Aug. 16, 1949. C. L. MATTHEWS ET AL 2,479,388

APPARATUS FOR DRYING HAIR

Filed Feb. 18, 1948

2 Sheets-Sheet 1

FIG. 1.

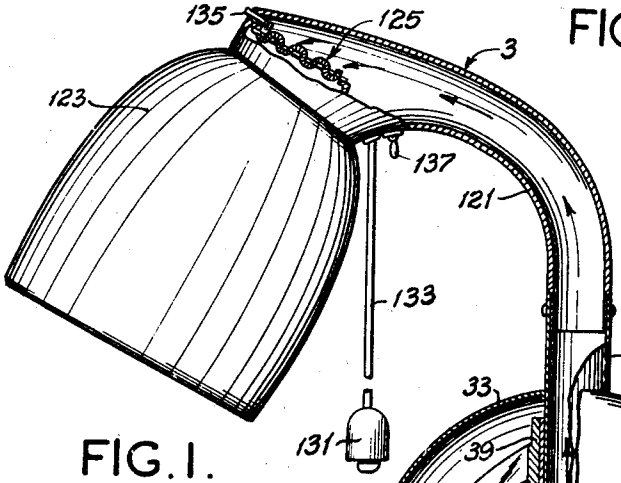


FIG. 4.

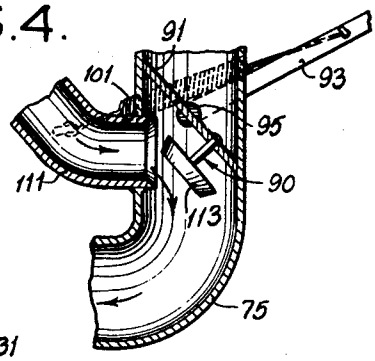
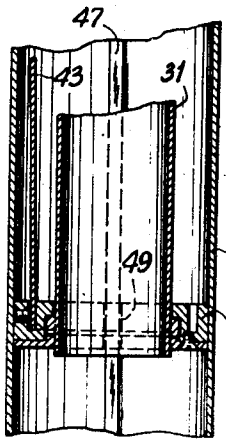
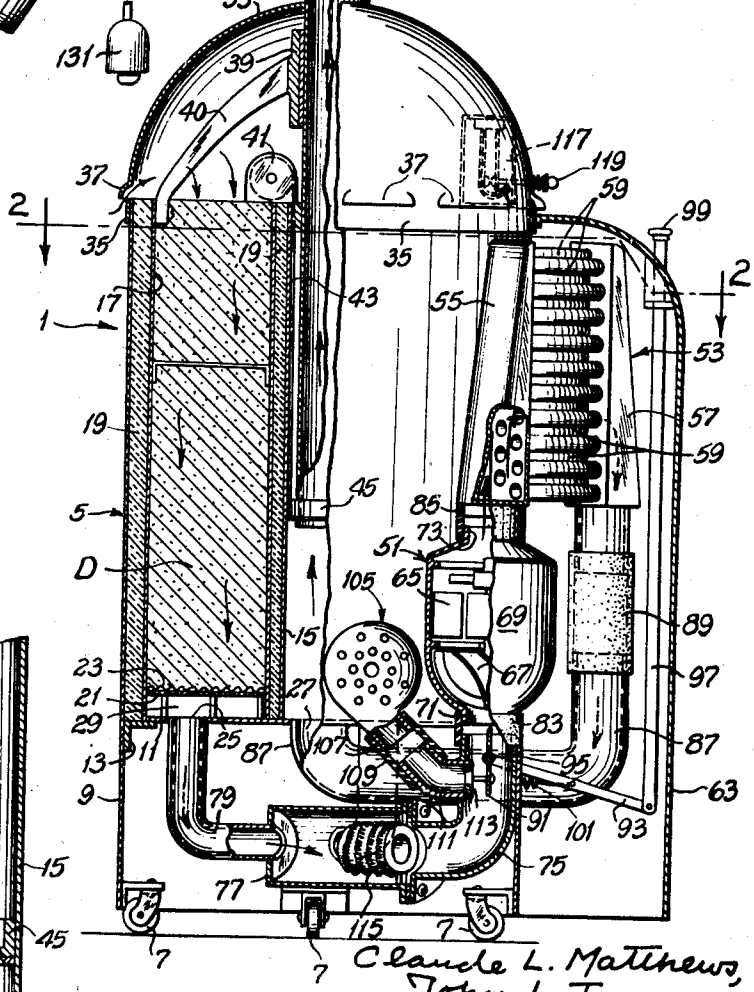


