May 4, 1954 R. S. M. MITCHELL 2,677,196

APPARATUS FOR DRYING HAIR

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FIG. 1

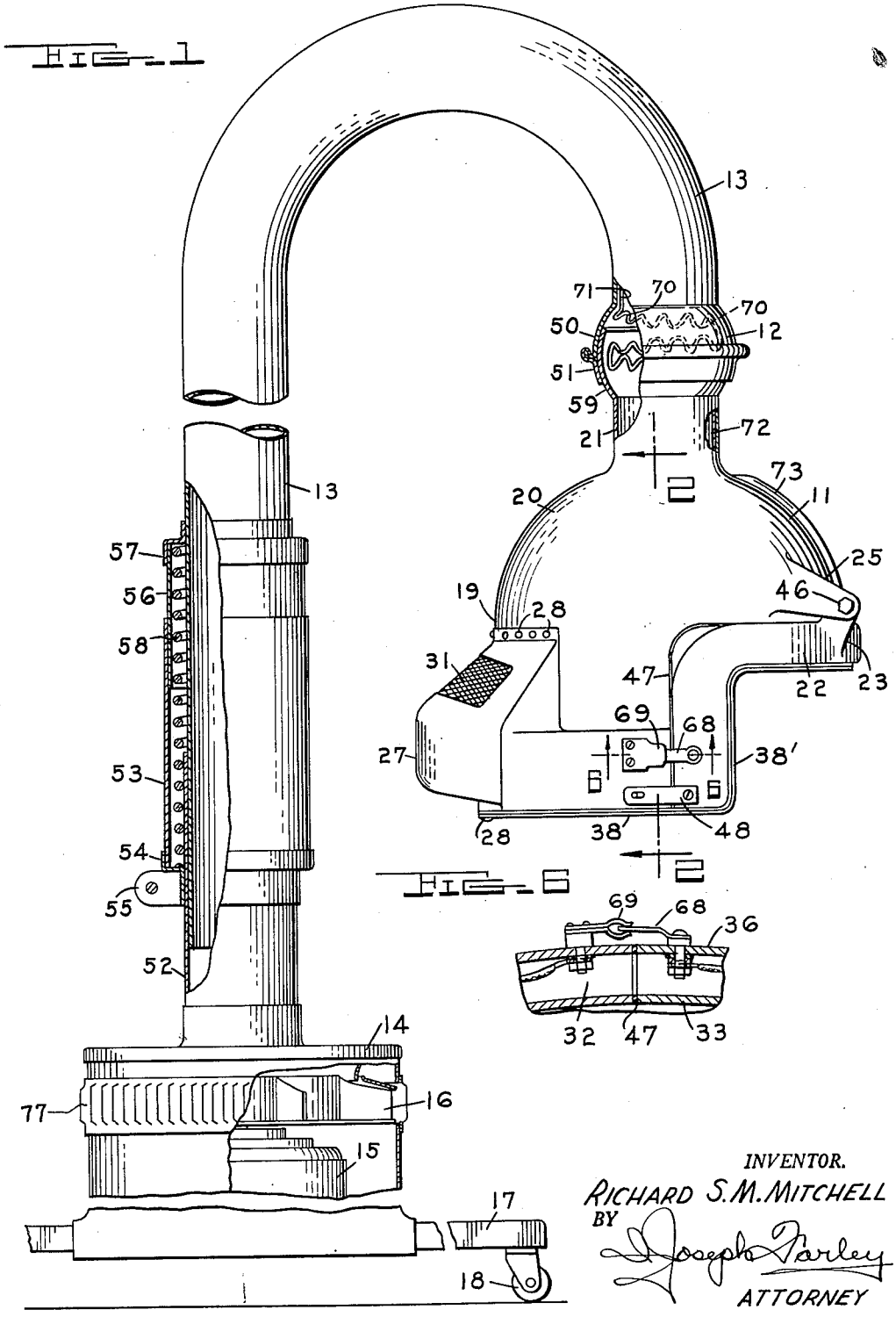

FIG. 6

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FIG. 3

