April 25, 1950 R. C. BELGAU ET AL 2,505,378

AIR CONDITIONER FOR HAIR DRIERS AND THE LIKE

Filed June 20, 1946 7 Sheets-Sheet 1

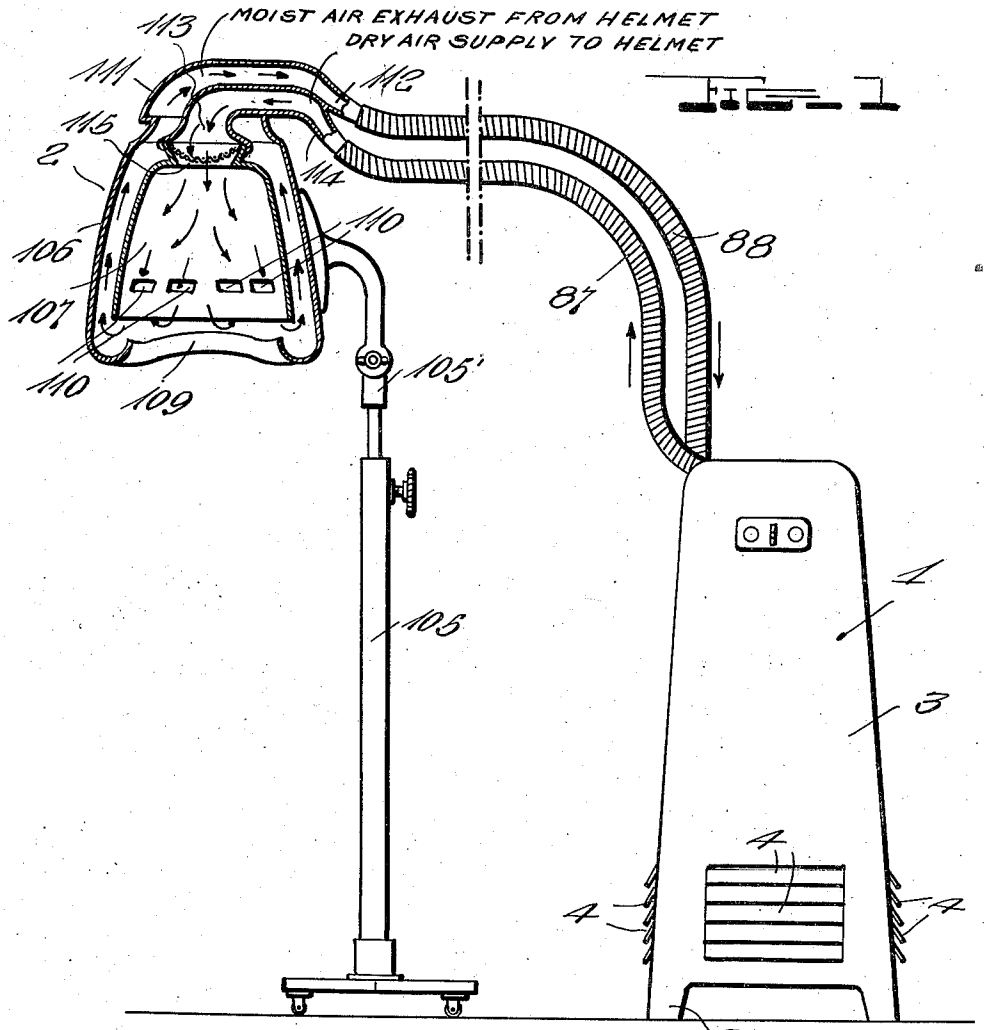

FIG. 1

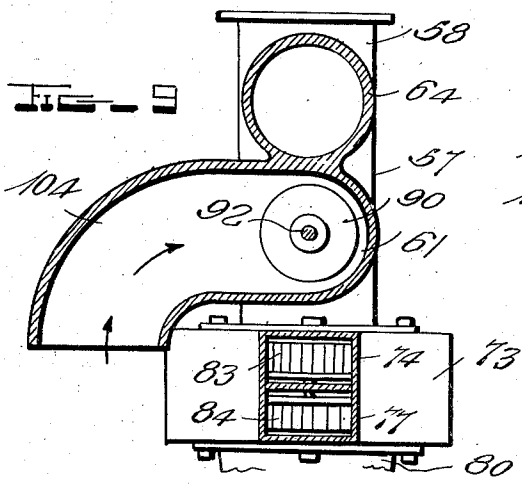

FIG. 9

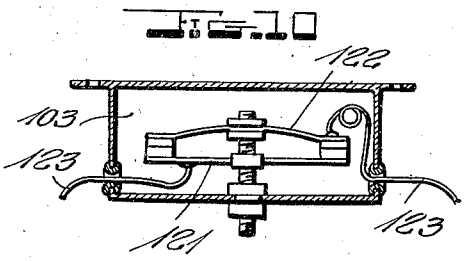

FIG. 10

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AIR CONDITIONER FOR HAIR DRIERS AND THE LIKE

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FIG. 2

