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R. W. GOBLE
APPARATUS FOR DRYING AND TREATING HAIR OR OTHER
FIBERS VIA ULTRASONICS
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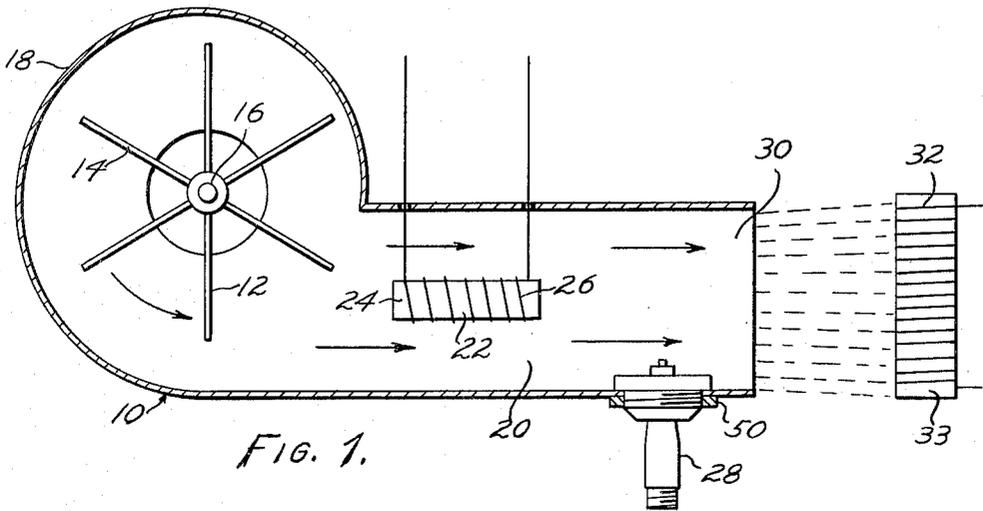


FIG. 1.

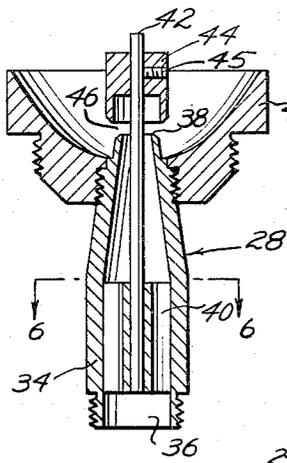


FIG. 2.

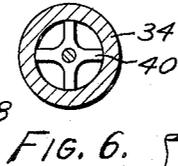


FIG. 6.

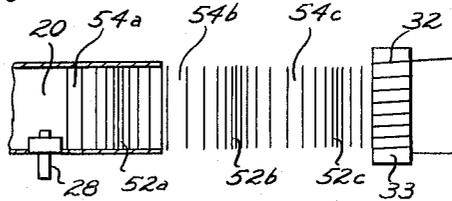


FIG. 3.

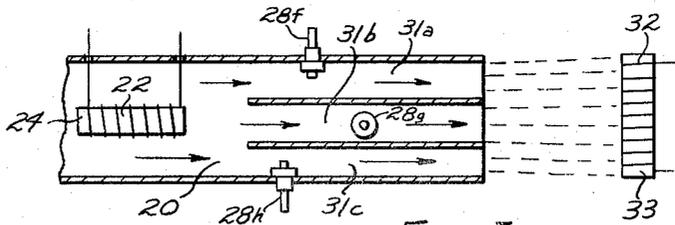


FIG. 5.

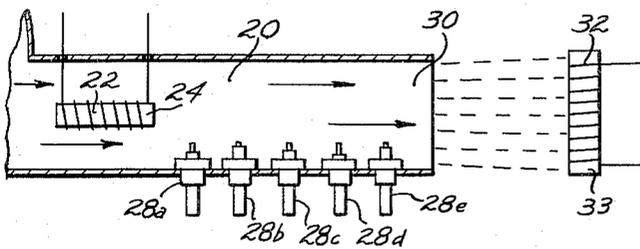


FIG. 4.

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APPARATUS FOR DRYING AND TREATING HAIR OR OTHER FIBERS VIA ULTRASONICS

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9 Claims. (Cl. 34-97)

This is a continuation-in-part of application Serial No. 190,924, filed April 27, 1962.

