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C. A. COBB ET AL

3,239,945

HEAT AND BLOWER CONTROL FOR A DRYER

Filed Oct. 10, 1962

3 Sheets-Sheet 1

FIG. 1

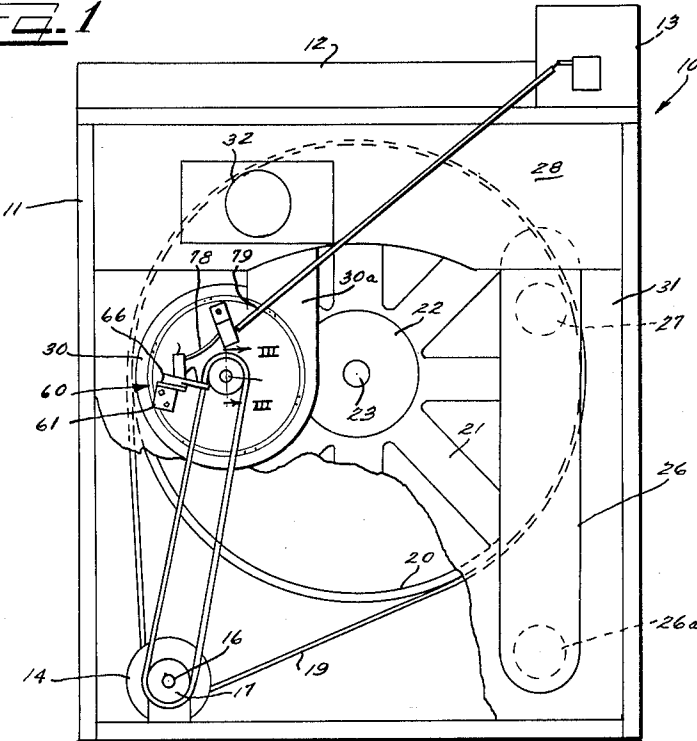
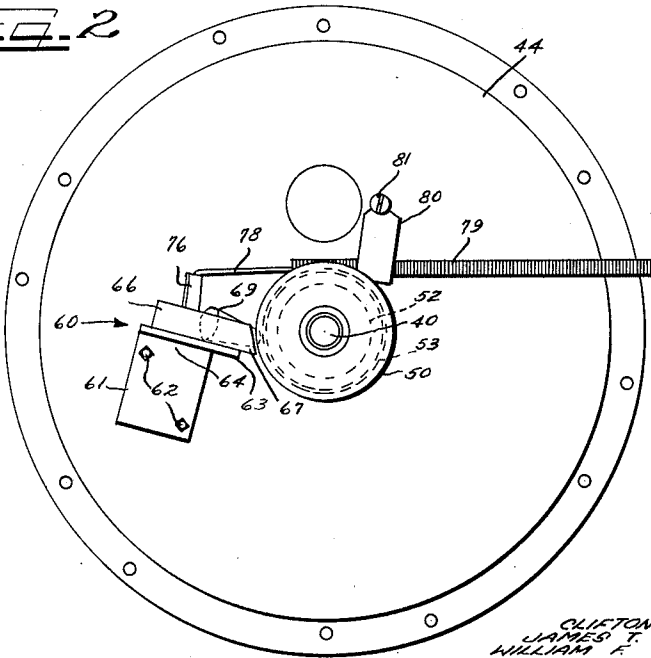