FIG. 3





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APPARATUS FOR DRYING HAIR

Filed Feb. 18, 1948 2 Sheets-Sheet 2

FIG. 2.

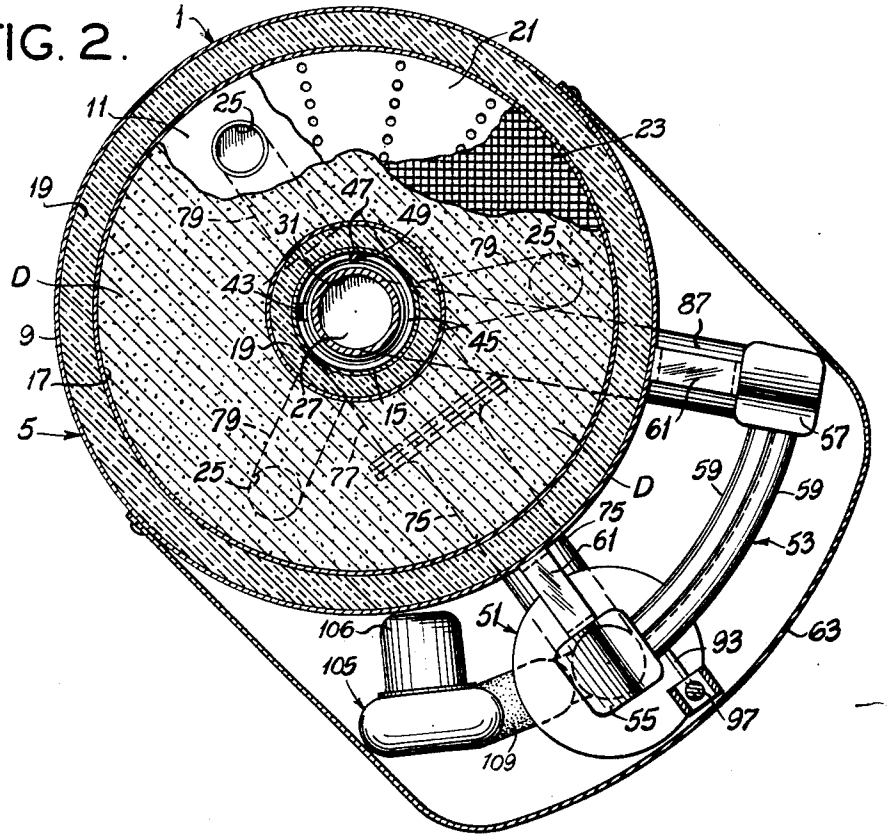
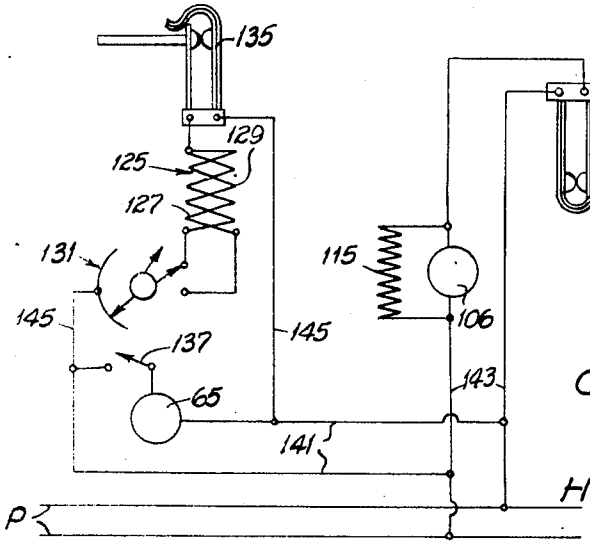


FIG. 5.