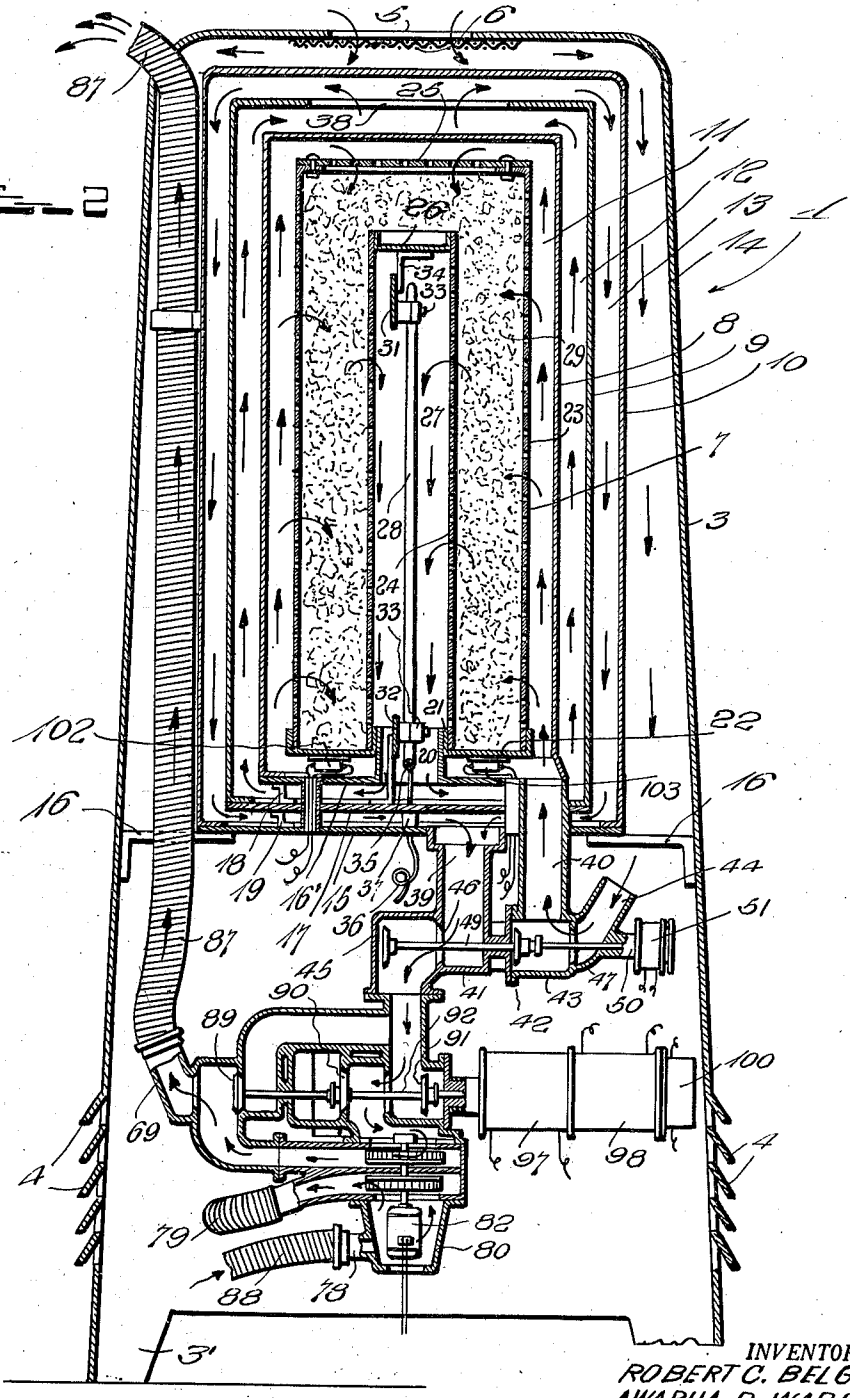

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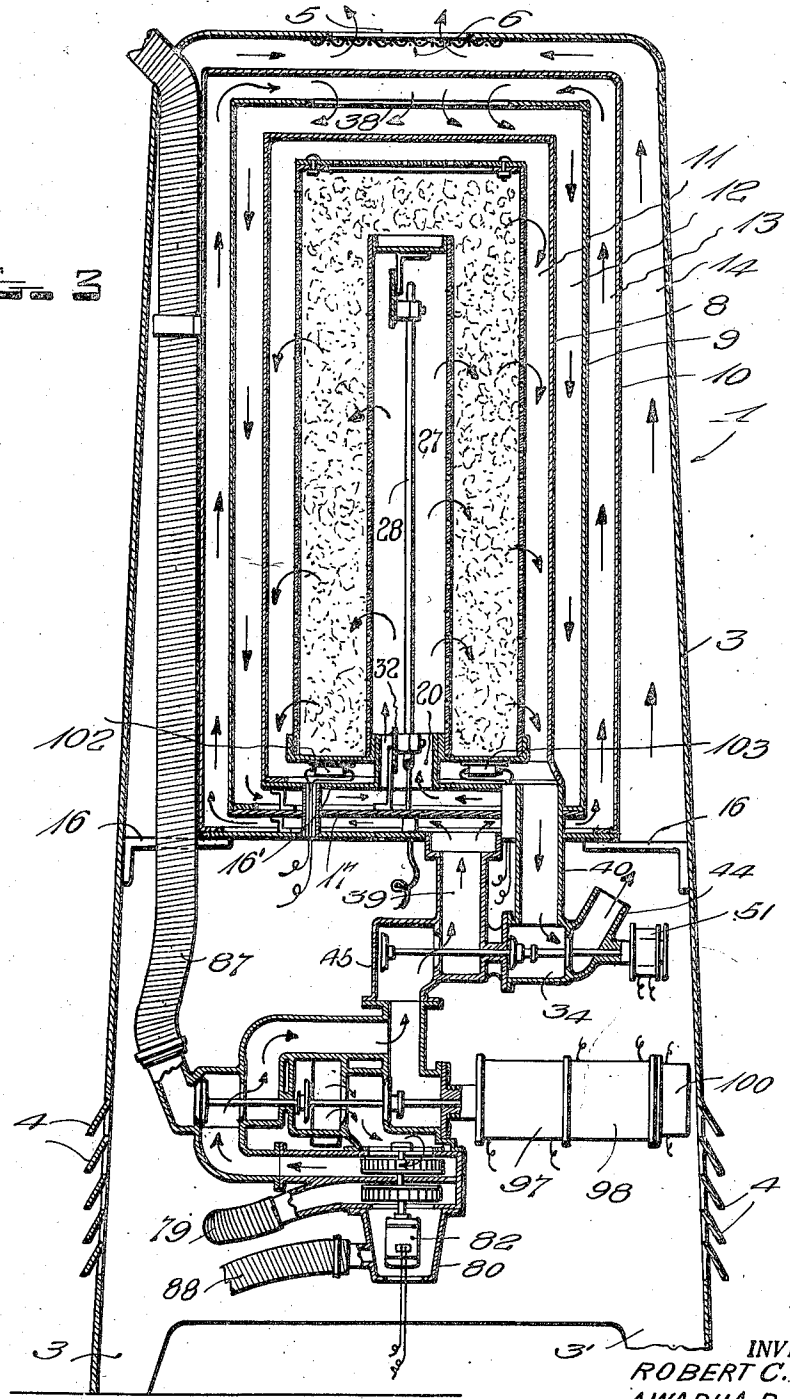
Fig. 3



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AIR CONDITIONER FOR HAIR DRIERS AND THE LIKE

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FIG. 4

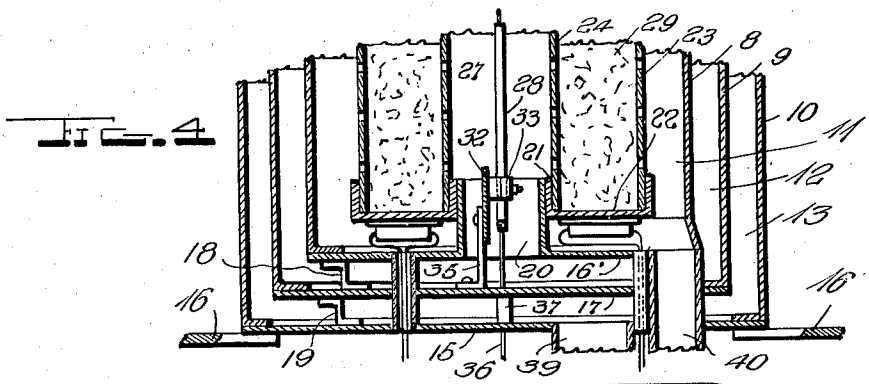
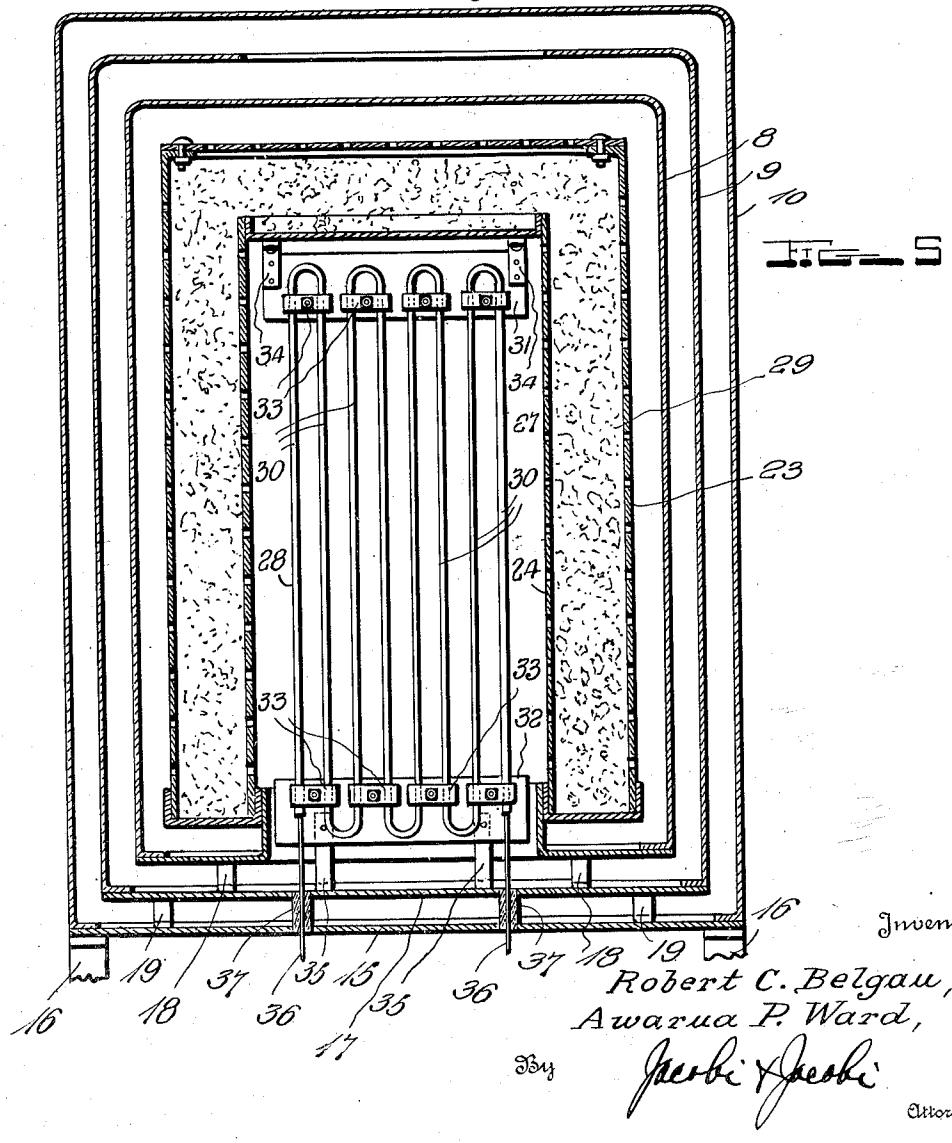


