United States Patent

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[54] **ELECTRICALLY HEATED HAIR ROLLER WITH SELF-CONTAINED POWER SOURCE**
8 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** ..... **219/222,** 132/33 R, 219/240, 219/242, 219/531, 320/2
[51] **Int. Cl.** **A45d 2/36,** H05b 3/00, H01m 45/04
[50] **Field of Search** ..... 219/222–226, 221, 227–242, 531; 132/33 R, 36 R; 320/2

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Primary Examiner—A. Bartis
Attorney—R. W. Furlong

ABSTRACT: A hollow tubular hair roller about which hair may be wound incorporates a resistive heating element in its tubular wall structure. A battery, which may be rechargeable, is supported within the hollow interior of the roller and connected to the heating element. A zone of heat insulation at least one-sixteenth inch deep and having a thermal conductivity less than 0.003 cal./(sec.) (cm.²) (° C./cm.) is provided between the resistive heating element and the battery. The zone of insulation may be a tube of solid or foamed synthetic polymer or an airgap through which battery supporting nibs extend.

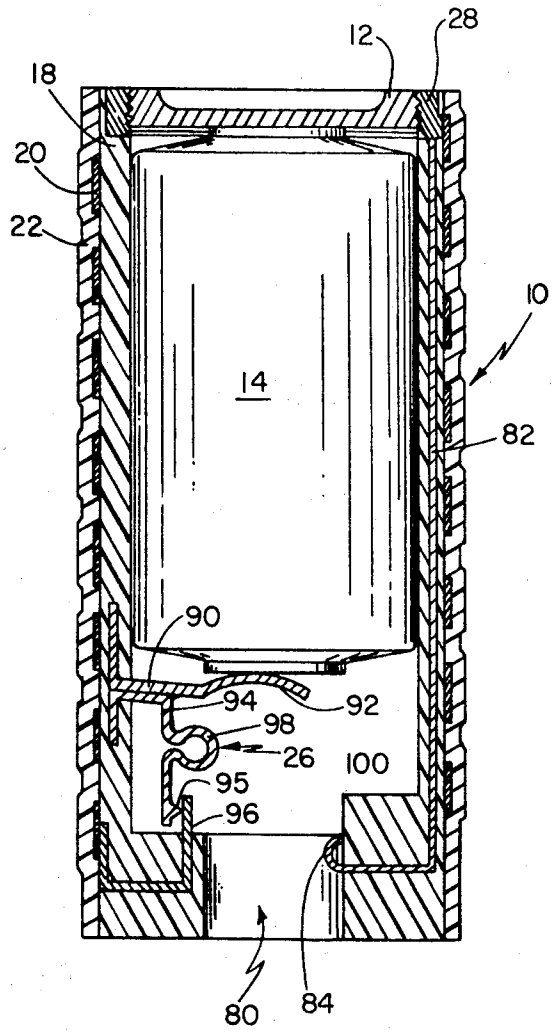


FIG. 6

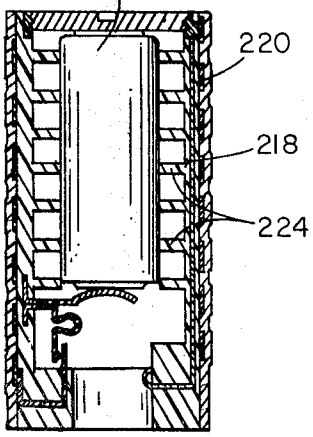
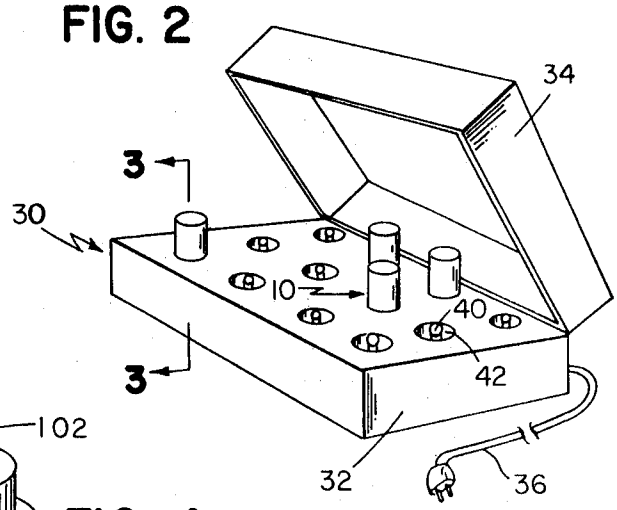


