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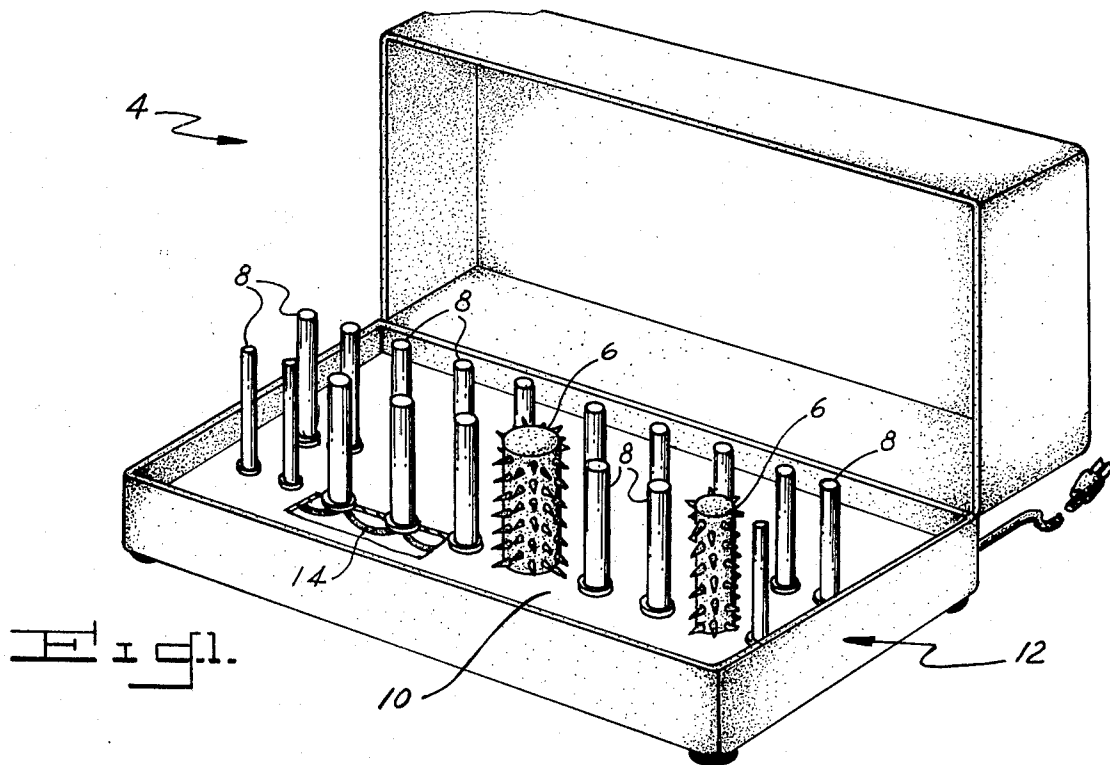
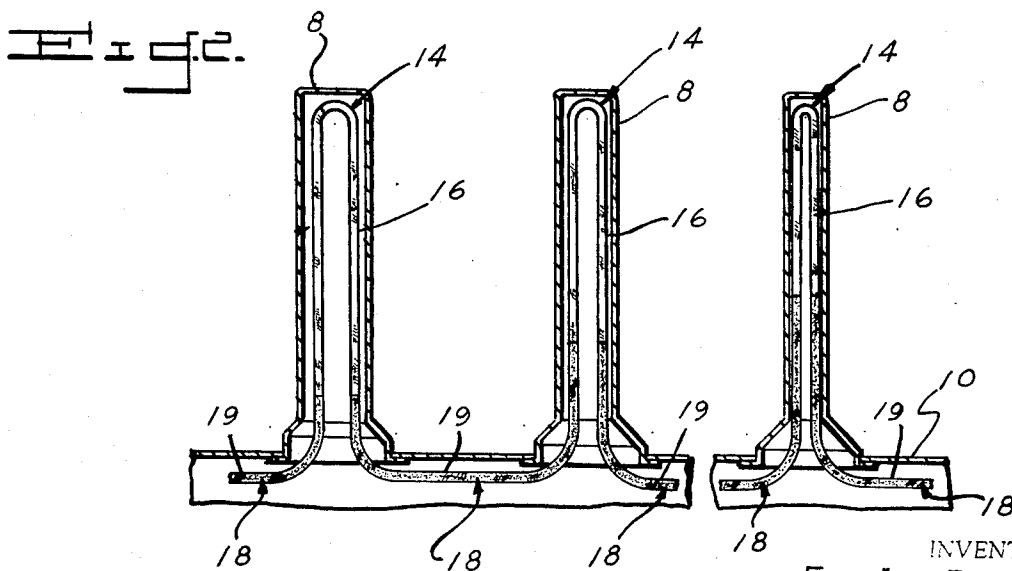
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3,705,974

