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2,633,646

METHOD AND MEANS OF DRYING CLOTHES

Filed July 6, 1950

3 Sheets-Sheet 1

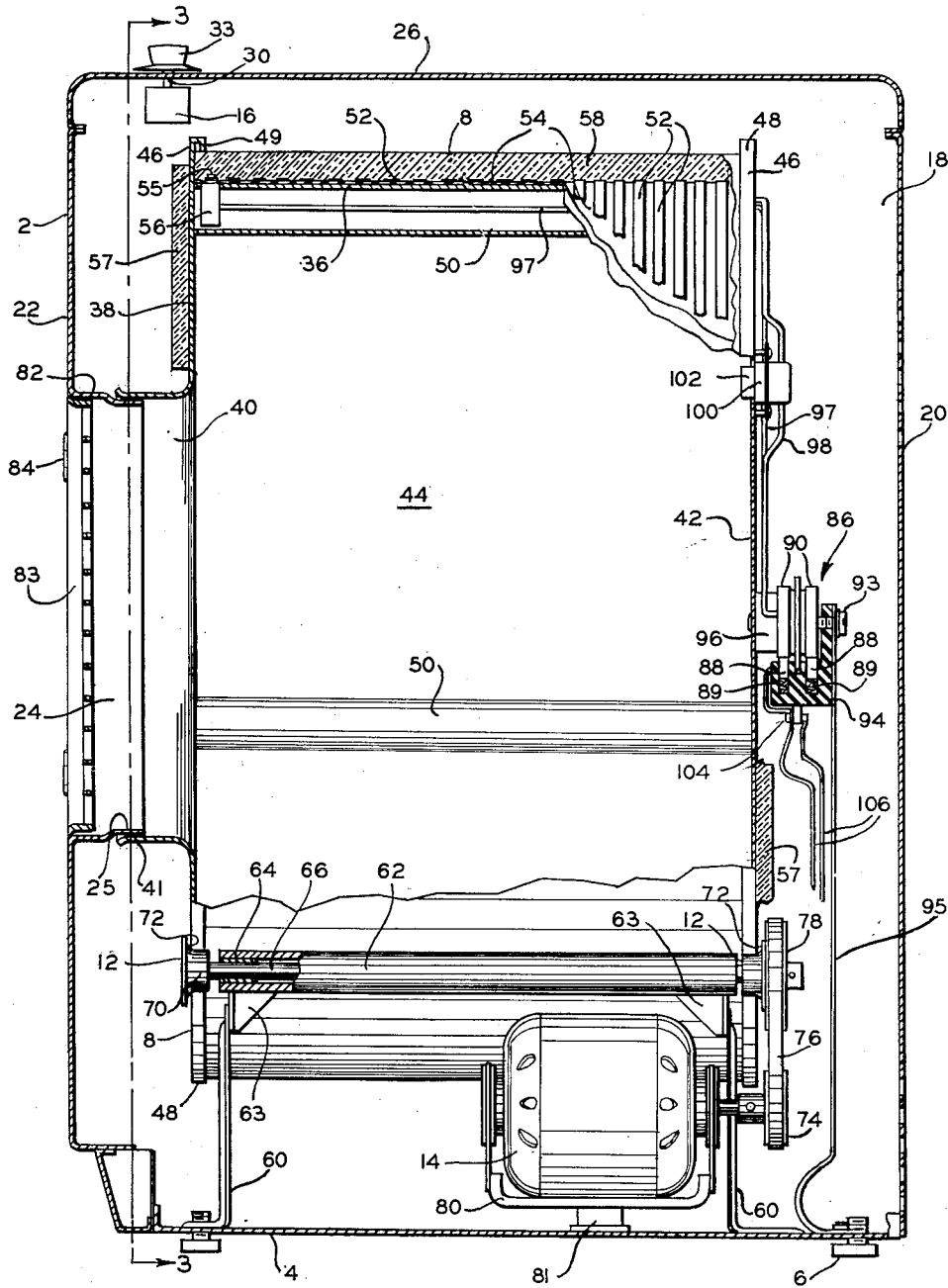


FIG. 1

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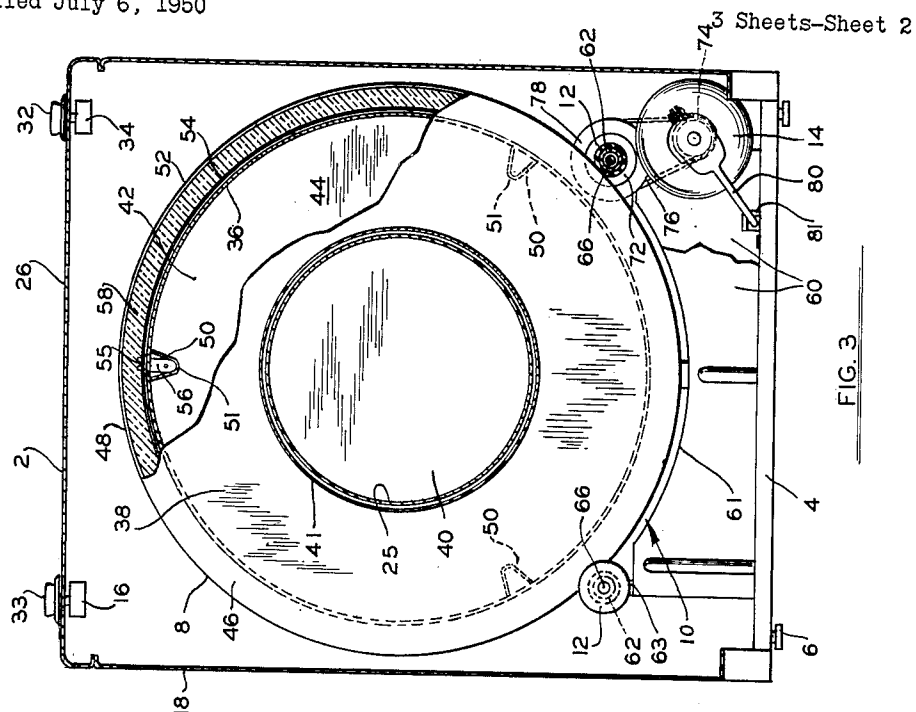