The present invention relates to a method and apparatus for drying and treating hair or other natural fibers. More specifically, this invention involves novel methods and apparatus for using ultrasonic energy in the drying and treating of hair and other natural fibers so as to produce a predetermined set therein.

Ultrasonics is defined as a general term referring to the generation, detection, and/or utilization of vibratory mechanical energy, usually but not necessarily beyond the audible range.

While various methods and apparatus have been employed for treating and drying of hair, much of the prior art has been found to be deficient in one way or another. Most of the present methods and apparatus are slow, laborious, not too effective and require the use of reagents which may damage the fibers being treated.

Accordingly, one of the objects of the present invention is to provide a novel method of treating natural fibers which avoids the deficiencies of the prior art and produces a selected degree of lasting results.

A further object of the present invention is to provide a novel and rapid method of treating natural fibers which avoids the use of strong chemical treating agents and provides positive results.

Another object of the present invention is to provide a novel method of drying hair or other natural fibers.

Another object of the invention is to provide a novel method of curling natural fibers including hair.

A still further object of the present invention is to provide new and improved apparatus for carrying out the novel methods.

According to the present invention, the method of treating hair or other natural fibers with ultrasonic energy comprises wetting the hair with an aqueous media, such as water, and arranging the hair or other natural fibers and forcibly restraining same in a predetermined configuration. The fibers are then contacted with a fluid stream which is modulated at an ultrasonic frequency by the application of ultrasonic energy thereto, in a manner to be later explained, whereby the fibers so treated will selectively remain indefinitely in the predetermined configuration on removal of the restraining force. The invention has been found to have particular utility and efficiency in the curling and decurling of human hair. It has additionally been found that modulating a heated air stream in the ultrasonic range in connection with hair drying produces a much more rapid and efficient drying of the hair.

Other objects and advantages of the invention will become apparent from the description hereinafter following and the drawings forming a part hereof, in which:

FIGURE 1 is a partly schematic and partly a plan view of one embodiment of the apparatus in accordance with this invention;

FIGURE 2 is a view in section of one form of the whistle which may be used in this invention for ultrasonically modulating the heated air;

FIGURE 3 is a diagrammatic view of the modulated air stream as it is believed it would appear on impinging the hair;

FIGURE 4 is a schematic view, with parts broken away to conserve space, of the apparatus shown in FIGURE 1

wherein the outlet end of the conduit is provided with a plurality of whistles mounted in the conduit;

FIGURE 5 is a schematic view, with parts broken away to conserve space, of the apparatus shown in FIGURE 1, wherein the conduit is divided into several channels each provided with a whistle;

FIGURE 6 is a view in cross-section along line 6-6 of FIGURE 2;

Referring now to FIGURE 1, there is shown an air blower and heating device indicated as 10. This may be merely a portable hair drying apparatus or it may be any of the large air heating devices used commercially, adapted to produce a heated or non-heated fluid stream. The fan 12 with its blades 14 are rotatably mounted within the housing 18 on the hub 16 and are rotated thereon by a suitable electric motor and the like, not shown. The housing 18 opens into an elongated conduit 20 and within the conduit is mounted a heating element 22 that heats the air which is forced past the heater 22 by the aforesaid fan 12. The type of heating element is not critical, however, it may be an asbestos board 24 around which are wound high resistance heating wires 26 through which an electric current is passed from a suitable current source. A suitable whistle means 28, to be described in detail hereinafter, is mounted in the conduit 20 downstream of the heating element and is preferably actuated by a relatively high pressure external source of air. The purpose of the whistle means 28 is to produce ultrasonic modulation in the heated air stream passing through the conduit 20 prior to its leaving the air heating device 10 at the exit 30. It will be noted that the whistle, which may also be a series of whistles, is mounted downstream of the heating element in order to provide the proper efficiency in the ultrasonic modulation of the heated air stream which ultimately will contact the hair fibers. If the whistle means were to be mounted upstream of the heating element, the desired modulated effect of the air would be substantially diminished by the presence of element 22 in the modulated air stream in passing through the conduit 20. The modulated air after leaving the conduit is then directed against the wet prearranged hair fibers 32 wound or constrained on a suitable form 33. The hair fibers are rapidly dried and thereafter substantially maintain their predetermined configuration for an indefinite period of time.