HAIR SETTING APPARATUS

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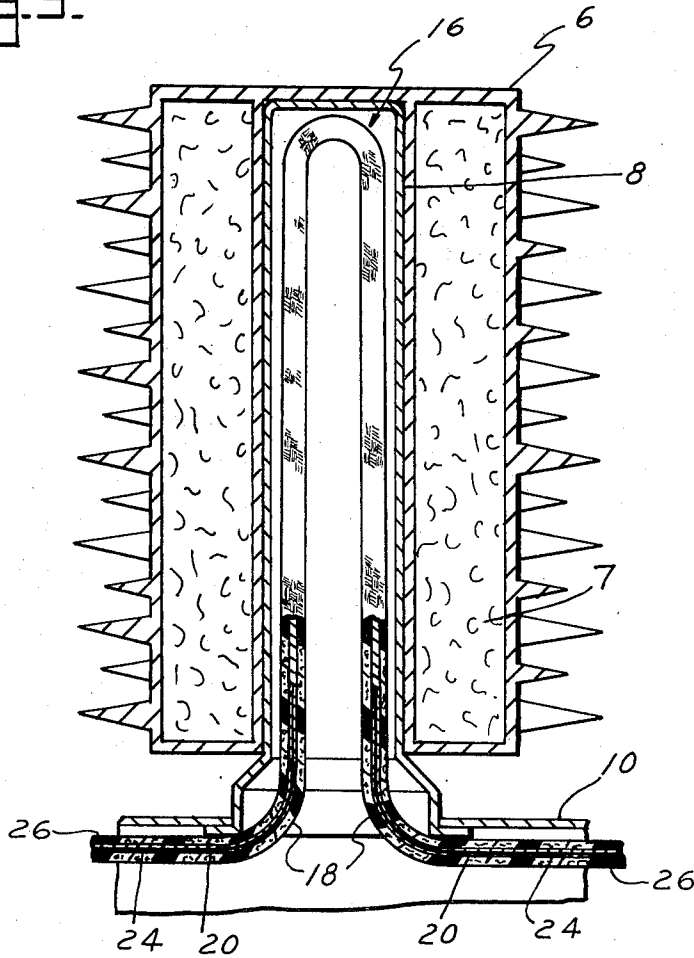
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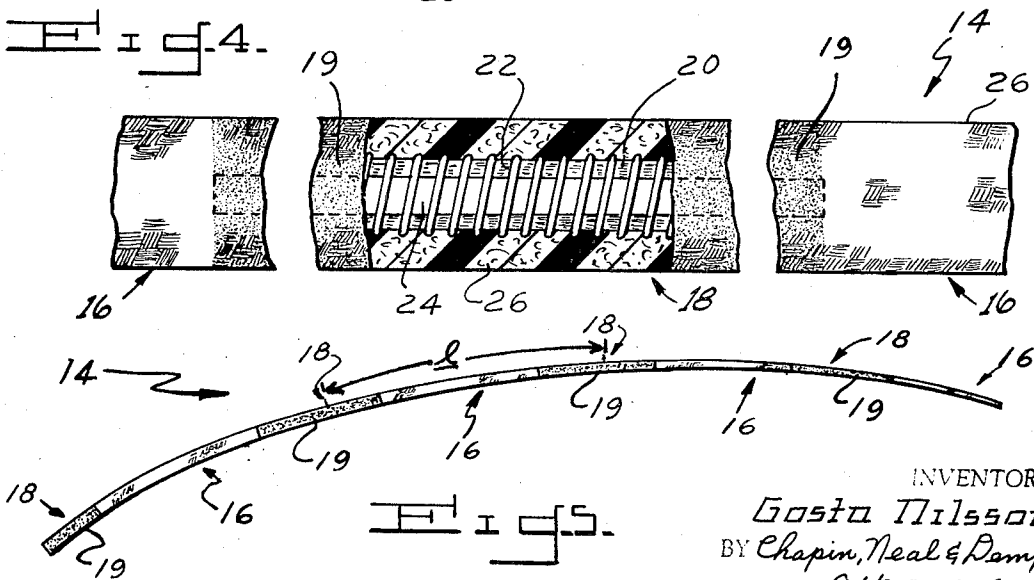
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HAIR SETTING APPARATUS