FIG. 3

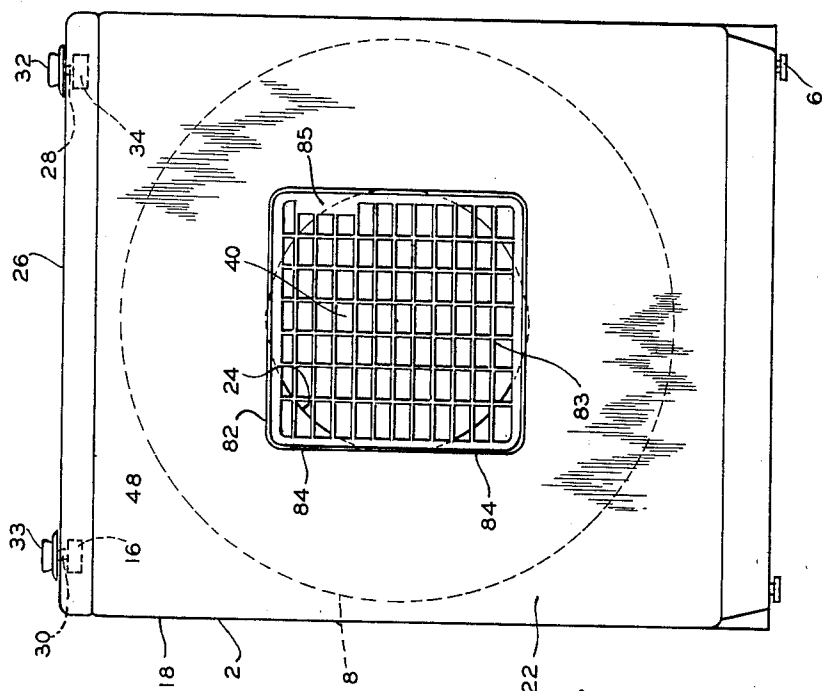


FIG. 2

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3 Sheets-Sheet 3

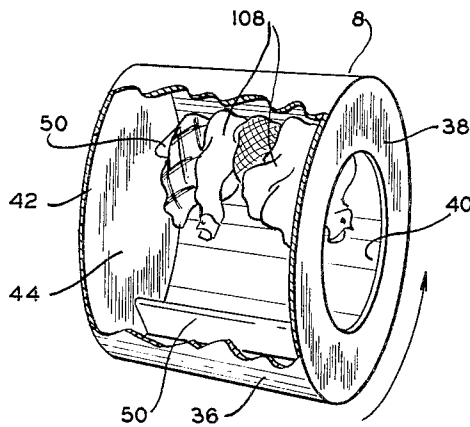


FIG. 4

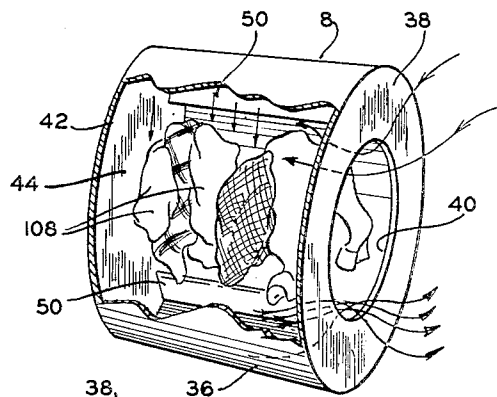


FIG. 5

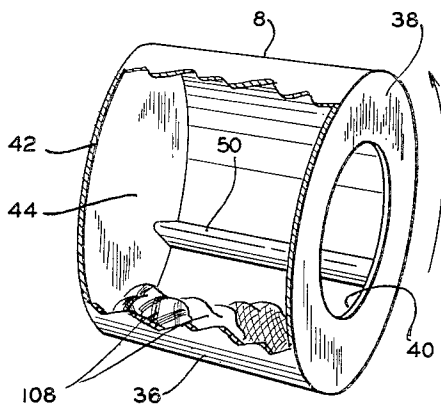


FIG. 6

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UNITED STATES PATENT OFFICE

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METHOD AND MEANS OF DRYING CLOTHES

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7 Claims. (Cl. 34—17)

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The invention relates to driers, more particularly to clothes driers wherein the clothes to be dried are tumbled in a heated imperforate drum and it has for an object to provide an improved method of drying clothes and apparatus therefor.

It is another object of the invention to provide an improved tumbler type clothes drier which utilizes the clothes being dried as the means for circulating ambient air into and out of the drum.

Heretofore, it has been customary in tumbling apparatus utilized for drying clothes, to include air motivating fans or blowers or the like, to circulate relatively large quantities of heated air through the clothes being dried in order to remove the moisture therefrom. The use of fans or blowers require, in most instances, duct work to direct the air from one part of the drier to another, across heating elements, thermostats, etc. for the proper control of both temperature and total volume of flow. In the above constructions the addition of blowers, duct work, etc. all materially increase the over-all manufacturing cost of the drying unit and it has been found that these elements are not necessary.

Accordingly, it is an object of the invention to provide an improved clothes drier which eliminates the necessity of air circulating fans or blowers, special duct work therefor, and other material required for the circulation of air through the tumbling apparatus and to depend entirely upon the action of the clothing being dried to effect the proper circulation of air from the ambient atmosphere into and out of the access opening.

It is another object of the invention to provide an improved tumbler type clothes drier which is provided with a single access opening and is imperforate elsewhere and wherein the clothes to be dried are tumbled in such manner as to act as a pump for circulating ambient air into and out of the interior of the tumbler through the access opening.

It is still another object of the invention to provide an improved tumbler type clothes drier construction of the domestic type wherein the tumbler is mounted on a horizontal axis and is provided with an access opening on that axis having a diameter smaller than the diameter of the drum and which is imperforate elsewhere, and wherein the tumbling action of the clothes being dried in the sole pumping means for circulating ambient air into and out of the tumbler through the access opening.

Other objects, features, capabilities, and ad-

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vantages are comprehended by the invention as will later appear and as are inherently possessed thereby.