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UNITED STATES PATENT OFFICE

2,479,388

APPARATUS FOR DRYING HAIR

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Application February 18, 1948, Serial No. 9,155

14 Claims. (Cl. 34—55)

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This invention relates to apparatus for drying hair, and more particularly to such apparatus for use in beauty shops and the like.

Among the several objects of the invention may be noted the provision of an improved hair drying apparatus, particularly for beauty shops, adapted to dry the hair in less time than heretofore possible with maximum consideration to the user's comfort; the provision of apparatus of the class described wherein air for drying purposes is dried by being passed through a desiccant adapted to be reactivated by heating, and including improved means for reactivating the desiccant; and the provision of apparatus such as described which is economical, safe and sanitary. Other objects will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

Fig. 1 is a side elevation, partly in section, of the hair drying apparatus of this invention;

Fig. 2 is an enlarged transverse horizontal section taken substantially on line 2—2 of Fig. 1;

Figs. 3 and 4 are enlarged detail sections; and,

Fig. 5 is a wiring diagram.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

This invention is an improvement upon the apparatus for drying hair disclosed in our copending application entitled Apparatus for drying hair, Serial No. 747,296, filed May 10, 1947. That application discloses an apparatus for drying hair wherein air is dehydrated by causing it to flow through a porous, solid desiccant, such as activated alumina or silica gel, and the dehydrated air is brought to a dry bulb temperature such that it has a comfortable effective temperature according to its rate of flow before flowing out upon the user's head for drying the hair. The desiccant is one that may be reactivated by heating, and the apparatus includes means for heating the desiccant to reactivate it. This invention embodies improvements for more closely controlling the temperature of the dehydrated air to enhance the user's comfort, and for facilitating the reactivation of the desiccant.

Referring to the drawings, an embodiment of

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the apparatus of this invention is shown generally to comprise a portable hair drier 1 having an air distributor 3 carried by a base 5. The apparatus is supported on casters 7 so that it may be wheeled from place to place. The base 5 comprises a vertical cylindric casing 9. The casters 7 are located within the lower end of the casing. The casing has a circular bottom plate 11 supported at 13 above its lower end. A tube 15 extends upward from bottom plate 11 centrally of the casing to the open upper end of the latter. Casing 9, tube 15 and bottom plate 11 define an annular desiccant chamber 17, open at its upper end. The interior vertical walls of this chamber are preferably heat-insulated as by means of linings of spun glass insulation 19.

Within the chamber 17 and spaced above bottom plate 11 is a flat annular perforated plate 21 forming a false bottom for the chamber. On this false bottom is a screen 23. Chamber 17 is filled with particles of a solid desiccant D, such as silica gel, from screen 23 up to its upper end. The screen 23 is of sufficiently fine mesh as to prevent passage of the particles of the desiccant. The bottom plate 11 is provided with a number of ports 25 communicating with chamber 17 and a central port 27 communicating with the interior of the central tube 15. Three ports 25, spaced around the plate at 120°, are herein illustrated. These ports open into the space 29 between bottom plate 11 and false bottom 21.

The air distributor 3 is fixed upon the upper end of a hollow standard 31 in fluid communication therewith. The standard extends downward into the tube 15. It slides through a central aperture in the top of a dome 33 for casing 9. The dome is removably mounted on the casing as by having its lower margin removably telescoped over the upper end of the casing as indicated at 35. The dome is formed with a plurality of air intake louvers 37 for passage of air into or out of the dome. The outside diameter of the standard 31 is substantially less than the inside diameter of the tube. The standard is guided for vertical sliding movement concentrically of the tube by means of a slide bearing 39 within the dome. The bearing has a plurality of angularly spaced arms 40 extending outward and downward and fixed at their lower ends to the casing 9. The standard is also rotary in the aperture in the dome, in bearing 39, and in the tube 15.