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1 Claim

ABSTRACT OF THE DISCLOSURE

Electrical hair setting apparatus having a plurality of heating elements in the form of tubular columns or posts of different diameters on which hair rollers or curlers to be uniformly heated may be removably fitted for heating preparatory to use in hair setting. A generally uniform diameter, flexible, continuous, cable formed of a resistance wire of uniform resistivity wound on a flexible core and having a plurality of alternate hot and cold sections formed by conductive strips of various lengths spaced along the length of the cable extending in a series of loops into and out of each of the heating posts with the hot sections disposed generally at the outer portions of the posts and the cold sections extending from within to without the heating posts and traversing the distance between adjacent posts. The cold sections are spaced apart so as to leave hot sections of various predetermined lengths with the longer hot sections being disposed in the larger diameter posts and the shorter hot sections in the smaller diameter posts whereby the power generated and heat given off by each post is a function, at least in part, of said predetermined length.

This invention relates to electrically heated curler sets which in the past few years have become very popular. These sets include a built-in electric heating element housed within a suitable storage or carrying case. A plurality of post elements project from the case and are heated by the heating element to raise the temperature of hair rollers removably telescoped over the post elements. In many of these curler sets individual resistors or electrical resistance heaters are installed in each heating post and each is connected to terminal pins or lead wires at the open ends of the posts. This means a very large number of connections or splices is required for each set. In previously available, twenty post curler sets, for example, as many as forty connections or splices have been utilized, and it will readily be appreciated by those skilled in the art that each splice is a source of possible trouble because of breakage or improper assembly and in such large numbers contributes to excessive assembly time and labor costs.

This invention relates to hair setting apparatus which includes upstanding heating posts some of which are of different surface areas and onto which are removably fitted hair curlers to be uniformly heated by the posts. The heat source for the posts comprises a flexible, uniform diameter heating cable arranged in a series of loops of uniform length, one loop being disposed in each post. The cable is composed of a resistance wire of uniform resistivity, helically wound about a flexible core, with shorting strips of different length disposed in spaced locations along the cable to provide alternate hot and cold sections of different length. The longer hot sections are disposed in the posts of larger surface area and the shorter being dis-

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posed in posts of smaller surface area, whereby uniform heating is provided for the different size curlers.

The principal object of this invention is to provide electrical hair setting apparatus of superior operating reliability and having constructional characteristics which are uniquely adapted to high speed and efficient assembly with consequent reduction in manufacturing costs as compared with similar apparatus heretofore available.

A further object of this invention is to provide for use in combination with a plurality of tubular heating elements a heating cable or wire of generally uniform diameter and flexibility with alternate cold or hot sections throughout its length whereby the power output of the cable over given portions of its length may be varied by the spacing and/or length of shorting strips used to form the cold sections of the cable.

The above and other objects and advantages of this invention will be more readily appreciated from the following description and with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view showing one type of hair setting apparatus embodying this invention;

FIG. 2 is a cross sectional view showing different size heating elements taken from FIG. 1;

FIG. 3 is an enlarged cross sectional view showing details of one of the heating elements of the FIG. 1 apparatus;

FIG. 4 is an enlarged portion, partly in section showing constructional details of the heating cable of the apparatus shown in FIGS. 1-3; and

FIG. 5 is a perspective view of a portion of the heating cable used in the apparatus shown in FIG. 1.

Referring in detail to the drawings, and in particular to FIG. 1, a curler set 4 embodying this invention comprises a plurality of hair rollers or curlers 6, one removably telescoped over each of a number of upstanding tubular post elements 8. The post elements are secured to a base plate 10 which is supported in any convenient manner in a suitable case 12. In the embodiment shown, the posts are of equal length, on the order of $2\frac{1}{2}$ ", but, as shown, are of three different diameters, depending upon the size of rollers each is adapted to receive. The surface area of the large posts is approximately 3.5 sq. in., of the medium size posts 2.9 sq. in. and of the small posts 2.3 sq. in.

