# United States Patent

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[54] **HAIR ROLLER INCLUDING INTERNAL CYLINDRICAL INSERT CONTAINING A HEAT STORAGE MEDIUM**
**4 Claims, 3 Drawing Figs.**


[52] **U.S. Cl.** ..... **132/39**
[51] **Int. Cl.** ..... **A45d 2/12**
[50] **Field of Search** ..... 132/33, 39, 40



[56] **References Cited**

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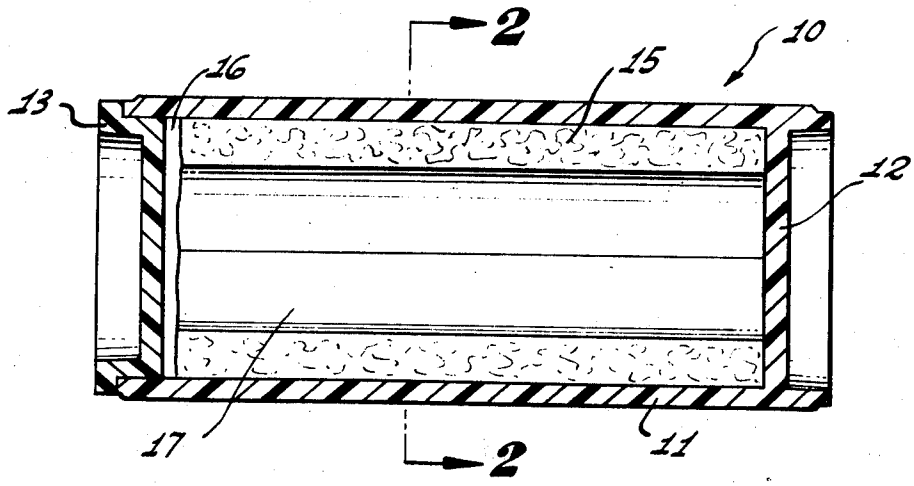
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**ABSTRACT:** A hair roller device comprising a tubular plastic sleeve sealed at both ends and containing a wad of absorbent material which is saturated with a substance such as paraffin wax having a high heat of fusion and being characterized by a change of phase from a solid to a liquid at a temperature below the boiling point of water.