Referring to the drawings:

5 Figure 1 is a partial vertical longitudinal sectional view of a tumbler type clothes drier constructed in accordance with the present invention;

10 Figure 2 is a front elevational view of the clothes drier showing the front access opening;

Figure 3 is a vertical sectional view of the drier taken on the line 3—3 of Figure 1 and with a portion of the drum broken away; and

15 Figures 4, 5, and 6 are diagrammatic views showing the action of the clothes being dried and the air currents.

Referring now more in detail to the drawings for one form of a clothes drier embodying the features of the present invention, there is shown 20 an outer cabinet 2, secured to a base or frame structure 4 having adjustable legs 6 for completely enclosing the operating parts of the clothes drier. The base 4 provides a support for a hollow clothes receiving rotatable tumbler or 25 drum 8 mounted for rotation about a horizontal axis within a cradle 10, formed by four spaced rollers 12, and rotated by means of an electric drive motor 14 in a manner as will be hereinafter more fully described. The drier further includes control mechanism, generally referred to as 30 16, for automatically controlling the operation and duration of the drying cycle.

The cabinet 2 has its main body portion formed with side panels 18, a perforated back panel 20 for permitting the flow of cooling air about the drive motor 14, a front panel 22 having a substantially centrally located access opening 24 therein with an inwardly directed cylindrical flange 25 disposed about the horizontal axis of the tumbler 8, whereby the operator may gain 40 access to the interior of the drum, and a top panel 26 to provide a substantially rectangular unitary structure. The top panel 26 is preferably formed with a pair of small openings adjacent the front corners thereof through which 45 upwardly projecting control shafts 28 and 30 extend having thereon control knobs 32 and 33, respectively, adapted to be grasped by the operator for manipulation. One of the control knobs 32 is adapted to be adjusted for actuating a timer 50 motor 34 for controlling the duration of a timed-drying cycle and the other knob 33 is utilized to effect automatic operation of the drier, when desired, without the benefit of the timer motor 34. The horizontally mounted drum or tumbler 8

in the casing 2 comprises an imperforate cylindrical wall 36 disposed between a vertical front wall or header 38 having a single centrally located access opening 40 therein with a forwardly directed cylindrical flange 41 which overlaps the inner end of the cylindrical flange 25 on the front panel 22, and a vertical imperforate rear wall or header 42 spaced in parallel relation with the front header. All three elements are welded or secured together, in any suitable manner, to form a unitary rigid structure to define a drying chamber 44 therein. In this construction the access opening 40 is approximately one-half the diameter of the drum. Each header or wall has identical portions extending radially outward beyond the outer periphery of the cylindrical wall 36 to provide integral front and rear flanges 46. The outer portion of each flange is rolled or formed with a flat horizontal cylindrical supporting surface or rim 48 and a backwardly directed strengthening rib 49. The positioning of these rims are such as to rest on the rollers 12 which act as the sole supporting means for holding the drum in its horizontal plane.

Within the drying chamber 44 adjacent the cylindrical wall 36 are a plurality of horizontally disposed and parallel arranged lifting ribs or baffles 50 having radially inwardly extending rounded ends 51. These ribs preferably extend across the entire width of the cylindrical wall 36 and engage both the front and back walls to eliminate the possibility of snaring the clothing being dried and they may, if desired, be formed as an integral part of the cylindrical wall 36 or be individual elements welded or secured in place in any suitable manner. The purpose of these ribs is to elevate the clothing, when the drum is rotated, from the lower portion of the drum up one side thereof to the upper portion, whereat gravity acting on the clothing plus the rotational movement imparted to them by the drum and ribs 50 causes the same to drop downwardly to the bottom of the drum in a tumbling manner out of contact with the downwardly moving side of the drum.

In order to evaporate the moisture in the clothing within the drum heat must be applied thereto. The preferred means for heating the drum is in the form of an electrical heating element 52 formed as a single flat, long, thin and relatively wide strip of stainless steel or other material having similar characteristics. In this instance, in order to obtain proper wattage, the heating element 52 would be approximately 0.0055 in thickness, three-quarters of an inch in width and approximately 119 feet long. This would be the equivalent of about 17 to 18 turns about the periphery of the drum. It is to be understood, of course, that these figures are only given by way of example and that the thickness, width and length may be varied, within limits, to obtain the desired wattage. The heating element is tightly wound in an open spiral to cover substantially the entire outer periphery of the imperforate cylindrical wall 36, and a thin layer of electrical insulation 54, such as, for example, asbestos or the like, is placed therebetween to prevent electrical contact with the drum and the opposite or free ends 55 of the heating element are secured to terminal posts 56 disposed in the recess provided in one of the ribs 50. Relative axial shifting movement of each spiral or turn is prevented by applying an adhesive of any suitable type to the electrical insulation when the heating element is

