

DRYER

This invention relates to a dryer suitable for drying a person who is wet after swimming, showering, or bathing.

Hot air dryers for drying small areas of the body, for example the hands, are well known. However, known dryers do not provide a sufficient output to be effective other than over a relatively small area I have now devised a dryer which is suitable for mounting in the ceiling of a room (for example a changing room, shower room or bathroom) and which produces a sufficient output of heated air to permit the effective drying of a complete individual.

According to one aspect of the present invention a dryer for drying a person who is wet after swimming, showering or bathing, comprises: a centrifugal fan having its axis of rotation perpendicular to the ceiling surface to which it is mounted; at least one heater element located radially outwardly of the centrifugal fan whereby air delivered by the centrifugal fan is blown through the heater element; and a duct extending from the outlet side of the heater element to turn the air leaving the heating element through approximately 90° to be directed substantially vertically downwards through an outlet nozzle into the room below.

The preferred embodiment of the present invention offers a number of substantial advantages. The device is preferably mounted in the ceiling void above a changing room, bathroom or shower room, with just the nozzle and inlet openings visible, although it may be mounted behind a wall panel in which case the axis of rotation of the centrifugal fan will be perpendicular to the wall panel. The arrangement of the fan, the or each heater element and the or each duct produces a structure which is particularly compact in the direction of the axis of rotation of the fan. Such a structure is able to be accommodated within a ceiling or wall void without projecting an excess distance from the ceiling or wall panel. Preferably, the inlet to the centrifugal fan is an opening in the ceiling located directly below the centrifugal fan itself and preferably the fan and the or each heater element are contained within an enclosure which is open only to the room into which the heated air is directed. Accordingly, the required air will be drawn by the fan from the

room in a vertically upward direction, will be turned through 90° by the fan to pass substantially horizontally through the or each heater element, and will then be turned to return downwardly into the room below.

Not only does the structure of the preferred embodiment as described above have compact dimensions in the direction of the axis of rotation of the fan, enabling relatively easy installation, but the format of the device allows readily available fan and heater components to be utilised in a novel structure. In this context, the design facilitates the use of heating elements which are supplied in essentially a cassette form and which can be slotted into the dryer casing in a quick and easy manner.

In a preferred embodiment of the invention two heater elements are provided. These heater elements may both be provided on one side of the fan so that air flows successively through the heater elements, or may be located on opposite sides of the fan so that air flows from the fan in opposite directions through the respective heater elements. In the case when two heater elements are provided on opposite sides of the fan each heater element will have associated therewith a respective outlet duct and nozzle so that two downwardly directed columns of heated air are produced.

One particular advantage of the present invention arises if it is used in a shower room which is furnished with an electric shower. Such showers typically require dedicated power supplies capable of providing, in some cases, up to 9 kW. By utilising appropriate control arrangements the power supply provided for an electric shower may be used to run the dryer of the present invention. Under these circumstances, the heating elements of the present invention may be designed to utilise the maximum power available via the shower power supply. This high level of power, coupled with a fan to produce a high volumetric flow rate, ensures an adequate supply of drying air and rapid and effective drying of the individual.

Preferably, the dryer of the present invention is controlled by means of a "remote control" in the form of a hand-held or wall mounted unit which communicates with the dryer by means of infra-red or radio signals. The control arrangements are preferably such that if the dryer is actuated no power will be supplied to the shower and vice versa.

Preferably, electronic control arrangements are provided to control both the operation and safety aspects of the design. As noted above, the control arrangements preferably provide that when the heater is in use a shower, which shares the same electrical feed, cannot be used, and vice versa. Additional preferably control functions may include variable speed, variable temperature, feedback arrangements to control the fan speed or heater power in light of ambient room temperature, automatic shutdown and/or warnings in the event of fault conditions and predetermined operating sequences, for example initial operation at low fan speed and low power output with progressively increased fan speed and heater power output as the drying process continues.

The invention will be better understood from the following description of a preferred embodiment thereof; given by way of example only, reference being had to the accompanying drawings wherein:

Figure 1 is an exploded perspective view of a first embodiment of the invention;

Figure 2 is an exploded view of a second embodiment of the invention; and

Figure 3 illustrates schematically a control system for the present invention

Referring firstly to Figure 1, the dryer 1 of the present invention comprises a casing 2 made up of a lower casing part 3 and an upper casing part 4, a fan 5, two heater elements 6,7 and covers 8,9. In use, the upper and lower covers 3,4 will be secured to each other with the fan 5 and heating elements 6,7 enclosed within the resultant casing. These components will be located above a ceiling panel or behind a wall panel. The cover 9 will cover electrical connections to the unit. Below the ceiling panel or on the room side of the wall panel the cover 8 will provide an aesthetically pleasing finish to the device.