FIG. 2



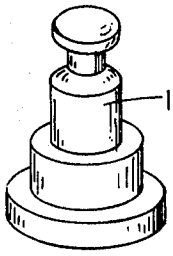
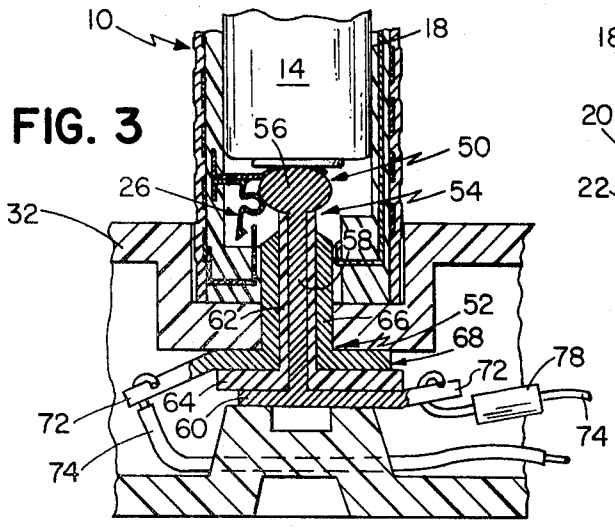


FIG. 4

FIG. 3



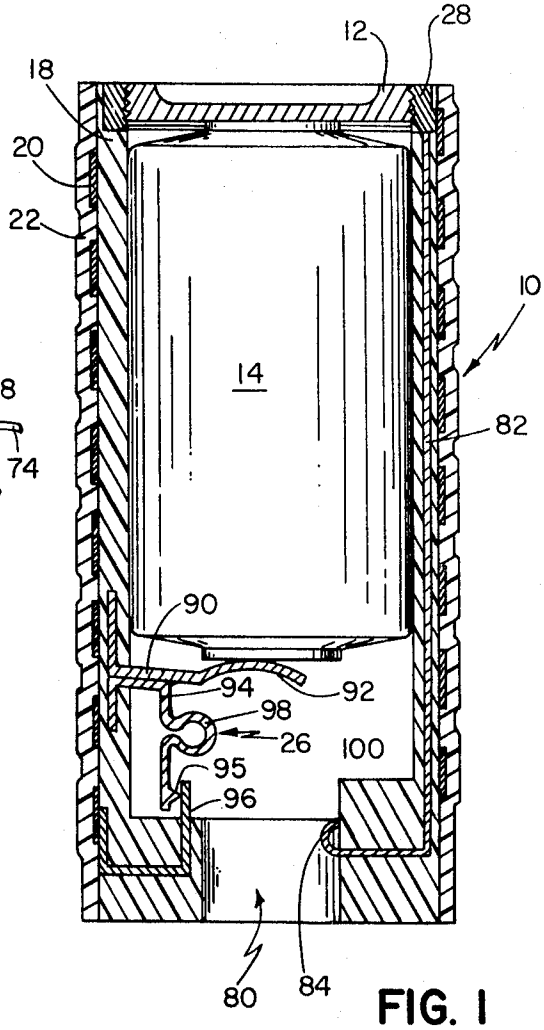
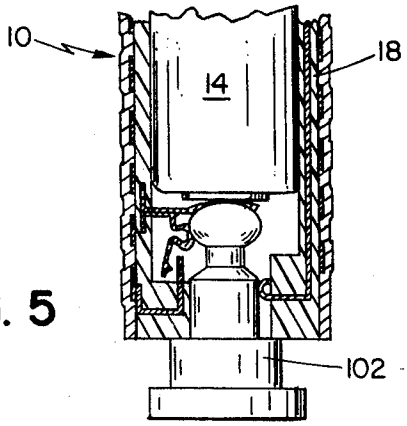


FIG. 1

FIG. 5



ELECTRICALLY HEATED HAIR ROLLER WITH SELF-CONTAINED POWER SOURCE

This invention relates to portable heating hair rollers.