Suitably mounted within dome 33 at the upper end of the tube 15 is a spring counterbalance 41. The cable 43 of this counterbalance extends down-

ward in the tube in the space between the interior wall of the tube and the standard 31. Its lower end is connected to a sealing ring 45 carried by the lower end of the standard 31 (Fig. 3). The sealing ring has a slidable sealing fit in the tube 15. To avoid twisting of cable 43, the ring is prevented from rotating by means of an elongate vertical key 47 fixed upon the interior wall of tube 15 and engaging in a keyway 49 in the periphery of the ring. The hollow standard 31 is rotary in the sealing ring. Its lower end is open to the tube 15 for fluid communication therewith. The arrangement is such that the air distributor 3 may be adjusted vertically to any desired position by sliding standard 31 up or down within its range of movement. The weight of the air distributor and standard is counterbalanced in any adjusted position by the spring of counterbalance 41. The sealing ring seals off the space within tube 15 below the ring from the space within tube 15 around standard 31 above the ring in any vertical position of the standard.

Mounted exteriorly of the casing 9 is a motor-blower unit 51 for causing a flow of room air downward through the desiccant D in chamber 17 and thence through hollow standard 31 and air distributor 3 for distribution upon the user's head of hair. As the air flows through the desiccant it is dehydrated by adsorption of moisture therefrom by the desiccant. The air is also heated because of an exothermic action resulting from adsorption. This exothermic action may heat the air to a temperature too high for the user's comfort particularly if the humidity of the room air is high. To dissipate the exothermic heat, the dehydrated air is passed through a heat exchange radiator 53 before it is delivered to standard 31.

Radiator 53 comprises intake and outlet manifolds 55 and 57, respectively, and a plurality of cooling tubes 59 connecting the manifolds. Dehydrated air is delivered to the intake manifold 55, from which it flows through the cooling tubes 59 to the outlet manifold 57. As it flows through tubes 59 it is cooled by heat exchange through the tubes with the ambient atmosphere. The radiator 53 is mounted on the exterior of casing 9 adjacent the upper end of the latter as by means of brackets 61 (Fig. 2), with the radiator manifolds extending vertically. The tubes 59 are curved in horizontal planes around the casing 9 so that the radiator may be mounted close to the casing to reduce the overall space taken up by the apparatus. The motor-blower unit 51, the radiator 53 and other parts to be described are concealed by a cover 63.

The motor-blower unit 51 comprises an electric motor 65 driving a blower 67. The motor and blower are enclosed in a housing 69 having an air inlet 71 and an air outlet 73. The inlet 71 is in communication with desiccant chamber 17 through a valved elbow fitting 75, a manifold 77 and air ducts 79. Ducts 79 lead from ports 25 in bottom plate 11 to the manifold 77. The latter is disposed within casing 9 beneath bottom plate 11. The fitting 75 leads from manifold 77 to the blower inlet 71 and is coupled to the latter by means of a short length of flexible hose 83. The blower outlet 73 is coupled to the inlet of radiator intake manifold 55 by means of a short length of flexible hose 85. The motor blower unit 51 is supported in vertical position only by the flexible hose couplings 83 and 85 and any vibration thereof is thus isolated from the remainder of the apparatus. The radiator outlet manifold 57 is in communication with the lower end of the tube 15 through a duct 87 connected at one end in the central port 27 in bottom plate 11 and at its other end through a length of flexible hose 89 to the outlet of the outlet manifold.

A two-way valve 90 includes butterfly valve member 91 pivoted in the elbow fitting 75 for movement between an open position (Fig. 1) and a closed position (Fig. 4) blocking off the blower inlet 71. Any suitable means for operating this valve may be provided. As illustrated, the valve has an operating arm 93 extending from its pivot 95. A link 97 is pivoted to the free end of the arm and extends upward loosely through the top of cover 63. The upper end of the link has an operating knob 99 thereon. An overcentering spring 101 is connected to the arm 93 to bias the valve and its operating linkage to open or closed position upon overcentering. The arrangement is such that link 97 may be pulled upward by knob 99 from the Fig. 1 position to swing arm 93 upward to close the valve member 91, pushed downward from its raised position to open the valve member.