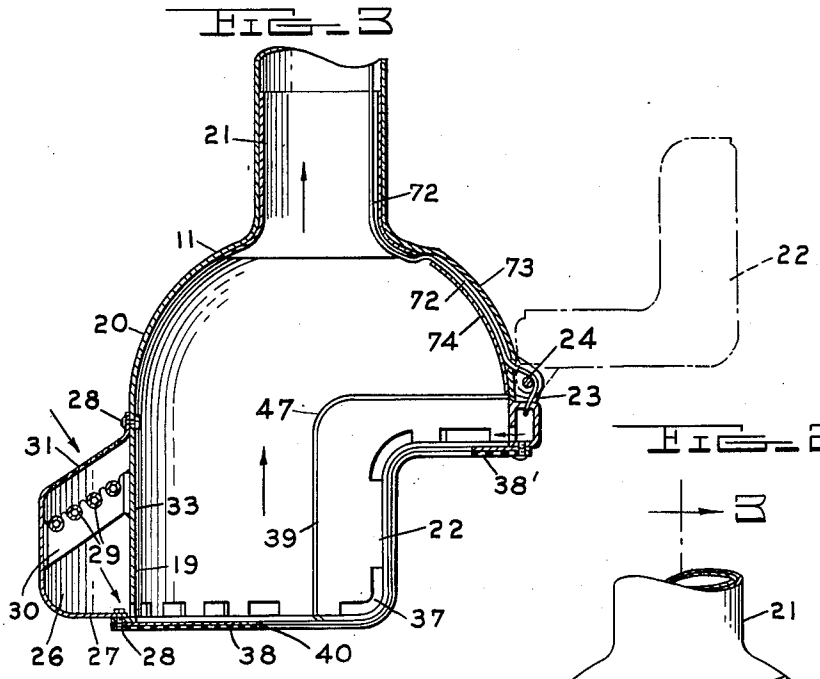


FIG. 2

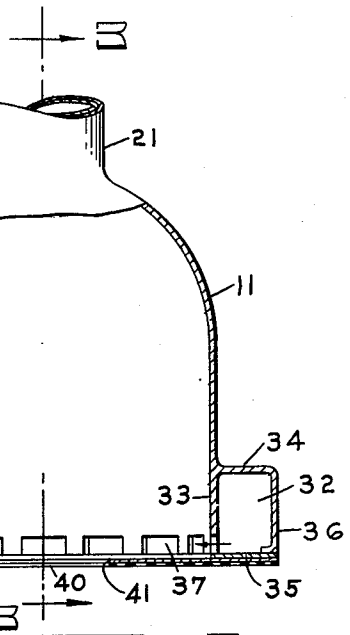


FIG. 5

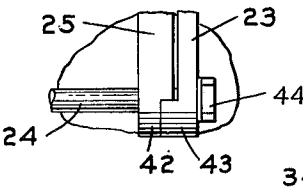


FIG. 4

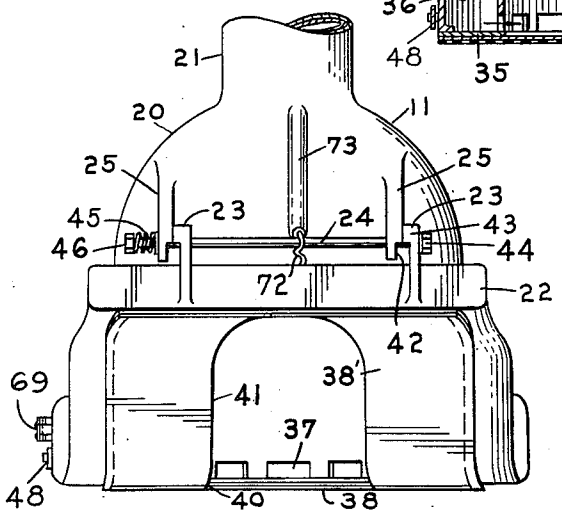
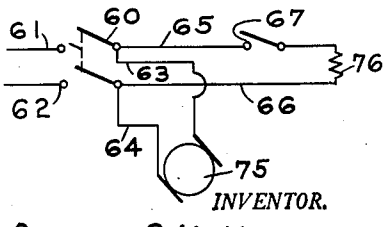