FIG. 2



INVENTORS
CLIFTON A. COBB
JAMES T. WILLIAMS
WILLIAM F. GOURDEAU

BY

Wm. Spearman, Merri, Good & Simpson
ATTORNEYS

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C. A. COBB ET AL

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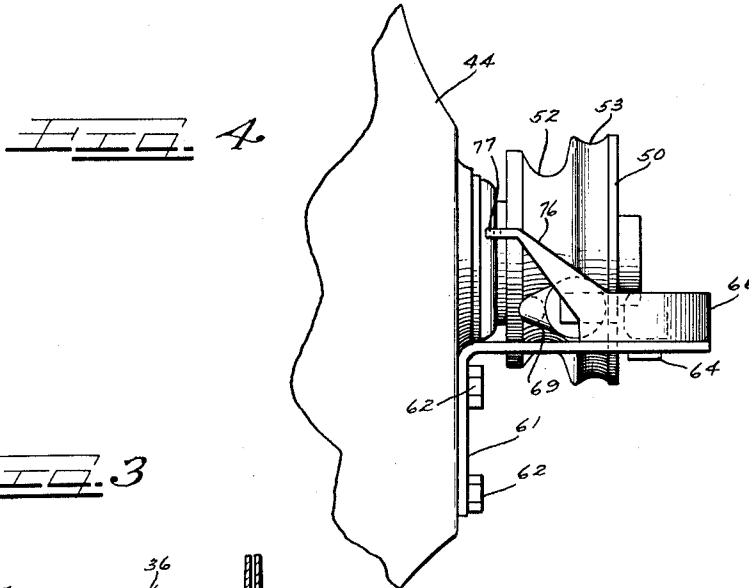


FIG. 3

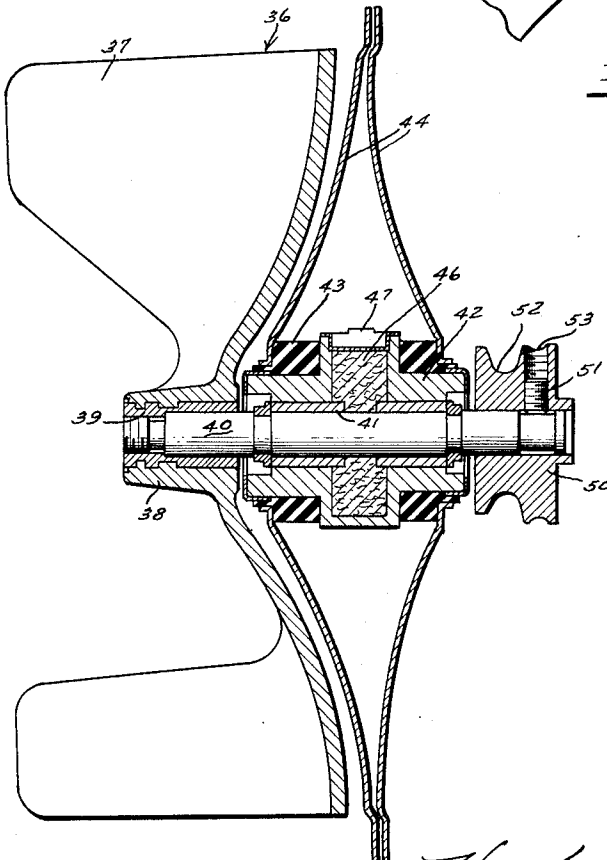
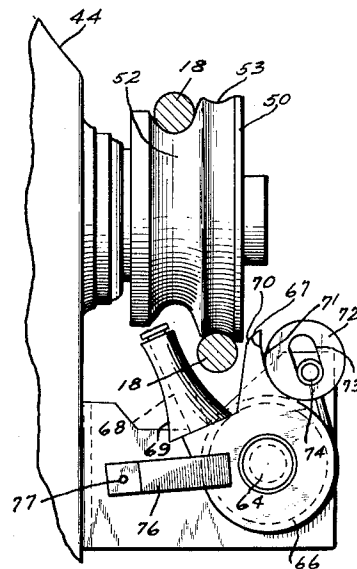