With butterfly valve 91 open, and motor-blower unit 51 in operation, air is drawn through louvers 37 into dome 33, thence downward through desiccant D in chamber 17. As it passes through the desiccant it is dehydrated and heated. From chamber 17 it flows through ducts 79 to manifold 77 and thence through elbow fitting 75 to the blower inlet 71. The blower delivers air through radiator 53, thence through duct 87 to tube 15, and through hollow standard 31 to air distributor 3.

The desiccant D may be one of several porous, solid types of desiccant in granular form which will adsorb and hold moisture without substantial change in form or properties including resistance to air flow; that is, it will not liquefy or obstruct the flow of air therethrough. Between the desiccant granules are ample voids for air flow. Also, the desiccant is one which may be reactivated or dried by heating it without impairing its dehydrating efficiency so that it may be used over and over again. A particularly suitable desiccant for use in the apparatus of this invention is silica gel. Other suitable desiccants having the desired properties, such as activated alumina (essentially a porous form of aluminum oxide, Al_2O_3), may be used.

For regenerating desiccant D when it has adsorbed its capacity of moisture, there is provided means for causing a flow of heated air through the desiccant in reverse direction to that of the flow for air dehydration purposes. Since blower 67 is preferably of the centrifugal type, it is not used to reverse the flow of air. Consequently, a second motor-blower unit 105 is employed for this purpose. Unit 105, which may be of smaller capacity than motor-blower unit 51 is disposed exteriorly of casing 9 under cover 63. The outlet 107 of unit 105 is coupled by means of a short length of flexible hose 109 to an air duct 111 leading into fitting 75 between the manifold 77 and the valve 90. The unit 105 is supported only by hose 109 so that vibrations are isolated from the remainder of the apparatus. The butterfly valve member 91 carries an auxiliary valve member 113 for movement therewith in position to block flow of air from fitting 75 into duct 111 when valve member 91 is open (Fig. 1). Valve member 113 opens to permit flow of air from duct 111 into fitting 75 when valve member 91 is closed (Fig. 4).

With two-way valve 90 set to close valve mem-

34-80 CROSS REFERENCE SEARCH ROOM

ber 91 and open valve member 113, and with motor-blower unit 105 in operation, air is delivered through duct 111 to fitting 75 and manifold 77. Flow of air upward to the inlet 71 of motor-blower unit 51 is blocked by valve member 91, now closed. In manifold 77 is an electrical resistance heating coil 115 for heating air for desiccant drying purposes. Heated air flows from manifold 77 through ducts 79 to chamber 17 and slowly rises through the desiccant D in the chamber to dry it, ultimately passing out through louvers 37 in dome 33. The motor-blower unit 105 and heater 115 are under control of a manual reset thermostatic switch 117, which may be of any suitable conventional type, mounted within dome 33 at the upper end of casing 9 in heat-exchange relation to the desiccant. This switch is manually closed to initiate operation of unit 105 and heater 115 to regenerate the desiccant. It cuts out unit 105 and heater 115 when the temperature of the desiccant has risen to a value at which drying is complete. In the case of silica gel, this is about 200° F. Switch 117 has a manual operating knob 119 extending out of the dome for resetting it, also for opening it before it trips out due to heating if desired.

The air distributor 3 includes a manifold 121 connected at its lower end to and in communication with the upper end of the hollow standard 31. The manifold curves upward and outward away from the standard and carries a drying hood or helmet 123 of any suitable type on its outer end. Within the manifold 121 adjacent the hood 123 is a two-stage electrical resistance heater 125 comprising a pair of heating coils 127 and 129 (Fig. 5). This heater is for the purpose of warming dehydrated air flowing through the manifold to the drying hood to a comfortable effective temperature prior to its emission from the hood upon the user's hair, if any warming is necessary. A manually operable selector switch 131 for controlling heater 125 is carried at the end of an electrical extension cord 133 so that the user may conveniently personally operate the switch to suit her convenience while seated with her head in the hood. Switch 131 may be set selectively to energize one of coils 127 or 129 for low heat, both coils for high heat, or to deenergize both coils completely. The heater 125 is under control of a manual reset thermostatic safety switch 135 for automatically deenergizing the heater if the air should inadvertently become too hot. The motor-blower unit 51 is under control of a main control switch 137 mounted on manifold 121.