FIG. 5



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AIR CONDITIONER FOR HAIR DRIERS AND THE LIKE

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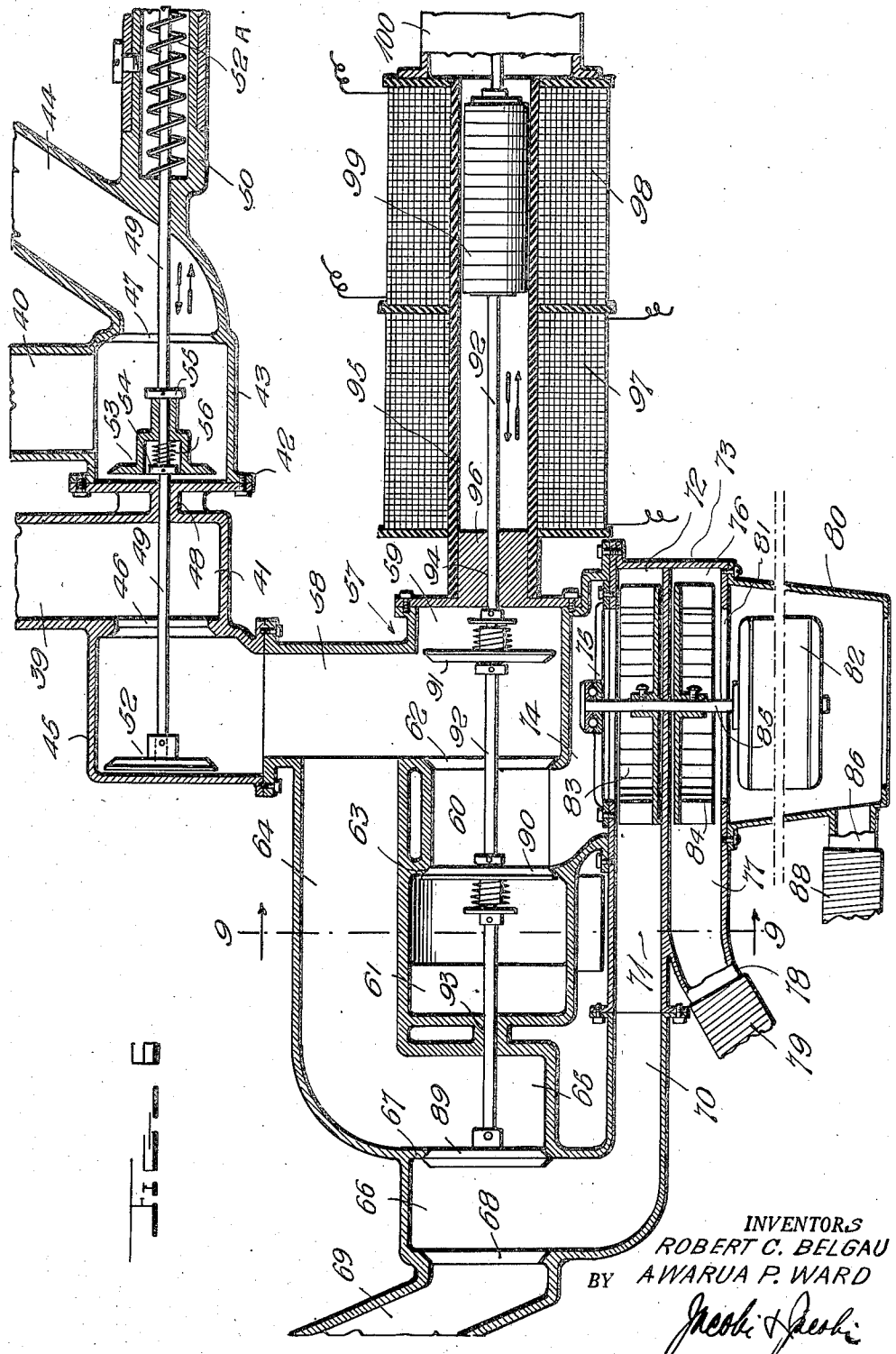

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AIR CONDITIONER FOR HAIR DRIERS AND THE LIKE

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FIG. 7

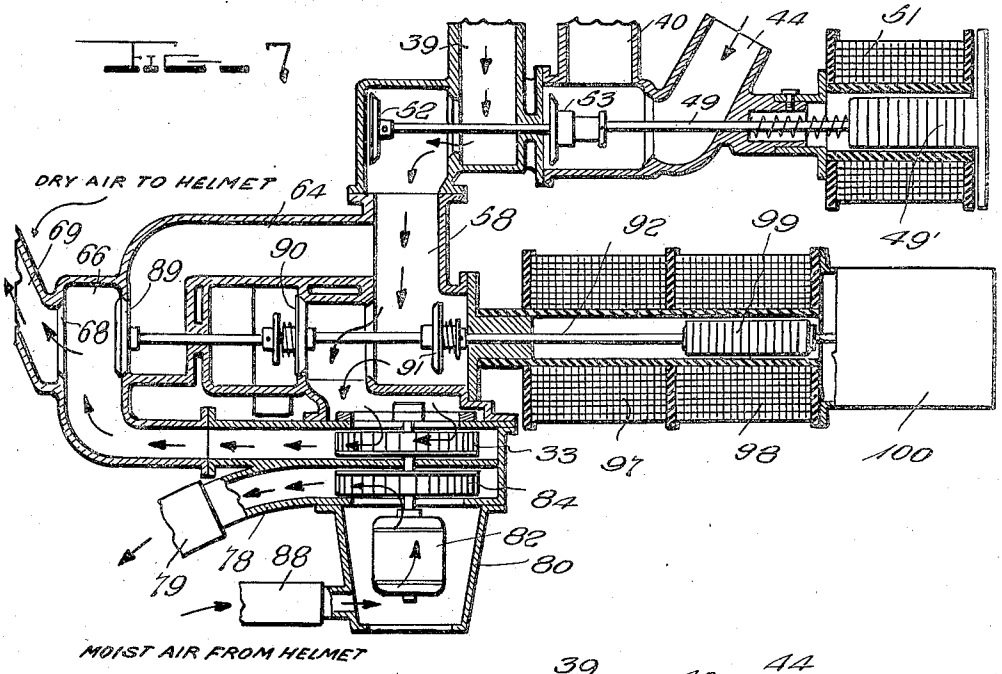
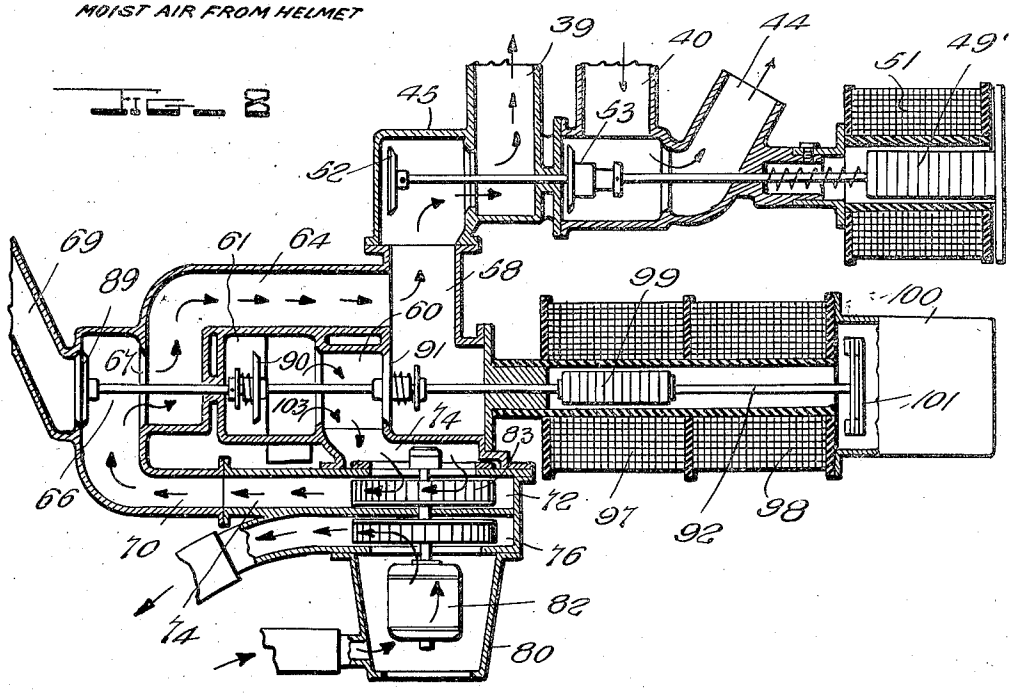