Heat is useful adjunct in many cosmetic treatments as well as in the setting of hair. It is known that the bleaching, waving and dyeing processes are all usefully accelerated by heat. It is also known that the effects of conditioning treatments consisting of lanolated oils, olive oil, or fatty cationic compositions are enhanced by heat. Heat is also useful in the straightening of hair.

A variety of devices for the heating and setting of hair have been used, including hot-air blowers, preheated rods or rollers, and curlers containing chemical agents or embedded electrical heating elements energized by outside sources such as household current available at household outlets.

Hot-air blowers are usually bulky to store and inconvenient to use. In commercial establishments they are of the type that allow the subject to move her head slightly within the device but require a fixed body position. Home hot-air blowers generally include a cap which is fixed on the subject's head, allowing her to move more freely but even this mobility is limited by connections to the blower supplying hot air to the cap. The cap, moreover, is often insecurely and uncomfortably fixed on the subject's head.

Individually heated hair rollers have solved some of these problems, but caused others. Hair rollers have been devised to be heated before use and then applied to the head to have the heat transferred to the hair. Since the rollers cool on the head an initially large heat reservoir is required. Besides, the high temperatures needed are supplied by preheating devices which are often dangerous to use and control, and handling the rollers creates dangers of burns to the hands, scalp, and hair.

Other hair rollers have been devised which generate heat while on the head. They include curlers containing chemical agents which react to give off heat. Mobility is possible, but problems arise regarding activating the reaction and the danger of chemicals escaping and causing discomfort and even danger to the user.

Some heat generating rollers have resistive elements supplied with electricity from household outlets, usually through a stepdown transformer so that the voltage of elements on the head is at a safe minimum. Mobility of the user is limited by the electrical connection required. At low voltages, large currents and current-carrying equipment are needed to supply adequate heating energy. Wires leading to all the curlers are inconvenient and a safe way of disconnecting unneeded curlers must be devised.

The object of the invention, therefore, is to provide individual heating hair curlers that are comfortable and convenient to use, that are simple and safe to activate and use in the hair, that allow mobility of the user, that may be used in any number desired, and that are easily and inexpensively manufactured.

The invention features a hair roller made of a structure having an electrically insulated resisting heating element about which hair may be wound, the structure supporting a battery to be connected to the terminals of the resistive element. In preferred embodiments the battery is disposed within the structure and the structure has a low heat capacity and a zone of heat insulation at least one sixteenth inch deep between the resistive heating element and the battery, the zone having a thermal conductivity less than 0.003 cal./(sec.)(cm.^{2})(°C./cm.). In some cases the zone of insulation is a tube of solid or foamed synthetic organic polymer, in others an air gap through which battery supporting nibs extend.

Other objects, features, and advantages will appear from the following description of preferred embodiments of the invention, taken together with the attached drawings thereof, in which:

FIG. 1 is a longitudinal sectional view of a first hair roller embodying the invention;

FIG. 2 is a perspective view of a battery-charging unit for the rollers;

FIG. 3 is a longitudinal sectional view of a roller of FIG. 1 inserted in the battery-charged unit;

FIG. 4 is a perspective view of a dummy plug for deactivating the hair roller;

FIG. 5 is a longitudinal sectional view of a roller with the dummy plug inserted; and

FIG. 6 is a cross-sectional view of a second roller embodying the invention.

FIG. 1 shows a hair roller **10**, a conductive battery plug **12**, and a battery **14** inserted into the hair roller.

The hair roller includes a tube **18** made of Teflon (polytetrafluoroethylene), a fluorocarbon polymer. The tube has a thermal conductivity of about 0.0025 cal./(sec.)(cm.^{2})(°C./cm.). The tube is about one-sixteenth of an inch thick.