FIG. 5



INVENTORS
CLIFTON A. COBB
JAMES T. WILLIAMS
WILLIAM F. GOURDEAU

BY

Hill, Sherman, Morris, Cross, Simpson
ATTORNEYS

March 15, 1966

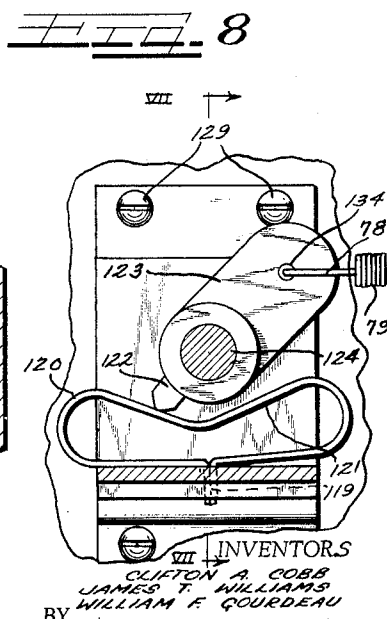
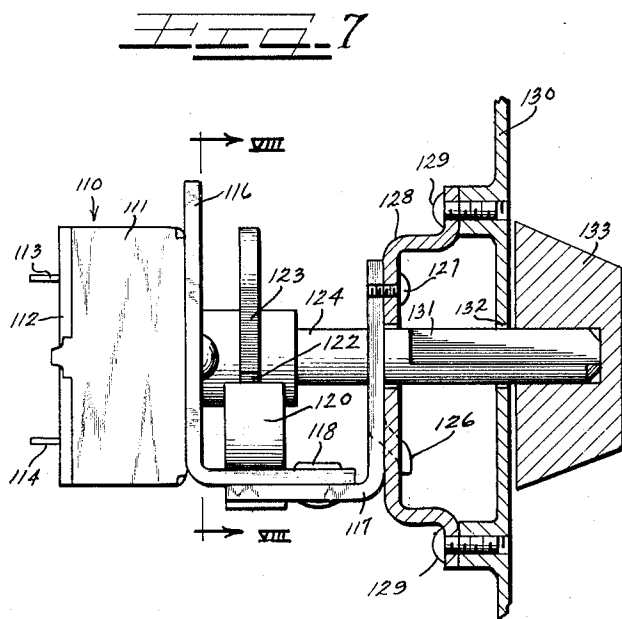
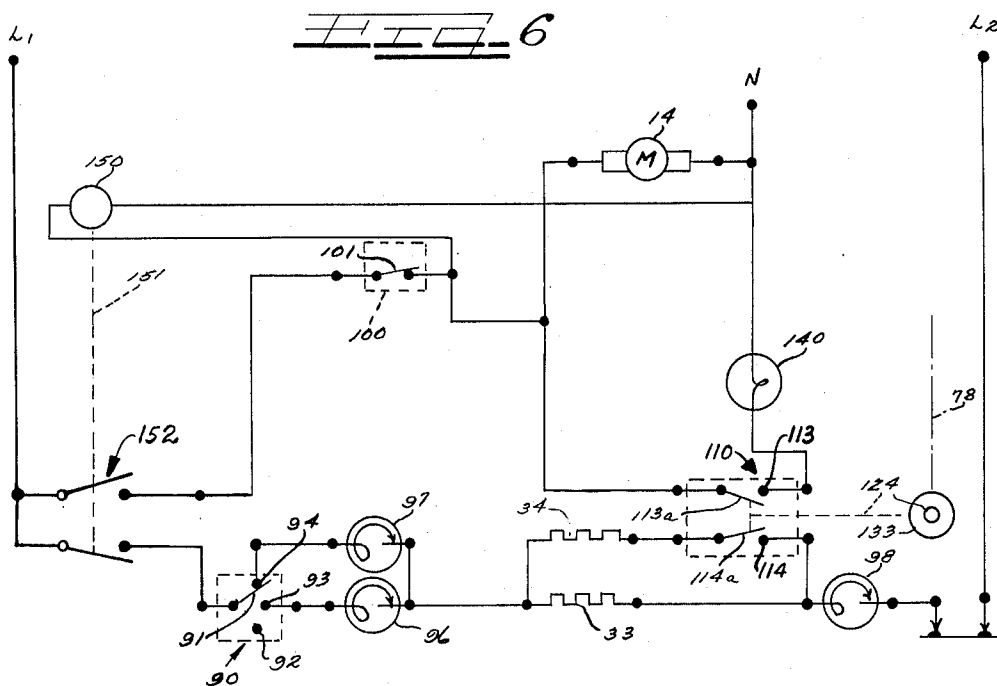
C. A. COBB ET AL

3,239,945

HEAT AND BLOWER CONTROL FOR A DRYER

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3 Sheets-Sheet 3



INVENTORS
CLIFTON A. COBB
JAMES T. WILLIAMS
WILLIAM F. GOURDEAU

BY

Full, Sherman, Merritt, Gross & Simpson
ATTORNEYS

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3,239,945

HEAT AND BLOWER CONTROL FOR A DRYER
Clifton A. Cobb, James T. Williams, and William F. Gourdeau, St. Joseph, Mich., assignors to Whirlpool Corporation, St. Joseph, Mich., a corporation of Delaware

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8 Claims. (Cl. 34—45)

This invention relates generally to drying systems and dryers and more particularly relates to an apparatus for drying materials wherein the thermal energy input rate is simultaneously changed to match a changed flow volume of air when the ratio of motor to blower speed is selectively varied.