FIG. 8



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AIR CONDITIONER FOR HAIR DRIERS AND THE LIKE

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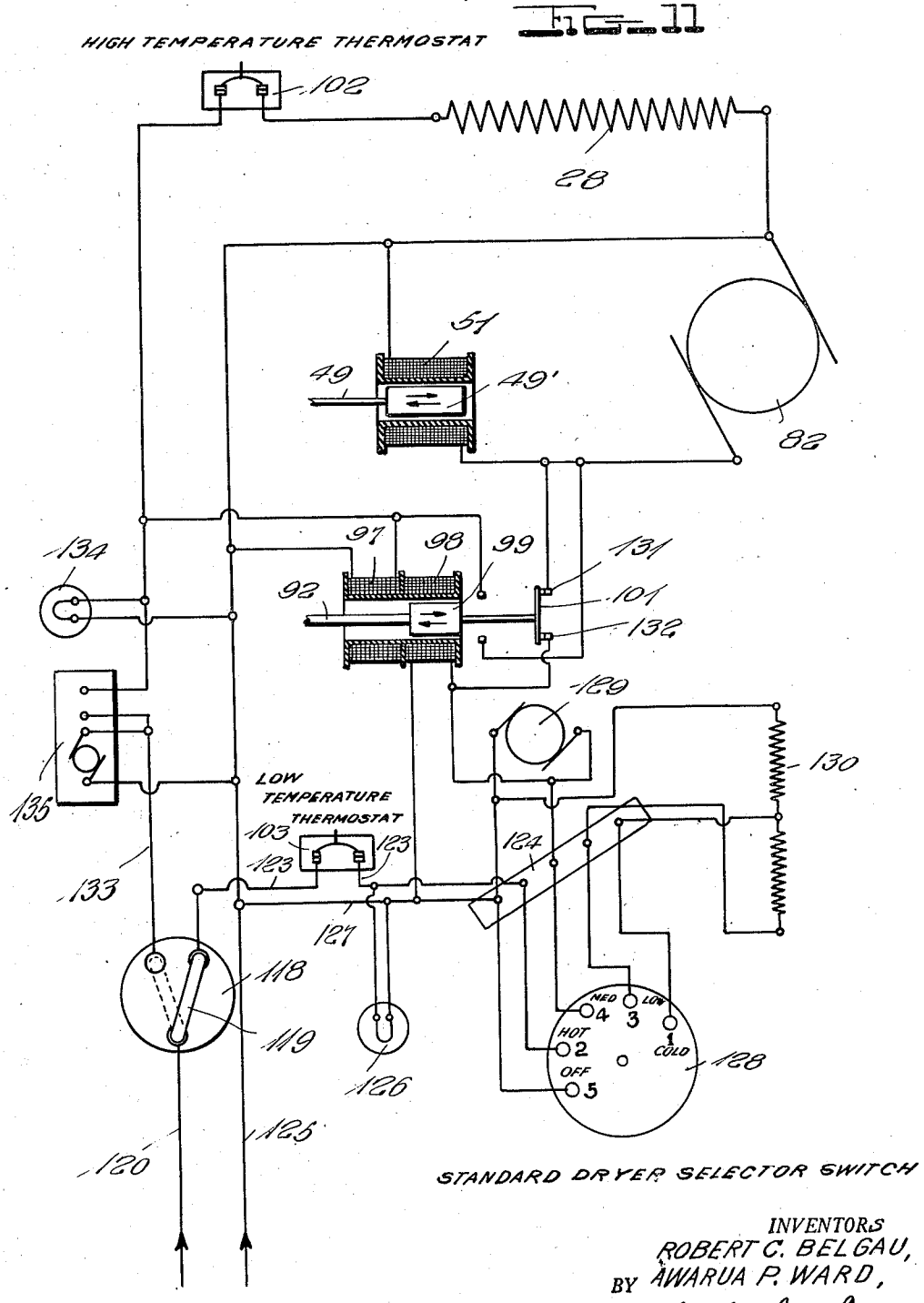
FIG. 11



STANDARD DRYER SELECTOR SWITCH

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Patented Apr. 25, 1950 2,505,378

UNITED STATES PATENT OFFICE

2,505,378

AIR CONDITIONER FOR HAIR DRIERS AND THE LIKE

Robert C. Belgau and Awarua P. Ward, Detroit, Mich., assignors to Heat Generating Systems, Inc., Detroit, Mich., a corporation of Michigan

Substituted for abandoned application Serial No. 375,064, January 18, 1941. This application June 20, 1946, Serial No. 677,928

6 Claims. (Cl. 183—4.3)

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This invention relates to an air conditioner, and more particularly to an air conditioner adapted to be connected with a hair drier helmet and by means of which air passed through the helmet is dehydrated and heated so that air passing through the helmet will be capable of quickly absorbing a large quantity of moisture as it passes over and through hair to be dried.

This is accomplished by means of a dehydrating device used to control the initial moisture content of the drying air and of thereafter heating the dehydrated air to a suitable degree of temperature and of properly exposing this heated dry air to the moist hair, for a suitable period of time, sufficient to properly increase the rate of evaporation of the moisture and simultaneously increase the moisture absorption rate and carrying capacity of the air, and of providing the proper rate of dry air supply.

The proper application of dry air for drying hair, as described in this application, has two very outstanding features that are not possible of accomplishment without the use of dry air. While there are other desirable features, these two features are the most requisite and are: (1) The ability to dry hair in a very minimum period of time, and (2) within a temperature range that is conducive to maximum comfort for the patron.

In the method we are herein disclosing, we are using relatively dry air so that, when this air is heated to a high degree and comes in contact with the moisture on the wet hair, a number of heat units (from the highly heated air) are transmitted to the moisture in order to transform the moisture from the liquid to the vapor phase so that it will be removed by the air.

In this method, the dry air can be heated to a very high degree (relatively speaking) because the latent heat of evaporation of the moisture will prevent the temperature of the remaining moisture (of liquid phase), on the patron's head, from becoming uncomfortable to the patron. The air, upon becoming moist, will carry off the heat units that have been "used" to transform the moisture to the vapor phase. Therefore, we are using, to the maximum degree of efficiency, the natural tendency for air to absorb water vapor in proportion to its lack of moisture content; the excessive heat units that have been added to the "starved" air, in order to increase the rate of evaporation of the moisture and at the same time employing the heat of evaporation to keep the remaining moisture at a cool or comfortable temperature. To effect complete drying in a minimum time, the volume of air (and the velocity thereof) must, of course, be maintained in proper relationship in order to obtain the "peak" of efficiency.

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The present application is a substitute for our allowed forfeited and abandoned application filed January 18, 1941, Serial No. 375,064.

The primary objective of this invention is to provide a simple, fool-proof means whereby a device of relatively low production cost can be used to control the moisture content of the air regardless of atmospheric conditions and to supply air that has been dehumidified by the device, to a suitable drying helmet, for the purpose of employing the advantages and obtaining the results described.

Another object of the invention is to provide a means for removing a relatively large part of the moisture content from air and other gases, thereby reducing the relative humidity of the air and of increasing its moisture absorbing capacity so that when used, as fully described, in conjunction with a suitable hair drying helmet, the dry air will carry off a greater volume of water vapor than it would if the degree of humidity was near the point of saturation.

Another object of the invention is to provide a means whereby, after the moisture adsorbing means has absorbed its full quota of moisture, the accumulated moisture can be readily dissipated so that moisture can again be adsorbed to the full extent of the capacity of the moisture adsorbing means.

A still further object of the invention is to provide a moisture adsorbing means of extreme portability, of relatively small floor space requirement and so designed that when heat is being used to dissipate the accumulated moisture, the heat is confined within the cabinet so that the exterior of the cabinet does not become heated, and relatively small percentage of heat is dissipated into the room in which the cabinet is located.

