

Feb. 21, 1950

G. E. MINTNER ET AL
GAS HEATED CLOTHES DRIER

2,498,172

Filed Oct. 18, 1947

8 Sheets-Sheet 1

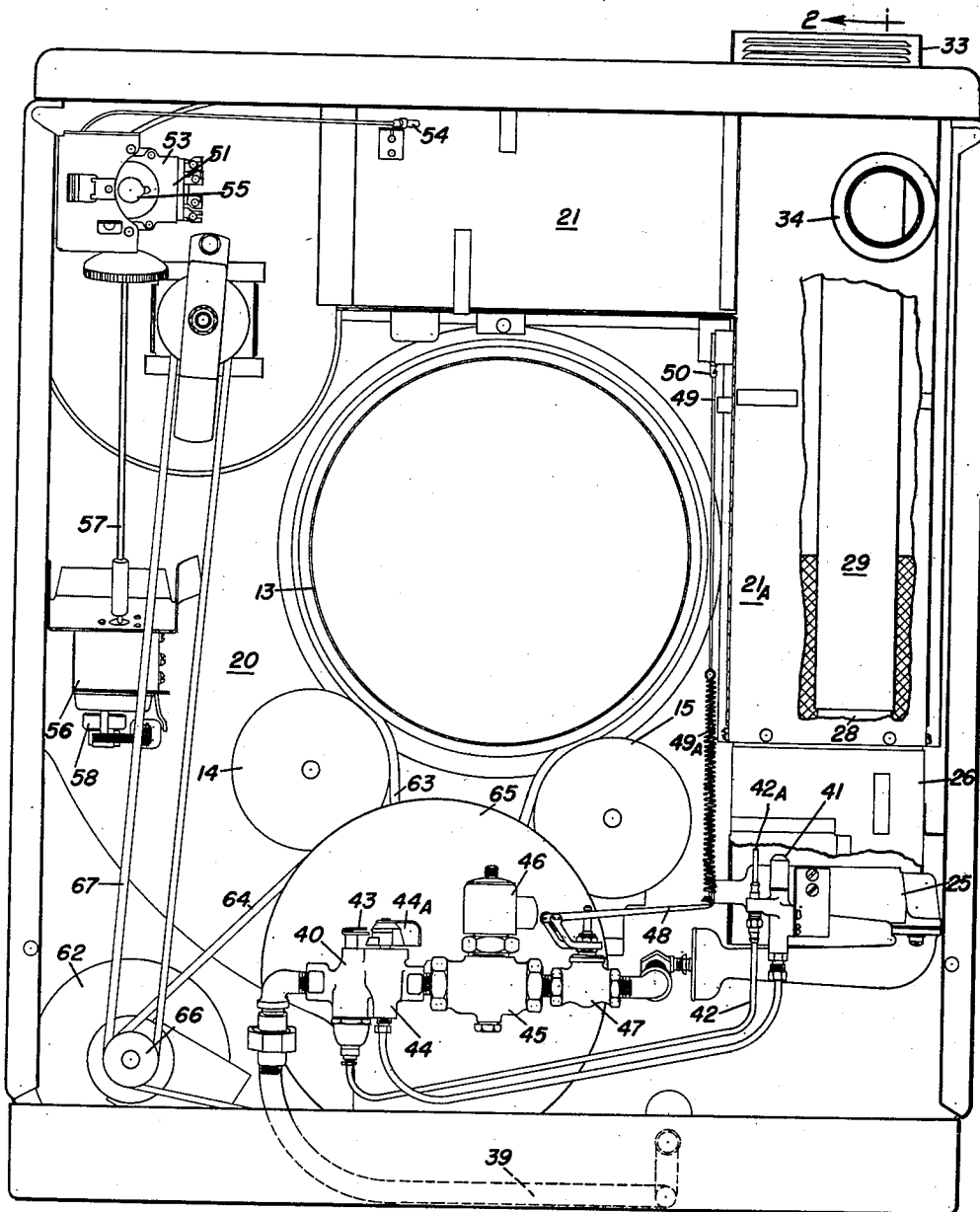


FIG. 1

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8 Sheets-Sheet 2

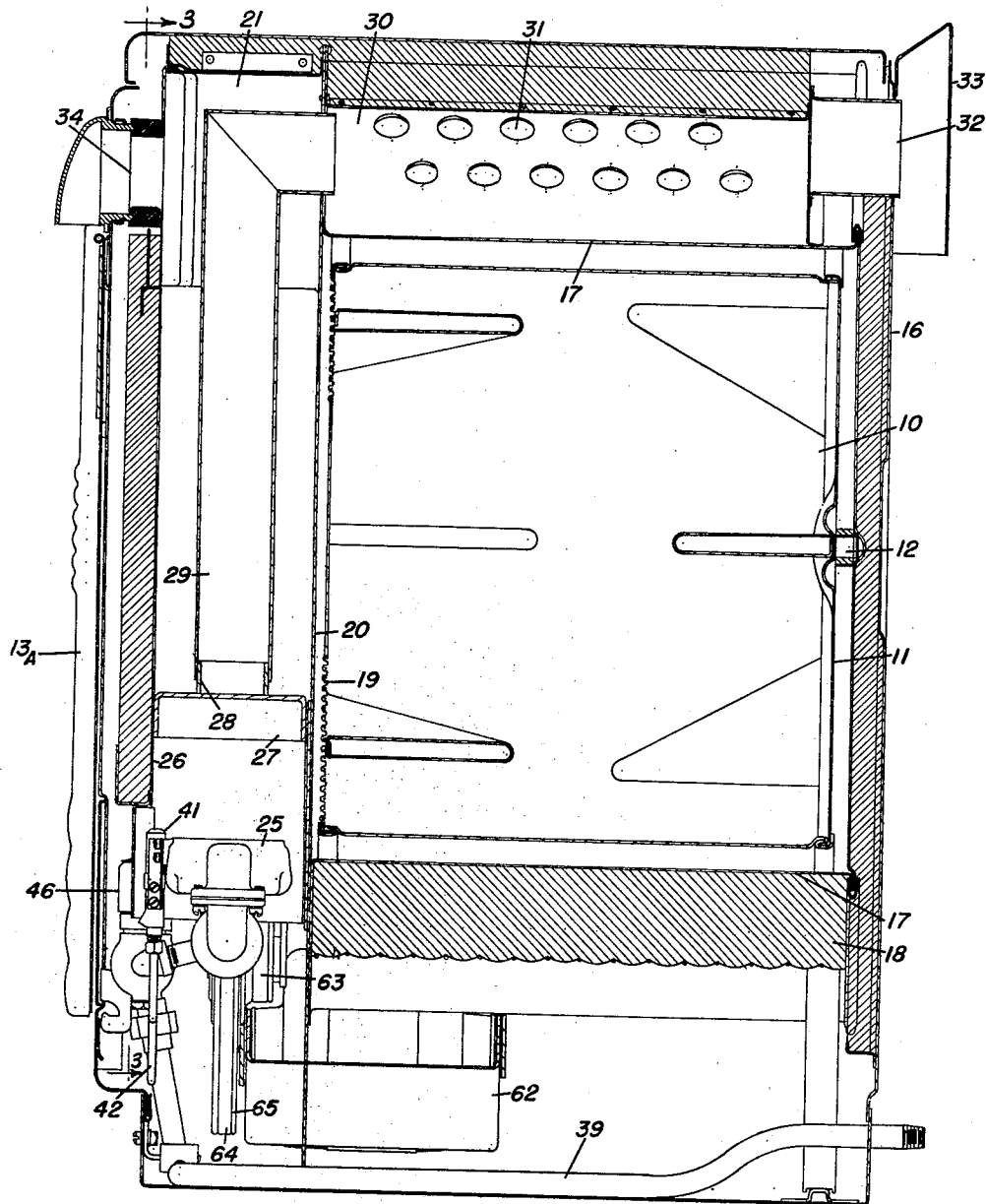