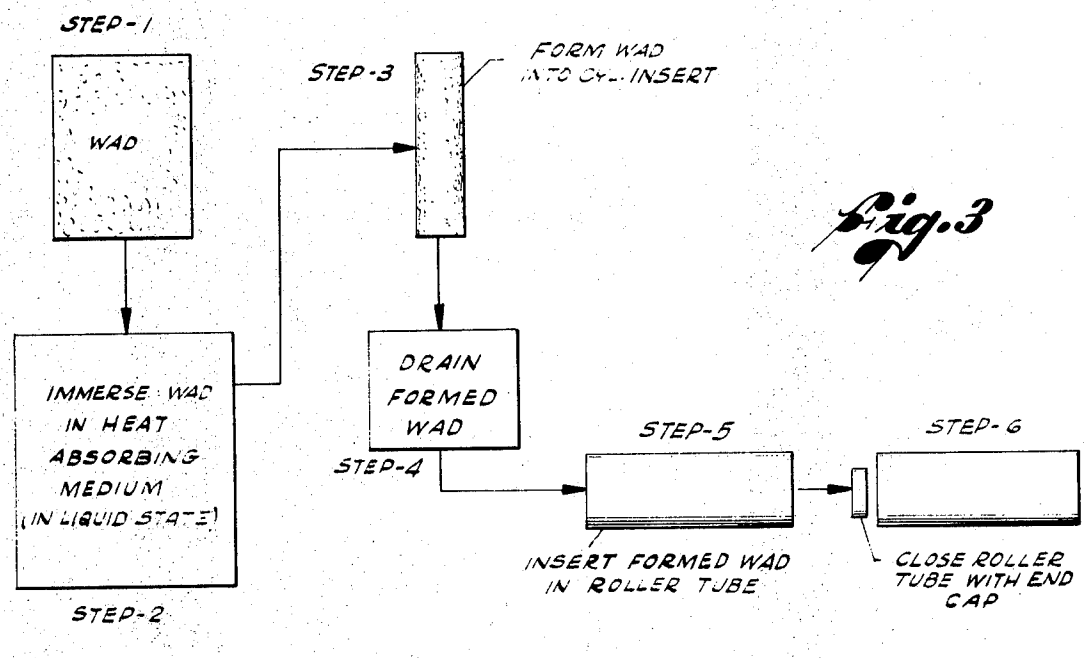



Fig. 3

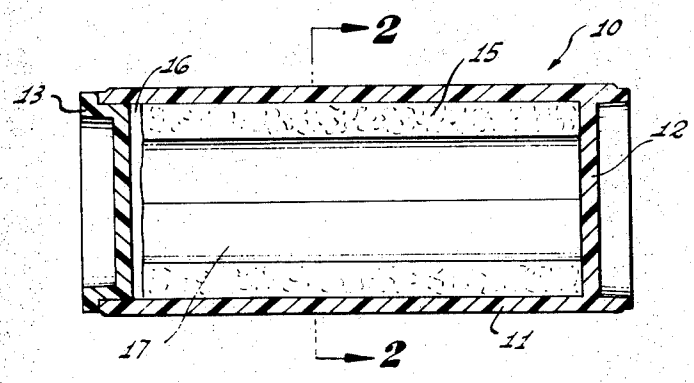



Fig. 1

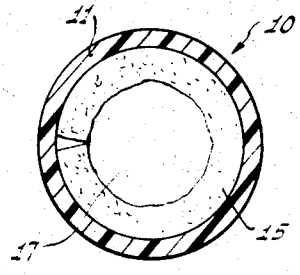



Fig. 2

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# HAIR ROLLER INCLUDING INTERNAL CYLINDRICAL INSERT CONTAINING A HEAT STORAGE MEDIUM

## BACKGROUND OF THE INVENTION

This invention relates generally to improvements in hair rollers and, more particularly, to a new and improved hair setting roller containing a material having heat of fusion properties which enhance the efficiency of heat storage within the hair roller.

It has become increasingly popular to set hair by means of sealed tubular hair rollers which contain a heat storage medium. Such hair rollers can be preheated in any appropriate manner so that a suitable amount of thermal energy is acquired and stored by the heat storage medium within the rollers. This stored thermal energy is subsequently given off by the heat storage medium and passes through the walls of the roller to elevate the temperature of the hair around the roller and thereby enhance the hair setting process.

Recently, the aforedescribed hair roller has been further improved by utilizing a heat storage medium which undergoes a change of phase from one physical state to another at a temperature below the boiling point of water and which is characterized by a relatively high heat of conversion, *i.e.*, the amount of thermal energy absorbed by the medium merely to change its phase without any additional increase in temperature. Typically, for a given weight of material, this heat of conversion, while not involving any additional increase in temperature, represents a considerable amount of thermal energy comparable to that which would be required to bring about a substantial elevation in temperature without a change in phase. Hence, the change of phase enables a large amount of thermal energy to be stored while, at the same time, maintaining the device at a temperature low enough to be compatible with human contact. The result is a hair roller with substantially enhanced heat storage properties capable of superior performance in hair setting application.

While the aforedescribed phase conversion hair rollers have generally served their purpose, they have not proven entirely satisfactory. In this regard, such rollers have shown some tendency to crack in use, whereby the heat storage medium is prone to seep through the roller tube and into contact with the hair and scalp. The result may be a serious burn, or depending upon the chemical nature of the heat storage medium, injury due to chemical reaction between the medium and the hair or scalp.

In addition, since the heat storage medium may expand considerably in the process of changing phase and rising in temperature, it has been the general practice to only partially fill the roller tube with the heat storage medium and thereby leave room for subsequent expansion. However, this results in dead air pockets within the roller tube, and such air pockets provide a heat insulating barrier between portions of the heat storage medium and the walls of the roller tube, so that the heat given off by the roller tube is not distributed uniformly over the outer surface of the tube. Hence, the reliability of such a device may be substantially reduced.

In addition to the foregoing, phase conversion rollers can be rather heavy, especially where a plurality of such rollers are used for setting hair, in view of the relatively dense core provided by the heat storage medium. This is particularly true with the larger size rollers where the volume of heat storage medium required to fill them would be inordinately great as compared to small and medium sizes.

