ELECTRICAL CONTROL SYSTEM FOR CLOTHES DRYER

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1. Claim. (Cl. 34—45)

This invention relates to clothes dryers, and more particularly to an electrical control system for such machines.

An object of this invention is to construct a clothes dryer having definite and distinct operating temperatures for selection by the operator, so that the dryer may be employed as safely for delicate and synthetic fabrics as for more rugged linen and cottons.

A further object of this invention is to provide temperature selection in an electrically operated automatic clothes dryer without the use of an adjustable thermostat, thereby increasing reliability while decreasing manufacturing cost.

Other objects of this invention lie in increasing safety, ease of operation and temperature selection in an electric clothes dryer of the type having a tumbling basket or drum with an electric heater, and a fan for forcing heated air through the tumbling clothes.

In carrying out my invention, a feature thereof pertains to the use of an electric heater for the dryer which is divided into two independently controlled sections, adapted to be electrically connected together in parallel. A cycling thermostat in series with both heater sections limits maximum drying temperature, while a time controlled switch determines the period of operation. For manual selection of a lower operating temperature, safe for the more delicate and synthetic fabrics, a manually operable switch is provided to open the circuit of one section of the heater.

The power output of the remaining heater section is selected to provide a considerably lower peak temperature within the machine, and below the temperatures held by the cycling thermostat. The dryer further includes an access door and a switch actuated upon opening of the door to terminate both motor and heater operation. Additionally, the time-controlling means provides a cool-down period during which the motor and fan are operating, but without heater operation.

The features of the invention which are believed to be novel are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in which Fig. 1 is a cross-sectional elevation through a clothes dryer embodying the invention with certain surfaces broken away to illustrate details; Fig. 2 is a partial rear elevation of the machine illustrated by Fig. 1, with portions thereof broken away to illustrate details; and Fig. 3 is a schematic wiring diagram representing the invention.

Referring to the drawings, the invention is illustrated as applied to a clothes dryer of the domestic type enclosed in a cabinet structure including, as shown by Fig. 1, a rear wall 1, rear wall 2, and top 3. The cabinet enclosure may be completed with conventional side walls 4 and 5 as illustrated by Fig. 2. The front wall 1 of the dryer is provided with an access opening in which is mounted a loading ring 6. This access opening is closed by a suitable door 7 hinged to the cabinet structure. An air seal between door and cabinet is provided by means of a flexible gasket 8.

Within the cabinet structure is rotatably mounted a clothes basket or drum indicated generally at 9. This basket is of the type having a cylindrical outer wall perforated to permit air flow therethrough and with a plurality of baffles 10 to assist in tumbling the clothes on rotation of the basket. Front wall 11 of the basket is provided with a flanged opening 12 of slightly larger diameter than the diameter of loading ring 6. Thus, opening 12 in the basket provides access to the interior thereof for loading and unloading of clothes. A rear wall 13 of the basket is riveted or otherwise secured to a hub 14 formed on the end of a driving shaft 15. Hence the basket is supported in cantilever fashion on shaft 15, it is desirable to reinforce rear wall 13 by an additional rear wall section 16, likewise secured to hub 14 and riveted as at 17 to the main rear wall section 13 of the basket.

The rotatable mounting of the basket within the cabinet is provided by suitable structural members 18, for example in the form of angle iron supports, which rest upon base 19 of the machine. Secured to this supporting structure 18 is a bearing support sleeve 20. Sleeve 20 in turn carries front bearing 21 and rear bearing 22 in which shaft 15 rotates. A suitable clamping means 23 is provided in a manner well understood in the art for securing the bearing support to the supporting structure.

To define an air chamber surrounding drum or basket 9, an outer wrapper is provided comprising an outer curved sheet 24 extending upwardly from base 19 and around the peripheral wall of the basket, and front and rear wrapper walls 25 and 26. The enclosing wrapper wall portion 24 is covered with an insulation blanket 27; and similarly front wall 25 is covered with an insulation blanket 28 while the rear wall is insulated by blanket 29. Thus it can be seen that basket 9 is enclosed in an insulated space confining the heated air employed for evaporating moisture from damp clothes tumbling within the basket.

Air flow through the basket and rotation thereof is provided by utilizing as motive power an electric motor 30. Shaft 31 of this motor rotates a fan 32 and a driving pulley 33. Pulley 33 is belted-connected to a large idler pulley 34 having as a unitary part thereof a small idler pulley 35 which in turn is connected by belt 36 to the main driven pulley 37 keyed to shaft 15 of the basket. Idler pulleys 34 and 35 may be carried on a shaft 38 journaled in a supporting plate 39 in a well-understood manner. The idler pulley arrangement is, of course, designed to provide a speed reduction from motor 30 to the basket, whereby the basket rotates at a speed to cause tumbling of clothes contained therein.