FIG. 2

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8 Sheets-Sheet 3

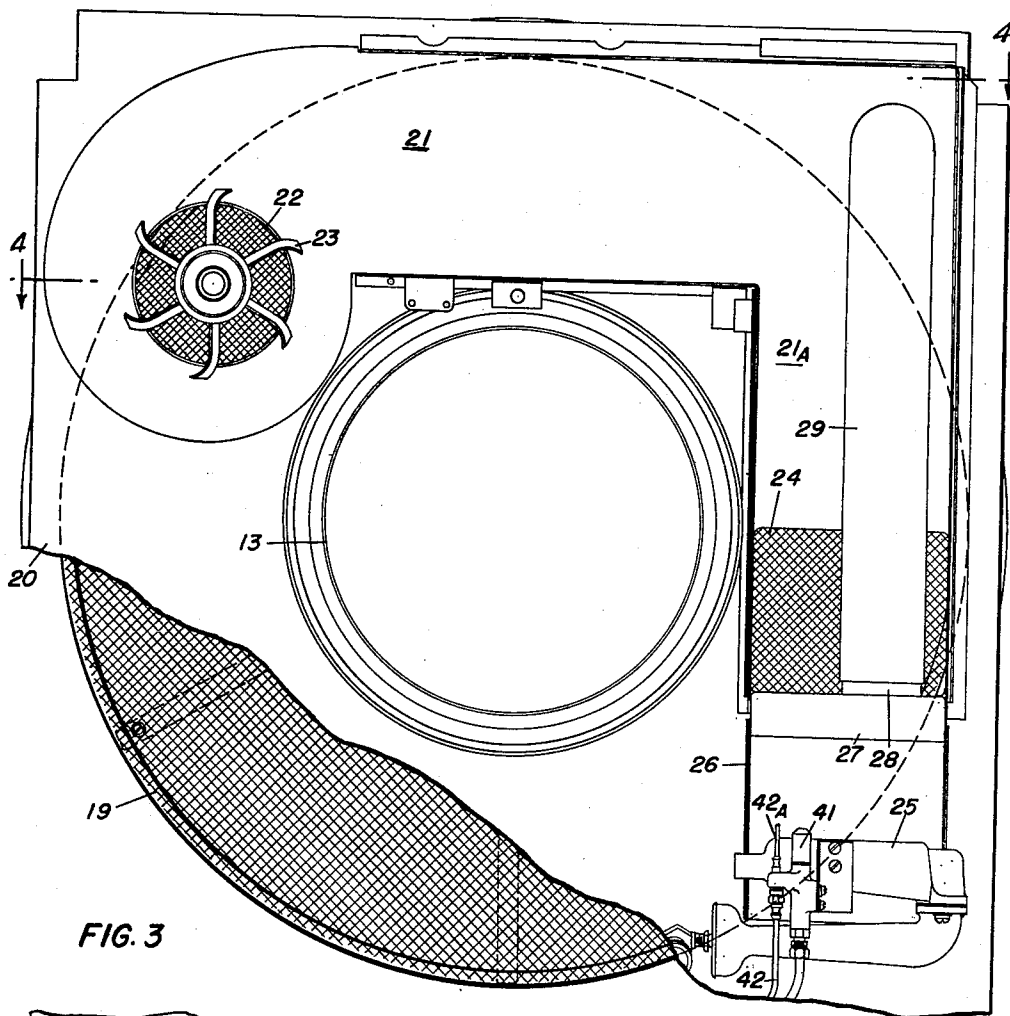


FIG. 3

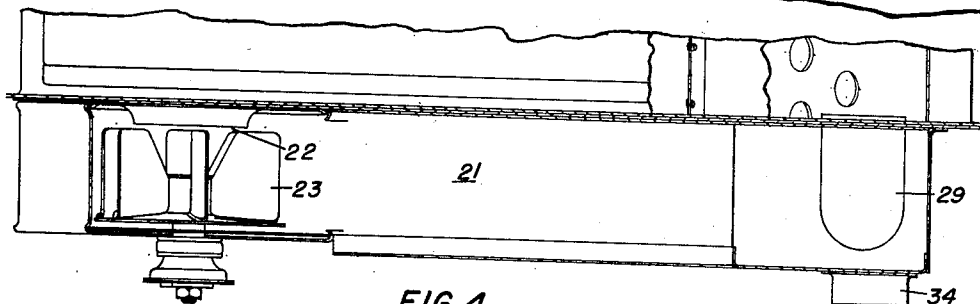


FIG. 4

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8 Sheets-Sheet 4