assembled on the drum, so that the turns of the heating element are held in their proper spaced relation and cannot move axially relative to each other and short a portion of the same. Also, the adhesive holds the heating element tight against the drum and along with the terminal posts it tends to prevent the heating element from unwinding.

With a heating element of the above mentioned type, it is possible to uniformly heat the entire periphery of the drum, which of course, heats the clothing to drive off the moisture or a high percentage thereof. By mounting the heating element as shown and controlling the total length, width and thickness of the same, the over-all temperature of the entire heating element may be reduced considerably, in fact, it may be reduced to a point below that which would normally cause ignition should the clothing remain in contact with the drum for any length of time such as, for example, if the drive motor 14 should fail and the drum 3 stop rotating, or for any other reason.

In order to improve the efficiency of the drier, insulating pads 57 may be attached to the outer surface of the front and rear walls 38 and 42, and a layer of thermo-insulation 53 of any suitable dielectric type is wrapped about the outer periphery of the heating element 52 to totally enclose the same. With a construction of this type any lint shaken off of the clothing during the drying operation which may enter the interior of the casing through the overlapping flanges 25 and 41 cannot accumulate on the heating element, thus an additional fire hazard is eliminated.

From the above it can be seen that a relatively simple drum and heating means therefor has been provided and that the drum is imperforate except for the central access opening 40 for the insertion or removal of the clothing being dried.

In order to support the rotatable drum in its horizontal position there are provided a pair of similar, oppositely disposed and upwardly extending parallel webs 60, which may be struck or cut from the base 4 to form an integral structure therewith, and they are preferably positioned adjacent the front and rear walls 38 and 42 of the drum transverse to its horizontal axis and are dished or relieved at 61 (Figure 3) to insure clearance for the drum. Bridging the upper outer ends of the opposite webs 60 there are mounted a pair of parallel horizontally spaced tubular members 62 disposed parallel with the drum and rigidly secured to the webs 60 by means of angle brackets 63 to provide a relatively simple rigid supporting structure. Adjacent each end of the tubular members 62 there is mounted a bearing 64, of the self-lubricating type, for journalling horizontal shafts 66. These shafts project outward beyond both ends of the tubular members 62 and the rubber supporting rollers 12 are secured to the projecting end portions of the shafts in any suitable manner.

The outer peripheral portion of the rollers in contact with the rims 48 is preferably formed from a compound, such as, for example, rubber, synthetic rubber or the like, which is sufficiently hard and resistant to wear and its outer cylindrical surface 70 is normally wider than the rim surface 48 on the drum to permit slight misalignment therewith. These four spaced rollers provide the sole support for the drum 3. In addition, each supporting roller has its outermost end provided with a radial projecting flange to constitute a thrust collar or surface 72 extending

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inwardly adjacent the outer portion of the flanges 46 on both the headers and closely spaced thereto in such a manner as to limit axial shifting movement of the drum 8 when it is rotated about its horizontal axis.

Means for rotating the drum includes the drive motor 14 having a driving pulley 74 secured thereto mounted for rotation on an axis parallel to the drum axis and connected by means of a belt 76 to a driven pulley 78 rigidly secured to a projecting end of one of the horizontal supporting shafts 66 adjacent one of the rollers 12. In order to maintain a relatively constant tension or loading on the belt 76 and reduce slippage to a minimum, the motor frame is secured to a bracket 80 loosely mounted in an offset pivot 81 so that the major portion of the weight of the motor is gravity responsive to maintain the belt in tension. When the motor is energized the drive pulley 74 rotates one of the shafts 66 through the driven pulley 78 to cause the same to rotate. With the weight of the drum 8 insuring proper contact with the pair of rubber rollers 12 on the driving shaft 66 the friction between the engaging portions of the rollers and rims 48 cause the drum to rotate about its horizontal axis, while the opposite shaft carrying its rollers merely acts as a rolling support. It is obvious that while the motor rotates at its rated speed there is a relatively large speed reduction between the pulleys, rollers, and flanges, for example, with the motor rotating at 1750 R. P. M. the drum is rotated between 45 and 50 R. P. M.