Fig. 5 illustrates the electrical connections for the apparatus of this invention. The motor 65 of motor-blower unit 51 and the motor 106 of motor-blower unit 105 are connected in independent circuits 141 and 143 across power supply line P. Circuit 141 includes the main control switch 137 in series with motor 65. Circuit 143 includes the manual reset thermostatic switch 117 in series with the motor 106. Heater 115 is connected in parallel with motor 106 so that when switch 117 is closed both the heater and motor are energized. Heater 125, selector switch 131 and safety switch 135 are of the same types as fully disclosed in our aforesaid copending application. They are connected in series in a shunt circuit 145 around the main control switch 137 so that the heater 125 may be energized only when switch 137 is closed. Heater 125 and switches 131 and 135 are of the same types and are connected in circuit 145 in the same manner as disclosed in our aforesaid copending application.

In using the hair drier, the drying hood 123 is adjusted by raising or lowering the standard 31 to a convenient height to accommodate the user's head. The weight of the assembly comprising the hood, manifold 121 and standard 31 is counterbalanced in any adjusted position by spring counterbalance 41, and such adjustment may therefore be made with little manual effort. The main control switch 137 is closed to energize the blower motor 65. This also energizes air heater 125, assuming selector switch 131 to be in position for either high or low heat. Regenerating control switch 117 is open so that blower motor 106 and regenerating heater 115 are deenergized and not functioning. Butterfly valve 91 is open, auxiliary valve 113 is closed (Fig. 1).

Motor 65, being energized, drives blower 67 to draw room air through desiccant D in chamber 17 to the space 29 between false bottom 21 and bottom plate 11. The desiccant adsorbs almost all the moisture from the air as it flows therethrough so that the air drawn into space 29 has a very low relative humidity. The air drawn into this space is also heated above room temperature by the heat of adsorption. The higher the relative humidity of the room air, the higher is the temperature of the dehydrated air. The dry heated air is drawn from space 29 through ducts 79, manifold 77, fitting 75 and blower inlet 71, and is delivered through radiator 53 wherein it is cooled. The cooled dehydrated air flows from the radiator through duct 87, tube 15 and hollow standard 31 to air distributor manifold 121. Air flowing through manifold 121 is warmed by heater 125 to a dry bulb temperature such that it has comfortable effective temperature prior to its emission from the drying hood so that it is pleasantly warm upon the head. This warming of the air is most desirable, particularly in the initial stage of the hair-drying period, as the flow of dry air upon the wet hair has a substantial cooling effect. The temperature of the air may be manually controlled by means of selector switch 131 so that the person whose hair is being dried may regulate the effective air temperature to a value suitable for her comfort at any stage of the drying period.

When the supply of dessiccant has adsorbed its capacity of moisture, it may be reactivated by closing valve 91, opening valve 113, and closing the manual reset thermostatic switch 117. This energizes the blower motor 106 and also the heater 115. Main control switch 137 is now open so that motor 65 is deenergized. Motor 106 drives the blower of unit 105 to cause a flow of air through duct 111 and fitting 75 to manifold 77. Heater 115 heats air flowing through the manifold to a temperature suitable for drying the desiccant. The heated air flows from the manifold through ducts 79 to chamber 17 and rises therein to heat and dry the desiccant. The temperature of the desiccant increases until the thermostatic element of switch 117 is heated to its trip-out temperature and opens to deenergize the motor 106 and heater 115. This occurs when the entire mass of desiccant has been heated to its reactivation temperature.

From the above, it will be clear that dehydrated air at a comfortable effective temperature is discharged from the air distributor 3 upon the user's hair for rapidly and comfortably drying it, with all of the advantages disclosed in our aforesaid copending application. This invention provides

for a closer control of the effective temperature of the air by inclusion of the radiator 53 for dissipating the heat of adsorption. This is a most important feature, inasmuch as the temperature of the dehydrated air from the desiccant chamber may be too high for comfort, particularly when the room air is humid and the heat liberated by the adsorption of moisture is relatively high. With radiator 53, the dehydrated air is cooled to or below a comfortable effective temperature and, if cooled below such temperature, may be warmed by heater 125 under control of the user to a comfortable effective temperature.