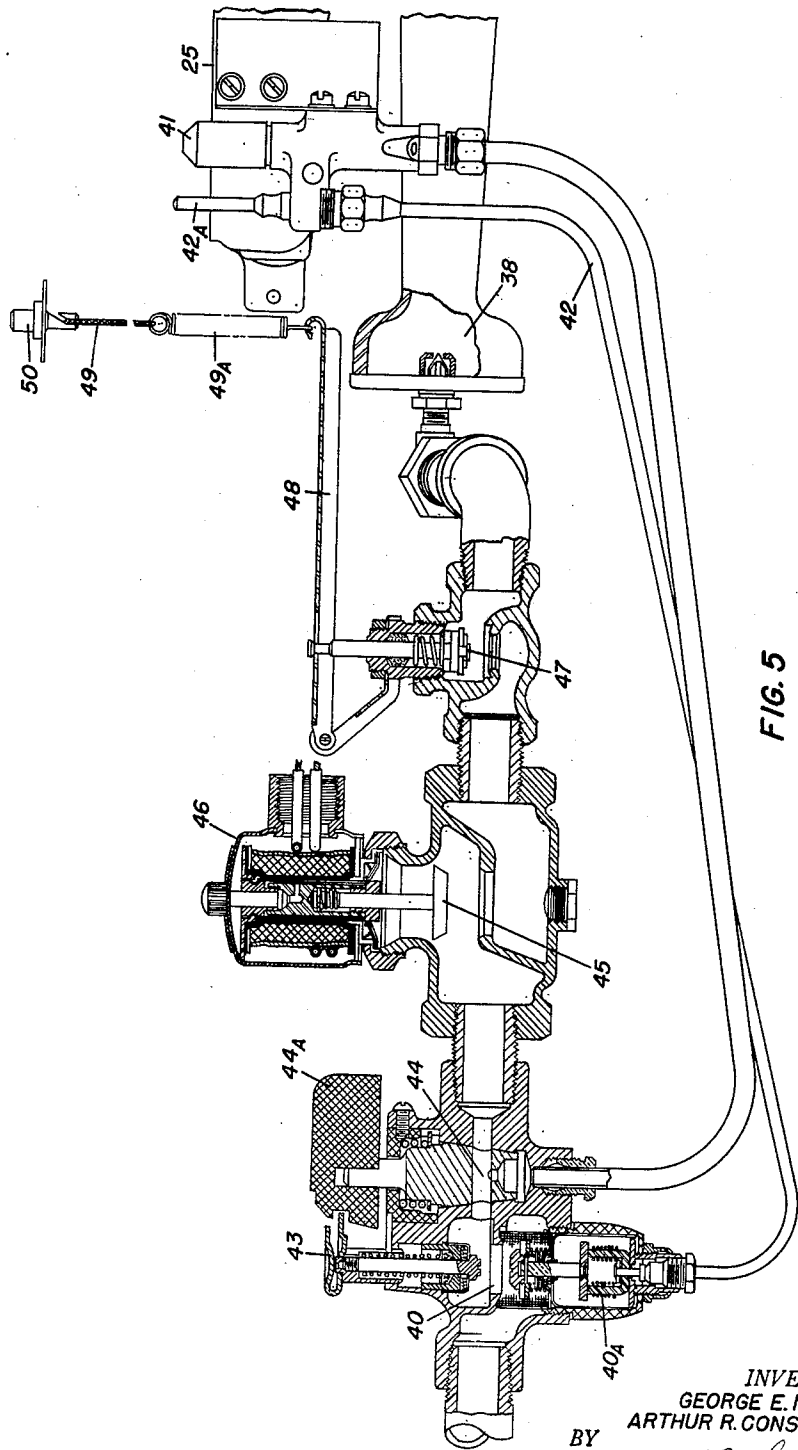


FIG. 5

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8 Sheets-Sheet 5

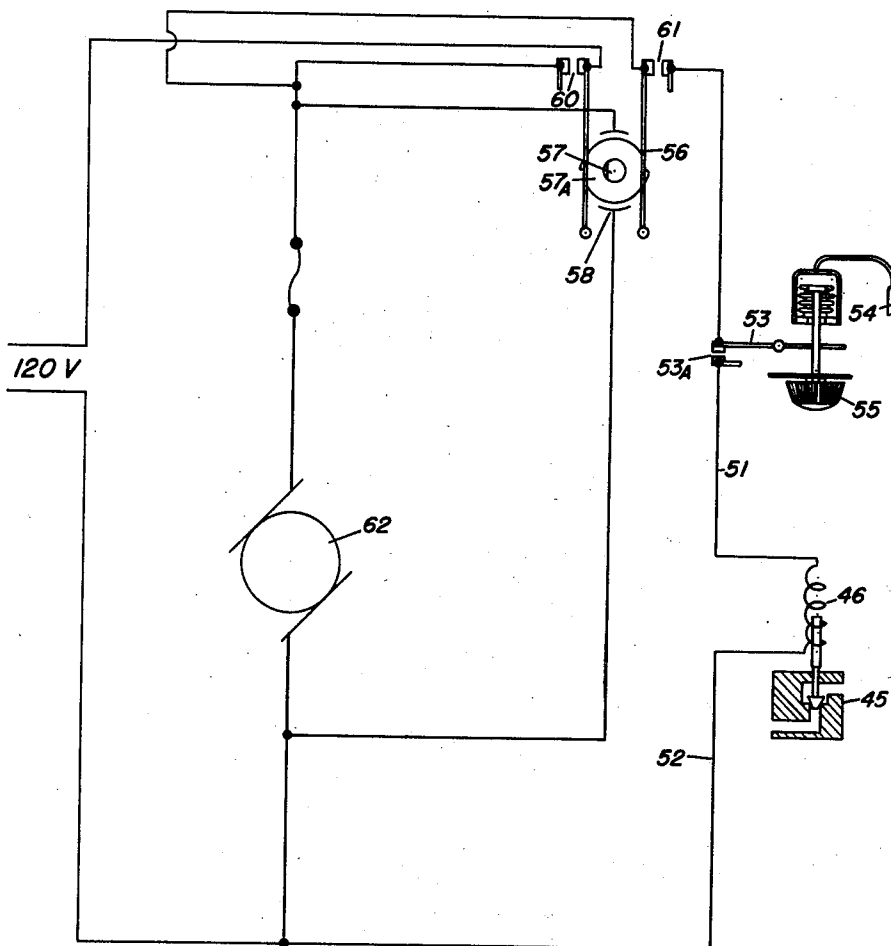


FIG. 6

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8 Sheets-Sheet 6

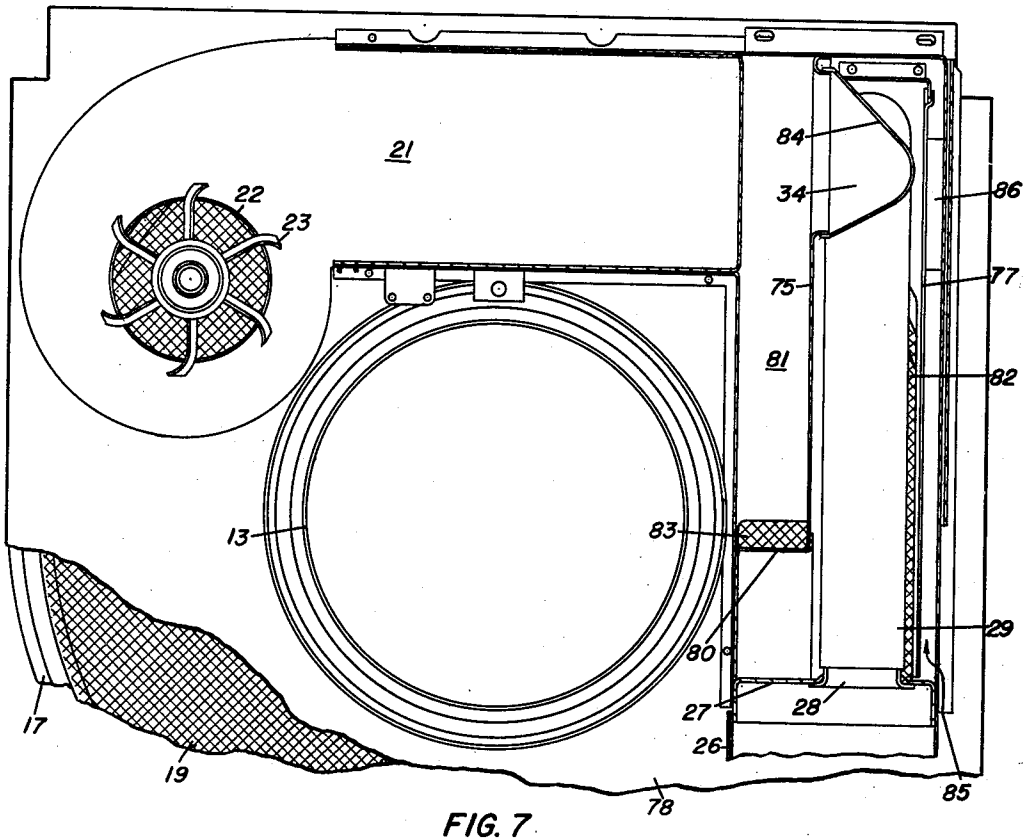