Hence, those concerned with the development and use of hair roller devices have recognized the need for an improved heat storage type of hair roller which is light in weight, irrespective of size, is capable of more uniform heat distribution, and poses less of a danger to the user in the event of roller tube cracking. The present invention clearly fulfills this need.



## SUMMARY OF THE INVENTION

Briefly, and in general terms, the present invention resides in the provision of a sealed hair roller tube containing a concentric, hollow cylindrical insert in close-fitting abutment with the inner wall surface of the roller tube. The cylindrical insert is of absorbent material and contains a heat storage medium which has a high heat of conversion and preferably undergoes a change of phase at a suitable operating temperature. One example of such a heat storage and phase changing medium is paraffin wax. Preferably, the amount of heat storage medium absorbed by the insert is such that the absorbent material of the insert will be less than completely saturated when the heat storage medium is at its highest temperature in use. Hence, if the outer roller tube should crack for any reason during use of the roller on the head, the heat storage medium will not drip from the insert through the crack and, therefore, harmful contact with the user is prevented.

The aforedescribed structural arrangement concentrates all of the heat storage medium in its most useful location, *i.e.*, adjacent the inner wall surface of the roller tube. This arrangement also provides for more uniform heat distribution, since the heat storage medium and the roller tube wall are always in engagement and heat transfer is uniformly taking place all over. In addition, the resultant structure is relatively lightweight, since the more efficient dispersion of the heat storage medium (adjacent the inner wall surface of the roller tube) eliminates the need for as large a volume of the medium as is necessary in types not utilizing this arrangement.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an enlarged, longitudinal sectional view through the center of a hair roller device constructed in accordance with the present invention;

FIG. 2 is a sectional view taken along the line 2–2 in FIG. 1; and

FIG. 3 is a partially schematic flow diagram of a method of fabricating the hair roller device of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, and particularly to FIGS. 1 and 2 thereof, there is shown a hair roller 10 embodying the novel structural features of the present invention.

The roller 10 includes an outer roller tube 11 in the shape of a hollow cylinder of circular cross section. The tube 11 is preferably molded from a plastic material having no more than moderate heat conduction properties, such as polypropylene and the like.

The tube 11 is sealed at one end by a wall 12 integrally formed with the tube. The opposite end of the tube is sealed by a suitable cap 13. The cap is appropriately shaped to mate with the end of the tube 11 in such a manner that the over all appearance of the roller 10 is substantially symmetrical. The cap 13 is typically fabricated from the same material as the tube 11, and the cap may be secured in place at the end of the tube by any appropriate means, as by a suitable adhesive, ultrasonic welding or the like.

A concentric, cylindrical insert 15, of substantially circular cross section, is contained within the sealed roller tube 11. The outer cylindrical surface of the insert 15 is in close contact along its entire length with the inner wall surface of the tube 11. In this way, heat insulating dead air spaces are substantially eliminated between these contacting surfaces.

The insert 15 may be formed from a material characterized by high liquid absorption capacity, such as cotton sheeting, polyurethane or rubber foam and the like, usually about one-eighth inch in thickness.

The insert 15 contains an essentially uniform dispersion throughout its volume of an efficient heat storage medium. This may be the type of substance that undergoes a change of phase from one physical state to another, at a suitable operating temperature and is further characterized by a relatively

high heat of conversion, so that a large amount of thermal energy is absorbed by the material in the process of converting from its lower energy physical state to its higher energy physical state.

Typically, the heat storage medium dispersed throughout the insert **15** is paraffin wax of the like which is normally in the solid state at ambient room temperatures and converts from a solid to a liquid at a melting temperature of approximately 150°F. – 165°F. Since the latter melting temperature is below the boiling point of water, boiling water is one convenient means for transferring thermal energy through the walls of the roller tube **11** to the heat storage medium within the insert **15**. In addition, by limiting the maximum temperature of the interior of the roller tube **11** to something less than the temperature of the boiling point of water, the normal temperature drop across the cylindrical wall of the tube is sufficient to lower its outer surface temperature to a level which is compatible with the hair setting application to which the roller **11** is to be put, without any danger of inflicting burns upon the user.