A still further object of the invention is to provide in an air dehumidifying device, employing chemical drying agents or desiccants, a means whereby with the use of solenoid valves, the flow of air during the air-drying cycle is in opposite direction to that of the air being circulated through the desiccant when the moisture is later being dissipated therefrom so that the desiccant will again adsorb its full quota of moisture.

Another object of the invention is to provide an air conditioner wherein a mass of moisture adsorbing material is mounted within a housing or casing about a heating unit so that the air by means of which hair is dried may have moisture

extracted therefrom by passing through the adsorbing material and then heated to provide a supply of warm dry air which passes through a hood to absorb air from hair over which the hood is placed.

Another object of the invention is to provide means for controlling directional flow of air through the housing or casing, thus permitting the air to be caused to reverse its normal flow through the moisture adsorbing material to the heater and instead flow from the heater through the adsorbing material where the hot air serves to absorb and drive off moisture from the moisture adsorbing material. The adsorbing material may thus be restored to condition for use as means for absorbing moisture, and since this is done during hours when a beauty shop is closed use of the drier during working hours will not be interfered with.

Another object of the invention is to provide within the housing or casing means for defining a tortuous path through which the air must pass as it moves through the housing toward the moisture adsorbing material surrounding the heater. It will thus be seen that the air will be heated as it approaches the cartridge in which the moisture adsorbing material is packed and the air caused to retain all of the moisture taken up thereby until the air reaches the moisture adsorbing where the moisture is extracted from the air and the dry air then heated and delivered to the air enclosing helmet to take up moisture from the hair as it passes through the helmet and returns to the conditioning apparatus.

Another object of the invention is to provide an apparatus of this character of such construction that air capable of quickly absorbing a large quantity of moisture will be delivered to and passed through the helmet and then returned to the air conditioning device where moisture is extracted from the air and the air restored to proper condition for taking up moisture before it is again delivered to the helmet.

Another object of the invention is to provide an air conditioning apparatus which is compact and will occupy a minimum amount of space in a beauty parlor.

Still another object of the invention resides in providing a device which is simple and durable in construction, inexpensive to manufacture and one which will be very efficient in operation and application to use.

With these and numerous other objects in view, our invention consists in the novel features of construction, combination and arrangement of parts as will be hereinafter referred to and more particularly pointed out in the specification and claims.

The invention is illustrated in the accompanying drawings wherein:

Figure 1 is a view showing an air conditioner of the improved construction in elevation and a helmet in vertical section;

Figure 2 is a sectional view upon an enlarged scale taken vertically through the air conditioner, the arrows indicating the normal movement of air through the same;

Figure 3 is a view similar to Figure 2 wherein the arrows indicate the movement of air during driving off of moisture from the moisture adsorbing material;

Figure 4 is a fragmentary sectional view taken through the lower portion of the housing or casing through which the air passes;

Figure 5 is a vertical sectional view taken at right angles to Figure 4;

Figure 6 is an enlarged sectional view of the means for controlling directional flow of air;

Figure 7 is a view similar to Figure 6, but upon a reduced scale, indicating by arrows the normal flow of air, this flow being the same as shown in Figure 2;

Figure 8 is a view similar to Figure 7 showing the flow of air reversed, the flow of air in this figure being the same as shown in Figure 3;

Figure 9 is a fragmentary sectional view taken along the line 9—9 of Figure 6;

Figure 10 is a sectional view upon an enlarged scale taken vertically through a thermostat embodied in the invention; and

Figure 11 is a wiring diagram.

The improved air conditioning apparatus which is indicated in general by the numeral 1 has been shown associated with a hair drying helmet 2 of the type used in beauty parlors for drying hair, but it is to be understood that the air conditioner is not limited to this specific use. The cabinet 3 of the air conditioner is formed of sheet metal or other suitable material and at its lower end is formed with short legs or feet 3' at its corners for supporting it upright and spacing the lower end of the cabinet from the floor upon which the legs rest, so that air may enter through spaces between the legs as well as through inlets formed by stamping walls of the cabinet to provide louvres 4. The top or upper wall of the casing is formed with a centrally located opening 5 constituting an air passage and guarded by a sheet of screening 6 which is secured against the under face of the upper wall about margins of the opening. By so forming the casing or housing the air conditioner will be of relatively small dimension and may be easily moved from one location to another when so desired.

Within the casing 2 is located a chemical container indicated in general by the numeral 7 and enclosed in a plurality of shells 8, 9 and 10 which are spaced from each other and from walls of the casing to provide air passages 11, 12, 13 and 14 within the shells and between the outer shell and walls of the casing. The outer shell 10, which is provided with a bottom 15, is supported in the casing in spaced relation thereto by a suitable number of brackets 16 carried by walls of the casing. The shells 8 and 9 are also provided with bottoms 16' and 17 and supported by a suitable number of brackets 18 and 19 which maintain them in vertical spaced relation to each other and to the bottom 15 of the outer shell 10. It will also be noted that the bottom 16' of shell 8 carries an upstanding centrally located throat or neck 20 fitting within the neck 21 of the bottom 22 of the chemical container 7. The outer wall 23 of the chemical container is formed of perforated metal and its inner wall 24 is also formed of perforated metal. A perforated top wall 25 is welded to inwardly extending flanges at the upper ends of the outer perforated wall 23 and the inner wall 24 also carries a wall 26 which is of solid formation and constitutes a top wall for a central chamber 27 in which a heating unit 28 is mounted. It will thus be seen that the heating unit will be surrounded by the mass of chemical within the container 7 and that air circulating through the conditioner must pass through the chemical either as it moves toward the heating unit as shown in Figure 2, or as it moves away from the heating unit as shown in

Figure 3. The chemical container is of oblong outline in horizontal cross-section, as shown in Figures 4 and 5, thus providing a mass of chemical of substantially large area and of sufficient thickness to cause moisture to be removed in a very effective manner from air passing through the chemical.

The chemical with which the container is loaded is anhydrous calcium sulfate or an equivalent chemical capable of absorbing moisture from air passing through the chemical. This chemical has a very great affinity for moisture (from 10% to 20% of its weight), and must be heated to a temperature in excess of 212 degrees F. (the boiling point of water) in order that moisture may be driven from the chemical and the chemical reconditioned for use as an adsorbent. By passing heated air through the chemical in a reverse direction during a regenerative cycle, any moisture which may not have been carried off will be located adjacent the outer surface of the chemical which is first engaged by incoming air during a dehydrating cycle, thus assuring proper dehumidification of the air during use of the air conditioner.

Under normal operating conditions, for each three to six grains of moisture that are removed from the air, the average heat value of one B. t. u. is deposited in the chemical, so that the temperature of the chemical bed increases in direct proportion to the volume of moisture (and the heat value thereof) that the chemical adsorbs. The efficiency of the chemical decreases as this bed temperature increases and the most efficient temperature range is considerably below the average room temperature, and in order to maintain as low a bed temperature as possible, it is desirable to spread the chemical over as large an area as possible and thus make the bed depth as shallow as possible. In this manner the bed temperature can be kept at the operating minimum, as considerable cooling by radiation takes place. It is for this reason that the chemical container has been formed oblong in transverse cross-section and the chemical of the proportionate thickness shown in Figures 4 and 5.

