

Nov. 29, 1960

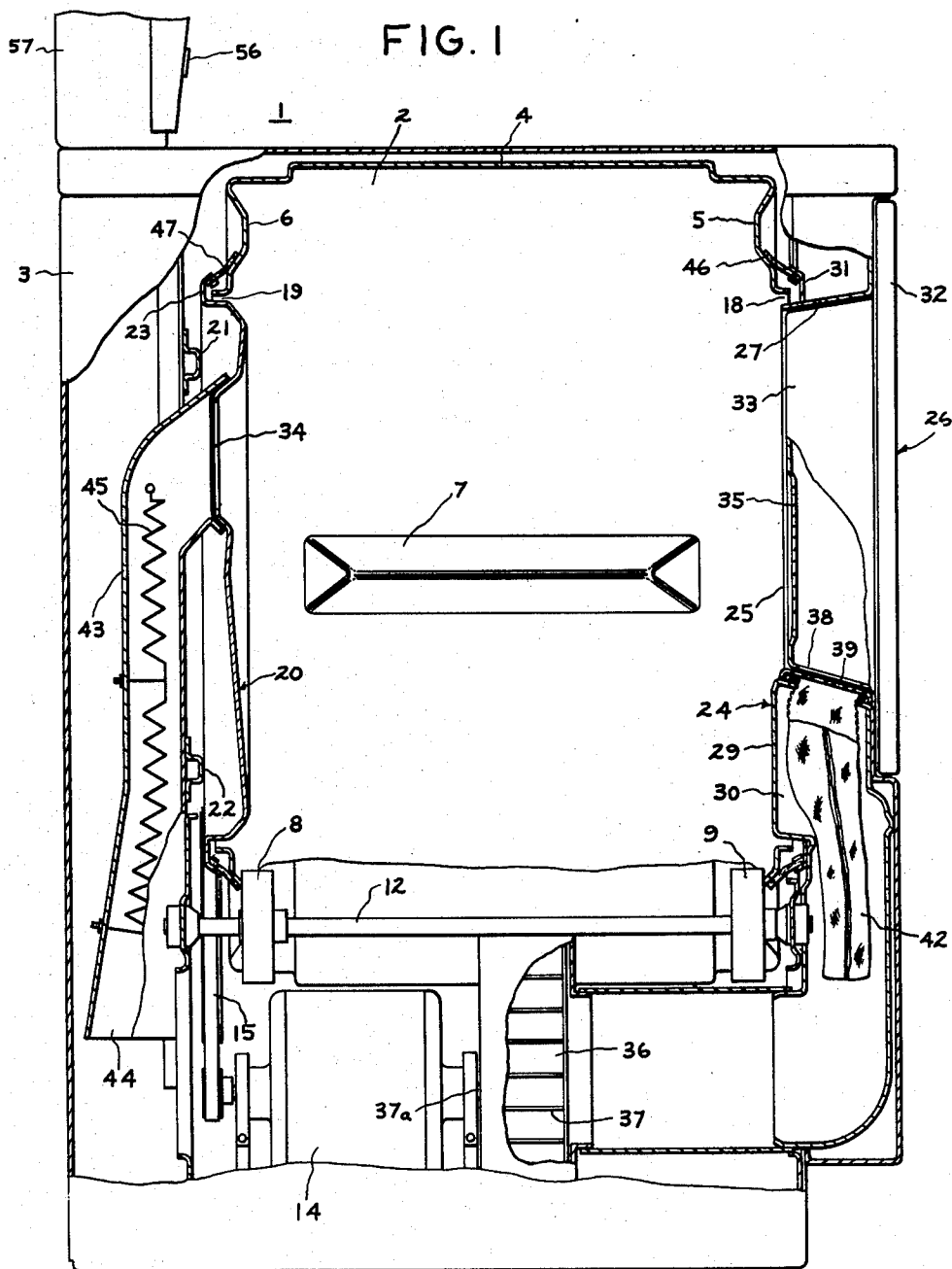
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2,961,776