In a further embodiment of the invention shown in FIGURE 4, a plurality of whistles indicated as 28a, b, c, d and e are positioned in the conduit 20 downstream of the heating element 22 and mounted in a suitable manner. The principal requirements of the whistles are that they emit ultrasonic vibrations so that the heated air stream is properly modulated. The several whistles may emit ultrasonic vibrations at the same frequency or, if desired, they may emit ultrasonic vibrations at different frequencies as may be required for best results. For example, whistle 28a may emit vibrations which modulate the air stream at 15 kilocycles, whistle 28b at 20 kilocycles, whistle 28c at 22 kilocycles, whistle 28d at 25 kilocycles and whistle 28e at 27 kilocycles. The only major requirement of the frequency of the ultrasonic energy created when the whistles are actuated is that it should be above the audible range. The frequencies best suited for a particular hair fiber may be readily determined by experimental treatment thereof. Different frequency combinations may be made use of by substitution of whistles of different frequencies. Therefore, it is seen that in this embodiment the fan 12 with its blades 14 rotatably mounted in the housing 18 on the hub 16 forces air into the elongated conduit 20 past the heating element 22 and is then modulated to the desired frequency by the series of whistles 28a, b, c, d and e after which it leaves the apparatus at the exit 30. The thus modulated air is directed against the wet constrained

hair fibers in order to rapidly dry the hair fibers so that they will indefinitely retain their predetermined configuration.

In another embodiment of the invention as shown in FIGURE 5, the conduit 20 is separated in several separate independent channels 31a, b and c, posterior of the heating device 22. Each channel contains a suitable whistle 28f, g and h, mounted therein. All of the whistles are actuated by a high pressure air, the source of which is not shown. The several whistle means may also emit ultrasonic vibrations at different frequencies as may be required for best results.

The whistle means utilized by this invention is shown in FIGURE 2 and is of the stem-jet variety comprising a tube 34 having an inlet 36 and an outlet 38 tapered to a smaller diameter. A perforated plate 40 is positioned within the tube supporting a stem 42 which protrudes axially from the outlet 38. A cup 44 is axially supported on stem 42 with the opening thereof in opposed relation to outlet 38 to form an annular slot 46. A bell collar 48 is positioned on tube 34 near the outlet end thereof with the bell opening being directed opposite the opening of cup 44. The edges of the tube at the outlet and the edge of the cup 44 are tapered to a knife edge. When high pressure air is introduced into tube 34, the escape thereof between the tube outlet and cup 44 through annular slot 46 produces a high efficiency whistle. This type of whistle is very efficient and produces the necessary ultrasonic frequencies with a minimum volume of air. The size of the whistle and the positioning of cup 44 relative to outlet 38 determine the frequency of a particular whistle. The air stream passing through conduit 20 is modulated at the frequency or frequencies of the whistles mounted thereon.

In carrying out the present invention, strands of aqueously treated or wetted fibers, including hair, which are to be dried are forcibly restrained in a predetermined arrangement by a suitable means, and then are subjected to the heated ultrasonic modulated air stream emitted from conduit 20 via exit 30. It is found that drying natural hair by using a modulated air stream in the ultrasonic range will considerably hasten the drying effect without any deterioration of the individual hair fibers. Moreover, the hair fibers will tend to remain indefinitely in the predetermined configuration in which they were arranged after being subjected to the aforesaid ultrasonic modulated air stream during the drying thereof. This configuration will tend to be retained even though the fibers are later washed, bleached or subjected to other types of treatment.

It is not precisely understood why the process of the invention utilizing an ultrasonically modulated air stream operates to more efficiently dry the hair and other natural fibers. However, as is depicted in FIGURE 3 the modulated air contains low pressure zones 54a, b, c interspersed with higher pressure zones 52a, b, c and the repeated application of the low pressure zones to the wet hair fibers will tend to lift the scales located on the exterior surface of all individual hair fibers and thereby permit the easy and rapid vaporization of the water. It should be noted that when any heated air is applied to a wet hair fiber the moisture is removed therefrom by evaporation. However, the scales located on the exterior sides of all natural hair fibers tend to resist the removal of evaporated water and locks or bars the easy exit from the hair fibers of any water therein. It is only with the repeated application of the low pressure zones which occur in the modulated air as specified in this invention to the wet hair fibers that the aforesaid scales are lifted away from the exterior sides of the individual hairs and thereby will remove the obstacles which prevent the easy exit of the water therein and accordingly will cut the required drying time to an absolute minimum.