Although the principles of the present invention are of general applicability, a particularly useful embodiment is provided in a drying system of a laundry appliance or dry cleaner wherein a blower is used to drive a stream of temperature-conditioned air through a treatment zone. In accordance with prior art procedures, dryer apparatus for clothes or for dry cleaning apparatus generally utilize a single speed blower motor which directs a stream of air through the treatment zone in accordance with a fixed flow volume. In accordance with the principles of the present invention, a single speed electric motor is provided, however, the blower shaft is particularly characterized by a multiple pulley groove driving hub wherein the multiple grooves are of different diameter and the pulley belt is selectively shiftable between the grooves, thereby to vary the speed of the impeller of the blower and hence adjust the flow volume of the air flowing through the treatment zone. It is further contemplated by the present invention that the thermal energy input rate be simultaneously changed with the blower speed adjustment, thereby matching the thermal energy input rate to the changed flow volume of air.

It is an object of the present invention to provide a blower apparatus which has a capacity for changing the flow volume of an air stream directed through the treatment zone.

Another object of the present invention is to provide an apparatus for drying wherein the thermal energy input rate can be matched to a changed flow volume of air.

Yet another object of the present invention is to provide a blower for a dryer wherein the blower shaft has a driving hub characterized by multiple pulley grooves of different diameter and wherein a pulley belt may be selectively shifted between the grooves to vary the flow volume of air discharged by the blower.

Yet another object of the present invention is to provide a control device for simultaneously effecting regulation of an electric circuit and for mechanically shifting a speed changing device.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the accompanying sheets of drawings in which a preferred structural embodiment of a laundry appliance incorporating the principles of the present invention is shown by way of illustrative example and in connection with which the present invention may be effectively practiced.

On the drawings:

FIGURE 1 is a rear view of a dryer incorporating the principles of the present invention;

FIGURE 2 is an enlarged fragmentary view with

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parts removed showing additional details of the pulley belt shifting mechanism of the present invention;

FIGURE 3 is a cross-sectional view of the blower impeller taken generally on line III—III of FIGURE 1;

FIGURE 4 is a fragmentary view showing additional details of construction of the pulley belt shifting mechanism;

FIGURE 5 is a view similar to FIGURE 4 but taken on a plane shifted 90° to illustrate additional details of construction of the belt-shifting means;

FIGURE 6 is a circuit diagram illustrating the control circuit associated with the dryer of FIGURE 1;

FIGURE 7 is a cross-sectional view taken on line VII—VII of FIGURE 8; and

FIGURE 8 is a cross-sectional view taken on line VIII—VIII of FIGURE 7, FIGURES 7 and 8 showing the control device for simultaneously effecting control of the circuit and the belt-shifting means.

As shown on the drawings:

The principles of the present invention are advantageously incorporated in and practiced with a laundry dryer apparatus shown generally in FIGURE 1 at 10 wherein the machine is shown as having a casing 11 with a console panel 12 and a so-called control tower 13 on one side thereof.

The rear of the machine is shown with a back wall removed, thereby to expose the operating components of the dryer apparatus 10 and as illustrated in FIGURE 1, there is provided a single speed electric motor 14. In an exemplary form of dryer construction, the single speed motor can take the form of an electric motor having a normal operating driving speed of 1725 r.p.m. and has a drive shaft 16 to which is attached a pulley 17 cooperating with a blower pulley belt shown at 18.

The motor 14 also drives a belt 19 which is trained over the outer periphery of drum 20 which is mounted for rotation on axially disposed shaft 23 so as to extend into the interior of casing 11, thereby providing a clothes treatment zone. Shaft 23 is fixedly attached to the bulkhead 31. Ribs 21 and hub 22 provide stiffening means for bulkhead 31.