CLOTHES DRYER WITH REVERSIBLE BLOWER

Filed Sept. 26, 1958

4 Sheets-Sheet 1



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FIG. 2

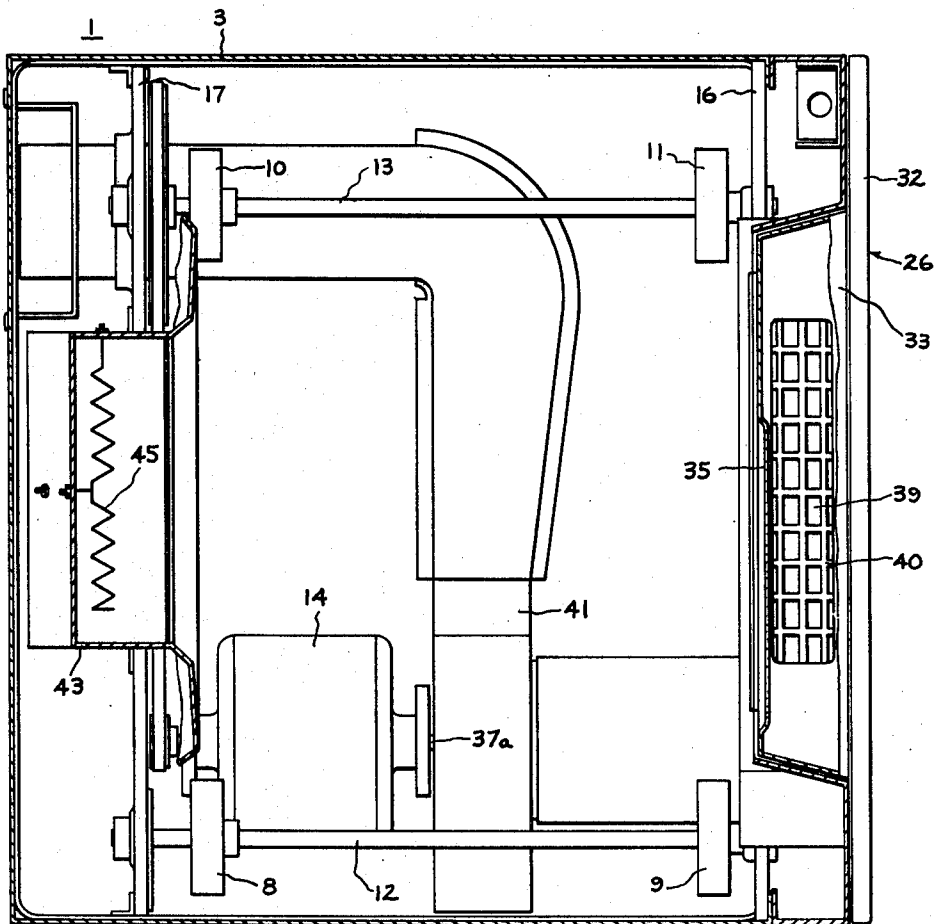
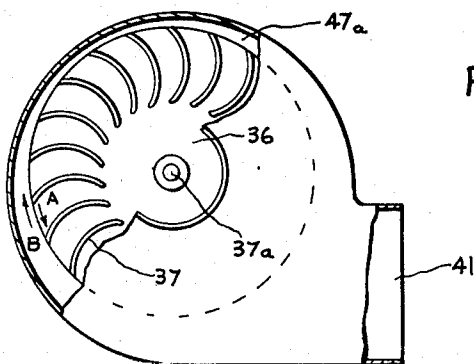