FIG. 7

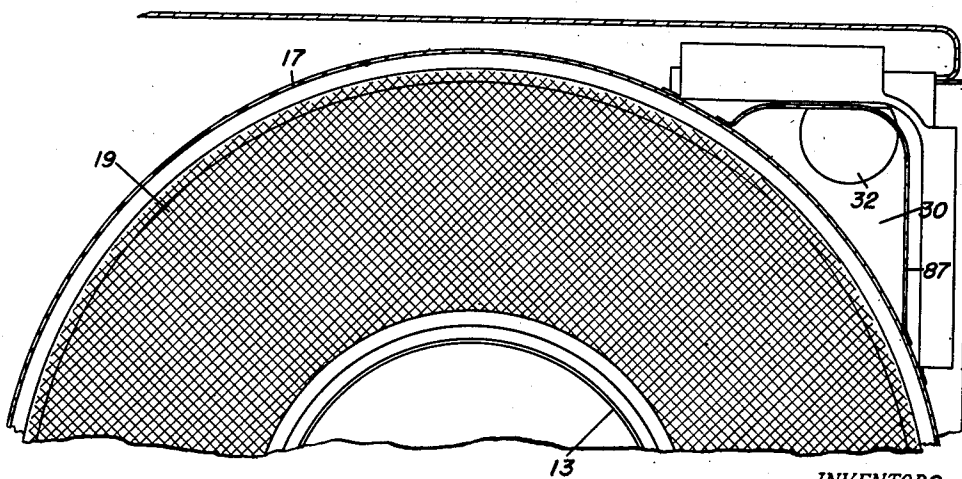


FIG. 8

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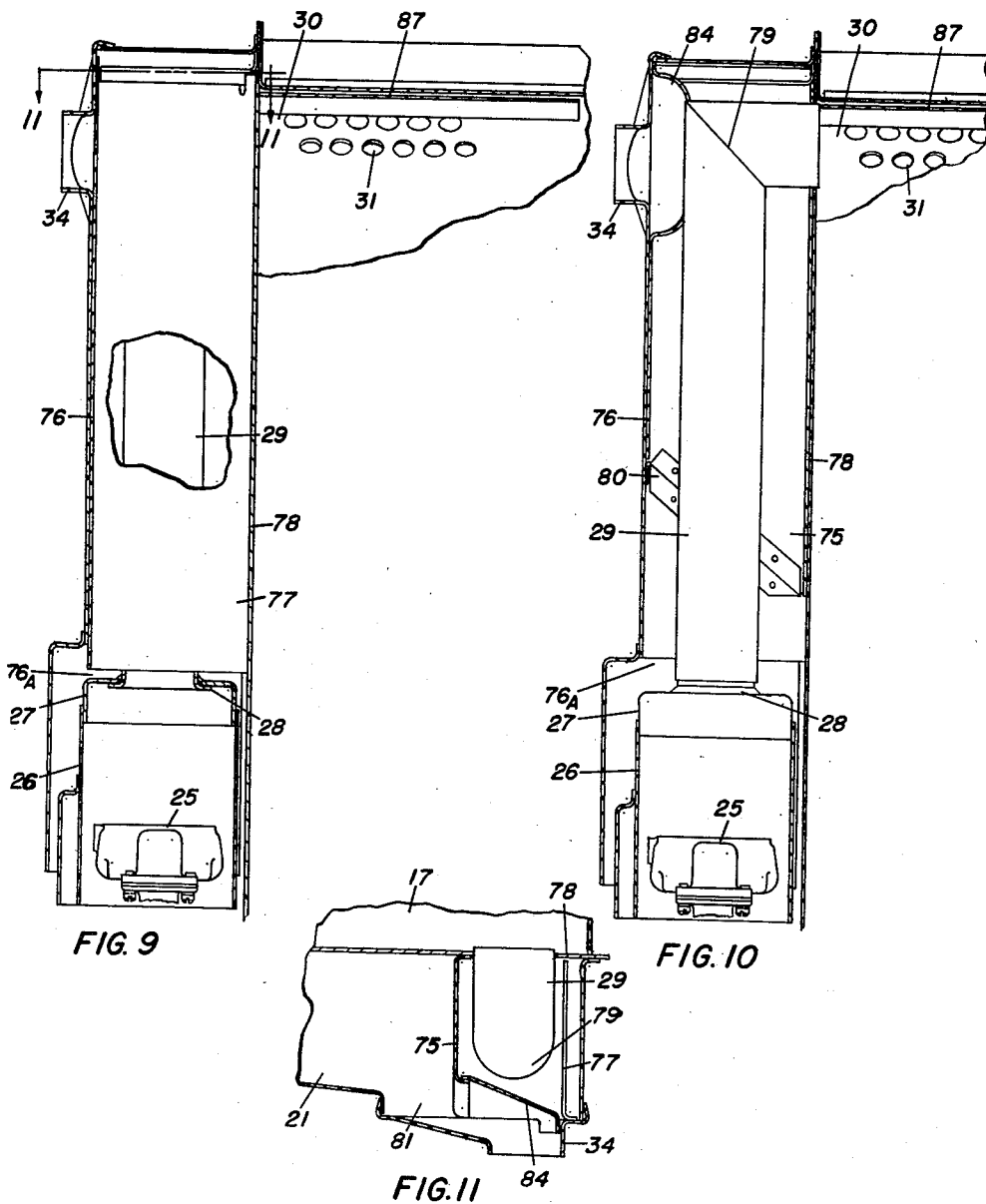
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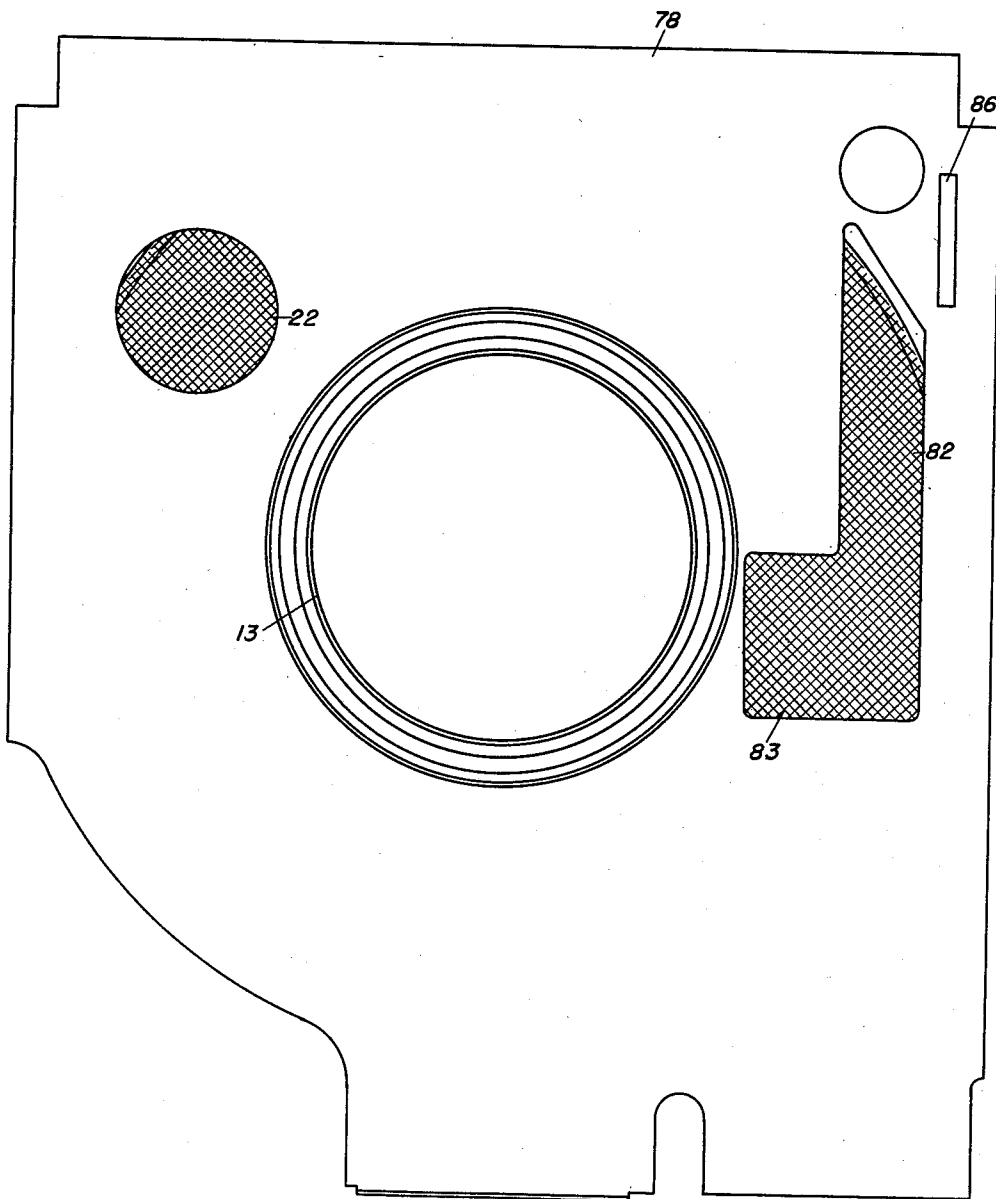