Heat for drying the clothes is provided by an electric heater structure designated generally by the reference numeral 40. While numerous electric heater structures may be employed in accordance with the teachings of this invention, conveniently the actual heating coils 41 are carried on a series of ceramic insulators 42, which in turn are secured to a base plate and supporting structure 43. The heater assembly is closely adjacent to the periphery of basket 9 and preferably a screen 44 is provided between the heating coils 41 and the basket to avoid direct contact of lint with the heater. The entire heater assembly may be connected to an attaching plate 45 adapted to be secured to rear wall 26 of the wrapper.

In accordance with this invention, I provide in connection with the heater assembly at least two independent heater sections having respective terminal studs 47 and 48 and a common terminal 46. As illustrated schematically in Fig. 3, these heater sections are 65 and 66.
Control of the dryer by the operator is provided by a means 50 mounted on a backslash panel 49 (Fig. 1) forming a part of top 3 of the outer cabinet. In accordance with this invention, timer control knob 58a is available for adjustment by the operator along with a temperature selector switch 51. The operation of these devices will be explained more fully in connection with the wiring diagram of Fig. 3.

The control of the dryer is accomplished in part by the use of temperature control and safety controls, thermostats 52 and 53 respectively as shown by Fig. 2. The temperature control thermostat 52 is of the type adapted to cycle between "on" and "off" positions in a relatively narrow temperature band, thereby to hold operating temperature within the dryer. The safety control thermostat is normally closed and is set to open at a predetermined high temperature, higher than the temperature held by thermostat 52, primarily as a safety precaution to prevent over-temperature of the dryer. For example, the cycling thermostat 52 should hold a temperature in the range from 190° to 210° F.; while the safety thermostat is set to open the circuit to the electric heaters at a temperature from 250° to 330° F.

In accordance with conventional practice in clothes dryer construction, Fig. 1 illustrates the use of an illumination light 54 for the interior of the machine and an ozone lamp 55 to freshen the air employed in drying the clothes. These two lamps are placed in position in front of a transparent window 56 and in the inlet air stream.

While I have not shown in detail interior wall sections within the dryer to direct the flow of air through the dryer, it is to be understood that any of the numerous arrangements well known in the art may be employed. Preferably, the dryer includes an air circulation system as disclosed and claimed in the co-pending application of John H. Robinson and Paul L. Paulsen, Serial No. 209,920, filed February 3, 1951, now Patent 2,707,837 assigned to the General Electric Company, assignee of this application. In brief, fan 32 draws fresh air in through the back wall of the dryer through a plurality of louvres 57, illustrated by Fig. 1. This incoming air passes downwardly in the space between rear wall 2 of the cabinet and the insulation blanket 29, through the fan blades and over the lamp 55 and by ozone lamp 54. A substantial portion of the air then flows upwardly toward and over the electrical heater assembly 40 and into the dryer basket. The air is finally exhausted out front of the machine through a lint trap assembly 58 of conventional construction.

Referring now to Fig. 3, the motor 29 is illustrated as including conventional run and start windings 59 and 69 along with a centrifugal switch including contacts 61 and 62 bridged by an armature 63 operated by centrifugal mechanism 64. While the motor is at rest, the armature 63 bridges contacts 61 and 62 to include start winding 60 of the motor in the electrical circuit. However, as soon as the motor has come up to speed, the start circuit is opened by the centrifugal mechanism. This same centrifugal mechanism closes a circuit through contacts 72 and 73 to energize the electrical heaters when the motor is operating at normal or near normal speed.

The electrical heater assembly 40 as shown by Fig. 3 comprises two separate and distinct heating sections 65 and 66. These two heater sections are connected together at one end by utilizing the common terminal 46. Power is supplied to the heaters at the opposite ends thereof through separate terminals 47 and 48 so that the heater sections are in electrical parallel. In series with heater section 65 is the manually operable temperature selection switch 51. It is contemplated in accordance with this invention that when both heater sections 65 and 66 are operating, switch 51 closed, heat is supplied to the dryer at a relatively rapid rate to increase the temperature thereof and evaporate water as quickly as possible. Under these conditions, maximum dryer temperature is under control of the cycling thermostat 52. For example, this thermostat is set to permit a rise in temperature to approximately 210° F. whereupon the circuit to the motor stops and the timer starts to approximately 190° F. before reclosing. The heater sections are not necessarily of equal wattage but are selected so that with both heaters operating the maximum operating temperature of 210° F. can be reached with a normal clothes load. However, the heater section 66 operating alone, switch 51 open, it is contemplated that with a normal clothes load a maximum temperature of only 160° F. is attained.

Fig. 3 also illustrates in more detail the nature of the timer comprising a pair of cams 67 and 68 for actuating switches 69 and 70 respectively. These cams are driven by a timer motor 74, or they may be manually adjusted to any desired position by control knob 58a.