FIG. 3



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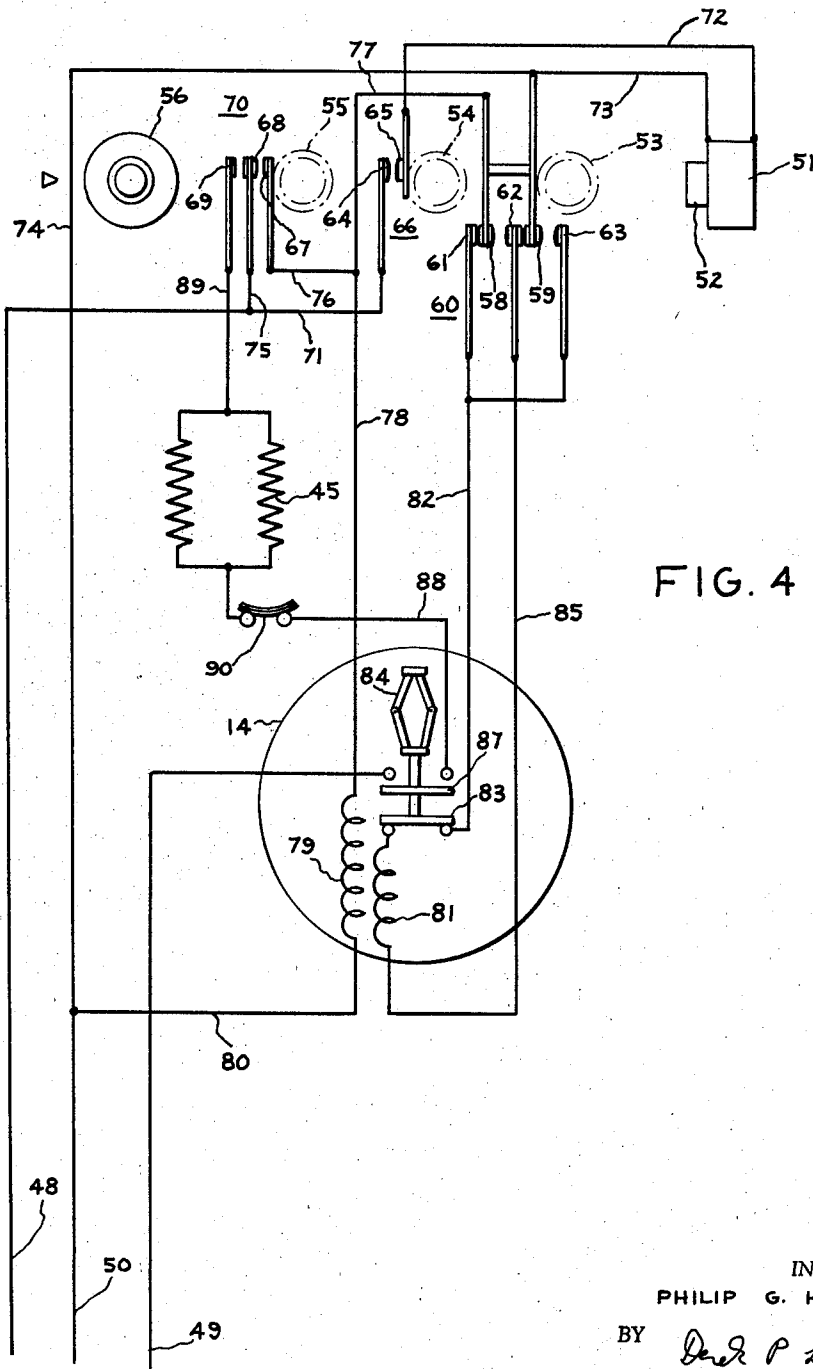