FIG. 7



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UNITED STATES PATENT OFFICE

2,677,196

APPARATUS FOR DRYING HAIR

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Application October 5, 1951, Serial No. 249,853

4 Claims. (Cl. 34—99)

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This invention relates to a new construction for hair driers together with a new mode of operation for devices of this type and a new method of drying hair resulting therefrom.

To my knowledge all present forms of hair driers operate on the principle of causing evaporation of the moisture in the hair by circulating hot air over the head. Energy, of course, is required to transform water from a liquid to a vapor, and in present driers, this energy is supplied in the form of heat which is directly applied to the moisture in the hair principally by convection, though a certain amount of radiation and conduction aids in transferring the heat needed for evaporation. A contributing factor to the operation of these driers is the ability of the air to absorb a greater amount of water vapor when its temperature is increased.

Most commercial forms of driers now available for professional use consist of a large hood or chamber, adapted to be placed over the head to be dried, and having a large heating element and a small blower mounted in the upper portion thereof. Air is drawn through the heating element and directed downwardly over the head by the blower to escape from the chamber and pass over the neck, chest, back and shoulders of the patron. The temperature of the air can usually be controlled by the operator or the patron, but the customary practice is to maintain the air as hot as possible for as long a time as the patron can endure, and the total drying time with this method and equipment averages between forty-five minutes and an hour and one-half, depending upon the head of hair and the coiffure.

Physiological disadvantages and objections to present drying methods and equipment are many and arise first from the use of heat at temperatures above the normal temperature of the body to increase the rate of evaporation. The application of this heat to the head causes the natural oils to be baked out of the hair and scalp. Equipment which exhausts the hot air downward over the face, neck and body causes secondary harmful effects in the form of irritation of the nasal passages and the glands of the neck, physical discomfort from heat and perspiration during the drying process, and colds from the hot draft and the chilling which usually follows. In a way, the physical discomfort is the most important of these disadvantages because it is always present and therefore leads people to desire to hasten the drying as much as possible and consequently to apply more heat until a point is reached where some of the other more serious effects frequently are induced.

The principal object of the present invention is

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to discard this old, dangerous, uncomfortable and slow method of evaporating moisture from the hair by the application of direct heat energy, and instead of relying primarily upon the temperature of the air supplied, a further object is to remove the moisture by directing a large volume of air upon the hair, at high velocity, together with the coincident application of other factors, related to and resulting from the use of air in large volume, as will be presently explained in connection with other objects of the invention. In other words, energy is required to dry the hair, and instead of utilizing heat energy as the principal means of removing moisture, this invention employs an entirely different form, namely, kinetic energy of the air stream passing over the hair. While the amount of energy that can be used in the form of heat is limited by the harmful effects on the body previously mentioned, the amount of energy that can be used in the kinetic form is limited chiefly by the aero-dynamic force mechanically obtainable from such types of air-circulating equipment as can be used within practical limits of size and cost.

Another object is to provide a helmet which confines the flow of air supplied solely to the hair and which prevents any air from being directed or exhausted upon any other part of the body, so that all air supplied is efficiently used in removing moisture and so that no discomfiture or harmful effects are caused by the air stream flowing over other parts of the body. This helmet is also designed so that the passage of air therethrough will be somewhat restricted in order that a partial vacuum may be produced within the helmet. In accordance with well-known principles, such a partial vacuum results in decreasing the energy required for evaporation, or in other words, in increasing the rate at which moisture can be absorbed by the air.