The components are illustrated in Fig. 3 in the positions occupied when the dryer is at rest. The clothes or materials to be dried are inserted into basket 9 through the access door 7. A switch 71 is opened upon opening the door and is closed upon closure of the door. This switch functions to stop operation of the machine whenever the door is open.

In operation, when the door is closed after loading the machine, control knob 58a is rotated to rotate switches 67 and 68 in a clockwise direction. This closes switches 69 and 70 to commence operation of the machine. Both the temperature control and the safety control thermostats are closed when the machine is cool. The manually operable switch 51 may be either open or closed depending upon the desire of the operator. Until such time as the motor has come up to speed, armature 63 of the centrifugal mechanism is in its down position as shown by Fig. 3. Electrical power is supplied to the machine through terminals 75, 76, and 77 on a terminal block 78 for the machine. Normally, line 76 is electrical neutral while lines 75 and 77 represent the 220 v. electrical supply lines. With cam operated switches 69 and 70 closed, a circuit is completed from line 75 through switch 70, line 79, to a terminal 80 of the motor. Motor terminal 80 connects both to main winding 59 of the motor and to contact 62 of the centrifugal switch for the armature winding and the rear armature winding. From the opposite side of the motor windings, terminal 81 of the motor, the circuit is completed through line 82, door operated switch 71, line 83, and a fuse 84 to the neutral terminal 76 of the power supply. By this circuit, approximately 110 v. is applied to the motor, and it commences its operation.

The heater sections cannot be energized while the motor is at rest. However, as soon as the motor comes up to speed, a circuit is completed from terminal 75, through switch 70, line 79, motor terminal 80, centrifugal switch contact 72, centrifugal mechanism armature 63, contact 73, to common terminal 46 of the heating elements. From terminals 47 and 48 of the heaters, the circuit is completed through the safety control thermostat 53, temperature control thermostat 52, line 85, timer switch 69, to the opposite side of the line 77. Thus, both heating elements are energized if the manually operable switch 51 is closed and the motor is operating. If the temperature selector switch 51 is open, only one section of the heater is effective.

The timer motor is energized and is effective to rotate cams 67 and 68 upon commencement of operation by a circuit commencing with terminal 75 and continuing through switch 70 and a line 86 to one terminal of the timer motor. The other terminal of the timer motor completes its circuit through line 87, to line 82, the door operated switch 71, the line 83 to the electrical neutral 76. It may be noted that the timer motor operates continuously while switch 70 is closed unless the door is opened, thus opening switch 71.

If the temperature control switch 51 is closed, the
temperature within the dryer rises to the maximum temperature determined by the setting of the cycling control thermostat 52. As previously explained, this thermostat holds the temperature within the dryer to a range such as 190° F. to 210° F. If the temperature control switch 51 remains open, however, the temperature in the machine under normal circumstances would rise only to approximately 160° F.

The timer motor continues to rotate cams 67 and 68 to the point in the cycle where switch 69 opens the circuit to the heating elements. However, at this point switch 70 remains closed under the influence of cam 68 to continue the motor in operation for a period of time without operation of the heating elements. Subsequently, the complete cycle of operations is terminated by opening of switch 70, which not only terminates operation of motor 30, but also operation of timer motor 74.

If at any time during operation of the machine an abnormally high temperature occurs for any reason whatsoever, the safety control thermostat 53 opens the circuit to the heating elements.

In accordance with this invention, it is contemplated that both thermostats 52 and 53 are of the type pre-set upon manufacture to actuate at a particular temperature. No adjustable feature is needed for either of these thermostats. It is found in practice that a more reliable thermostat can be provided if the adjustable feature can be omitted. However, temperature control of the dryer is still achieved by the use of independently controlled parallel sections in the heater winding, which sections are under the control of one or more manually operable switches. While I have shown the complete heating element assembly as including only two sections, with one manually operable switch, it can be readily understood that additional sections and additional switches for control thereof may be added as desired.

While this invention has been described by reference to a particular embodiment, it is to be understood that numerous modifications may be made without actually departing from the spirit of the invention. It is therefore aimed in the appended claim to cover all such equivalent variations as come within the true scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

A clothes dryer comprising a tumbling basket, air circulating means for circulating air through said tumbling basket, a motor for rotating said basket and driving said air circulating means, electrical heating means including a basic heater section and an auxiliary heater section and positioned in the path of at least a portion of the air circulated by said air circulating means, means forming parallel electrical circuits for said heater sections, a cycling temperature control thermostat switch in electrical series with both heater sections to limit maximum temperature within the dryer when both basic and auxiliary heater sections are in operation, a time controlled switch in series circuit relation with both sections of said heating means, and a manually controlled temperature selector for independently controlling said auxiliary heater section, the energy output of said basic heater section providing insufficient heat to heat said air to a level effective to actuate said cycling control thermostat switch.

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