FIG. 4

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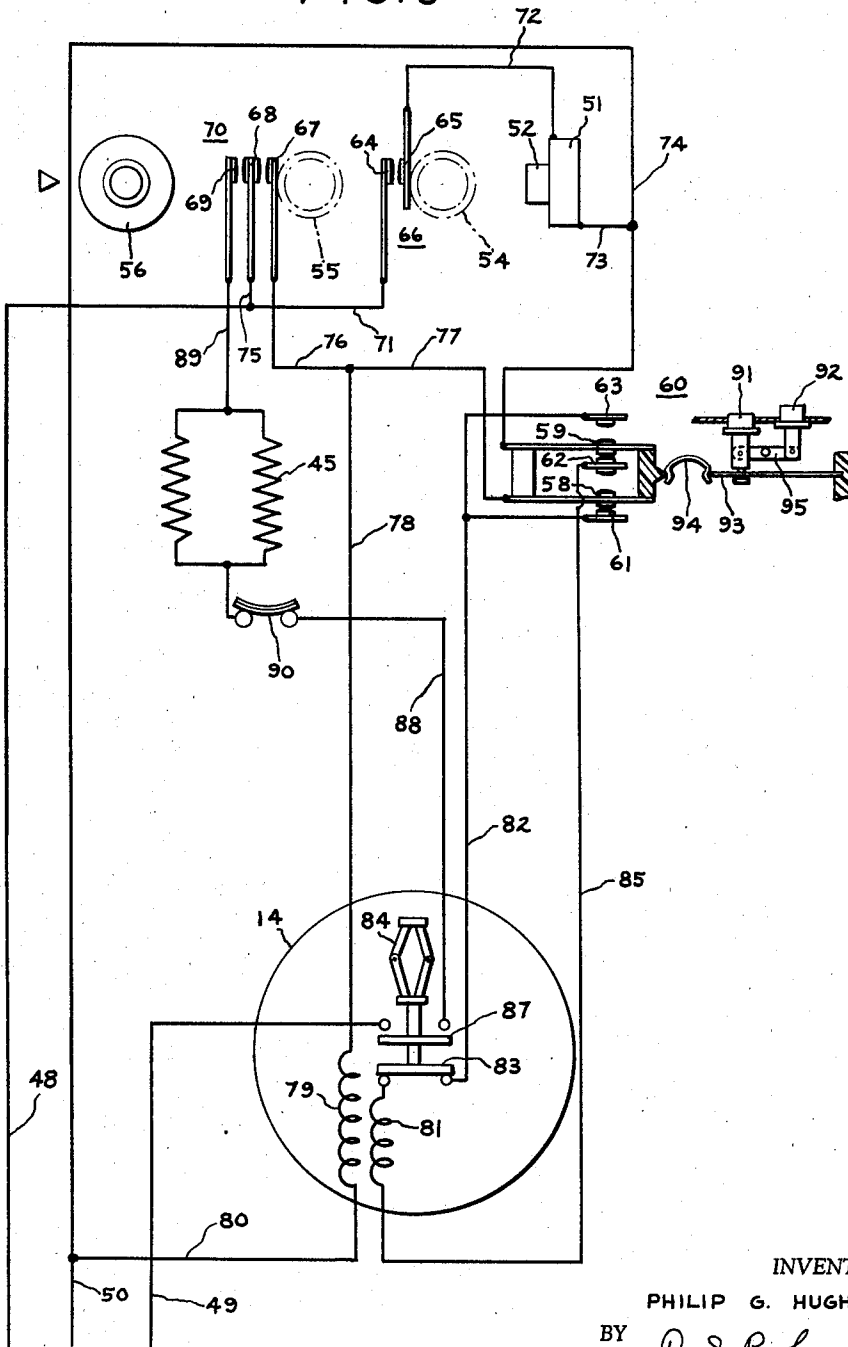
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FIG. 5



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CLOTHES DRYER WITH REVERSIBLE BLOWER

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6 Claims. (Cl. 34-133)

This invention relates to clothes dryers, and more particularly to dryers of the type which incorporate an air blower for moving heated air over the clothes to effect moisture removal therefrom.

Heretofore, the pumping rate provided by the blower in a dryer has been substantially constant. This has resulted primarily from manufacturing and economic considerations. One such economic factor is, for instance, the fact that the same electric motor is generally used to drive the blower and to rotate the basket, and therefore any variability in the blower rotational speed to improve the dryer performance would also, unless clutching means were used, involve a change in the basket rotational speed. Since the rotational speed of the basket is critical insofar as obtaining a proper tumbling pattern of the clothes therein is concerned, variations in the basket speed are obviously out of the question. For these and other related reasons, domestic dryers have to date provided a single speed blower.

Despite the fact that single speed blowers are the rule, substantial advantages to be obtained from a two speed blower have occurred to me. For instance, a limited air flow optimum for drying purposes could be provided during the heating operation, and then, during the cool-down period which is often provided in domestic clothes dryers at the end of the heating operation to cool the clothes down to a point where the operator can handle them readily, a higher air flow could then be provided to provide a more effective cooling of the clothes. Another factor I have noted is that for different types of cycles different air flows may be desirable.

In view of the foregoing, it is an object of this invention to provide a new and improved arrangement capable of giving two different air flows in a domestic clothes dryer.

A further object of the invention is to achieve a two-air-flow blower by making the blower reversible, with the output of the blower passing in the same direction for both directions of rotation but being different in amount for each rotational direction.

A further object of the invention is to achieve a reversible blower by making the motor which powers both the blower and the clothes tumbling basket reversible so that the basket and blower may be rotated in either direction at the same speed, with different air flows being provided for the two directions of rotation.

In carrying out the invention in one form thereof, I provide a clothes drying machine which has the conventional rotatable clothes basket driven by suitable means at a predetermined speed so as to tumble the clothes therein. Inlet and outlet air conduits lead respectively to and from the basket and a heater is positioned in the inlet conduit so as to heat the air before it reaches the basket; thus, when the air passes over the clothes in the basket it effects moisture removal therefrom. To cause the air to flow through the basket from the inlet heater I provide a rotatable blower which, for any given speed, provides one flow rate when driven in one direction and a different flow rate when driven in the other direction.

