

SPECIFICATION

Infrared heating hair dryer

5 This invention relates to a hair dryer. More specifically it relates to a hair dryer which utilizes a selective range of wavelengths of infrared (IR) radiation for drying hair and a low velocity air stream that breaks up water vapor layers on the hair.

10 Prior art hair dryers utilizing IR heaters have been found to be cumbersome because of their use of large, conventional IR lamps. Also such known hair dryers have been found to produce excessive temperatures in the hair under normal conditions of hair drying. For instance, when placed at a distance of one inch from the hair, such a known dryer produces a temperature therein of 230 degrees C. These hair dryers do not use a selective range of wavelengths of IR radiation to dry the hair. It was found to be desirable to avoid frequent exposure of the hair to high temperatures. Changing hairstyles and customs have brought about a greater degree and frequency of use of hair dryers. The hair dryer of the present invention at that same distance from the hair produces a temperature therein of about 90 degrees C, which is more than sufficient for hair drying because of the characteristic of this dryer discussed below.

A hair dryer is provided with means for blowing air outwardly of said dryer, and an infrared radiant energy source, the improvement in the hair dryer comprising means in the dryer limiting the predominant energy emitted from the dryer to wavelengths of 0.8 microns and above. A preferred embodiment of the dryer of the present invention includes a fan for blowing an air stream at a relatively low velocity out of the dryer, an IR energy source for emitting infrared (IR) radiation from the dryer, a preferably anodized reflector which modifies the radiated energy by reflecting substantially only selected wavelengths, and a filter further to narrow the emitted IR radiation to the desired wavelength range. Suitably the IR energy source is a silicone carbide igniter such as is sold by the Carborundum Company under the trade name Globar and the reflector is suitably anodized, black, parabolic reflector.

In accordance with this invention, we have discovered that in order to dry wet hair most efficiently with an IR hair dryer, the IR wavelengths to be emitted from the dryer should be in the wavelength range generally approximating the IR absorption maxima of wet hair. We have also discovered that the sensible heat on the scalp at these wavelengths is considerably less during the drying process than at shorter wavelengths of IR energy. These wavelength regions encompass the strongest fundamental infrared absorption bands of molecular water and hair. The infrared wavelengths which fit this criteria are primarily those above about 0.8 microns. Wavelengths of greater than about 10 microns, e.g., those up to 25 microns, will be absorbed by wet hair and dry the hair, however, as the wavelength increases, the drying becomes gradually more inefficient. Therefore, we prefer IR radiation of

wavelengths of from about 0.8 to about 10 microns for the purposes of the present invention. The maximum IR absorption of wet hair is in the wavelength bands of about 2 to 3 and 6 to 8 microns and the most efficient drying occurs when radiation in these wavelength ranges is simultaneously emitted from the dryer.

Dry hair absorbs IR radiation very poorly and absorbs visible radiation much better. Thus, a further resulting advantage of this invention is that as the hair is dried, especially from the outer layers of the hair inwardly towards the inner layers, the radiant energy is transmitted from the outer layers towards the inner layers to assist in their drying process. Part of the heat of vaporization is supplied by the body heat from the scalp and, therefore, exercises a cooling, protective effect upon the scalp. As the hair becomes dry, then (in addition to scattering and reflection) more of the energy reaches the scalp and the cooling effect of vaporization is also at an end. Therefore an increase in the sensible temperature of the scalp is an indicator that the hair is now dry.

Accordingly, IR energy emitted at the above discussed wavelengths will be satisfactory for use in this invention and will dry hair at considerably lower than heretofore customary temperatures, usually at no more than about the 90 degrees C. The customary IR energy sources generally emit both visible radiation and IR. Various devices can be employed to restrict this radiation to the maximum absorption wavelengths of wet hair. Suitably an anodized aluminium parabolic reflector in combination with an IR filter which is transparent to the desired wavelengths can be used. The reflector absorbs the visible radiation and some of the IR radiation and the filter can be selected to allow transmission mainly only of the desired IR wavelengths. It may be desired to allow the emission of some visible red light to create possibly desirable illusions in the user. In order to assist in accomplishing the drying in as short a time as possible at low temperatures, it is preferred to introduce a low velocity air stream to carry away the water vapors from the surface of the hair without chilling or condensation and to assist in breaking up the water particles and to agitate the hair for better penetration of the radiation.

Fig. 1 is a partially broken-away, side view of a dryer of this invention.

Fig. 2 is a schematic view of a silicone carbide igniter useful in the dryer of Fig. 1.

Fig. 3 is a view showing the various components of the dryer of Fig. 1 in its disassembled condition.

Referring to Fig. 1, the dryer indicated generally at 10 includes a housing 11, and outlet grill 12, a handle 13, and a switch 14 in handle 13. Inside the dryer 10 is a fan motor 15, which operates a fan 16 that blows a low velocity air stream out of the dryer around the outer rim of the grill 12.

Disposed between the fan and grill is an IR energy source for emitting IR radiant heat which acts to dry hair. In addition, the air stream picks up heat by cooling the IR energy source and maintaining it at operational temperatures. This air stream assists in the efficiency of the hair drying operation since it carries

away water vapours from the surface of the hair, preventing buildup of layers of water vapor on the hair which shield the hair from radiant heat. The low velocity prevents the air from cooling the water vapor and causing condensation. The energy source depicted is a silicone carbide igniter 17 sold by the Carborundum Company under the Globar trade name. As shown best in Fig. 2, the igniter 17 includes an alumina fin 18, which terminates on one end of an alumina body member 19 shown in dotted line, which body member is coated with a recrystallized silicone carbide coating 20. This electrical resistor type heater is capable of heating up to about 1800 degrees F. in less than 80 seconds. The Globar element in one commercial form is sold under the designation Type CDI; Model 0206D; Voltage 80 ± 1 VAC; Current 2.0-3.6 amperes. Heating to 1800° F. in less than 60 seconds.