The lower casing 3 includes an inlet 10 which, in use, will be in register with the corresponding cut-out in the ceiling or wall board. The inlet 10 provides direct communication to the inlet opening 11 of the fan 5. As will be understood by those skilled in the art the fan 5 is, in use, rotated by an electric motor to discharge air in the radial direction relative to the axis of rotation of the fan. The fan is surrounded by a wall 12 of the upper casing part 4 so that the entire output of the fan is directed through a first

heating element 6 and a second heating element 7 which are located one after the other in the direction of air flow. It will be noted that the heater elements 6,7 are each self contained cassettes which located within corresponding recesses 13,14 in the lower casing 3 and the upper casing 4. Cassette heating elements of the type in question are readily obtainable as commercial items and accordingly can be provided at relatively low cost. In this context, it must be remembered that the dryer of the present invention is intended to operate with substantial power levels and the use of commercially available tried and tested heater elements operating at high currents is a substantial economic advantage in manufacturing embodiments of the present invention.

Downstream of the heater elements 6,7 the casing forms a duct 15 which turns the air flow through 90° to exit from the casing vertically downwardly via a nozzle 16. In use, the nozzle 16 extends through a corresponding cut-out provided in the ceiling or wall board and registers with an opening 17 provided in the cover 8. It will be noted that the cover 8 includes a plurality of lateral openings 18 which allow air to pass from the room into a chamber 19 defined between the cover 8 and the ceiling or wall boards and hence to the inlet 10.

The cover 8, shown in Figure 1, is furnished with an opening 20 located symmetrically relative to the opening 17. In the embodiment shown in Figure 1 the opening 20 is closed by a blanking plate or grill since it is not required for the embodiment shown in Figure 1.

Referring now to Figure 2, an alternative embodiment of the present invention is shown. The alternative embodiment has two nozzle outlets 25, 26 located either side of a central inlet 27. The cover 8 illustrated in Figure 1 will be utilised in the embodiment of Figure 2, with both of the openings 17,20 opened to register with a corresponding nozzle 25,26.

In the embodiment of Figure 2 the fan 28 is located centrally with two heating elements 29, 30 located on diametrically opposite sides of the fan. The upper casing part 31 and lower casing part 32 co-operate to define a chamber 33 which directs air exiting radially from the fan 28 through both of the heating elements 29, 30 simultaneously.

Separate outlet ducts 35, 36 are provided at opposite ends of the device to turn the respective air flows through 90° upon leaving the heating elements to exit vertically downwardly through the nozzle 25, 26. Again, it will be noted that the design of Figure 2 makes use of standard fan and heater elements and can accordingly be constructed at relatively low cost. Although the plastics mouldings required for the casing and cover are relatively large and complex, relatively few individual components are required which again assist in controlling production costs.

As noted above, the dryer of the present invention is preferably controlled by means of a remote control and preferably includes control functions to control the fan speed and/or the power output of the or each heater element. The controls may be relatively simple providing only limited individual control functions, or may include pre-programmed sequences. For example, the system may be programmed to start at a relatively low fan speed and low power heater output, and to increase the fan speed and heater power output as drying continues. Such an arrangement has a particular advantage in that when a person first uses the dryer he may be very wet in which case a high fan speed may induce a high rate of evaporation from the skin which will have a chilling effect even though the heater is operating at a high power level. It may therefore be preferable to start the fan at a relatively low speed and to increase the speed as the drying continues.

Referring now to Figure 3, there is illustrated schematically a control system for use in connection with the present invention. The control system facilitates operating the dryer using the same electrical feed as that supplying an electric shower. Such an electrical feed may, for example, be a 9kW feed provided direct from a consumer unit. In the illustrated system, the supply arrives on a cable 40 as the input to a relay 41. The normal state of the relay (as illustrated in Figure 3) is to connect the input exclusively to a first relay output 42 to which is connected a cable 43 to supply power to an electric shower.

Operation of the relay 41 and of the remainder of the system is under the control of a master controller 44. One input to the master controller is a current detecting device

45 which may be a toroidal coil surrounding the cable 43 or some other device to indicate the presence of a current in the conductor 43. The detector 45 is connected to the master controller by way of a connecting cable 46. If a signal is received by the master controller 44 on the cable 46 indicating that a current is flowing through the cable 43 (which in turn indicates that the shower is in use) operation of the dryer is totally inhibited and the relay will remain in the configuration illustrated in Figure 3. Any attempt to operate the heater by way of a remote control 47 will be ineffective. If desired, the master controller may include an audible warning device which emits a distinctive tone if an attempt is made to operate the heater whilst the shower is in use. If the shower is not in use and the remote control 47 is operated to turn on the heater the master controller will immediately change the relay 41 so that the supply input 4D is connected to a second output 48 which is in turn connected to a fan controller 49, a first heater controller 50 and a second heater controller 51 by way of a connecting cable 52. Once the relay has been switched into the second position it will remain in that position until the heater is turned off thereby preventing the flow of current to the shower.