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To take advantage of this characteristic of the blower, I provide suitable means for operating the blower in either direction, and for selecting the direction of blower rotation so as to make advantageous use thereof during the drying cycle.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. My invention however, both as to organization and method of operation together with further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings.

In the drawings, Fig. 1 is a side elevational view of a clothes dryer embodying my invention, the view being partially broken away and partially sectionalized to illustrate details of the dryer;

Fig. 2 is a horizontal sectional view of the dryer with the basket removed and with certain surfaces broken away and partly sectionalized to illustrate further details;

Fig. 3 is an enlarged fragmentary view in perspective of a blower mechanism suitable for use in connection with my improved construction;

Fig. 4 is a diagram showing an improved dryer control circuit incorporating my invention; and

Fig. 5 is a diagram showing a second improved dryer control circuit arrangement incorporating my invention.

Referring now to Figs. 1 and 2 of the drawings, I have shown therein a domestic clothes dryer 1 which includes a rotatable open-ended clothes tumbling basket 2 mounted within a suitable cabinet 3 which encloses in on all sides. The basket is mounted for rotation about a horizontal axis and comprises a cylindrical drum-like member having an outer cylindrical wall 4 and front and rear walls 5 and 6. The outer cylindrical wall 4 of the basket is imperforate over its entire length, and on its interior surface is preferably provided with a plurality of clothes tumbling ribs such as illustrated at 7. Basket 2 is rotatably supported within the outer cabinet 3 by means of a plurality of roller wheels 8, 9, 10 and 11 (see Fig. 2). Wheels 8 and 9 are mounted on an idler shaft 12 and wheels 10 and 11 are mounted on a drive shaft 13. Shaft 12 has no driving connection; shaft 13 is driven from the drive motor 14 of the dryer through a suitable transmission such as belt and pulley drive 15. As will be set forth in detail, motor 14 is preferably of the reversible type, operable at the same speed in both directions.

As shown, both the idler shaft 12 and the drive shaft 13 are supported adjacent the front and the rear of cabinet 3 by means of suitable bearings mounted in front and rear support plates 16 and 17. Being freely supported on the roller wheels, basket 2 will turn thereon whenever drive shaft 13 is turned by motor 14, the frictional engagement between the side wall of the basket and rollers 10 and 11 causing the basket to turn as the shaft turns. The ratio of the driving and driven pulleys in the drive 15 is suitably chosen so that the basket is rotated at an appropriate speed to provide a tumbling action for articles of clothes placed therein.

In order that a stream of drying air may be introduced and passed through the clothes basket, the basket is apertured at both front and rear ends. Specifically, a central aperture 18 is provided in wall 5 and a similar aperture 19 is provided in wall 6. Rear opening 19 is substantially covered or closed by means of a stationary bulkhead 20 which is mounted within the dryer cabinet by means of a pair of cross braces 21 and 22. As shown, a suitable clearance is provided between the edge of aperture 19 and the outer flange 23 of bulkhead 20 so that there is no contact between the basket and the bulkhead during rotation of the basket. The front opening 18 of the basket is likewise substantially closed by means of a stationary bulkhead, generally indicated at 24.

Bulkhead 24 is made up of a number of adjacent members including the inner surface 25 of an access door 26 mounted on cabinet 3, seat 27 of the door, the inner surface 29 of an exhaust duct 30 leading from the basket, and an annular flange 31 mounted on seat 27 and the duct wall. All of these members cooperate to define a generally circular bulkhead covering opening 18, with flange 31 at its outer edge surrounding the opening. As with the rear bulkhead, a suitable clearance is provided so that there is no rubbing between the edge of opening 18 and the edge of bulkhead 24 during rotation of the clothes basket.

Door 26 includes an outer flat section 32 and an inwardly extending hollow section 33 mounted on the flat section. Hollow section 33 extends into the door seat 27 when the door is closed, and the door surface 25 which comprises part of bulkhead 24 is actually the inner wall of this hollow section.