The amount of the heat storage medium contained within the insert **15** may be any amount sufficient to retain the necessary amount of heat, but not to exceed the liquid saturation level of the material from which the insert is formed at the temperature it attains when in use on the head. Hence, of the outer roller tube **11** should crack for any reason while the heat storage medium is in the liquid state, the liquid medium will not drip from the insert **15** through the crack in the tube and into possibly harmful contact with the user, but rather will be retained by the absorbent insert within the roller.

As best observed in FIG. **1**, the length of the cylindrical insert **15** is such that it falls just short of filling the entire length of the sealed compartment within the tube **11**. This leaves a small end space **16** to provide room for thermal expansion when the roller **10** is heated. It will also be noted that the hollow cylindrical insert **15** provides a large air space **17** at the center of the roller **10** along its axis, thus providing a relatively lightweight construction, since the heat storage medium does not need to fill the entire tube compartment volume, but rather is uniformly concentrated along all inner wall surfaces of the tube **11** where enough of it is disposed to efficiently transfer the necessary heat out of the roller for a sufficient time period to achieve the desired result.

In normal use, the hair roller **10** is placed in an external heating means, such as a container of water, which is heated to bring the water up to boiling temperature. Boiling water insures a heating environment which is above the melting point or phase conversion temperature of the heat storage medium within the insert **15**, yet not too hot to cause excessive expansion or welting of the components themselves. The boiling is carried out for a minimum prescribed time interval, typically 15 minutes, sufficient to enable heat to pass through the cylindrical wall of the roller tube **11**, into the insert **15**, and to raise the temperature of the heat storage medium sufficiently beyond its melting point so that the heat of fusion or other thermal phase conversion energy is accomplished, and the resulting heat stored within the insert.

After the aforedescribed heating process has been completed, the rollers are removed and the remaining water is poured from the container for the hair setting application. Even though the interior of the roller tube may typically exceed a temperature of 150°F., the thermal drop across the wall of the tube **11** is sufficient to enable the roller to be handled comfortably, once it has been exposed to the air for a few seconds.

After the roller **10** has been applied to the hair, the heat stored within the insert **15**, including the heat of fusion of the heat storage medium, is gradually released and passed through the roller tube wall to the hair as the interior of the roller cools down to ambient temperatures. The rate at which heat is given off by the roller **10** to the hair can be controlled by choice of materials and wall thickness for the tube **11** and insert **15**.

FIG. **3** illustrates the steps of a typical manufacturing process for the roller **10** of FIGS. **1** and **2**.

In step **1**, a wad of material capable of absorbing a large amount of liquid is provided. In step **2**, the latter wad is immersed in the previously described heat storage medium while the medium is in the liquid state.

In step **3**, the wad is formed into the cylindrical insert **15**, while in step **4** the formed wad is drained to rid the wad of any excess heat absorbing medium beyond the liquid saturation level of the wad.

In step **5**, the formed wad is inserted into the roller tube and, finally, the roller tube is sealed with an appropriate end cap in step **6** to provide the completed hair roller.

The present invention satisfies a long existing need in the hair treatment arts for an improved hair roller which is relatively lightweight, economical, capable of substantially uniform heat distribution, and which poses no danger to the user in the event the roller tube should crack.

It will be apparent from the foregoing that, while a particular form of the invention has been illustrated and described, various modifications can be made without departing from the spirit and scope of the invention.

I claim:

**1**. A hair roller comprising:

a hollow, circular cylindrical plastic tube sealed at both ends to define a closed cylindrical compartment; and

a hollow, cylindrical insert concentrically positioned within said cylindrical compartment and having an outer cylindrical surface in abutment along substantially its entire length with the inner wall surface of said tube, said cylindrical insert being constructed from a single strip of a material having a relatively high liquid absorption capacity, said material containing a heat storage medium which is normally in the solid state at ambient room temperatures, said medium having a high heat of fusion and having a melting point below the boiling point of water.

**2**. A hair roller as set forth in claim **1**, wherein the length of said cylindrical insert is shorter than the length of said cylindrical compartment.

**3**. A hair roller as set forth in claim **2**, wherein said heat storage medium is paraffin wax.

**4**. A hair roller as set forth in claim **2**, wherein the amount of said heat storage medium contained within said material does not exceed the liquid saturation level of said material.