Reactivation or regeneration of the desiccant is effected simply by pulling out the knob 39 and closing switch 117. The latter remains closed to energize blower motor 105 and heater 115 until the desiccant reaches the temperature at which it is completely dried, then automatically opens. No other attention is required. The arrangement for flow of heated air in reverse direction for desiccant-drying purposes is advantageous in that no moisture-laden air from the heated desiccant flows through the motor-blower unit 51, radiator 53, duct 87, tube 15, standard 31 or air distributor 3, and there can be no condensation in these parts.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim:

1. A hair drier comprising a desiccant chamber containing a desiccant adapted to be reactivated by heating, a motor-blower unit including a centrifugal blower, an air connection between the chamber and the inlet of the blower, an air distributor for distributing a flow of air upon a head of hair in communication with the outlet of the blower, an auxiliary blower having its outlet connected into said air connection, a valve in said air connection movable between a hair-drying position permitting flow to the motor-blower unit and blocking flow to the auxiliary blower and a reactivating position permitting flow from the auxiliary blower into the air connection and thence into the chamber and blocking flow to the motor-blower unit, and a heater in the air connection for heating air flowing into the chamber through the connection.

2. A hair drier comprising a desiccant chamber containing a desiccant adapted to be reactivated by heating, said chamber being open to the ambient atmosphere at its top, a motor-blower unit including a centrifugal blower, an air connection between the bottom of the chamber and the inlet of the blower, a radiator for cooling air flowing therethrough by heat exchange with the ambient atmosphere having its inlet connected to the outlet of the blower, an air distributor for distributing a flow of air upon a head of hair in communication with the outlet of the radiator, an auxiliary blower having its outlet connected into said air connection, a valve in said air connection movable between a hair-drying position permitting flow from the chamber to the centrifugal blower and blocking flow to the auxiliary blower and a reactivating position permitting flow from the auxiliary blower into the air connection and thence into the bottom of the chamber and blocking flow to the centrifugal blower, and a heater in the air connection for heating air flowing into the bottom of the chamber.

3. A hair drier as set forth in claim 2, further including a temperature-responsive device in heat-exchange relation to the desiccant at the top of the chamber controlling the auxiliary blower and heater automatically to discontinue operation thereof when the desiccant has been heated to the temperature required for reactivation.

4. A hair drier comprising a portable base including a desiccant chamber containing a desiccant, a vertical tube on the base open at both ends, a hollow standard in slidable sealing relation in the tube, a motor-blower unit mounted on the base outside the chamber and tube, an air connection between one end of the chamber and the inlet of the blower of said unit, the other end of the chamber being open to the ambient atmosphere, an air connection between the outlet of the blower and the lower end of the tube, and an air distributor mounted on the upper end of the standard in communication therewith.

5. A hair drier comprising a portable base including a desiccant chamber containing a desiccant, a vertical tube on the base open at both ends, a hollow standard in slidable sealing relation in the tube, a motor-blower unit mounted on the base outside the chamber and tube, an air connection between one end of the chamber and the inlet of the blower of said unit, the other end of the chamber being open to the ambient atmosphere, a radiator mounted on the base having its inlet connected to the outlet of the blower and its outlet connected to the lower end of the tube, and an air distributor mounted on the upper end of the standard in communication therewith.

6. A hair drier comprising a portable base including a desiccant chamber containing a desiccant adapted to be reactivated by heating, a vertical tube on the base open at both ends, a hollow standard in slidable sealing relation in the tube, a motor-blower unit mounted on the base outside the chamber and tube, an air connection between one end of the chamber and the inlet of the blower of said unit, the other end of the chamber being open to the ambient atmosphere, an auxiliary blower connected into said air connection, a valve in said air connection movable between a hair-drying position permitting flow from the chamber to the inlet of the centrifugal blower and blocking flow to the auxiliary blower and a reactivating position permitting flow from the auxiliary blower into the air connection and thence into the chamber and blocking flow to the centrifugal blower, a heater in the air connection, an air connection between the outlet of the motor-blower unit and the lower end of the tube, and an air distributor mounted on the upper end of the standard in communication therewith.