The heating unit which is mounted in the chamber 27 consists of a resistance wire 29 bent to form vertically extending convolutions 30 which have their upper and lower portions secured to mounting strips 31 and 32 by clamp 33. The strips of insulating material 31 and 32 are supported by brackets 34 and 35 carried by the top wall 26 and the bottom wall 17 and conductors 36 for the heater extend from ends of the resistance coil through insulating sleeves 37 mounted between the bottom 17 and 15 of the two shells 9 and 10. By this arrangement the heating unit will be mounted vertically centrally of the chamber 27 and as air passes through the heating chamber it will be heated by contact with the heating unit. The shells 8, 9 and 10 will constitute auxiliary heating elements and upon referring to Figure 2 it will be noted that the chamber 27 communicates with the space 12 through the neck 20 and that an opening 38 is formed through the top of the shell 9 in order to establish communication between the spaces 12 and 13. At its lower end the space 13 communicates with a neck 39 and the lower end of the space 11 communicates with a neck 40 serving as an inlet neck when the air conditioner is in operation. The neck 39 leads from the section 41 of a valve housing 42 and the neck or conduit 40 leads from the section 43 of the valve housing. This section 43 of the valve housing has a throat 44 extending upwardly at an incline so that air which enters through opening 5 and passes downwardly through space 14 may readily enter the throat and pass upwardly through the neck or conduit 40 into the space 11. The valve housing is mounted in the casing 3 under the bottom of shell 10 and in addition to the sections 41 and 43 is also formed with a section 45 defining a chamber which communicates with the section 44 through an opening 46 which has its walls beveled to form a valve seat. A similar opening 47 having beveled walls to form a valve seat is provided between the throat 44 and the section 43 of the valve casing and between the sections 41 and 43 is provided a bearing 48 through which passes a valve stem or rod 49. This rod or stem 49 projects outwardly through a hollow arm 50 projecting from the lower portion of throat 44 and constitutes the core of a solenoid 51 carried by the arm 50. Valves 52 and 53 are carried by the rod or valve stem 49 and a spring 52A urges the rod in a direction to move the valves 52 and 53 into normally closed position, seated against the valve seats 44 and 47. When the solenoid is energized the rod will be shifted to the position shown in Figure 6 and the valves will be held open. Each of the valves is slidable longitudinally upon the rod and each of the valves moves with the rod, but the valve 53 is slidable thereon between collars 54 and 55 and is yieldably held in engagement with collar 55 by a spring 56. By this arrangement the rod may have movement relative to valve 53 after the valve 53 is seated against the valve seat 47 and valve 52 may then close tightly against the valve seat 46. This insures tight closing of both of the valves when so desired. A spring 56 returns the valve 53 into engagement with collar 55 when the solenoid 51 is deenergized, and the spring 52A returns the valve stem or rod 49 to the closed position, not shown.

A casting 57 constituting a valve housing or casing is mounted below the valve casing 42 where it is secured with its throat 58 in registering relation to the open lower end of the section or chamber 45 of the valve casing 42. From the chamber 59 of the valve casing 57 extends a passage 60 leading to a chamber 61 having valve seats 62 and 63 at its end so that communication between the passage 60 and the chambers 59 and 61 may be controlled. There has also been provided a passage 64 leading from the throat 58 above the chamber 59 and extending longitudinally of passage 60 over the chamber 61 with its outer end portion extending downwardly to a chamber 65. The chamber 65 communicates with a chamber 66 through an opening 67 having its walls beveled to form a valve seat and opposite the opening 67 is another opening 68 establishing communication between chamber 66 and a throat 69. The walls of the opening 68 are also beveled to form a valve seat. A passage 70 leads from the bottom of chamber 66 and the neck through which this passage 70 is formed is secured to a companion neck 71 leading from the upper chamber 72 of a fan casing 73. This fan casing 73 is secured against the bottom of the casting 57 in communication with a passage 74 leading from the passage or chamber 60, and across the opening between the fan casing chamber and the passage 74 is mounted a bearing 75. The fan casing is also formed with a lower chamber 76 from which extends a passage 77 terminating in a neck 78 with which a hose 79 is connected and upon referring to Figure 2 it will be

seen that the hose extends outwardly through a side wall of the casing 3. A motor casing 80 is mounted under the fan casing about an opening 81 which establishes communication between the motor casing and the lower chamber 76 of the fan casing and this casing 80 encloses an electric motor 82 having a shaft which extends vertically through the two fan chambers and is rotatably mounted through the bearing 75. Fans 83 and 84 are fixed to the motor shaft 85 within the upper and lower fan chambers. These fans or blowers 83 and 84 may be referred to as right and left-hand blowers and when mounted back to back within their respective chambers of the fan housing, the suction or inlet sides of the blowers or fans are positioned toward opposite ends of the motor shaft; the inlet for the upper fan 83 being directed toward the passage 74 and the lower fan or blower having its inlet side facing the motor casing. Therefore, when the motor is in operation air will be drawn through the inlet neck 86 of the motor casing and forced outwardly through the passage 77 and neck 78 and at the same time air will be drawn through the passage 74 into the upper fan chamber and forced out through the passage or neck 71. Flexible hose pipes 87 and 88 lead from the neck 69 and 78 to the helmet and when the apparatus is in use for drying hair, air is forced through pipe or hose 87 into the helmet and after taking up moisture from hair passes through pipe or hose 88 into the motor casing from which it is drawn by the lower fan or blower 84 and forced through the pipe or hose 79 which extends through the wall of the casing 3. It will thus be seen that a circulation of air is established through the helmet.

Directional flow of air through the casting must be controlled. In order to do so, there have been provided valves 89, 90 and 91. These valves are mounted upon a valve stem or rod 92 which extends through the chambers 59, 60, 61 and 65 and in a certain position of adjustment also extends into the chamber 66. The rod is slidably mounted through bearings 93 and 94 into an elongated solenoid spool 95 carried by the block 96 which is secured against the casting 57 in closing relation to one end of the chamber 59 and through which the bearing 94 is formed. These spools 95 carry two solenoids 97 and 98 and within the spool the rod or valve stem 92 carries a core 99 adapted to be moved and adjust the rod 92 longitudinally when either of the solenoids are energized. The rod also extends into a shield 100 at the outer end of solenoid 98 and carries a cross-bar 101 constituting a bridge for closing circuits through wiring to be hereinafter described when the solenoids are energized to shift the core 99 and the rod longitudinally. When the rod is in the position shown in Figures 6 and 7, it being moved to this position by energizing of solenoid 98, the valve 91 is in an open position, the valve 90 is seated against the valve seat 63 in a closed position and the valve 89 which is a double valve is seated against the valve seat 67 to shut off communication between chambers 65 and 66. It will be noted that valves 90 and 91 are of the same construction as valve 53 so that they may yield when moved into engagement with the seat 62 and 63, whereas the valve 89 is rigidly fixed to the end of the rod. With the valve in the position shown in Figures 6 and 7, and also in Figure 2, air entering the casing 3 through the opening 5 flows downwardly along and about the shell 10 into the lower portion of the casing 3 and passes inwardly through the throat 44 of the valve casing 42 to enter the chamber 43 and flow upwardly through the throat or conduit 40 into the space 11 within the shell 8 about the chemical container 7. This incoming air may be referred to as atmospheric air as it is taken from the beauty parlor or other room in which the air conditioner is located. The incoming air passes through the chemical which is packed into the chemical container and moisture will be extracted from the air by the chemical. The dehydrated air flows through the perforated wall of the chemical container into the chamber 27 down which it flows and through the neck 20 into the space between the bottom of the shells 8 and 9, and then flows upwardly through space 12 within the shell 9 and out through the opening 38 at the top of this shell into space 13 between the shells 9 and 10. The air then flows downwardly through the space 13 within the shell 10 to the bottom of this shell and through the neck or conduit 39 into chamber 41 from which it flows into chamber 45 and through neck or conduit 58 into the chamber 59. In view of the fact that the valve 91 is open and valve 90 closed, the air which has been heated by contact with the heater 28 will now flow through the chamber 60 and through passage 74 into the upper fan housing chamber from which it is expelled by the upper fan 83 and driven through the necks 70 and 71 into chamber 66 and out through the hose 87 to the helmet through which it moves and back through hose 88 to the motor casing. The fan 84 sucks the air out of the motor casing and drives it through the neck 78 and the hose 79 which returns the air to the atmosphere. It will thus be seen that a constant supply of air which has been dried by passage through the chemical and heated to the proper temperature by the heating element and the hot walls of the shells will be fed to the helmet and after passing through the helmet to absorb moisture from the hair drawn through the hose 88 to the motor casing and discharged through the hose 79 back to the atmosphere. The temperature of the air must be kept within certain limits and in order to do so there has been provided a high temperature thermostat 102 and a low temperature thermostat 103 which are incorporated in the heating circuit and operate automatically to shut off flow of current to the heating unit when the temperature rises to a predetermined degree and then automatically close the circuit through the heating unit when the temperature has been reduced to a predetermined degree. This will be more fully explained.