Each end of the fin 18 is supported in a slot of a block 21 to prevent movement of the igniter. Surrounding and supporting the coated body member of the igniter is a member 22, which has affixed on its inner surface two electrical contacts 23a and 23b. The contacts are conventionally connected to a switch 14 and ultimately to a power source for electrically energizing the igniter.

As best shown in Fig. 3, forward of an surrounding the coated body portion of the igniter 17 is a heater board support 24 around which is an open coil resistor 25 that is used to reduce the voltage of the motor 15 for operation in the dryer 10 of this invention. The support 24 also holds in place in the dryer 10 an anodized parabolic reflector 26. This parabolic reflector 26 preferably is made of aluminium and has on its reflecting surface a darkly pigmented, anodized coating to maximize the desired wavelength in the forward-directed IR radiation and to minimize the visible spectrum component in the forward radiation.

Maintaining the reflector 26 in place in the dryer is a reflector support 27, which also provides a surface against which an IR filter 28 abuts.

The filter 28 preferably filters out most of the IR radiation coming from the dryer except IR wavelengths of greater than about 0.8 microns and is made of a colored borosilicate furnace observation glass available from the Corning Glass Work, Corning, New York under the trade name "Code 7740". The composition of the filter can be chosen to allow predominantly IR wavelengths of about 0.8 to about 10 microns or IR wavelengths of about 2 to 3 and about 6 to 8 microns to be emitted. A grill 12 is holding the lens 28 in place.

In operation of the dryer, air is drawn into it through an appropriate inlet in the rear of the housing 11 by fan 16. The air is blown at low velocity over the rear surface of the reflector 26 and around the opening, indicated at 29, between the reflector 26 and the surrounding support and housing structures described above. As the igniter 17 heats up, it emits IR radiation. The air stream picks up heat from the igniter 17 and the resistor 25, as it flows through the dryer 10. The wavelength of IR radiation from the igniter 17 which is reflected by the parabolic reflector 26 is principally in the range of about 0.8 microns

and above, much or most or practically all of the remaining visible and IR radiation is absorbed. Thus, the air stream also picks up heat from the reflector 26. As the reflected IR radiation is emitted from the dryer 10, the wavelength can be further narrowed to remove more of the less preferred radiation by the filter lens 28. This results in an IR emission of a wavelength spectrum of greater than about 0.8 microns or from about 0.8 microns to about 10 microns or from about 2 to 3 and about 6 to 8 microns, depending on the particular filter used. Depending on the absorption characteristics of the filter, the reflector might be entirely omitted. Alternatively, depending on the appropriate selective reflectivity characteristics of the reflector, it might be possible to eliminate the need for the filter.

The IR radiation bands, which encompass the absorption maxima for wet hair, and harmonics thereof, heat essentially only the hair and water on and in it, causing the water to vaporize. The slow velocity air stream which is warm, blows away the water vapor, preventing it from building up layers and shielding the hair from further radiation. Because the air is warm and is moving at a slow velocity, it does not cool the hair or cause the water vapor to condense. Until the hair is entirely dried, it shields the scalp from the IR radiation and heat.

Thus, the IR radiation of the selected wavelengths and the air stream coact to dry hair sufficiently and relatively quickly at low temperatures when the dryer 10 of this invention is used.

It is contemplated that if only IR radiation drying is desired, the opening 29 can be redefined to vent substantially all the air stream from the dryer 10 without blowing it out through the grill 12. Also, it is contemplated that the IR energy source utilized can be one other than the igniter 17 described above, as long as it is capable of emitting IR radiation of the proper wavelength and is of a size adaptable to the hair dryer of this invention.

CLAIMS

1. In an infrared radiation hair dryer which contains means for blowing air outwardly of said dryer, and an infrared radiant energy source, the improvement which comprises means in said dryer for limiting the predominant amount of the radiant energy emitted from said dryer to wavelengths of 0.8 microns and above.

2. The hair dryer of claim 1, comprising a housing with an air inlet and an air outlet in said housing wherein said means for creating a movement of air comprises a motor that operates a fan which blows air from the dryer at a relatively low velocity, and said means for limiting the radiation comprises, a reflector which reflects predominantly infrared radiation of a wavelength of about 0.8 microns or greater out of the dryer, and an infrared filter that transmits predominantly infrared radiation having a wavelength of about 0.8 microns or greater.

3. The hair dryer of claims 1-2 wherein the predominant amount of infrared energy emitted by the dryer is in the wavelength range of from about 0.8 microns to about 10 microns.

4. The hair dryer of claims 1-2 wherein the predominant amount of the infrared energy emitted by



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the dryer is in the wavelength bands of about 2 to 3 and about 6 to 8 microns.

5. The hair dryer of claims 1-4 wherein the infrared energy source is a silicone carbide igniter.

- 5 6. The hair dryer of claims 2-4 wherein the reflector is anodized with a darkly pigmented coating for absorbing substantially all visible radiation and reflecting mostly only the infrared spectrum which is maximally absorbed by wet hair.

- 10 7. A hand-held hair dryer in accordance with any one of Claims 1 to 6.

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

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