The laundry apparatus 10 incorporates the usual air system through which a stream of ventilated air is directed. In this connection, the air system includes a vertical tempering conduit 26 which is mounted on the rear of bulkhead 31, the conduit 26 having a temperature-conditioned air outlet 27 which leads to the interior drum 20. Thermal energy is added to the air stream in the tempering conduit 26, thereby to temperature-condition the air which passes through air inlet 26a. A blower shown generally at 30 is located on the rear of bulkhead 31 and draws moisture-laden air from the interior of drum 20, and discharges this stream of moisture-laden air through vent 32 which extends from the blower outlet conduit 30a through the partial back panel 28.

An exhaust outlet which coincides with the blower inlet is also provided for the treatment zone in the bulkhead 31. Vent 32 may be connected to a suitable pipe if the machine is vented to the outside atmosphere or else the discharging air may vent directly into the space in which the dryer is located.

Although the laundry drying apparatus 10 is of a type which could be advantageously employed with either a source of heat comprising a gas burning means, or electrical resistance elements, the present exemplary form of the invention is described for purposes of illustration in connection with a machine employing electrical resistance-type heating elements wherein two separate heating elements 33 and 34 and located within the tempering

conduit 26 (see FIGURE 6). For example, the heating elements 33 and 34 could comprise elements of 3600 watts and 2000 watts, respectively.

In accordance with the principles of the present invention, it is contemplated that the volume flow of air driven through the treatment zone be selectively variable. To effect that end, a speed-changing mechanism is associated with the blower.

In FIGURE 3 there is shown a blower impeller 36 having plural vanes 37 carried on a hub 38 fastened as at 39 to the end of a shaft 40. The shaft is journaled in a bearing sleeve means 41 retained within a bearing housing 42 cushioned in a rubber mount 43 carried by a double wall portion 44 which mounts on the blower 30 which in turn mounts on the rear of bulkhead 31 of the casing 11. The bearing housing 42 is formed with a lubricant reservoir 46 preferably filled with a lubricant-impregnated packing material and the reservoir is closed by a closure shown at 47.

On the outside of the rear bulkhead 31 and on the end of the shaft 40 opposite the impeller 36, there is provided a driving hub 50 retained in corotatable assembly with shaft 40 by means of a set screw 51. The hub 50 is particularly characterized by the formation in the peripheral surface thereof of multiple pulley grooves, for example, 52 and 53, which are of different diameters, the groove 52 having a smaller diameter than the groove 53.

In order to selectively shift the pulley belt 18 between the multiple pulley grooves 52 and 53, a pulley shifting mechanism is provided, different aspects of which are illustrated in FIGURES 1, 2, 4 and 5.

The pulley shifting mechanism as indicated generally at 60 and more specifically includes a bracket having a mounting leg 61 secured by fasteners 62 to the outermost of the walls 44 adjacent the hub 50. The bracket includes a second leg 63 which extends at right angles to the leg 61 and carries a pivot pin 64 to which is connected a rotatable or pivotable disk 66.

The disk 66 has projecting radially outwardly therefrom two separate angularly spaced arms or projections 67 and 68. The projection 68 carries a tapered roller 69 in journaled relation and it will be noted upon inspecting FIGURE 5 that the projection 68 with the roller 69 thereon is somewhat longer than the corresponding projection 67. The projection 67 has a belt-engaging surface 70 on one side thereof and is concavely recessed as at 71 on the other side thereof, thereby to engage a stop 72 which can be adjustably set by virtue of having formed therein a centrally disposed elongated slot 73 and an adjustable fastener 74.

Also projecting radially outwardly from the disk 66 is a lever arm 76 having a connecting lug 77 to which is connected the inside wire 78 of a Bowden cable 79 leading to a remotely located actuating device. The Bowden cable is retained by a clip 80 secured as at 81 to one of the walls 44.