In the illustrated dryer, the drying air flow is introduced into the basket by means of a screened air inlet 34 in the rear bulkhead 20; the flow then passes through the basket, and out through a screened opening 35 formed in wall 25 of the door section 33. The air movement is effected by a blower 36, of the radial type having air moving vanes 37 (Fig. 3), which is secured to a motor shaft extension 37a of motor 14 so as to be driven thereby. The air then flows through an opening 38 in door 26 which is aligned with an opening 39 in door seat 27 leading to duct 30 and blower 36 when the door is closed. It can be seen that wall 25 of door section 33 is in effect a shield to prevent the clothes from plugging opening 39 which may, as shown in Fig. 2, be provided with a grill 40 to prevent clothes from falling into duct 30 during loading and unloading of the dryer. The blower then exhausts the air from the machine through the outlet duct 41 which extends from the blower to an opening (not shown) provided in the rear of cabinet 3. It can be seen that ducts 30 and 41 form together an outlet conduit for the air flowing out of the basket.

A suitable lint filter 42 may be positioned in any convenient location, such as in duct 30 as shown, to perform the usual function of removing lint picked up by the air in the clothes basket.

The air drawn through the above-described duct system by blower 36 is pulled into the basket 2 through opening 34 from an intake duct or conduit 43 which is mounted on the rear bulkhead 20 and which is open at its lower end 44 within cabinet 3. Thus, when blower 36 operates, air is drawn into the cabinet through any suitable opening (not shown) provided therein for that purpose, and then flows to the inlet 44 of duct 43, through the duct 43, and over a suitable heater 45 through opening 34 into basket 2. The air flow then passes out through opening 35, the door section 33, duct 30, blower 36, and duct 41 to the aforementioned exhaust opening. To prevent any leakage into the basket during this operation, suitable air seals 46 and 47 are provided to prevent leakage through openings 18 and 19 respectively. Seals 46 and 47 are preferably formed of felt-like material, and are biased against the basket so that in addition to serving as seals they also serve as thrust bearings to maintain the basket in its proper position on rollers 8, 9, 10 and 11. This construction is fully described and claimed in Patent 2,835,048, issued on May 20, 1958 to Eugene G. Olthuis, and assigned to General Electric Company, the assignee of the present invention.

Referring particularly to Fig. 3, it will be seen that the vanes 37 of blower 36 are curved in configuration; in effect this provides relatively high efficiency of the blower for rotation in the direction indicated by arrow A and relatively low efficiency when the blower is rotating in the direction of arrow B. Also, of course, the blower housing a scroll shaped, as shown at 47a, in the conventional manner so as to improve the air flow during rotation in direction A and decrease the air flow during rotation in

direction B. In other words, the blower provides a high air flow when rotated in direction A and a low air flow when rotated in direction B.

Referring now to Fig. 4, there is shown a circuit making use of the dual flow rate characteristic of blower 36, wherein the different flow rates are provided in connection with different steps of the drying cycle in order to provide the most effective cooperation between the heating element 45 and the blower 36. The system of Fig. 4 is energized from a three wire power supply (not shown) through supply conductors 48 and 49 and the neutral wire 50. For domestic use the conductors 48 and 49 are normally connected across 230 volts, with 115 volts appearing between the neutral line 50 and each of the supply conductors 48 and 49.

The main components of the system energized through wires 48, 49 and 50 are the heating element 45, the motor 14, and a timing control motor 51 which, through an appropriate gear train 52, operates cams 53, 54 and 55. The initial position of cams 53, 54 and 55 is presettable by means of a dial 56 which is positioned on a control panel 57 (Fig. 1) normally provided at the top of the machine. At the start of the drying cycle the dial 56 is rotated until cam 53 causes a pair of movable contacts 58 and 59 of a switch generally indicated at 60 to engage stationary contacts 61 and 62 of the switch. The switch also includes a third stationary contact 63 for a purpose which will appear more clearly herebelow. With the dial in this starting position, cam 54 is in a position which forces together contacts 64 and 65 of a switch 66, and cam 55 closes all three contacts 67, 68 and 69 of a switch 70.

With the switches in this position, an energizing circuit for timer 51 is completed, starting at conductor 48, through conductor 71, contacts 64 and 65 of switch 66, conductor 72, motor 51, and conductors 73 and 74 back to neutral line 50.

An energizing circuit for the motor 14 is also completed; starting with conductor 48, the circuit for motor 14 extends through conductor 75, contacts 68 and 67 of switch 70, and a conductor 76 to a pair of parallel conductors 77 and 78. From conductor 78, the circuit for the running winding of the motor is completed through the running winding 79 and conductor 80 back to neutral wire 50. A parallel circuit for the start winding 81 of the motor is provided from conductor 77 through contacts 58 and 61 of switch 60, conductor 82, and bridging contact 83 of the motor centrifugal mechanism 84, to winding 81; from the winding, the circuit is completed through conductor 85, contacts 62 and 59 of switch 60, and conductor 74 back to neutral wire 50. With both running winding 79 and starting winding 81 thus energized, motor 14 will start to rotate in a predetermined direction. The direction of this rotation is selected to be effective to rotate the blower 36 of Fig. 3 in the direction of arrow B, that is, with the smaller of the two possible air flows.