FIG. 12

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UNITED STATES PATENT OFFICE

2,498,172

GAS-HEATED CLOTHES DRIER

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tion of Delaware

Application October 18, 1947, Serial No. 780,608

8 Claims. (Cl. 263—33)

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This invention relates to clothes dryers, and more particularly to the type of clothes dryer employing gas heat for drying.

It is a primary object of the invention to provide a gas heated tumbler type clothes dryer into which clothes previously washed may be placed and the dryer set in operation and the drying completed automatically without further attention by the operator.

It is a further object to provide a tumbler type clothes dryer in which the heat is supplied by a gas flame and in which the products of combustion are allowed to circulate in the dryer but with a minimum possibility of contact with the clothes to be dried while also assuring a maximum use of the heat in the gas for drying purposes.

It is a further object to so locate and control the air intake to the dryer so that air necessarily required to replace air discharged with moisture may be used to reduce the temperature of the products of combustion of the heating gas and to thereby assure satisfactory maximum temperature for the parts of the machine adjacent the clothes to be dried and to prevent the outer walls and other parts of the machine from becoming overheated.

Another object is to provide an arrangement of the parts of a gas dryer so that the products of combustion leaving the burner are first carried through a conduit for indirect heat transfer to air used in drying and subsequently the products of combustion are caused to flow around and into the rotatable clothes containing member.

Still a further object of the invention is to provide means of balancing the pressure in several parts of the dryer through which heated gases must flow so that desired gas flow and heat flow is obtained which will assure a maximum use of the heat generated by the combustion of the gas.

The above and other objects of the invention will appear more fully from the following more detailed description and by reference to the accompanying drawings forming a part hereof and wherein

Figure 1 is a front view of the dryer with the front cover removed showing major portions of the mechanism.

Figure 2 is a side view partly in section showing the cylindrical drum and parts of the gas circulation system, particularly the means of directing the products of combustion above the gas flame.

Figure 3 is a sectional view from the front of the machine showing particularly the duct for

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recirculating the air into and out of the clothes containing cylinder.

Figure 4 is a top view of the duct substantially on the line 4—4 of Figure 3.

Figure 5 is a view partly in section showing the several gas control valves.

Figure 6 is a wiring diagram showing the electrical connections to the several units.

Figure 7 is a sectional view from the front of the machine similar to Figure 3 showing a proposed modification of the air recirculating duct and the arrangement for the conduit directing the products of combustion above the burner.

Figure 8 is also a showing of the modified form, and is a section from the front of the machine, but with the front plate and the recirculating duct removed to show the entrance to the heating chamber and the radiant shield therein.

Figure 9 is a side view and shows the vertical portions of the duct and the housing for the conduit in the modified form shown in Figures 7 and 8.

Figure 10 is a view similar to Figure 9, but with the wall which houses the conduit removed.

Figure 11 is a top view of the vertical section of the conduit from line 11—11 of Figure 9.

Figure 12 shows the front plate and the openings therein as used in the modified form.

Referring to the drawings, a cylinder 10 which serves as a drying chamber is mounted for rotation, it being supported centrally on its rear wall 11 by a bearing 12 and further supported through a forwardly extending annular flange 13 which forms a central opening in the front of the machine and which is supported by two rollers 14 and 15. The annular flange 13 is also designed to provide an opening for access into the cylinder 10 for inserting the wet clothes and removing the dry clothes after drying. The front of the cabinet is closed by a door 13A as shown in Figure 2. Suitable insulation 18 may be provided between the cylindrical member 17 and the outer cabinet panels 16 as shown. The clothes cylinder 10 is provided with a perforated or screened front wall 19 and when the cylinder 10 is supported for rotation this perforated front wall 19 rotates parallel to and closely adjacent a front plate or dividing wall 20. This dividing wall 20 carries a duct 21 and an inlet 22 formed by an opening in the wall 20 opens into said duct 21 adjacent a blower wheel 23 which is located in the duct 21. The blower wheel 23 therefore assists entry of air into the duct 21 through the opening 22 through the perforated wall 19 of the cylinder 10. The air thus caused to circulate

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into the duct 21 through the opening 22 passes horizontally across the top of the machine through the duct 21 and downwardly through the vertical portion 21A of the duct 21 to a second opening 24 through the wall 20 which opens adjacent the perforated wall 19 of the cylinder 10 and serves as an outlet for the duct 21. Thus the rotation of the blower wheel 23 will cause air to be circulated and recirculated out from the cylinder 10, into duct 21, through the opening 22, and will return the air into the cylinder 10 through the duct outlet opening 24.

For the purpose of supplying heat, a gas burner 25 is mounted below the vertical portion 21A of the duct 21, and this burner 25 is surrounded by a stove housing 26. The stove housing 26 is provided with a top member 27 which serves as a wall between the stove housing 26 and the bottom of the vertical portion 21A of the duct. The top member 27 is provided with a pipe connection 28 which provides a communication with a conduit 29 for carrying the products of combustion. This conduit 29 which extends upwardly through the vertical portion 21A of the duct 21 makes a right angle bend, and as shown in Figure 2, opens into a mixing chamber 30. The mixing chamber 30 is constructed adjacent the cylindrical wall 17 which surrounds the rotatable clothes cylinder 10. The mixing chamber 30 has a plurality of holes 31 which provide communication from the mixing chamber 30 into the space between the cylindrical wall 17 and the periphery of the clothes cylinder 10.