In a similar manner, it is believed that the extraordinary and novel curling of the hair when contacted with

a heated air modulated to ultrasonic frequencies as contemplated by this invention is achieved by the repeated application of the higher pressure zones of the ultrasonically modulated air to the wet hair fibers. This results in a constant pounding effect and will cause a stress reorientation of the hair fibers. It would appear that the molecular structure of the hair fibers has actually undergone a change in position under the constant and repetitious pounding of the higher pressure zones within the heated modulated air thereby resulting in a substantially permanent stress reorientation or curling of the hair. Of course, when a new curl or curling design is required the hair may merely be wetted again and constrained in the desired manner after which the properly modulated and heated air is applied thereto. This will again reorient the molecular structure of the individual hair fibers and result in a substantially permanent curling configuration of the hair.

Although I have described the invention with a certain degree of particularity, it is to be understood that the present disclosure has been made only by way of example and that numerous changes in the details of the invention and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed. For example, the air entering whistle 28 may be heated to provide the source of heated air or in addition to that from blower and heating device 10.

What is claimed is:

1. In a hair drier, a housing having an inlet and outlet, a fan mounted within said housing for forcing air through the housing, a conduit connected to receive air from the said housing outlet and adapted to eject said air out of said drier, a heating element mounted within said conduit for heating the air stream as it enters the conduit and a whistle mounted in said conduit in the flow of heated air downstream of the heating element as the air passes through the conduit, said whistle imparting an ultrasonic modulation to the air stream prior to and upon its emission from the conduit and thus outside of said conduit said modulated air being employed in the treating of natural and synthetic fibers.

2. The hair drier as defined in claim 1 in which a plurality of whistles are mounted in the conduit downstream of the heating element in order to insure proper ultrasonic modulation characteristics of the air emitted from the hair drier.

3. The hair drier as defined in claim 2 wherein the several whistles mounted in the conduit are adapted to modulate the air stream at different frequencies.

4. The hair drier as defined in claim 1 in which the whistle utilized is of the stem-jet type and imparts an ultrasonic modulation to the air stream at a frequency above the audible range.

5. In a hair drier, a housing having an inlet and an outlet, a fan rotatably mounted in said housing driven by a motor, said fan being adapted to force air through the housing, a heating element within said housing for warming the air prior to its exit from the hair drier, the improvement comprising a whistle mounted within the housing in the flow of heated air downstream of the heating element, said whistle being adapted to modulate the air stream at an ultrasonic frequency prior to and upon its exit from the said housing, said modulated air being employed in the treating of natural and synthetic fibers.

6. The hair drier according to claim 5 in which the whistle utilized is of the stem-jet type and imparts an ultrasonic modulation to the air stream with a frequency above the audible range.

7. In a hair drier, a housing having an inlet and outlet, a fan mounted within said housing for forcing air through the housing, a conduit connected to receive air from the said housing outlet, a heating element mounted within said conduit for heating the air stream as it enters the

conduit, said conduit being divided into a plurality of separate channels downstream of the heating element, each channel having a suitable whistle mounted therein adapted to impart an ultrasonic modulation to the air stream in its channel prior to its emission therefrom.

8. In a hair drier, a housing having an inlet and outlet, a fan mounted within said housing for forcing air through the housing, a conduit connected to receive air from the said housing outlet, a heating elements mounted within said conduit for heating the air stream as it enters the conduit, said conduit being divided into a plurality of separate channels downstream of the heating element, each channel having a suitable whistle mounted therein; said whistles each being adapted to modulate the air stream at a different frequency prior to its emission from each of said channels.

9. In a hair drier, a housing having a inlet and an outlet, a fan rotatably mounted in said housing driven by a motor, said fan being adapted to force air through the housing, a heating element within said housing for warming the air prior to its exit from the hair drier, the improvement wherein said housing is divided into a plurality of separate channels, each channel adapted to receive the air after being heated by the heating element and each

channel having a suitable whistle mounted therein adapted to impart an ultrasonic modulation to the air stream.

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