The portion of the front panel 22 defining the access opening 24 has a portion thereabout recessed at 82 which is then curved inwardly to merge with the cylindrical flange 25. Fitting within this recess 82 is a grilled closure or door 83, hinged at 84 to pivot about a vertical axis, and having the usual handle or grip device 95 which is opened by the operator to gain access to the interior of the drum, and when the door is in its closed position during the drying operation, it deflects and prevents the fabrics being dried from accidentally falling outward through the opening 24. At the same time the grilled door offers little or no resistance to the flow of cool ambient air into the drying chamber 44 and the flow of heated air and vapor out of the chamber into the ambient atmosphere.

While various means may be employed for energizing the heating element 52 there is diagrammatically disclosed in this modification a collector ring assembly 86 secured to the back portion of the rear wall 42 and mounted on the approximate axis of rotation of the drum 8. This slip ring assembly generally comprises a pair of spring biased carbon brushes 88 disposed in recesses 89 which are held in engagement with a pair of spaced annular metallic slip rings 90. The brushes and springs are mounted in a relatively stationary support 94 made from insulating material of any suitable type, and the slip rings 90 are mounted on the outer periphery of a generally cylindrical rotatable insulating block 96 which is in turn anchored or secured to the wall 42 of the drum and, of course, turns therewith. The stationary support is positioned by means of a pin 93 and held against rotational movement by means of a flexible holding arm 95 whose lower end is secured to the base to provide an anchor. This flexible arm permits the assembly to be displaced from the true axis of rotation of the drum. The arm 95 cooperating with the

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pin and securing means for the slip ring holder also provides a ground connection for the drum.

Electrical conductors 97 and 98 extend from each respective slip ring radially outward along the back 42 of the drum. The conductor 97 passes through an opening in the back wall of the drum and is directly connected to one end 55 of the heating element 52 at one of the terminal blocks 56, while the opposite end of the heating element is connected to the conductor 98 at the other terminal block. Conductor 98 is connected in series with a fixed temperature responsive thermostat or limit switch 100 secured to the rear wall adjacent the outer periphery of the drum which deenergizes the heating element 52 when the temperature within the chamber 44 of the drum reaches or tends to exceed a predetermined safe value. The thermostat has a portion 102 projecting through an opening in the rear wall of the drum into the interior thereof so that it responds to both the actual temperature of the air in the drum and to the temperature of the rear wall 42, and is responsive if either collectively or individually exceeds a safe value. The leads 104 extending from the brushes are connected to any suitable electrical source through conductors 106.

The operation of a clothes drier of the tumbler type hereinabove described and incorporating the tumbling features of this invention for removing moisture from the fabrics and made in accordance with the invention is as follows:

The operator opens the grilled door 83 and inserts the damp clothing 108 to be dried into the interior 44 of the imperforate drum 8 and the door is closed. Next the operator manipulates either or both of the control knobs 32 and 33 to energize the drive motor 14 to rotate the drum 8 and to energize the heating element 52 for a predetermined length of time, or until the major portion of the moisture is removed from the clothing.

As the interior 44 of the drum is heated a portion of the moisture in the clothing is evaporated and taken up by the air in the drum, and due to the rotation of the drum the clothing is all agitated in such a manner as to uniformly heat the same. By referring to Figures 4, 5, and 6, it can be seen that as the drum is rotated counterclockwise, as viewed from the front, the lifting ribs 50 pick up the clothes 108 in the lower portion of the drum and elevate the same upwardly on the right hand side to adjacent the upper portion thereof. At this point the weight of the clothes and speed of rotation of the drum are such that gravity acting on the clothing causes the major portion to fall downwardly in a tumbling manner to the bottom of the drum out of contact with the downwardly moving side of the drum. In view of the fact that the drum is imperforate, with the exception of the single access opening 40, it can be seen that as the clothes fall toward the bottom, the air beneath the same is trapped between the parallel side-walls 38 and 42 and the cylindrical wall 36. Due to the weight and speed of the falling clothes it compresses the air thereunder and forces a portion of the same out of the reduced access opening 40 into the ambient air, thus, the falling clothes act in effect as a pumping means. This expulsion of a portion of the heated air carries with it a certain portion of the moisture evaporated from the clothes.