As will be evident from inspecting FIGURE 5, the roller 69 and the projection 67 are angularly disposed to confine in the included angle therebetween the pulley belt 18. Thus, if the disk 66 is pivotally displaced in a clockwise direction the roller 69 will engage the pulley belt 18 and will tend to shift the belt 18 out of the groove 52 and into the groove 53. On the other hand, if the disk 66 is rotated in a counterclockwise direction, the projection 67 will tend to push the pulley belt 18 out of the groove 53 and into the groove 52.

In FIGURE 6, the control circuit for the dryer apparatus 10 is illustrated. The control circuitry is shown associated with a three-wire source including lines L₁, L₂ and a neutral line N.

In the control circuit of FIGURE 6, there is shown a temperature selector switch 90 having a movable selector element 91 movable from an off or air contact position 92, a low or delicate temperature contact position 93 and a high or normal temperature contact position 94.

In circuit with the low temperature contact 93, there is an operating thermostat 96 and in circuit with the high temperature contact 94 there is an operating thermostat 97. It will be understood that the thermostats 96 and 97 can be set for different operating temperatures, for example, the low temperature thermostat could be set for 135° F., while the thermostat 97 could be set for 165° F.

The circuit also includes a safety thermostat which is indicated at 98 and which develops the function of protecting the apparatus against overheating at any time.

The circuit also includes a door switch shown generally at 100 including a movable element 101 operated to its open position upon opening of the door to stop the machine.

In order to effect simultaneous control of the thermal energy input rate and the blower speed or volume flow of air, a novel actuating mechanism is provided which is shown in FIGURES 7 and 8. The actuating mechanism includes an electric switch shown generally at 110 and having a box-shaped housing 111 open on one side and spanned on the open side by an insulator wafer 112 carrying electrically conductive terminals 113 and 114. The housing 111 is carried on a two-piece U-shaped bracket including a first leg 116 and a second leg 117 fastened together by rivets 118.

The bight portion of the U-shaped bracket 116, 117 is suitably apertured by a slot 119, thereby to confine the opposite ends of a spring taking the form of a strip member bent to form a loop 120 and including a horizontally disposed leg 121 extending upwardly from the bight portion to provide an engagement surface for a lug 122 carried on a lever arm 123 fastened in corotatable assembly with a switch shaft 124.

The shaft 124 is journaled for rotation in suitable apertures formed in the leg 117 and the leg 116 and actuates a movable switch element within the switch housing 111 for controlling electric circuitry associated with the terminals 113 and 114.

In order to mount the actuator on the control tower 13 in an accessible position for regulation by an operator, the leg 117 is fastened by a lug 126 and a fastener 127 to a bracket 128 by fasteners 129 to a wall 130 of the control tower 13. The shaft 124 has an end portion formed with a flat 131 extending outwardly through an aperture 132 in the wall 130 and a manual actuating knob 133 is fastened to the shaft 124 so that manipulation can be effected from the front of the machine.

In FIGURE 8, the lever 123 is shown formed with an opening 134 by means of which the wire 78 of the Bowden wire 79 can be attached.

In operation, when the knob 133 is angularly shifted, the shaft 124 is concurrently rotated, thereby actuating the electrical elements within the switch housing 111 and simultaneously angularly shifting the lever 123 so that the wire 78 in the Bowden wire 79 is actuated to move the lever arm 76 on the speed-shifting mechanism 60.

The action of the electrical switch 110 will be understood upon referring to the wiring diagram of FIGURE 6.

When the knob 133 is positioned so that a high input or thermal energy input rate is available, the belt 18 is automatically shifted from the groove 53 by the mechanical action of the Bowden wire 79 which rotates the disk 66 and, in turn, the projection 67 moves the belt into the groove 52, thereby providing a high speed for the blower impeller 36. Simultaneously, the shaft 124 closes both sets of contacts, shown at 113, 113a and 114, 114a (FIGURE 6) to energize the heater 34 and also to light an indicator light shown at 140. Both heaters 33 and 34 will be combined to give a maximum heat input. If the temperature selector switch 90 is set so that movable element 91 contacts contact 94, high temperature thermostat 97 will regulate the temperature conditioning of the air stream.