A resistive heating element **20** surrounds the outside of tube **18** in the form of a steel tape helically wound about the tube so that it is supported by and secured to the tube. Heating element **20** is covered with an epoxy varnish **22**, which together with tube **18** provides electrical insulation for element **20**.

The heating element on one end is electrically connected to a battery contact **26**. Contact **26** is supported by tube **18** so that the contact also acts as a support for battery **14**. The heating element's other end is connected to a conductive ring **28**, secured to the roller. Battery plug **12** is threadedly connected to the conductive ring.

The roller may be of any desirable shape other than the cylindrical shape shown. Cylindrical forms of the roller may vary in outside dimensions from one-fourth to 2½ inches in diameter and one-half inch to 12 inches in length. Long curlers may be flexible for uses such as setting a "page boy" hair style and may require more than one battery.

The tube **18** must absorb little of the heat given off by the heating element. This is accomplished by using a composite material of low specific heat, and as little of that material as possible, thus accomplishing the additional beneficial result of lightening the hair roller so that it may be worn comfortably. The material of which the tube is made must also provide sufficient strength to stand the stress of rolled hair, both at room temperature and at operating temperatures of at least 50° C.

In order to supply adequate heat for setting of hair and for various other cosmetic purposes the power supply, represented by a battery in this case, should yield one-eighth to 3 watts per square inch of surface area of the roller with a preferred range being one-fourth to 2 watts per square inch. For example, batteries whose voltage is about 1.2 volts and whose ampere hour capacity is in the range of at least 0.5 to 1.0 ampere hour and are designed for fast discharge rates, such as CH500 (Eveready), CH750 (Eveready), G.C. 5 (General Electric), G.C. 6 (General Electric), or G.C. 10 (General Electric), may be used effectively.

Even minimum energy cells, such as carbon-zinc batteries, can function in embodiments of the invention; alkaline batteries are obviously useful. For quick setting of dry hair the attainment of a temperature of at least 50° C. at the outer surface of the roller for at least 10 minutes is desirable. A battery and roller construction that yields a temperature of even 35° C. is useful for other applications such as bleaching, waving, dyeing or the like. When cells are used that are capable of discharging in still less time, the temperature reached is higher and the total energy required is much less. This is because the efficiency of setting of dry hair is roughly proportional to the temperature rise above 50° C.

Other resistive heating elements beside steel tape are useful, e.g. Nichrome wire, plastic-clad aluminum, carbon-filled fiber fabrics. The method of applying wire or tape to the tube surface need not be restricted to a spiral wind since a waffle pattern, or a longitudinal wind, is equally effective. Printed circuit resistive elements may also be utilized.

In order to avoid excessive loss of the heat generated by the resistive element to the battery itself which is a considerable component of the mass of the roller when used, it is essential that the battery be thermally insulated from the heating ele-

ment. A thermal insulation zone between the battery and heating element at least one-sixteenth inch thick is required, in which the thermal conductivity is no greater than 0.003cal./(sec.)(cm.²)(°C./cm.). cal./(sec.)(cm.

In the roller shown in FIG. 1 the required zone of thermal insulation is provided by tube 18. Many other materials may be used for the tube, such as nylon, polycarbonates, phenolics, glass filled polycarbonates, polyphenyloxides, paper and cardboard.

Battery 14 of the embodiment shown in FIG. 1 is rechargeable. A battery-recharging unit, generally designated 30, is shown in FIG. 2. Unit 30 includes a base 32, a cover 34 and a cord 36 supplying electric power to a conventional charging circuit (not shown). Battery-recharging elements such as plugs 40 connected to the circuit are found in base 32 of the unit within recesses 42 large enough to accommodate hair rollers 10.

Each recharging element such as plug 40 (FIG. 3) has an inner first conductor 50 and an outer second conductor 52 separated by an insulator 54. Inner first conductor 50 of the plug has a ball-like top 56 mounted on a core 58 which extends to a base 60. Insulator 54 includes a sheath 62 surrounding core 58 which terminates in a base 64 atop first conductor base 60. Outer second conductor 52 includes an annular portion 66, spaced below first conductor top 56, surrounding insulator sheath 62. Annular portion 66 terminates in a base 68 atop insulator base 64.