A further object is to supply the air in such volume that the resulting velocity or kinetic energy of the air flowing through the size conduits provided, and as increased by the restricted passages in the helmet, will be sufficient to cause entrainment and asportation of a large amount of moisture within the air stream. Such entrainment will be aided by the partial vacuum established within the helmet in accordance with principles employed in the operation of present types of so-called atomizers. Evaporation of the remainder of the moisture not entrained in the air stream will readily be accomplished by the large volume of air used.

Another object is to supplement the kinetic energy of the air stream by the use of some heat, which will incidentally aid in the removal of

moisture by evaporation, but which is to be employed principally to prevent the moist head from being subjected to a chilling blast of air. Accordingly, the amount of heat to be used will only be enough to maintain the air supply at a comfortable temperature, preferably below body temperature, but, due to the rapidity at which evaporation takes place and the cooling effect produced thereby, the temperature of the air supplied may range well above body temperature without causing any discomfort or other harmful effects.

Other important objects are: to provide a method of and equipment for drying which removes all moisture from the hair in far less time than that required by existing methods and equipment; to provide a construction for a complete drying unit which will permit a reasonable degree of freedom of movement of the user during the drying process without impairing the efficiency of operation of the unit and without danger of injury to the user; and to provide safety means to eliminate the possibility of the unit being damaged or the user injured through improper operation.

This application is a re-filed application of my abandoned application Serial No. 757,893, filed June 27, 1947, for "Method of and Apparatus for Drying Hair."

Other objects and advantages of the invention will be explained in the following description of the construction of a drying unit and discussion of its operation and the method of drying employed.

Constructional details of a hair drier embodying the invention are shown in the drawings accompanying and forming a part of this specification. These drawings consist of the following views:

Figure 1 is a side elevation of a complete drier unit;

Figure 2 is a transverse cross-section of the helmet portion of the drier taken along the line 2—2 in Figure 1;

Figure 3 is a longitudinal cross-section of the helmet taken along the line 3—3 in Figure 2;

Figure 4 is a front elevation of the helmet;

Figure 5 is a fragmentary view of one of the hinges of the helmet visor showing the relation between the parts when the visor is raised to the position indicated in phantom in Figure 3;

Figure 6 is a sectional detail of a visor operated safety switch taken in plan along the line 6—6 in Figure 1; and

Figure 7 is a schematic wiring diagram of a satisfactory electrical circuit for the drying unit.

This drier unit is composed of a helmet 11 attached by a universal type of joint 12 to a tubular standard 13 which is carried by a base 14. A motor 15 and an impeller or blower 167 are mounted within the base and the whole unit is supported upon a carriage 17 equipped with casters 18.

Constructional details of the helmet 11 are shown in Figures 2 to 6 inclusive. Referring first to Figures 2 and 3, the helmet consists of a shell formed with a cylindrical lower portion 19 and a dome-shaped upper portion 20 which extends into an air outlet tube 21. The front half of the lower cylindrical portion of this shell is cut away to receive a visor 22 which is provided with hinge brackets 23 drilled to be mounted on a hinge pin 24 carried by other hinge brackets 25 formed with or attached to the upper portion 20 of the shell.

An air inlet chamber 26 is located at the rear

of the helmet, the inner wall of this chamber being formed by the shell of the helmet and the outer wall by a plate 27 held in place by bolts 28. Heater coils 29 are mounted within this air inlet chamber upon brackets 30 immediately below an air inlet opening 31 so that all air entering the chamber passes around the heater coils. This air inlet chamber extends around a portion or segment of the periphery of the shell of the helmet, and at each end of this segment communicates with an air duct 32 which continues around the entire lower periphery of the shell and visor. The air duct can be molded integrally with the shell, as shown, or may consist of a separate member or members suitably attached to the shell. In the form illustrated, the air duct is enclosed by a vertical section 33 of the inner wall of the helmet and visor and upper and lower horizontal sections 34 and 35 which extend outwardly from the section 33 and are joined by an outer vertical section 36 to form a rectangular passage. A number of passages 37 are cut in the vertical section 33 to provide for communication between the air duct and the interior of the helmet around the entire length of the former. Since air supplied to the helmet flows from the air inlet chamber at the rear thereof into the annular air duct and thence to the interior, the cross-sectional area of the air duct is made progressively smaller as the distance from the inlet chamber increases in order to secure a more uniform distribution of air entering the helmet from the duct. This is clearly illustrated in Figure 3 which includes a section taken through the air duct at the front of the visor and which can be compared with the area of the duct at the sides of the helmet, as shown in Figure 2.