When the motor comes up to speed, the centrifugal mechanism 84 opens the circuit of start winding 81 by movement of bridging contact 83. Also at this time, the heater 45 becomes energized because bridging contact 87 moves into position to connect conductors 88 and 49. This then provides for completion of a heating circuit, starting with conductor 48, through conductor 75, contacts 69 and 68 of switch 70, conductor 89, the heating element 45, a suitable temperature limiting bimetallic disk 90, conductor 88, contact 87 and conductor 49. Thus, with dial 56 set as described to provide heating for a predetermined time, the timer motor will be energized to control the operation, the drive motor will be energized to effect rotation of drum 2 and rotation of blower 36 in direction B, and the heating element will be energized except as otherwise controlled by disk 90.

In accordance with one conventional type of drying cycle, I provide a period of several minutes at the end of the drying cycle when the heater 45 is shut off but tumbling of the clothes and flow of air over the clothes is

continued in order to cool the clothes down to a comfortable temperature for handling by an operator. The de-energization of the heating element 45 is effected when motor 51 moves cam 55 to a position where contacts 67, 68 and 69 separate. At the same time that the circuit to the heating element 45 is opened, the action of the switch 70 opens the circuit to motor 14. Cam 53 then causes switch 60 to be moved so that contact 58 engages contact 62 and contact 59 engages contact 63. This causes reversal of the connections of starting winding 81 with respect to running winding 79; therefore, since the motor has stopped and bridging contact 83 enables the circuit to be completed to starting winding 81 upon a reclosing of contacts 67 and 68 by cam 55, the motor 14 will be energized in the opposite direction to that in which it was driven during the heating operation. It will be noted that cam 55 at this time closes only contacts 67 and 68. Contact 69 is left disconnected so that no energization of element 45 can take place.

With the motor 14 now rotating in the opposite direction, the drive 15 provides the same speed of rotation of the drive wheels 10 and 11 in the opposite direction, i.e., basket 2 will rotate at the same speed as before but in the opposite direction. Since the speed is the critical element for the basket, the same appropriate tumbling pattern will be provided for the clothes.

At this time, with the opposite direction of rotation of motor 14, blower 36 is being driven in the direction A so as to provide a substantially higher air flow than before. Thus, in combination with the cessation of heating, a substantially higher flow of air is being passed over the clothes during the cool-down period. This aids to a very substantial extent in the cooling effect on the clothes, thus making the clothes much more agreeable for the operator to handle while nonetheless permitting the optimum combination of air flow and heat to be obtained during the heating operation. After an appropriate cool-down period, which may be on the order of nine minutes, for instance, the timer motor 51 will have run to the point where contacts 67 and 68 are opened and contacts 64 and 65 of switch 66 are opened; this de-energizes all parts of the dryer and terminates the cycle.

It will thus be observed that the invention utilizes the characteristics of blower 36 by which it provides differing air flows with different directions of rotation to effect the optimum air flow for the heating operation and the optimum air flow for the cooling operation.

Referring now to Fig. 5 of the drawings there will be described a second control circuit utilizing my improved blower arrangement, with like numerals being used for parts identical to those in Fig. 4. The one difference between the arrangements of Figs. 4 and 5 is that instead of the switch 60 being controlled by a motor-operated cam 53, as in the arrangement of Fig. 4, switch 60 in the arrangement of Fig. 5 is controlled by manually operable pushbuttons 91 and 92. Depression of button 91 moves member 93 which acts through a toggle spring 94 to move contacts 58 and 59 into engagement with contacts 61 and 62. In the same manner, manual depression of button 92 acts through a link 95 to cause toggle 94 to move contacts 58 and 59 into engagement with contacts 62 and 63.