When the knob 133 is positioned so that a low heat

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input is available, the shaft 124 moves the lever 123 and the Bowden cable 79 transmits the movement to the lever 68, thereby moving the roller 69 against the belt 18 and shifts the belt out of the groove 52 into the groove 53 to reduce the speed of the blower impeller 36.

Simultaneously, the contacts 113, 113a and 114, 114a are opened, thereby reducing the heat input by breaking the electrical circuit to the heating element 34.

The dryer control apparatus also includes a timer motor shown at 150 and which actuates through appropriate mechanical means 151 appropriate switching means 152 which are normally closed during a drying cycle, thereby effecting energization of the main drive motor 14. There is thus provided in a clothes drying machine including a heat source and an air translation means driven by a motor means through a belt a control apparatus wherein the belt may be shifted to effect an increase or a decrease in the speed of the air translation means simultaneously with the increase or decrease of the heat output of the heat source and thereby effecting a correlation or matching of air translation speed with heat input to the dryer.

Although various minor modifications might be suggested by those versed in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon, all such modifications as reasonably and properly come within the scope of our contribution to the art.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A clothes dryer comprising, a single speed electric drive motor, means forming a treatment zone in which materials are to be dried, means including a blower for directing a stream of air through said treatment zone, variable heat input heating means for applying thermal energy at different selected input rates to the air stream, a multiple speed transmission connecting said motor and said blower for selectively driving said blower at different motor to blower speeds, thereby to vary the volume flow of the air stream and control means regulating said heating means between said different input rates to vary the thermal energy input to said air stream, including synchronizing means interlocking the operation of said control means and said transmission to match the heat input to the blower speed.

2. A dryer as defined in claim 1, said control means comprising a switch having relatively movable switch contacts and a movable actuating element for effecting relative movement of said switch contacts, and said synchronizing means comprising a mechanical driving connection to said transmission for effecting shifting of said transmission upon movement of said actuating element.

3. A dryer as defined in claim 1, said transmission comprising a driving hub connected to said blower and having driving portions of different diameter, drive means interconnecting said driving hub and said motor, and said control means including an actuating device for shifting said drive means from one of said driving portions to another.

4. A clothes drying appliance comprising a blower having a pulley hub with multiple pulley grooves of different diameter, a pulley belt shiftable between said grooves to drive a stream of air at different selected rates of volume flow, heating means for temperature-conditioning an air stream directed through a treatment zone in the dry-

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ing appliance at different selected rates of heat input, and a common control means for the pulley belt and the heating means comprising, a switch having a rotatable shaft, mechanical pulley belt shifting means, an electrical heater control means, means mechanically interconnecting said shaft and said belt shifting means, and means electrically interconnecting said heater control means and said switch, whereupon actuation of said common control means will simultaneously change the heat input and the blower speed, thereby to match a selected heat input to a selected blower speed.

5. In a clothes drying machine including a heat source and an air translation means driven by motor means through belt means extending from said motor means to said air translation means, an improved control apparatus comprising, pulley means having a plurality of belt-retaining grooves and cooperating with said air translation means and said belt means to rotate said air translation means at different preselected speeds, belt shifting means for moving said belt from one of said grooves to another to effect an increase or decrease in speed of said air translation means, means for varying the heat input from said heat source at different preselected rates and a common control device for simultaneously controlling and matching the heat output of the heat source and the speed of the air translation means.

6. In a clothes drying machine as defined in claim 5, said common control device comprising switch means for increasing or decreasing the heat output of said heat source.

7. In a clothes drying machine as defined in claim 5, said common control device comprising switch means for increasing or decreasing the heat output of said heat source and control means for simultaneously actuating said belt shifting means and said switch means.

8. In a clothes dryer for drying fabrics including means defining a drying zone for receiving damp fabrics to be dried, the improvement comprising:

air translation means for moving air through said drying zone,
drive means including a transmission having means for varying the speed ratios for driving said air translation means at different rates of air flow,
a plurality of heaters for heating air moving through said drying zone,
circuit means including switch means for selectively energizing said heaters to vary the heat input, and common control means interconnected to said transmission and to said switch means for simultaneously effecting a coordinated change of heat input and air flow through said drying zone.

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WILLIAM F. O'DEA, *Primary Examiner*.

NORMAN YUDKOFF, *Examiner*.