The bottom of the helmet is partially closed by a sealing strip 38 of flexible rubber cemented to the lower section 35 of the air duct and extending inwardly around the entire lower periphery of the helmet and visor. At the parting line 39 between the helmet and visor the sealing strip 38 is split and the portion 38' attached to and movable with the visor overlaps the stationary portion 38 secured to the helmet. The function of this sealing strip is to close the space between the lower edge of the helmet assembly and the neck, face and forehead of the person whose hair is to be dried so that the circulation of air will be confined to the inlet and exhaust passages provided and previously described. Accordingly, the opening 40 at the bottom of the helmet, as defined by the inner edge 41 of the sealing strip, is considerably smaller than the physical dimensions of the smallest people and therefore the drier can accommodate all sizes of people by reason of the flexibility of the strip 38.

In spite of the small area of the opening 40, the movable visor 22 makes it possible for any head to be easily placed within the helmet, and also makes it more convenient for an operator to properly adjust and position the sealing strip. Means are included in the hinge construction of the visor so that when it is moved to its fully raised position, as indicated by the phantom lines of Figure 2, it will automatically be retained in this position until lowered by the operator. Such retaining means consist of a recessed shoulder 42 formed on each of the hinge brackets 25 of the helmet and a projecting lug 43 formed on the brackets 23 of the visor. The hinge pin 24 is fitted at its right-hand end (see Figure 4) with a nut 44 which bears against the hinge bracket 23 of the visor, and at the left-hand end the hinge

pin extends beyond the bracket 25 of the helmet. A spring 45 is held in compression between a nut 46 on the pin and the surface of the bracket 25 so that the action of this spring is to urge the hinge pin and visor to the left. As the visor is rotated 180° from the closed position of Figure 4 to the raised position of Figure 3, it moves to the left and the projecting lugs 43 of the visor hinge brackets fall into the recessed shoulders of the helmet brackets in the manner shown by the detail view of Figure 5 which illustrates the engagement between the hinge brackets when the visor is locked in its raised position.

Strips of some suitable sealing material 47 are carried by either the helmet or the visor along the parting lines 39 between the two, and a spring-type latch 48 is provided on each side of the helmet for tightly locking the visor in closed position so that there will be no leakage of air into the helmet along the parting lines and so that little or no air will escape into the helmet from the air duct 32 at this joint.

As previously mentioned, one of the objects of the invention is to provide a drier which is constructed so that the user is permitted a certain amount of freedom of movement while the hair is being dried. With present driers, the shield or chamber which deflects the hot air over the hair is stationary during operation of the drier and therefore, for best results, the user must remain stationary also. Any movement is necessarily reflected in the efficiency of the drying process, and may even cause injury from contact with a hot surface. The construction of the invention permits the drier to follow both horizontal and vertical movements of the user without appreciable change in the efficiency of operation, and without any danger of injury, by reason of the fact that the helmet is attached to the head through the sealing strips 38 and 38' and by reason of the type of connections used between the helmet 11 and standard 13 and between the standard 13 and base 14. The universal joint 12 which forms the first of these connections is of conventional construction and merely consists of a spherical socket 50 on the standard and a ball 59 on the helmet outlet tube 21 with a connection established between these two members by a retaining ring 51.