The supply of chemical in the container is sufficient to adsorb moisture during a normal day's use of the drier. Therefore, the drier will always be available for use and in proper working order. When the proprietor of a beauty parlor is ready to close the shop, the flow of current through solenoid 98 is shut off and current caused to flow through solenoid 97. The core 99 will then be shifted to the position shown in Figure 8 and the valve 91 will be closed and valve 90 opened. At the same time, valve 89 will be moved away from the valve seat about opening 67 and moved into engagement with the valve seat surrounding opening 68 to shut off communication between the chamber 66 and the neck 69. Air will then be drawn into the chamber 61 through the inlet neck 104 leading from one side thereof and this incoming air will travel through chamber 60 and passage 74 into the upper fan chamber from which it is expelled by the lower fan 83 and forced through the passages 74 and 70 into cham-

ber 66. From this chamber 66 the air flows through the passage 64 into the neck or conduit 58 and up through this conduit into chamber 45 from which it flows through the neck or conduit 39 into the space between the bottoms of the shells 9 and 10. The air then passes upwardly through the space 13 between these shells and through opening 38 into the space 12 between shells 8 and 9 and downwardly into the space between the bottom of the shells. At this point the air which has received a preliminary heating passes upwardly through the neck 29 into the heating chamber 27 where it is highly heated by contact with the heating unit 28. The hot air passes from chamber 27 through the mass of chemical to evaporate and drive off moisture which has been taken up by the chemical during the day and the moisture laden air passes downwardly through the space 11 between the chemical container and the shell 8 and through the neck or conduit 40 into the valve chamber 34 from which it passes outwardly through throat 44 and upwardly through the casing 3 until it reaches the top of the casing and passes out through the opening 5. It will thus be seen that the moisture laden air will be discharged into the room and the moisture eventually entirely removed from the chemical. By placing a time controlled switch in the circuit for the heater and the solenoid 51 the heating unit may be shut off after the retrograde flow of air has been continued a sufficient length of time to completely dry the chemical and restore it to condition for use and at the same time the solenoid 51 is de-energized so as to permit spring 52A to urge the rod 49 to move the valves 52 and 53 to a closed position against the seat 46 and 47 to prevent atmosphere air reaching the chemical during the interval of time between shutting off of the heater and use of the drier the next day.

Provision of the spaces 11, 12 and 13 by the shells 8, 9 and 10 is very important as reactivation of the chemical desiccant can only be accomplished by exposing the desiccant to temperatures in excess of 212° F., the boiling point of water, and at which temperature moisture is disassociated from the desiccant. The desiccant should be removed from the dehumidifying cabinet and reactivated in an oven, but this is not practical due to its weight and volume. Therefore, it is desirable to reactivate the desiccant while within the dehumidifying cabinet and in order to do so, in a practical manner, it is important that the air be gradually heated and pass at high temperature through the desiccant material and then gradually cooled before being discharged from the cabinet. This is accomplished through provision of the tortuous passage consisting of the spaces or chambers 11, 12 and 13 defined by the shells 8, 9 and 10. During the reactivation cycle, air at room temperature is delivered into chamber 13. After moving upwardly through the outer chamber 13, the air enters chamber 12 through the opening at the top of shell 9 and is gradually heated as it moves downwardly through chamber 12 to the lower end thereof from which it flows into the heating chamber 27 where it is highly heated and passed through the desiccant to carry off moisture with it into the space 11 of shell 8. In this manner the entering air is gradually pre-heated before exposure to the heater and the moisture laden air is gradually cooled to approximately 145° F. before it is discharged into the room through the opening at the top of the cabinet. The highly heated air passing through and emitted from the basket 7 into chamber 11 is surrounded by layers of cooler air passing through chambers 12 and 13 which in their turn are surrounded by hot air passing upwardly through the chamber 14 and premature cooling of the air is prevented. The rate of circulation and the volume of air for reactivation is such that saturation to the dew point does not occur, and, therefore, condensation does not take place during the reactivation cycle.

The helmet 2 is preferably formed, as shown in Figure 1, and is carried by a stand or pedestal 105 having an upper section 105' which is vertically adjustable and also angularly adjustable in order that the helmet may be conveniently applied to a person's head. This helmet has an outer shell 106 and an inner shell 107 which is mounted within the shell 106 by rods or brackets 108 which maintain the shell 107 in spaced relation to walls of the shell 106. An inwardly rolled flange 109 is formed about the lower end of the outer shell 106. It should also be noted that the lower end of the inner shell 107 is spaced upwardly from the flange 109 and in spaced relation to its lower edge is formed with a plurality of openings or slots 110 permitting passage of air through these openings as well as through the space between the flange 109 and the lower edge of the inner shell. A hood 111 is provided at the upper end of the outer shell and formed with a neck 112 for engagement by the outer end of hose 88 and the inner shell also carries at its upper end a hood 113 formed with a neck 114 with which the outer end of hose 87 is connected. It will thus be seen that hot dry air following through the hose 87 will enter the inner shell through the hood 113 and make contact with the hair of a person over whose head the helmet has been placed, so that moisture will be taken up by the air which passes through the slots 110 and through space between the flange 109 and the lower edge of the inner shell and then flows upwardly through the space between the two shells and out through the neck 112 and through hose 88 back to the air conditioner as previously explained. A screen 115 is provided at the junction of the hood 113 with the inner shell in order to serve as a "stop" against the patron's head in the event the helmet is carelessly lowered into contact with the patron's head and the screen is made of suitable material or shape to prevent injury (on contact) to the patron.

Figure 11 is a wiring diagram showing the circuit by means of which the air conditioner is controlled and the dehumidifying and reactivating cycles obtained. In this diagram the numeral 118 designates a two-way switch and when the arm of this switch is in the position shown in full line so connects the feed wires that current will be supplied for the dehumidifying cycle or circuit. When the switch is so set, the current is fed through the switch arm so that electric energy is delivered from the power wire 120 to the low temperature thermostat 103. This low temperature thermostat is of the construction illustrated in Figure 10 and includes in its construction the two contact bars or strips 121 and 122, the strip 122 being adapted to move out of engagement with strip 121 for breaking or interrupting flow of current through wire 123 at a predetermined temperature and later on returned to a closed position to reestablish flow of current through this wire. The thermostat is of the bi-metallic type having the characteristic of warping when heated to a predetermined temperature and thereby

breaking the circuit and is located adjacent the heating unit so that after the regeneration cycle has been started, the thermostat will maintain a broken or open position until it has cooled to a predetermined degree. The wire 123 extends from the thermostat 103 to an insulated terminal block 124 and a synchronous clock (not shown) is connected on one side to the power wire 120 and on the other side to the wire 125 so that the clock will be in operation as long as the switch arm 19 is in the position shown by full lines in the diagram. This clock will have its dial marked off so as to indicate the total operating time of the air drying cycle rather than to indicate the hours of the day. If a device has a predetermined operating capacity of, say for example, eight hours, this part of the dial will be termed and marked "Operating Range." The remaining part of the dial will be used to indicate the regenerating cycle and so marked. The dial and clock mechanism can be so timed that when the air drying cycle has become exhausted the clock hand will then have reached the starting point where it will remain during the reactivating or regenerating cycle, as during this cycle the circuit to the clock is broken. A lamp 126 which is connected to the lead wires 123 and 127 constitutes a pilot light and indicates when current is flowing through these lead wires. The numeral 128 indicates a customers' switch of conventional construction and is primarily used to control the operation of the air drying device simultaneously with control of the temperature of the air delivered to the helmet. This switch is termed a customers' switch as it is provided with long leads or so located that it may be easily reached and adjusted by the customer to control the temperature.

Numeral 130 represents heater elements used to raise, to the desired comfortable degree, the dry air that is being supplied to the drying helmet. As before explained, the temperature of this air and the corresponding heat content is an important factor as a means for accelerating the rate of evaporation of the moisture while in the liquid phase. The heater elements are connected so as to provide three heat ranges—hot, medium and low, according to the position of the switch-arm of switch 128. This switch, as illustrated, is of the "five-position type."

When the customers' switch is turned to "on," the windings in the position 98 of the double-acting solenoid are also "on" so that the core 99 assumes and holds the position shown in the diagram. When in this position, the contact arm or plunger 101 which is attached to the rod, moves into position of contact with contact points 131 and 132, so that current from switch 128 is fed therethrough to motor 82 and to the solenoid assembly 51. This latter solenoid is of the single acting type and controls the opening and closing of valves 52 and 53 which remain open at all times when the current is "on" for either the air drying or regenerating cycles.

When the arm 119 of the main switch 118 is moved to the position indicated by dotted lines lead wire 120 is connected to lead wire 133 and the circuit is broken in the other side of the switch and the customers' control switch 128, the helmet heaters 130 and all other circuits on the air drying phase of the wiring arrangement.

With the main switch 118, in this new position, current is supplied to a time clock and circuit-breaker mechanism, which "breaks" the circuit after a predetermined time, and at which time the reactivation of the chemical shall have been completed.