The master controller may be designed to provide any desired combination of heating characteristics and safety characteristics required for the operation of the system. Typically, the master controller via an output 53 will control the fan controller 49 which in turn controls the supply of current to the fan. The fan controller may be effective to initiate operation of the fan before current is supplied to the heating elements and/or to continue operation of the fan after supply of current to the heater elements has ceased. The fan controller may also provide variable fan speed control either on demand from the remote control 47 or in response to some detected condition, for example the output temperature of the air being delivered by the heater. The heater controllers 50,51 may typically comprise relays to connect and disconnect the heaters to the supply cable 52. Typically, the master controller may provide for operation of one or both of the heaters and may sequence switching on and switching off of the heaters to provide a desired operating sequence.

As noted above, if the heater system is operated the relay 41 will remain in its

second position until use of the heater system is stopped by way of the remote control. At this point, the master controller will return the relay 41 to its first configuration as illustrated in Figure 3. It will be noted that, as a result, the relay 41 is never required to switch any significant current. If it is in its first position (as illustrated) and the shower is in use the relay cannot be switched to its second position until use of the shower has ceased and accordingly no current flows through the relay at switching. Similarly, having switched the relay into its second position the relay will stay in that position until use of the heater has ceased. Accordingly, although the relay 41 is required, at different times, to carry the full operating currents of the shower and the heater, it is not required to interrupt current flow under load. This significantly reduces the degree of robustness required for the relay. In particular, relatively light contacts are required in the relay because no breaking of connections under load is required.

In relation to the heater itself, because the heater elements are controlled by separate heater controllers 50,51, each heater controller is required only to control half of the potential current load of the heaters. In practice, the controllers 50,51 may incorporate 18 amp relays to control 4kW heaters.

If desired, the master controller may incorporate indicator lights 54 to provide an indication of operating conditions and any fault states. The system preferably incorporates appropriate fault controls so that in the event of any detected fault (typically failure of the fan or over-current in any part of the system or any over-temperature in any part of the system) the system may be shut down and locked out until the fault is rectified.

It will be appreciated that in addition to providing the drying function which is the primary object of the invention, the device described above may be used simply to heat a room. Typically, a relatively short period of running (perhaps 30 seconds) will be sufficient to raise the temperature of a small bathroom to a very comfortable level. The dryer may accordingly be used to "pre-heat" a room before a shower is taken and used subsequently as a dryer.

Preferably, the duct 15 or the ducts 25,36 are shaped to prevent water being

splashed onto the elements and to obscure the elements from view from the inlet end of the duct. This may be achieved by appropriate profiling of the duct or by the inclusion of suitable baffles within the duct.

In a particularly preferred embodiment of the invention the inlets through which air is drawn from the room are fitted with filters to prevent particles of greater than a certain size being drawn into the dryer. It has been found that a nylon filter material having a nominal filter size of 500 microns is effective in preventing textile fibres and the like from being drawn into the dryer. The filter material is preferably supported between moulded plastic grids and can readily be cleaned by the application of a vacuum cleaner to the exterior surface to the dryer.

CLAIMS:

1. A dryer for drying a person who is wet after swimming, showering or bathing, the dryer comprising: a centrifugal fan having its axis of rotation perpendicular to the surface of a room ceiling or wall to which the dryer is mounted; at least one heater element located radially outwardly of the centrifugal fan whereby air delivered by the centrifugal fan is blown through the heater element; and a duct extending from the outlet side of the heater element to turn the air leaving the heating element through approximately 90° to be directed through an outlet nozzle into the room .
2. A dryer according to claim 1 wherein the inlet to the centrifugal fan is an opening in the ceiling or wall located directly in line with the centrifugal fan itself.
3. A dryer according to claim 1 or claim 2 wherein the fan and the or each heater element are contained within an enclosure which is open only to the room into which the heated air is directed.
4. A dryer according to any preceding claim wherein the or each heating elements is a cassette which is slotted into the dryer casing.
5. A dryer according to any preceding claim wherein two heater elements are provided on one side of the fan so that air flows successively through the heater elements.
6. A dryer according to any of claims 1 to 4 wherein two heater elements are provided, one on each of two opposite sides of the fan so that air flows from the fan in opposite directions through the respective heater elements.
7. A dryer according to any preceding claim comprising control means for controlling operation of the dryer, the control means being operative to control the

operation or the dryer and another electrical appliance connected to a common electricity supply so that simultaneous operation of the dryer and the other electrical appliance is prevented.

8. A dryer according to claim 7 wherein the control means has a normal configuration in which the incoming common electricity supply is connected to a first electrical outlet, and a second configuration in which the incoming common electricity supply is connected to a second electrical outlet, and including means for detecting a if a current is flowing through the first electrical outlet and, in response to a detected current, inhibiting the change-over of the control means from the first configuration to the second configuration.

9. A dryer according to claim 7 or claim 8 wherein the control means includes a remote control in the form of a hand-held or wall mounted unit which communicates with the dryer by means of infra-red or radio signals.

10. A dryer according to any of claims 7 to 9 wherein the control means includes means for controlling the speed of the fan and/or the output temperature of the dryer.

11. A dryer according to any of claims 7 to 10 wherein the control means includes automatic control of one or more predetermined operating sequences.

12. A dryer substantially as hereinbefore described with reference to the accompanying drawings