The bases 60 and 68 of the first and second conductors 50 and 54, respectively, have extensions 72 to which are connected leads 74 to a charging circuit. Battery-charging circuits are well known to those skilled in the art and such a circuit is not shown for purposes of clarity. A diode 78 is inserted in one of the leads to each plug 40 to prevent discharge into the charging circuit by a fully charged battery when batteries of varying states of charge are present in the unit.

The end of hair curler 10 adjacent contact 26 has an opening 80 which is circular in cross section, with an inside diameter slightly larger than the outside diameter of recharging plug 40. A lead 82 extending to conductive ring 28 but insulated from resistive heating element 20 terminates in a bowed metallic contact 84 on the interior wall of opening 80.

Contact 26 includes a support section 90 embedded in the roller. One part of support section 90 extends inwardly to become a battery supporting and contact arm 92. Another part of the support section (electrically connected to the first) extends in the form of a leaf spring contact 94 to a point contact 95 for connection with a lead 96 connected to resistive heating element 20. Leaf spring contact 94 forms, in one portion, an arcuate protrusion 98 extending into a cavity 100 between battery 14 and opening 80. Leaf spring contact 94 is biased so that pressure upon protrusion 98 breaks the electrical connection between point contact 95 and lead 96.

A dummy plug 102 (FIG. 4), made of electrically nonconductive material, has the same upper configuration as recharging plug 40.

During use, hair is wrapped around hair roller 10 in the ordinary fashion. Resistive heating element 20, connected at one end to one terminal of battery 14 via battery plug 12 and conductive ring 28, and at the other end to the other terminal via lead 96 and contact 26, is heated by the passage of electric current through it (FIG. 1). Battery 14 is supported within the roller by battery plug 12 and arm 92 of contact 26. The battery may be removed by unscrewing battery plug 12.

The batteries in the rollers may be recharged by using battery-recharging unit 30. Hair rollers 10, bearing batteries 14, are placed, opening 80 downward, into recesses 42 in the unit base (FIGS, 2 and 3).

Recharging plug 40 enters cavity 100 in the roller through opening 80 (FIG. 3). Ball top 56 of the first inner conductor 50 presses against protrusion 98 of contact 26, breaking electrical contact between battery 14 and lead 96 by moving point contact 95 away from lead 96. Ball top 56 also comes into firm electrical contact with protrusion 98 and therefore with one terminal of battery 14 through portions 94, 90 and 92 of contact 26. Annular portion 66 of outer second conductor 52, in opening 80, is pressed against by bowed metallic contact 84 and is therefore in electrical contact with the other terminal of battery 14 via lead 82, conductive ring 28 and battery plug 12. Electric current from the charging circuit, supplied to recharging plug 50 by leads 74 via plug extensions 72, is thus transmitted to battery 14 to recharge it.

When a roller 10 is removed from battery charging unit 30 point contact 95 returns to electrical contact with lead 96 and energization of resistive heating element 20 resumes. If delay in the energization of the heating element is desired dummy plug 102 may be inserted (FIG. 5). Having the same configuration as recharging element such as plug 50, the dummy plug will also cause point contact 95 to move away from lead 96, breaking the circuit of resistive heating element 20 and stopping heating. When the dummy plug is removed, heating resumes.

An alternate embodiment of the invention is shown in FIG. 6. Shown are a battery 214 electrically connected to an epoxy varnish covered resistive element 220 formed, as in the first embodiment, by a spirally wound steel tape mounted on tube 218. In the alternate embodiment, however, battery 214 is not laterally supported by the inner surface of tube 218 but rather by electrically insulating support elements such as nibs 224 extending inwardly from the inner surface of tube 218, the thickness of the tube in the alternate embodiment being only one-fiftieth inch, and the length of the nibs one-sixteenth inch.