An indicator lamp 134 is connected in the proper manner to leads 125 and 133 to indicate that the circuit is now "on" for the reactivating phase. This lamp remains lighted as long as the current is on through the circuit breaker and the switch 118.

The high temperature thermostat 102, which is similar in construction to the low temperature thermostat 103, is connected in the circuit between the circuit-breaker mechanism 135 and a heater 28. The thermostat 102 is also located within the heating cavity adjacent the heater and "breaks" the circuit to the heaters at 450 degrees F., again making the circuit at 375 to 400 degrees or thereabouts. When the thermostat circuit to the heaters is "open," the motor 82 continues operating so that air continues to flow through the chemical, thus quickly reducing the temperature to the "making" degree of the thermostat.

With the clock arrangement, the hour of "start" for reactivating can be predetermined and when that time arrives, the circuit will close and the reactivating cycle will start, continuing until the reactivation has been completed at a predetermined interval. In this manner, the reactivation can be done at night after a beauty shop or other establishment has closed.

The capacity of the air-drying device is sufficient to provide a full day's operation in the average beauty shop so reactivation during business hours is not necessary.

The low temperature thermostat 103 is used to prevent the use of the device for drying hair so long as the temperature is too high for exposure to a patron who may be otherwise seriously burned by hot air from the heated chemical.

When the switch 118 closes the reactivating circuit current is then supplied to the windings of the solenoid 97 and the valves 89, 90 and 91 are then moved to the position, as shown in Figure 8. In this manner, air that is being used to reactivate the chemical, is flowing in the direction opposite to that when air is being dried, as shown in Figure 7. This change of direction of air flow prevents moisture from remaining in the chemical adjacent the dry air outlet, in the event the reactivation cycle was not complete.

A diaphragm of suitable flexible material can be used by securing of same to the throat portion of the drying helmet and with the central portion being provided with an opening of sufficient shape and size to permit the diaphragm to encircle and snugly fit the head of the patron, a "closed" circuit method of drying can be accomplished; or a helmet of suitable shape and size can be made to rest directly upon the head of the patron, and being provided with a flexible rim of suitable material, the patron's head would form the "seal" so that air within the helmet and the cabinet would circulate therethrough by means of the flexible conduits interconnecting the combined equipments so that practically no room air would be introduced into the air-drying circuits. This is called the closed circuit method and this type helmet is anticipated in conjunction with the device herein described and additional modifications and improvements in connection therewith will subsequently be filed for patent applications.

It will be seen that the operation of the device is very simple, and the construction and arrangement of the three shells over the chemical cell

provide a very efficient means for dissipating excess heat in a manner that is most desirable as it does not cause the air in the room to become heated.

From the foregoing description of the construction of our invention, the operation thereof and the method of applying the same to use, will be readily understood. It will be seen that we have provided a simple, inexpensive and efficient means for carrying out the objects of the invention and while we have particularly described the elements best adapted to perform the functions set forth, it is obvious that various changes in form, proportion and in the minor details of construction may be resorted to, without departing from the spirit or sacrificing any of the principles of the invention.

What we claim is:

1. In an apparatus of the character described, a series of containers, one within the other, means for creating a flow of air through the containers, a basket in the inner container, a heater in said basket, moisture absorbing means in said basket surrounding said heater, means for directing flow of air through the containers and towards the basket and in contact with the moisture adsorbing means for the removal of moisture from the air, and for directing the then dry air in contact with the heater and thereby heat the dry air and furnish a supply of heated dry air to the place of use, and means for reversing directional flow of air to first heat the air and then pass the heated air outwardly through the basket and the inner container in contact with the moisture adsorbing means in order to extract moisture that has been accumulated within the moisture adsorbing means.

2. In an apparatus of the character described, an outer casing containing therewithin two lesser containers, one within the other, and with air passages provided on each of the sides of each container, an air inlet and air outlet provided for each container, a basket located within the central portion of the innermost container, a heating means within said basket, a moisture adsorbing substance retained within the said basket and surrounding the heater, the series of containers mounted one within the other being interconnected to form a tortuous air path therebetween, a valve structure in said outer casing having end ports, an auxiliary valve structure communicating with one port of the first valve structure and having ports communicating with the casing and the heater and one end of the tortuous path, the auxiliary valve also having a throat communicating with the port having communication with the heater, a valve in the auxiliary valve structure for shutting off flow of air through the casing when closed; a blower carried by the first valve structure for creating flow of air through the valve structures and the basket and series of containers; means for delivering heated dry air from the first valve structure to the place of use, and a valve in the first valve structure for controlling directional flow of air.

3. In an apparatus of the character described, a casing, a basket in said casing having inlet and outlet ports, a heater in said basket, moisture adsorbing means in the basket, means for directing flow of air through the basket between the ports thereof for successive engagement with the moisture adsorbing means and the heater, a valve body in said casing having chambers therein provided with ports and having necks communicating with the ports of said basket, means for controlling flow of air through the valve body, a second valve body in said casing having a port communicating with one port of the first valve body and an outlet, a delivery tube leading from the outlet, interconnecting chambers and passages between the port and the outlet, one chamber having an auxiliary air inlet, a blower communicating with the second valve body for creating flow of air through the chambers and the passages thereof and through the first valve body and the basket, and means in the second valve body for controlling directional flow of the air and also control flow of air through the outlet of the second valve body and the auxiliary air inlet thereof.

4. In an apparatus of the character described, a plurality of shells disposed one within another with their walls spaced from each other to provide air passages between the shells, there being an outer shell, an inner shell and an intermediate shell, the outer shell and the inner shell each having a port at its bottom and the intermediate shell having a port at its top communicating with the outer shell, a basket in the inner shell spaced from walls thereof and having perforated inner and outer walls spaced from each other, the perforated outer wall establishing communication between the basket and the inner shell and the perforated inner wall defining a heating chamber surrounded by the basket and communicating therewith, said heating chamber having its lower end communicating with the intermediate shell, a heater in said heating chamber, a moisture absorbing chemical in said basket surrounding the heating chamber and the heater therein, means for creating a flow of air through the shells and the basket and the heating chamber having communication with the ports at lower ends of the outer shell and the inner shell, and means for controlling directional flow of the air.

5. In an apparatus of the character described, a plurality of shells disposed one within another with their walls spaced from each other to provide air passages between the shells, there being an outer shell, an inner shell and an intermediate shell, the outer shell and the inner shell each having a port at its bottom and the intermediate shell having a port at its top communicating with the outer shell, a basket in the inner shell spaced from walls thereof and having perforated inner and outer walls spaced from each other, the perforated outer wall establishing communication between the basket and the inner shell and the perforated inner wall defining a heating chamber surrounded by the basket and communicating therewith, said heating chamber having its lower end communicating with the intermediate shell, a heater in said heating chamber, a moisture-absorbing chemical in said basket surrounding the heating chamber and the heater therein, a valve casing having a chamber provided with a port and a neck communicating with the port at the lower end of the inner shell, said valve casing having a second port and a neck communicating with the port at the lower end of the outer shell, a valve in said valve casing for controlling flow of air through its chamber and neck, a blower having a casing formed with a port and with an impeller-chamber and passageways leading therefrom and communicating with the port of the chamber of the valve casing, one passageway communicating with the port of the blower casing and the other with an outlet

adapted to have a conduit secured thereto, and a valve in the blower casing for controlling flow of air through its passageways and through its port and outlet and shiftable to control directional flow of air through the valve casing and through the shells and the basket and heating chamber.

6. In an apparatus of the character described, a plurality of shells disposed one within another with their walls spaced from each other to provide air passages between the shells, there being an outer shell, an inner shell and an intermediate shell, the outer shell and the inner shell each having a port at its bottom and the intermediate shell having a port at its top communicating with the outer shell, a basket in the inner shell spaced from walls thereof and having perforated inner and outer walls spaced from each other, the perforated outer wall establishing communication between the basket and the inner shell and the perforated inner wall defining a heating chamber surrounded by the basket and communicating therewith, said heating chamber having its lower end communicating with the intermediate shell, a heater in said heating chamber, a moisture-absorbing chemical in said basket surrounding the heating chamber and the heater therein, a valve casing communicating with the ports at lower ends of the outer shell and the inner shell, a valve in said valve casing controlling flow of air through the same, a blower having a casing formed with intercommunicating passages communicating with the valve casing and an outlet neck leading from one of its passages, and a valve in the blower casing for controlling flow of air through its passages and through its outlet and directional flow of air through the valve casing and the shells.

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