The mixing chamber 30 is provided with an inlet opening 32 at the back of the dryer which opening has a shield 33 attached thereto. The opening 32 is on the opposite end of the mixing chamber 30 from the outlet of the stack or conduit 29. When the gas burner 25 is in operation the products of combustion from the gas circulate upward through the stack or conduit 29 into the mixing chamber 30. Inasmuch as the stack or conduit 29 is inside the re-circulating duct 21 there will be a transfer of heat to the circulating air by the passage of such air over the outer surface of the conduit 29. However, the transfer takes out only a portion of the heat carried in the products of combustion and these products of combustion which enter the mixing chamber 30 are of a relatively high temperature; in fact of such high temperature that it would not be practical to force them directly into the openings 31 and onto the clothes contained in the cylinder 10 without some provision to reduce the temperature thereof. This reduction in temperature is accomplished by providing that the inlet air necessary to replace the air which is ejected from the machine is taken in through the opening 32. In other words, the possibilities for intake of air into other portions of the machine is restricted, thus forcing the air to come in, to a major degree, through the opening 32, and this air will dilute the products of combustion in the mixing chamber 30 to such a degree that a satisfactory temperature will be realized. It is evident that a certain amount of outside air will necessarily be taken into the machine and this construction assures that it will be taken in at a point which will reduce the temperature of the products of combustion to a practical temperature for admission into the container defined by the outer drum 17. It also is evident that the openings 31 are so positioned that the mixture of the products of combustion and inlet air first contact the outer periphery of the rotating cylinder 10 although

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the circulation is such that the major amount of air circulates around the front of the cylinder through the open screened front wall 19 thereof.

An outlet 34 to the outside of the machine is so positioned that only a portion of the recirculated air passing through the duct 21 will flow out from the duct 21 through the outlet 34 and such outlet 34 is between the blower outlet and the vertical heat transfer portion 21A of duct 21 as is shown in Figure 1 the outlet 34 is positioned at the right hand end of the horizontal portion of duct 21 on the outlet side of the blower housing formed around the blower wheel 23. The outlet 34 is also relatively close to the blower wheel 23 and there is a positive flow of air near the outlet 34 so that such outlet, as determined by the size of the duct 21 and the opening 34, is a positive outlet induced by pressure set up by the blower wheel 23. Inasmuch as the blower wheel 23 produces an increase in pressure in the duct 21 and tends to reduce pressure in the cylinder 10 on the other side of the opening 22 it is evident that the air displacement brought about by releasing air out from the outlet 34 will induce a pressure somewhat less than atmospheric in the drum 10 and inasmuch as such reduction in pressure exists it will tend to draw air from the mixing chamber 30 through the openings 31 into the drum or cylinder 10. Therefore there will be a pressure condition induced by displacement of air out from the outlet 34 such that an inlet of air into the mixing chamber 30 will occur in from the conduit 29 carrying products of combustion over the burner 25 and also will induce an inlet of air from the opening 32 at the back of the machine thereby mixing the products of combustion with outside air in the amount necessary to replace the air forced out through the outlet 34. It is understood that the air ejected from the outlet 34 is necessary to discharge moisture laden air from the dryer. The outlet 34 is positioned between the outlet of the blower and the heat transfer portion of duct 21 to insure a positive outward flow and to avoid unnecessary waste of heat.

The gas for combustion is fed to the machine through a pipe 35 connected to a valve 40 which valve has a gas connection to a pilot 41 and a thermocouple assembly comprising a thermocouple lead 42 and a thermocouple 42A. The thermocouple lead 42 forms a current conductor comprising two metal tubes, a copper outer tube which surrounds an insulated inner one. The inner and outer elements of each are brazed together to form so called "cold junctions" and the inner and outer tube are welded together at the tip to form the hot junction 42A. As shown in Figures 1, 3, and 5 this hot junction 42A is so located adjacent the pilot burner 41 that the hot junction 42A will actually be in the flame from the pilot burner 41 when the latter is lighted. Sufficient electricity is generated by the temperature differential between the hot and cold junctions to energize the electromagnet 40A thereby holding the valve 40 open as shown in Figure 5. The valve 40 is initially opened by manually depressing a plunger 43, which permits a flow of gas to the pilot 41 and enables it to be lighted manually. After lighting the pilot 41, the plunger 43 must be held down until the hot junction 42A of the thermocouple is heated sufficiently to generate electricity to cause the electromagnet 40A to hold the valve 40 open, after which the plunger may be released and the valve 40 will remain open. A valve 44 controlled by

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the valve handle 44A may then be opened manually to feed gas through the valves 40 and 44, but if, for any reason, the flame in the pilot 41 is extinguished, and the hot junction 42A is cooled, the current to the electromagnet 40A will fail and the electromagnet 40A will no longer hold the valve 40 open, thus resulting in the closing of the valve 40. Assuming that the gas valves 40 and 44 have been opened and the opening of the valve 40 has been assured by lighting the pilot 41, the gas will then flow through these two valves into a solenoid operated valve 45. This valve is opened and normally held open by the actuation of a solenoid 46. The electrical circuit for actuating this solenoid will be described more completely hereinafter. After the gas has been allowed to flow through the valve 45 by actuation of the solenoid 46 it may enter a safety valve 47 which is a spring operated valve having a normal tendency to close but which is held open by the action of the spring 49A which maintains a constant upward pull on the lever 48. The spring 49A is connected through a cable 49 to a fusible element 50 of suitable material having a melting point which is selected to conform to a temperature slightly above the maximum temperature normally attained in operation. This element 50 is mounted as shown in Figure 1 on the wall of the duct 21 and as long as the temperature on the wall of the conduit is below the melting point above mentioned, the valve 47 will remain open. However, should some control component fail and cause the temperature on the wall of duct 21 to exceed the melting point of the fusible element 50, the valve will close by spring action.

The gas, after having passed through the valve 47, enters the mixing chamber 38 which is connected to the previously mentioned gas burner 25. Thus it is apparent that the heating system for the dryer herein described is provided with two positive safety devices in addition to those employed in normal operation, the actuation of either of which will result in the flow of gas to the burner 25 being cut off completely. The thermocouple assembly 42—42A acts to shut off the gas through closing the valve 40 if the pilot is extinguished, whereas the spring 49A and cable 40 attached to the fusible element 50 will act to cut off the flow of gas at the valve 47 if the temperature in the dryer exceeds a predetermined maximum.

Considering Figure 6 which is an electrical wiring diagram showing the circuit which controls the operation of the dryer it is noted that the solenoid operated gas valve 45 previously mentioned in the above description is shown in Figures 5 and 6 as controlled by the solenoid unit 46. This solenoid unit 46, when actuated through the electrical circuit 51—52 causes gas to be fed into the burner 25 (see Figures 1 and 5). The electrical conductor 51 connects with a thermostat 53 which is shown diagrammatically in Figure 6 and is also shown on the drawing Figure 1. This thermostat has a temperature responsive element 54, shown in Figure 1, positioned in the air circulating duct 21. This thermostat may be of the general type disclosed in U. S. Patent 2,197,229. This thermostat 53 has its contacts 53A in series with the electrical conductor 51, and will close or fail to close that circuit at contacts 53A depending upon the temperature in duct 21 at which the circuit will be closed or broken by change in volume of liquid carried in the thermostat as shown in Figure 6. As shown in Figure 1 the temperature at which this thermo-

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stat breaks the circuit at contacts 53A is adjustable for various temperatures selected by rotation of the knob 55. Also in series with the circuit 51 is a timer mechanism 56. This timer is of the general type carrying a cam 57A rotated by an electric motor 58. A shaft 57 carries the cam 57A actuating individual switches 60 and 61 and this cam 57A is therefore rotated by timer motor 58. The individual switch 60 controls the circuits for the main drive motor 62 and timer motor 58 while individual switch 61 controls the circuit to gas valve 45 in series with the thermostat contacts 53A. The units above mentioned including the motor 62 and the timer 56 are shown on Figure 1 as well as on Figure 6. The belt connections for rotating clothes cylinder 10 are shown in Figure 1. The motor 62 drives the cylinder 10 through belts 63 and 64, annular flange 13, and pulleys 65 and 66, while the blower 23 is driven through the belt 67 also shown in Figure 1.