It will be seen that, with this arrangement, the motor reversing switch 60 is removed from control by timer 51 and is placed under manual control. This is particularly advantageous, for instance, where a greater or lesser heating effect is desired with a single wattage input from the heater. This occurs, for instance, where, during the drying of wash and wear fabrics which need to be de-wrinkled, the temperature should reach a higher level and the air flow should therefore be lower than the normal optimum air flow for drying of synthetics. In other words, for the de-wrinkle cycle the operator would push down member 92 to select the rotational direction of operation of blower 36 which provides the low air flow;

for a regular drying cycle, member 91 is pushed in to select the rotational direction which provide the higher air flow.

A further advantageous use of the reversible blower of this invention can be made where dryers are manufactured for use on either 115 volts or 230 volts. To improve the drying effect in machines connected to be operated at 115 volts, the rotational direction may be selected to provide the lower air flow; in machines to be operated on 230 volts, the reverse rotational direction would be selected to provide the higher air flow. Thus, dryers to be used on the different voltages could be manufactured alike without sacrificing optimum performance in either.

It will be seen from the foregoing that my invention provides an improved dryer arrangement whereby two different air flows can be obtained from the same blower at the same rotational velocity by reversal of the direction of rotation of the blower. It will further be seen that by so doing the blower can still be operated by the same motor which rotates the drum, without any additional clutching being necessary since the drum will rotate at the proper speed in either direction and the clothes will thus have their proper tumbling pattern regardless of the direction of rotation.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such equivalent variations as fall within the true spirit and scope of the invention.

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

1. In a clothes drying machine, a rotatable clothes basket, inlet and outlet air conduits leading respectively to and from said basket, a heater in said inlet conduit, control means for operating said heater at at least part of the time during a drying cycle, a rotatable blower arranged in one of said conduits to provide a predetermined air flow rate over said heater and through said basket upon rotation of said blower at a predetermined speed in one direction and to provide a second different predetermined air flow rate over said heater and through said basket upon rotation of said blower at said predetermined speed in the opposite direction, means for operating said blower in either direction, and control means for selecting the direction of blower rotation thereby to select one of the two different air flow rates.

2. In a clothes drying machine, a rotatable clothes basket, inlet and outlet air conduits leading respectively to and from said basket, a heater in said inlet conduit, control means for operating said heater at at least part of the time during a drying cycle, a rotatable blower arranged in one of said conduits to provide a predetermined air flow rate over said heater and through said basket upon rotation in one direction at a predetermined speed and to provide a second different predetermined air flow rate over said heater and through said basket upon rotation at said predetermined speed in the other direction, a reversible motor, means connecting said basket to said motor to effect rotation of said basket, means connecting said blower to said motor to effect rotation of said blower, said motor means rotating said basket in either direction at a predetermined speed for tumbling clothes therein, and control means for selecting the direction of motor rotation to provide alternatively one of said two predetermined air flow rates.

3. In a clothes drying machine, a rotatable clothes basket, inlet and outlet air conduits leading respectively to and from said basket, a heater in said inlet conduit, a rotatable blower arranged in one of said conduits to provide a first predetermined air flow rate over said heater and through said basket upon rotation at a predetermined speed in one direction and to provide a sec-

ond different predetermined air flow rate over said heater and through said basket upon rotation at the predetermined speed in the opposite direction, means for operating said blower in either direction, means controlling operation of said heater and controlling the direction of operation of said blower, said control means providing for operation of said heater simultaneously with operation of said blower in the direction to give the lower of said predetermined air flow rates, said control means then shutting off said heater and providing operation of said blower in the other of said directions to provide the higher rate of said air flow, said control means thereafter shutting off said blower operating means.

4. The apparatus defined in claim 1 wherein said selecting control means are manually operable to provide the operator with his selection as to whether the air flow will be at a high rate or at a low rate during a particular drying operation thereby to provide two different heating effects in said basket.

5. In a clothes drying machine, a rotatable clothes basket, inlet and outlet air conduits leading respectively to and from said basket, a heater in said inlet conduit, an air blower arranged in one of said conduits to provide a

first predetermined air flow rate over said heater and through said basket upon rotation at a predetermined speed in one direction and to provide a second different predetermined air flow rate over said heater and through said basket upon rotation at said predetermined speed in the opposite direction, common reversible drive means connected to reversibly rotate said basket and connected to reversibly operate said blower comprising a reversible electric motor, and means for selecting the direction of motor rotation.

6. The apparatus defined in claim 5 wherein said motor comprises two single phase windings connected in parallel, said means for selecting the direction of blower rotation comprising switch means for reversing the polarity of one of said windings relative to the other.

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