An extensible joint is used to attach the standard 13 to the base 14 and is constructed as follows: a length of tubing 52 having an inside diameter slightly greater than the outside diameter of the standard 13 is rigidly secured to the base 14 and projects upwardly therefrom to receive the lower end of the standard 13, as is clearly shown in the sectional portion of Figure 1, so that the standard is free to telescope within the tube 52. This joint is enclosed within a telescoping housing comprising a lower shell 53 secured to a Z-ring 54 which is fixed to the tube 52 by a clasp 55, and an upper shell 56 secured to a Z-ring 57 which is welded to the standard 13. A spring 58 is mounted within this housing and is designed to counterbalance the weight of the standard and helmet in order that a person using the drier may move his head and body vertically with relative freedom. The overall height of the standard and helmet is varied by adjusting the position of the clamp 55. Should a person move in a horizontal direction a greater amount than can be accommodated by the universal joint 12, the entire drying unit is free to follow such movement by rolling along the floor on the casters 19.

Wiring for the drying unit is illustrated schematically in Figure 7. Current is delivered to a master switch 60 located on the base 14 of the unit through wires 61 and 62 and travels to the blower motor 75 through a pair of wires 63 and 64. A second pair of wires 65 and 66 lead from the master switch 60 to the heating element 76 in the helmet, one of these wires 65 passing through a safety switch 67 which operates to interrupt the circuit to the heating element when the visor of the helmet is raised. This safety switch is shown in detail in Figure 6 and consists of a knife contact 68 movable with the visor, and a spring clip 69 attached to the helmet. If desired, either the contact or clip may be made adjustable so that the switch will not be closed when the visor is shut, in which case the heating element will not be operative—a condition which may be desirable during warm weather when the normal temperature of the air is high. Other modifications of equivalent purpose could consist of a separate heater on-off switch, a heater rheostat, or the safety switch shown could be replaced by a heater thermostat.

The safety switch illustrated is employed to prevent current from being supplied to the heating element unless the air supply to the helmet will circulate over the heating coils to maintain their temperature at a reasonably low value so that the helmet and heating coils will not be damaged or become overheated to the point where a person could be burned from contact with the helmet.

In the actual installation of the wiring from the master switch to the heating element, provision must be made to prevent this wiring from interfering with free relative movement between the helmet and standard and between the standard and the base. Figure 1 shows one form of such provision where an extensible coil of wire 70 is wound within the ball joint between the helmet and standard with one end 71 of this coil extending back through the standard to the master switch on the base and the other end 72 leading down into the helmet where it is fitted into a groove 73 protruding from the outer surface thereof. The wire 72 is retained within this groove by a thin strip 74 extending up the inner wall of the helmet. This groove communicates with the air duct 32 where connections are made to the safety switch and to the heating element.

Operation of the unit is as follows: with the visor raised, the helmet is placed over the head of the user and the sealing strip 38 is properly positioned around the sides and back of the neck. Then the visor is lowered and locked in place and the portion 38' of the sealing strip carried thereby is fitted to the cheeks and forehead and mated with the rest of the sealing strip to form a continuous closure between the lower periphery of the helmet and visor and the person of the user. Because of this closure, when the blower motor is turned on, all air withdrawn from the helmet will be replaced by air entering the helmet through the air inlet opening 31, the heating chamber 26, the air ducts 32 and the communicating passages 37 which direct the air onto and over the hair. Air withdrawn from the helmet by the blower is exhausted at the base of the unit through the louvers 77.

Since the blower is mounted in the base of the unit, its size is not governed by space and weight limitations and therefore a combination of motor and impeller can be used which has a capacity to circulate a volume of air far greater than

that employed in drying units now in use. For example, I have constructed a drying unit of the type disclosed herein having a one-half horsepower motor and impeller combination capable of circulating air through the helmet at rates up to approximately 1000 cubic feet per minute. The withdrawal of air from the helmet at this rate creates a vacuum of about four inches of water within the helmet and produces such a velocity of air flowing onto and through the hair that a great amount of the moisture present is entrained in the air stream and physically removed thereby. The kinetic energy of the air stream is sufficient to overcome the adhesion between the water and the hair and to carry off the water in small droplets in a manner similar to the action of the ordinary so-called atomizer. At the same time, this kinetic energy of the air stream is forcing large amounts of air over the entire head and through all the minute interstices in the hair so that a very rapid rate of evaporation is produced due to the fact that the circumambient relative humidity and vapor pressure are maintained at values lower than those obtained with the air-circulating capacity of present drying units. To some extent, the rate of evaporation is also increased by the conversion of kinetic energy to heat energy owing to the surface friction attending this passage of air.