7. A hair drier as set forth in claim 6 wherein the last-named air connection includes a radiator for cooling air flowing therethrough by heat exchange with the ambient atmosphere.

8. A hair drier having a portable base comprising a vertical casing having a ported bottom and open at its top, a vertical tube within the casing extending from its bottom to its top, the space between the tube and the wall of the casing constituting a desiccant chamber, a hollow standard in slidable sealing relation in the tube, an air distributor mounted on and in communication with the upper end of the standard, a motor-

blower unit mounted on the outside of the casing, an air connection between the ported bottom of the casing and the air inlet of the blower of said unit, and a radiator mounted on the outside of the casing with its inlet connected to the outlet of the blower and its outlet connected to the lower end of the tube through the bottom of the casing.

9. A hair drier as set forth in claim 8 wherein the motor-blower unit is resiliently carried between said air connection and radiator inlet to isolate its vibrations from the other parts of the drier.

10. A hair drier as set forth in claim 8, wherein the standard is of smaller external diameter than the internal diameter of the tube and is rotary in a sealing ring mounted on the lower end of the standard, the sealing ring having a sliding sealing fit in the tube, and wherein the standard is suspended by a cable from a spring counterbalance carried at the upper end of the tube, the cable extending downward between the tube and standard and being connected at its lower end to the sealing ring.

11. A hair drier comprising a portable vertical casing having a ported bottom and open at its top, a vertical tube within the casing extending from its bottom to its top, the space between the tube and the wall of the casing constituting a desiccant chamber for containing a desiccant adapted to be reactivated by heating, a hollow standard in slidable sealing relation in the tube, an air distributor mounted on and in communication with the upper end of the standard, a motor-blower unit including a centrifugal blower mounted on the outside of the casing, an air connection between the ported bottom of the casing and the inlet of the blower, a radiator mounted on the outside of the casing with its inlet connected to the outlet of the blower and its outlet connected to the lower end of the tube through the bottom of the casing, an auxiliary motor-blower unit including an auxiliary blower having its outlet connected into said air connection, a valve in said air connection movable between a hair-drying position permitting flow of air from the chamber to the inlet of the centrifugal blower and blocking flow to the auxiliary blower and a reactivating position permitting flow from the auxiliary blower into the air connection and thence into the chamber and blocking flow to the centrifugal blower, and a heater in said air connection.

12. A hair drier as set forth in claim 11 wherein the auxiliary motor-blower unit is resiliently carried by said air connection to isolate its vibrations from the other parts of the apparatus.

13. A hair drier as set forth in claim 11 further including a louvered dome on the upper end of the casing, the standard being slidable through the dome, and a temperature-responsive device within the dome controlling the auxiliary motor-blower unit and heater automatically to discontinue operation thereof when the desiccant in the chamber has been heated to the temperature required for reactivation.

14. A hair drier comprising a desiccant chamber containing a desiccant adapted to be reactivated by heating, a radiator for cooling air flowing therethrough by heat exchange with the ambient atmosphere, an air distributor for distributing a flow of air upon a head of hair, and a blower, all connected in fluid series communication in such manner that the blower causes a flow of air serially through the desiccant chamber, radiator and air distributor, a heater for warming the air from the radiator prior to its emission from the air distributor, an auxiliary blower for causing a flow of desiccant-reactivating air into the desiccant chamber, a heater for heating the latter flow of air, and valve means for blocking the flow of desiccant-reactivating air to the radiator, air distributor and first-mentioned blower when the auxiliary blower is operated.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,038,709	Abernethy	Sept. 17, 1912
1,667,316	Hartman et al.	Apr. 24, 1928
1,986,814	Hartman	Jan. 8, 1935
2,066,847	McShea	Jan. 5, 1937
2,190,168	Armistead	Feb. 13, 1940
2,278,854	Hunsicker	Apr. 7, 1942
2,290,259	Vose	July 21, 1942
2,445,516	Dickey	July 20, 1948