Since a portion of the heated moisture laden

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air has been expelled into the ambient atmosphere a quantity of cooler ambient air must be introduced into the drum to maintain the proper air balance. This is accomplished by having the access opening of sufficient size so that as a portion of air is expelled by the falling clothes through a portion of the opening 40 a quantity is drawn in through another portion of the same opening. The pumping action caused by the falling clothes appears to be generally intermittent or pulsating in character depending upon the type, weight and quantity of clothing being dried and the major portion of the expelled air appears to be discharged through the lower left-hand sector of the opening, while the major portion of the incoming cooler ambient air appears to enter through the upper right-hand sector.

As the drum continues to rotate and the falling and tumbling clothes continue to discharge the moisture evaporated from the clothing into the ambient atmosphere and the moisture content in the clothing is reduced to a relatively low value, the temperature of the drum which has been held to a relatively low value by the latent heat of vaporization begins to increase due to the decrease of moisture to be evaporated. When the temperature of the interior of the drum increases to a predetermined value, corresponding to a certain definite degree or percentage of dryness, the fixed temperature thermostat 100 opens to deenergize the heating element 52. Continued tumbling of the clothes, after deenergization of the heating element, acts as a means to reduce the temperature of the clothing to a sufficiently low value so they may be easily handled by the operator upon completion of the drying operation.

From the foregoing it can be seen that a drying operation has been performed on the damp clothing, and from the construction of the drum and operation thereof it can be seen that the drier is devoid of any external air translating means and has but a single access opening which is smaller than the diameter of the drum. With a drier of this type the circulation of ambient air into and out of the drum is entirely dependent upon the clothing being tumbled therein and upon the feature of having them lifted from the lower portion of the drum to the upper portion thereof by means of the lifting vanes and then having them dropped by gravity downward past the access opening in a tumbling manner. As the clothing falls from the upper to the lower portion of the drum it has a tendency to compress the air beneath and force the same out of the lower portion of the central access opening 40 and along with it a portion of the vapor evaporated from the clothing by means of the heating element 52. As a portion of the heated and moist air is expelled through the lower portion of the opening, a quantity of relatively cool and dry air will naturally be drawn into the chamber 44 at another portion of the same opening and it is agitated and heated with the fabrics as it is moved about during rotation of the drum until it is expelled outwardly by the falling clothes when it is trapped in the lower portion of the chamber. Thus it can be seen that the fabrics being dried act as their own air translating or circulating means and that by utilizing the clothing being dried a relatively efficient drier is provided, in fact, without the insertion of the clothing in the drum and the tumbling action resulting therefrom this drier cannot function.

In addition it has been observed that the dry-

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ing efficiency of this drier is equal to or better than most driers which incorporate air translating means.

Also, by providing the heating element about the entire periphery of the rotatable drum a constant source of relatively low temperature heat is applied over the entire cylindrical surface of the drum to thereby avoid the possibility of developing overheated areas which are liable to cause ignition should the clothes or lint driven therefrom accidentally come in contact therewith for any reason. By providing insulating material about the heating element and headers a relatively efficient drying drum is provided.

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

What is claimed is:

1. A drier for damp clothing, comprising a supporting frame, a tumbler mounted on said frame for rotation about a horizontal axis, said tumbler including an imperforate cylindrical drum with a front wall having a single centrally located access opening having a diameter less than the outer diameter of said drum therein and an imperforate rear wall to define a drying chamber in direct communication with the ambient atmosphere through said access opening and for receiving the damp clothing to be dried, heating means disposed adjacent the exterior of said drum for heating said chamber to evaporate the moisture in said fabrics, drive means for rotating said tumbler about its horizontal axis, and elevating means for the fabrics disposed in said chamber, said elevating means and rotational speed of said drum being such as to elevate the fabrics toward the upper portion of said drum whereat the fabrics fall by gravity to the bottom of said drum and in so doing expel a portion of the heated air and evaporated moisture through a portion of said access opening into the ambient atmosphere and ambient air is drawn into said chamber through another portion of said access opening to continue the drying operation.