Thus, during the drying process, moisture is removed both in the liquid and vapor state and such removal is not produced by direct heat as in present driers, but rather by the factors mentioned above. No harmful physiological effects are produced because of the absence of the high temperatures and radiant type of heat energy employed in direct heating, and even though the actual temperature of the air flowing over the head may be well over body temperature, the head will feel cool until dry because of the rapidity of evaporation and the absence of such radiant heat. Drying is completed in one-third to one-half the time required by the conventional units now in commercial use.

The method and principles of the present invention can be used with a number of possible constructions of driers, and hence the disclosure hereof can only be representative. The amount of kinetic energy available for removing moisture is dependent upon the mass of the air or other moisture-removing fluid used and the square of the velocity thereof. Since mass is in turn dependent upon volume, the practice of the invention depends primarily upon the use of an air-circulating unit having a capacity to move a relatively large volume of air together with a helmet designed to impart sufficient velocity to this volume of air to effectively transform the power drawn by the circulating unit into kinetic energy of the air stream passing over the hair. Specific values for these factors will vary with the overall size and moisture-removing capacity of any drying unit and as the amount of kinetic energy developed is increased, the amount of moisture removed by entrainment will increase, the evaporation rate will be increased with less moisture left to be removed by this process, and hence a marked decrease in the total time required for drying will result.

What I claim is:

1. A hair drier comprising a helmet, a visor hinged to the front portion thereof, means for retaining said visor in open and closed position, an air inlet duct extending from the atmosphere around the circumference of said helmet and visor, air inlet ports formed in said helmet and visor and connecting said duct with the interior of said helmet, an air exhaust opening provided in said helmet, air exhaust means located remotely from said helmet, an air conduit between said air exhaust means and said exhaust opening of said helmet, a pivotal connection between said conduit and said helmet, and sealing means carried by said helmet and said visor adapted to cooperate with the person of a user to substantially confine the passage of air entering and leaving the interior of said helmet to said inlet ports and exhaust opening respectively.

2. A helmet for a hair drier having a main portion shaped to enclose the head, a visor carried by said main portion and movable relatively thereto, an air inlet chamber separated from the interior of said helmet, an air inlet duct extending from said aid inlet chamber around the lower periphery of said main portion and communicating with the atmosphere through said air inlet chamber, a continuation of said air inlet duct formed around the periphery of said visor, air inlet ports located between said air inlet duct and the interior of said helmet, an air exhaust opening provided in said helmet, and sealing means carried by said main portion and visor of said helmet adapted to cooperate with the person of a user to substantially confine the passage of air entering and leaving the interior of said helmet to said inlet ports and exhaust opening respectively.

3. A hair drier as set forth in claim 2 having a heater disposed in said air inlet chamber to maintain the temperature of the air being moved through said helmet at a level comfortable to the person of a user.

4. A hair drier comprising a helmet having an air exhaust passage in the top thereof, an air exhaust unit, a conduit connecting said air exhaust unit to said exhaust passage, a visor hinged to the front portion of said helmet, means for retaining said visor in open and closed positions, sealing members extending inwardly from said helmet and said visor near the lower peripheries thereof and adapted to cooperate with the head of a user to substantially seal such head within said helmet, an air inlet duct extending from the atmosphere around the circumference of said helmet and visor, inlet passages formed in said helmet and said visor above the level of said sealing members and connecting said duct with the interior of said helmet, a pivotal connection between said helmet and said conduit, and an extensible connection between said conduit and said air exhaust unit, said air circulating unit having the capacity to withdraw air from said exhaust passage with such volume and velocity as to cause the removal of moisture from the hair of such head by entrainment and evaporation and to establish a partial vacuum within said helmet.

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