In the alternate embodiment the use of nibs 224 reduces the amount of material in the tube of the hair roller and reduces its weight. It also makes possible the use of materials for construction of tube 218 of relatively high conductivity such as aluminum (properly electrically insulated) The one-sixteenth inch airgap between tube 218 and battery 214 serves as an effective component of the zone of thermal insulation required, since the thermal conductivity of air is about 0.0005 cal./(sec.)(cm.²For additional structural strength of the tube, however, the airgap may be filled between adjacent nibs with such air-containing, heat-insulating materials as glass wool, foam plastic or vermiculite. In the embodiments of FIG. 1 and FIG. 6 the spiral conductor may be replaced by a tube or cylinder of wire mesh, the cylinder being of large enough diameter to fit over tube 18 or 218. The latter may be perforated to reduce weight and heat capacity. If desired, the perforations may be of such size and shape as to match the interstices of the wire mesh, to which it is secured.

It will be appreciated that the individual rollers, including their batteries, are normally kept in recharging unit 30 which serves both for recharging and for storage. Whether the unit is connected to a power supply or not the batteries are disconnected from heating elements 20, 220 so long as the rollers are mounted on plugs 40, and no appreciable discharge of the batteries or heating of the rollers occurs during such storage. Accordingly, when removed from unit 30, the rollers are cold to the touch, but become warm during the process of wrapping hair upon them. If for any reason it is desired to have the rollers remain outside of charging unit 30 for a substantial period of time without heating, a dummy plug 102 is inserted in each roller to interrupt the circuit by breaking the contact between point 95 and lead 96.

Even if the rollers are removed from charging unit 30 and allowed to heat up before the hair is wrapped upon them, the low heat capacity of each roller makes it possible for the rollers to be handled and used without gloves and without risk of burning the hands or fingers, differing in this important respect from conventional curlers which are preheated before use and which depend upon the high heat capacity of the curler for their effectiveness.

Other embodiments will occur to those skilled in the art and are within the following claims.

What is claimed is:

1. A hair roller comprising

a hollow tube about which hair may be wound,

an electrically insulated resistive heating element extending about the wall of at least a portion of said tube,

said tube including means for supporting a battery in a location within the hollow interior thereof with at least a portion of the battery positioned in said portion of the tube provided with said heating element and

including a heat insulating zone substantially coextensive with said portion of the battery and at least one sixteenth inch thick, said zone having a thermal conductivity no greater than 0.003 cal./(sec.)(cm.^{2})(°C./cm.) and being disposed between said heating element and said battery location,

and means for electrically connecting said heating element to a battery so supported.

2. A hair roller as claimed in claim **1** in which said heating element is disposed in helical form about said tube and extends the full length of said battery location.

3. A hair roller as claimed in claim **1** in which said supporting means is arranged to maintain said battery in spaced relation to the wall of the tube, said space between the battery and the wall forming at least a portion of said heat insulating zone.

4. A hair roller as claimed in claim **1** in which the wall of said tube comprises a thickness inwardly of said heating element of at least one sixteenth inch, composed of material having a thermal conductivity less than 0.003 cal./(sec.)(cm.^{2})(°C./cm.) forming said heat insulating zone.

5. A hair roller as claimed in claim **3** in which said heating element extends the full length of said battery location.

6. A hair roller as claimed in claim **5** in which said heating element extends the full length of said battery location.

7. A hair roller as claimed in claim **1** in which said battery is rechargeable, said electrical connecting means is normally closed and is actuatable to open position, and said roller includes an element for connecting said battery to a source of recharging power and for simultaneously actuating said electrical connecting means to open position to disconnect said heating element from said battery.

8. A hair roller as claimed in claim **7** including an additional electrically nonconductive element interchangeable with said connecting element for actuating said electrical connecting means to open position to disconnect said heating element from said battery without connecting said battery to a source of recharging power.

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,603,765 Dated September 7, 1971

Inventor(s) Donald L. Underwood

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 59, "resisting" should be --resistive--;

Column 3, line 4, delete after "(°C/cm)." the words "cal/(sec)(cm.";

Column 4, line 12, after "dummy", insert --element such as--;

Column 4, line 14, after "recharging", delete --element such as--;

Column 4, line 38, insert after "(cm^2)", --(°C/cm).--.

Signed and sealed this 28th day of March 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents