is in series with a pair of back contacts 58 on a centrifugally operated or speed responsive switch 59 carried by the drive motor 17 which has starting and running windings 61 and 62, respectively. As mentioned previously, the conductor 42 secured to one of the collector rings 38 and cooperating brush is connected to one of the terminals 33 of the heating element 32 which is wrapped about the outer periphery of the drum and the opposite terminal has the conductor 43 leading therefrom to the other collector ring and brush.

From this brush a conductor 63 leads to a terminal 64 provided at a timer mechanism 66 and this terminal is electrically connected to a first or heating element switch 67, having a movable arm or contact 68 and a stationary contact 69. The movable contact is provided with suitable abutment means for riding on a lobed timer disc or cam means 71 secured to a timer shaft 72 which is adapted to be rotated in a counterclockwise direction by a timer motor 73 through suitable speed reduction mechanism 74. The cam means shown has a lobe 76 for contacting and moving the movable contact 68 to its open position and a recessed portion 77 to permit the contacts to close. The stationary contact 69 is directly connected to the line L₂

by means of a conductor 78 to complete the 230 volt circuit across the heating element 32.

Extending outwardly from the cam means 71 and on the shaft 72 is a rotatable control knob 79 having indicia thereon which is adapted to be manually rotated by the operator independently of the timer motor.

The starting and running windings 61 and 62, respectively, on the drive motor 17 for rotating the drum to tumble the clothes are energized from Line L₂ through a conductor 81 and from the opposite side of the windings a conductor 82 leads to a stationary contact 83 of a second or motor switch 84 in the timer mechanism. The starting winding 61 is connected across the running winding 62 and is cut into or out of the motor circuit by means of the centrifugally operated switch 59 which moves to and from the inner contacts 86. The motor switch 84 has a movable arm or contact 87 with an abutment surface thereon for engaging a lobe 88 on the cam means 71 to open the switch and a relieved portion 89 on the cam means permits the switch 84 to close. The opposite or terminal end 91 of the movable contact 87 is directly connected to the neutral N through the door switch 23 to complete the drive motor circuit.

Energization of the timer motor 73 from the neutral N is through the second or motor switch 84 and conductor 82 to a conductor 92. The opposite side of the timer motor circuit may be completed either through a conductor 93 which is connected to the line L₂ through the conductor 78, or through a parallel conductor 94 connected to the line L₂ in the same manner. An adjustable low capacity temperature responsive thermostat 96 of any suitable type is connected in series with the first mentioned conductor 93. This thermostat is calibrated to maintain its contacts 97 open when the temperature of the drying medium to which it responds is below a predetermined value and, as shown in the diagram, the timer motor circuit may be opened and closed at this point. The parallel conductor 94 is connected to the conductor 93 between the timer motor 73 and the thermostat 96 and is provided with a normally open third or shunting switch 98 having a movable bridging contact 99, which is adapted to be engaged or operated by the timer 66 to move the same to its closed position. In this instance, the switch 98 is shown as being actuated by the movable contact 68 of the heating element switch 67; however, it may be equally as well operated in any other manner as long as it is actuated in the proper sequence.

From the foregoing it can be seen that the timer motor circuit will be completed, assuming the door and motor switches 23 and 84, respectively, are closed, if either the thermostat 96 or the shunting switch 98 are closed, and that when the shunting switch 98 has been closed, the timer motor circuit is completed therethrough regardless of the demands of the thermostat 96.

The operation of a tumbler type clothes drier incorporating the improved control means is as follows:

The operator opens the door 22 and inserts the clothing to be dried through the aligned access openings 19 and 27, after which the door is closed and this action closes the door switch 23 and conditions the drive and timer motor circuits for operation.

Next the operator grasps the control knob 79 extending above the top of the cabinet and rotates the same in a clockwise direction to the position as shown in the drawings, until it engages a stop (not shown). This action moves the lobed surfaces 76 and 88 away from their respective abutments on the movable contacts 68 and 87, and the shunt switch 98 is in its open position, as shown in the drawings. Since the drive motor circuit is now energized through the starting and running windings 61 and 62, the motor starts to rotate which in turn rotates the drum 13 about its horizontal axis at approximately 35 to 50 R. P. M. When the drive motor attains a predetermined speed the centrifugal switch 59 is actuated to cut out the starting winding 61 at the contacts 86 and at the

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same time bridge the back contacts 58 to complete the circuit to the heating element 32.

Since both the thermostat switch 96 and the shunt switch 98 are open, the timer motor circuit is deenergized, therefore the cam means 71 remains stationary. Should the drive motor 17 fail for any reason, the centrifugal switch 59 will either not operate or will move to open the heating element circuit when the motor drops to a predetermined speed. Likewise, if the operator opens the door 22 the motor circuit will be opened and the heating circuit will be opened as soon as the motor speed drops to a predetermined value.

Upon energization of the heating element, heat is supplied to the drum 13 to elevate its temperature and evaporate the moisture from the clothing. After a time interval, dependent upon the quantity of clothing, moisture to be evaporated and the rate at which heat is applied to the drum, the clothes will approach their dried condition. At such time the temperature within the drying chamber 24 will start to rise because of the reduced evaporation rate and when the temperature reaches a predetermined value as selected on the thermostat by the operator, the thermostat 96 moves in a direction to close its contacts 97 to thus complete the timer circuit.

Upon closing the timer circuit the timer motor 73 begins to rotate the cam means 71 on the timer in a counterclockwise direction, as viewed in the drawings. Shortly after the timer is energized, the lobe 76 on the timer engages the abutment surface on the movable contact 68 of the heating element switch 67 and moves the same away from its fixed contact 69. This action opens the heating element circuit and permanently deenergizes the heating element 32; however, the drive motor circuit is still energized through its switch 84. At the same time or with the same motion, the third or shunting switch 98 in the conductor 94 is closed by the motion of the movable contact 68 to energize the timer motor 73 in a parallel branch to shunt the thermostat 96. It can be seen that as the drum 13 cools down with continued rotation of the drum and tumbling of the clothes, the thermostat 97 will be cooled also and operates to open its contacts 97; however, the timer motor is still energized independently of the thermostat position through the parallel

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conductor 94 and closed switch 98 to continue to rotate the cam means 71.

After a predetermined length of time depending upon the desired handling temperature of the clothing, the motor lobe 88 gradually moves in a position to contact and move the movable contact 87 of the second switch 84 to its open position. Upon opening of the second switch, both the timer and drive motor circuits are opened to terminate the drying cycle or operation. The operator then may open the door and remove the dried clothes from the drying chamber 24 through the aligned access openings.

From the foregoing it can be seen that an improved simplified automatic control means has been provided for a tumbler type clothes drier which is simple in operation, utilizes a relatively inexpensive low capacity adjustable thermostat in the timer circuit and that the timer is operative after energization by the thermostat to open the main heating element circuit. Also, that shunting means for the thermostat has been provided to prevent premature opening of the timer circuit after the heating element has been deenergized to cool the clothes for a predetermined length of time.

While I have herein described and upon the drawings shown an illustrative embodiment of the invention, it is to be understood that the invention is not limited thereto but may comprehend other constructions, arrangements of parts, details and features without departing from the spirit of the invention.

It is claimed:

In a control mechanism for a drying apparatus having a drive motor, a timer motor and heating means, the combination of an energizing circuit for said heating means, energizing circuits for each of said drive and timer motors, a single-pole double-throw switch closing said heating means circuit and opening said timer motor circuit, a cam controlling said switch, and a normally open thermostatic switch controlling said timer motor and said cam.

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