As shown on the electrical circuit drawing Figure 6, the 120 volt power circuit furnishes electrical current through the thermostat 52 to the lines 51 and 52 provided the cam operated switch 60 on the timer 56 is closed. When the cam operated switch 60 on the timer 56 is closed current will then be provided to drive the timer motor 58 and the main drive motor 62. The several cams carried by the shaft 57 on the timer 56 and the rate of rotation of the shaft 57 are so arranged that desired time for operation of the motor 62 for the rotation of the cylinder 10 is provided and during such time the circuit through switch 61 is closed to furnish current to the solenoid 46 and thereby hold the gas valve 45 in an open position in order to furnish gas to the burner 25.

In operation the gas pilot 41 is first manually lighted while holding down the plunger 43. When the pilot 41 has continued burning a sufficient length of time to assure that the hot junction 42A has generated sufficient electricity to enable the electromagnet 40A to hold the valve 40 in an open position to feed gas to the pilot, the handle 44A is turned to open the main valve 44. The timer 56 may be set in motion by rotating it to a starting position so that the timer motor 58 and the main motor 62 will be put in rotation. Such position will provide electrical current controlled by the switch unit 60 for both motors 58 and 62 and will also at the same time provide electrical current through switch 61 and, if the thermostat 53 is set for a relatively high temperature, will allow current to be fed to the solenoid 46 of the gas valve 45. This will cause the gas valve 45 to be opened which will feed gas to the burner 25. The gas burned in the stove 26 will heat the top member 27 and adjacent parts of the stove and the products of combustion and heated gas will flow up through the connection 28 and the conduit 29 which will also be heated and transfer heat to the recirculating air in duct 21. The products of combustion then enter the mixing chamber 30 adjacent the holes 31 which communicate with the housing surrounding the rotatable cylinder 10. As previously mentioned, the air pressure in the mixing chamber 30 is such that the tendency will be to permit flow of the heated products of combustion out through the holes 31 and into the space surrounding the rotatable cylinder 10. Inasmuch as the gases which are so carried through the housing 31, diluted by inlet air from opening 32 as previously

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mentioned, will be required to contact the outside surface of the cylinder 10 the heat in these gases will be used to heat the cylinder although the gases will eventually flow into the cylinder 10 itself.

The products of combustion in their passage through the conduit 29, will heat the conduit 29 and the air passing in duct 21 around the conduit. Therefore as the gas is burned in the stove housing 26 and passes into the conduit 29, a portion of the heat of the gas is used in heating the stove housing and the conduit 29 and furthermore the products of combustion circulate between member 17 and cylinder 10 so that there is a heat transfer and use of the burned gases to heat the portion of the dryer cylinder directly adjacent the clothes to be dried and also there is a partial transfer of heat to the clothes in the air recirculating duct 21 in the front of the machine by flow of air around conduit 29. It can therefore be stated that heat is removed from the gas to the clothes by indirect transfer through heated surfaces and also heated by later direct passage of products of combustion into the clothes cylinder. However, the use of an indirect transfer of a portion of the heat assures that the final direct contact temperature of the gas products of combustion on the material to be dried will be materially lower than would be the case if products of combustion were allowed to contact the clothes without initial indirect heat transfer as herein disclosed.

Figures 7 to 12 inclusive show a modification wherein the conduit 29 is enclosed to prevent the air and lint circulating through the duct 21 from coming in direct contact with the walls of the conduit 29, and with flow of air over conduit 29 into cylinder 10 from the outside. In some cases this construction is desirable particularly for drying special types of fabrics which give off lint particles having a tendency to cling to surfaces of relatively high temperature.

As shown in Figure 11, the conduit 29 is sealed off from the air duct 21 by a housing composed of three walls, 75, 76, 77 and a plate 78. The walls 76 and 77, as shown in Figures 9 and 10, extend from a point slightly above the bend 79 in the conduit 29 to a point adjacent but spaced above the top member 27 of the stove housing 26. The space 76A provides for inlet of air from the outside around the conduit 29 and into the clothes cylinder 10 through screen 82 and screened front wall 19 of cylinder 10.

The wall 75 is cut off diagonally at a point somewhat above the stove housing 27, and to this diagonal lower edge of the wall 75 is secured a bottom member 80, which member serves as the bottom of a vertical duct 81 which is connected to the horizontal duct 21. As shown in Figure 12 the wall 78 is provided with a long vertical screened opening 82 which is adjacent the conduit 29, enabling heated air passing around conduit 29 to pass into the clothes containing cylinder 10 through the screened front wall 19. The vertical opening 82 is widened at the bottom to provide an opening 82 from the vertical duct 81 into the cylinder 10 through the screened front wall 19 thereof. Thus it appears that there are two closely adjacent openings into the cylinder 10, one from recirculating duct 81 and the other from the chamber in which conduit 29 is enclosed. Since the air taken around conduit 29 comes from outside there is no possibility of lint content in such air and

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since the flow blends immediately with the recirculated air from conduit 81 the temperature will not be too high. As can be seen from inspection of Figure 10 the bottom member 80 is slanted diagonally downward toward the opening 83 to facilitate passage of the air into the cylinder 10. At the junction of the horizontal duct 21 and the vertical duct 81 there is situated an air scoop 84 which deflects air from the horizontal duct 21 into the outlet 34 which was described in the first form of the invention for removing vapor laden air from the machine.

In order to prevent the outside wall of the machine from becoming overheated due to heat radiation from the conduit 29, an opening indicated as 85 in Figure 7 is provided to permit the passage of cool air between the wall 77 of the conduit housing and the outside wall. The air which passes through this opening 85 is enabled to enter the mixing chamber 30 through an opening 86 in the wall 78 as shown in Figures 7 and 12. The mixing chamber 30 is substantially the same as the mixing chamber in the first described form, with the exception that in the modification herein described, a radiant shield 87 is provided to prevent the outside walls of the machine from becoming overheated.

In operation the modified form is not greatly different from the first described form. Air is withdrawn from the rotatable cylinder 10 through the opening 22 in the wall 78 by means of the fan or blower 23 and is circulated through the horizontal duct 21. Upon reaching the junction of the horizontal duct 21 and the vertical duct 81, a small portion of the air is picked up by the air scoop 84 and is discharged from the machine through the outlet 34. However, the major portion of the air passing through the duct 21 is deflected into the vertical duct 81. Upon striking the bottom member 81 which slants toward the opening 83 in the wall 78, the air is caused to pass through the opening 83 and through the screened front wall 19 of the rotatable cylinder 10.