2. A drier for moist clothing, comprising a horizontally mounted rotatable cylindrical imperforate drum provided with an imperforate rear wall and a front wall having a centrally located access opening therein whose diameter is smaller than the outer diameter of said drum to define a drying chamber for receiving the moist clothing to be dried, said chamber being in communication with the ambient atmosphere at all times through said access opening, means for uniformly heating said chamber through said drum to heat the air and evaporate moisture from the clothing, lifting means disposed in said chamber, and drive means for rotating said drum about its horizontal axis, said lifting means and speed of rotation of said drum cooperating to continuously lift the clothing upwardly to adjacent the upper portion of said chamber whereat they fall toward the bottom of said chamber, said falling clothing producing a pulsating pumping action which expels a portion of the heated air and vapor in the lower portion of said chamber out of said access opening into the ambient atmosphere and withdraws a quantity of cooler and drier air from the ambient atmosphere through said opening into the chamber to continue the drying operation.

3. In a clothes drier, the combination of a drum

mounted for rotation about a horizontal axis, said drum comprising an imperforate cylindrical wall with an imperforate rear wall and an imperforate front wall except for an access opening of smaller diameter than said cylindrical wall to define a drying chamber for receiving the moist clothes which is in direct communication with the ambient atmosphere at all times through said opening, means for rotating said drum about its horizontal axis, heating means carried on the periphery of said drum to heat said chamber and evaporate the moisture in said clothing, a plurality of ribs disposed in said chamber for elevating the clothes when said drum is rotated, and a grilled closure disposed in said opening to prevent the clothes from falling out of said chamber and to permit free flow of air into and out of said chamber during rotation of said drum.

4. A drier for damp clothing, comprising a rotatable drum mounted for rotation about a horizontal axis, said drum including an imperforate cylindrical wall for an imperforate rear wall and an imperforate front wall except for an access opening therein in direct communication with the ambient atmosphere, heating means disposed about said drum for heating the air and evaporate moisture in said clothes, elevating means carried in said drum, drive means for rotating said drum about its horizontal axis so that the speed of rotation and the elevating means lift the clothes to the upper portion of the drum whereat they fall by gravity to the lower portion thereof and in so doing expel a portion of the air through said opening and withdraw ambient air through said opening to continue the drying operation, and a grilled closure disposed adjacent said opening to permit the free flow of air therethrough.

5. The method of drying moist clothing which comprises the steps of confining the moist clothing in a horizontally rotatable chamber which is entirely closed except for an opening having communication with the ambient atmosphere, supplying heat to said chamber from the exterior thereof to heat the air therein and convert the moisture content in said clothing into vapor, and causing portions of the vapor and heated air to be expelled through the opening into the ambient atmosphere and causing air from the ambient atmosphere to be simultaneously drawn through said opening into said chamber by a pulsating action caused solely by elevating and dropping the clothes in said chamber upon rotation thereof.

6. The method of drying moist clothing which comprises the steps of confining the moist clothing in a horizontal rotatable chamber which is entirely closed except for a lateral opening having direct communication with the ambient atmosphere, supplying heat to said chamber from the exterior thereof to heat the air therein and convert the moisture content in said clothing into vapor, and causing portions of the vapor and heated air to be expelled through said opening into the ambient atmosphere and air from the ambient atmosphere to be drawn through said opening into said chamber to continue the drying operation by a pulsating action caused solely by the clothes when elevated and dropped in said chamber upon rotation thereof.

7. A method of drying clothes, comprising the steps of tumbling the moist clothing about a horizontal axis in a rotatable chamber having a single passage therein disposed on the horizontal axis in direct communication with the ambient atmosphere in such manner to cause a pulsating action of the air and vapor within said chamber to be set up to act as the sole fluid actuating medium to force a portion of the air at the lower portion of the chamber into the ambient atmosphere and to simultaneously draw ambient air through the passage into said chamber, and supplying heat through the chamber exteriorly thereof to heat the air and evaporate the moisture in the fabrics.

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