It will be noted that at no time does the air circulating through the ducts 21 or 81 come in direct contact with the walls of the conduit 29. However, a partial heat transfer is afforded into the duct 81 through the wall 75 and directly into the rotatable cylinder 10 through the screened opening 82 in the wall 78 adjacent the screened front wall 19. But the products of combustion and the greater portion of the heat generated by the gas burner 25 are carried through the conduit 29 into the mixing chamber 30 where they are free to pass through the holes 31 and through the perforated front wall of the rotatable cylinder 10. As previously mentioned, the radiant shield 87 prevents the overheating of the outside walls and insures that the heat in the mixing chamber 30 will be transmitted to the clothes inside the rotatable cylinder.

Although this invention has been disclosed by reference to a particular machine which has been found practical in actual operation, it is not intended to limit the scope of this invention to that disclosure or otherwise than by the terms of the appended claims.

We claim:

1. In a dryer of the type which utilizes a rotatable clothes containing cylinder having a solid peripheral wall and a perforated front wall, an air circulating duct adjacent said perforated front wall of said cylinder, an inlet opening in said duct adjacent said perforated front wall of

said cylinder into said duct, an outlet opening in said duct through which the air flows into said cylinder from said duct, a gas burner located adjacent to said duct outlet, a conduit for carrying the heated air and products of combustion from said burner, said conduit passing through said air duct, a mixing chamber at the outlet of said conduit, said mixing chamber having one of its sides provided with openings adjacent the solid peripheral wall of said rotatable cylinder to permit heat transfer through said peripheral wall and subsequent admission of said mixed air and products of combustion into said clothes containing cylinder through said perforated front wall.

2. In a dryer of the type which utilizes a rotatable drum having a screened or perforated front wall to contain the clothing or other fabrics to be dried, an air circulating duct having an open portion adjacent said screened front wall, a blower positioned in said duct for producing a flow of air therethrough, a gas burner, and a conduit for carrying the heated air and products of combustion from said burner, said conduit being positioned adjacent to said screened front wall and inside said duct adjacent said open portion permitting a transfer of the heat radiated from said conduit through said screened front wall and into said drum and also a transfer of radiated heat to the air in said duct.

3. In a dryer of the type which utilizes a rotatable drum having a screened or perforated front wall to contain the clothing or other fabrics to be dried, an air circulating duct having an open portion adjacent said screened front wall, a blower positioned in said duct for producing a flow of air therethrough, a gas burner, a conduit for carrying the heated air and products of combustion from said burner, said conduit being positioned adjacent to said screened front wall and inside said duct adjacent said open portion permitting a transfer of the heat radiated from said conduit through said screened front wall and into said drum and also a transfer of radiated heat to the air in said duct, and a mixing chamber at the outlet of said conduit into which heated air and products of combustion from said gas burner may be discharged, said mixing chamber being located adjacent a peripheral wall of said rotatable drum and having perforations or openings therein through which the hot air and products of combustion may escape to contact said peripheral wall and subsequently to enter said drum through the perforations in the front wall thereof.

4. In a dryer of the type which utilizes a rotatable drum having a screened or perforated front wall to contain the clothing or other fabrics to be dried, an air circulating duct having an open portion adjacent said screened front wall, a blower positioned in said duct for producing a flow of air therethrough, a gas burner, a conduit for carrying the heated air and products of combustion from said burner, said conduit being positioned adjacent to said screened front wall and inside said duct adjacent said open portion permitting a transfer of the heat radiated from said conduit through said screened front wall and into said drum and also a transfer of radiated heat to the air in said duct, a mixing chamber at the outlet of said conduit into which heated air and products of combustion from said gas burner may be discharged, said mixing chamber being located adjacent a peripheral wall of said rotatable drum and having perforations or openings therein through which the hot air and products of com-

bustion may escape to contact said peripheral wall and subsequently to enter said drum through the perforations in the front wall thereof, and an air inlet to admit outside air to said mixing chamber to combine with the products of combustion contained therein.

5. In a dryer of the type which utilizes a rotatable drum having a screened or perforated front wall to contain the clothing or other fabrics to be dried, an air circulating duct, a blower positioned in said duct for inducing a flow of air therethrough, a gas burner, a conduit for carrying the heated air and products of combustion from said burner, said conduit being adjacent said screened front wall and inside said duct, a housing surrounding said conduit preventing contact of the air in said duct with the exterior walls of said conduit, said housing being open on the side facing said screened front wall of said drum permitting a transfer of heat radiated from said conduit through said screened front wall and into said drum, the walls of said housing permitting the heat radiated from said walls to heat the air circulating in said duct, a chamber at the outlet of said conduit into which heated air and products of combustion from said gas is discharged, and an outlet from said chamber to permit the escape of said heat and products of combustion from said chamber around and into said rotatable drum.

6. In a dryer of the type which utilizes a rotatable clothes containing drum having a screened or perforated front wall, an air circulating duct, a blower positioned in said duct for producing a flow of air therethrough, a gas burner, a conduit for carrying the heated air and products of combustion from said burner, said conduit being adjacent said screened front wall and inside said duct, a housing surrounding said conduit preventing contact of the air in said duct with the exterior walls of said conduit, said housing being open on the side facing said screened front wall of said drum permitting a transfer of heat radiated from said conduit through said screened front wall and into said drum, and an inlet opening in said housing permitting outside air to enter into said housing and flow around said conduit and into said rotatable drum through said screened front wall of said drum.

7. In a dryer of the type which utilizes a rotatable clothes containing cylinder having a screened or perforated front wall, an air circulating duct, a blower positioned in said duct, an inlet opening in said duct adjacent said blower and said screened front wall through which air is withdrawn from said cylinder into said duct by the action of said blower, an outlet opening in said duct through which air is forced out of said duct into said cylinder, a gas burner located adjacent to said duct outlet, a conduit for carrying the heated air and products of combustion from said burner, said conduit being adjacent said screened front wall and inside said duct, a housing surrounding said conduit preventing contact of the air in said duct with the exterior walls of said conduit, and an opening in said housing permitting outside air to enter into said housing and flow around said conduit and into said rotatable cylinder through said screened front wall thereof at a point sufficiently close to said duct outlet to permit the air from both said outlets to mix as it flows into said rotatable cylinder.

8. In a dryer of the type which utilizes a rotatable clothes containing cylinder having a screened or perforated front wall, an air circulat-

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ing duct, a blower positioned in said duct, an inlet opening in said duct adjacent said blower and said screened front wall through which air is withdrawn from said cylinder into said duct, an outlet opening in said duct through which air is forced out of said duct into said rotatable cylinder, a gas burner located adjacent to said duct outlet, a conduit for carrying the heated air and products of combustion from said burner, said conduit being adjacent said screened front wall and inside said duct, a chamber at the outlet of said conduit to receive the heated air and products of combustion carried by said conduit, said chamber having openings communicating with the interior of said rotatable cylinder, a housing surrounding said conduit preventing contact of the air in said duct with the exterior walls of said conduit, and an inlet opening in said housing permitting outside air to enter into said

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housing and flow around said conduit and into said rotatable cylinder through said screened front wall thereof at a point sufficiently close to said duct outlet to permit the air from both said outlets to mix as it flows into said rotatable cylinder.

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The following references are of record in the file of this patent:

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