The rollers 6 may be of any suitable construction including the type containing a heat storage material as disclosed in U.S. Pat. No. 3,257,541. As shown in FIG. 3, the curlers may be of a double wall construction filled with an ablative material 7 having a high heat of fusion whereby the rollers once heated will retain for a relatively protracted time an effective hair-setting temperature. This temperature is generally considered to be in the neighborhood of 100-140° F. In this temperature range the hair, without danger of damage, may be set and, if wet, dried within a reasonably short period of time commensurate with the time during which the rollers remain effectively warm.

To encourage widespread acceptance of such hair-setting apparatus, it has been found that the rollers must be heated to an operating temperature within a fairly short time or within a matter of a few minutes after the set is "plugged in" or turned "on." For explanation of this invention, a five minute heating period has been provided for.

The base plate 10 and posts 8 are preferably made of a suitable metallic material, such as aluminum for the rapid transfer of heat from the heating cable 14 disposed within each of the upstanding post elements 8. With commercially available rollers of the type disclosed in Pat. No. 3,257,541, it has been found that a heating post temperature of about 500° F. will produce the desired curler temperature of 100–140° F. In order to achieve this surface temperature in five minutes, it is necessary to dissipate approximately 11 watts in the small diameter posts, 15.4 watts in the medium posts and 17.5 watts in the large posts.

A heating cable 14 for connection to a suitable electrical power source, which may be of the type disclosed in U.S. Pat. No. Re. 26,522, is composed of a series of alternate hot or heat emitting portions 16 and relatively cold or non-heating portions 18. The cold portions of the cable are marked as at 19 with a suitable dye so that the hot and cold sections are visually distinguishable during assembly of the apparatus. Each hot section and adjacent cold sections may be said to form a heating element or loop-forming-portion of approximately equal overall length, shown at 1 in FIG. 5. In the embodiment shown, the loop-forming-portions 1 of the cable are formed into loops and fitted into the tubular post elements. The hot sections 16 are disposed in the upper ends of the posts and the adjacent unheated or cold sections 18 extend from the lower or inner end of the tube outwardly of the tube and into the next adjacent heating post. This assembly may be accomplished by winding the insulated heating cable over the fingers of an insertion jig (not shown) and inserted into all the posts simultaneously. In this manner, a series of heating loops are provided, one within each post, and because each loop has short circuited extremities, heat will not be generated at the base plate of the heating unit where it would serve no useful purpose and where it may, because of the low rate of heat transfer at that location, cause overheating of the cable 14 or the case 12 on which the base plate is mounted. Each cold section 18 serves three functions: first, it acts as a terminal pin extending from the end of the hot sections, secondly, it serves as a lead wire from post to post and thirdly, it serves to provide a variable watt output for each different size post as will be hereinafter discussed.

The heating wire or cable comprises a flexible core 20 (FIG. 4) which is in the form of a continuous length of heat resistant insulation material, such as fiberglass, asbestos or suitable synthetic fiber of sufficient thermal and mechanical properties for use in curler sets of the type shown. The core is preferably of small diameter which may be on the order of $\frac{1}{32}$ of an inch. A flexible resistance wire 22 is wound helically around the core continuously from one end of the core to the other. The resistance wire may be of any suitable resistance material with a temperature coefficient most suitable for the desired purpose. The resistance and heating capacity for the wire selected is determined by the resistance of the wire and the pitch of the resistance wire about the core.

Electrically conductive material is disposed longitudinally at predetermined spaced locations along the length of the core. The conductive material may comprise flexible wires, ribbons, strands or strips 24 of metallic material disposed longitudinally in spaced locations along the core. Lengths of conductive material 24, preferably underlie and electrically short circuit the overlying convolutions or coils formed by the resistance wire 22. But it is also within the scope of this invention that the conductive strips which lie in contact, and short out lengths of conductive material may be disposed outside the convolutions of the resistance wire so long as it is held in intimate contact with the turns of the resistance wire over which it extends so as to short circuit the turns with which it is in contact. As the element comes from a serving spindle it may be wound on a suitable spool which may be marked with appropriate identifying data, such as the heating capacity of the wire. Thereafter, as will be de-

scribed below, the wire is insulated throughout its length as at 26.

The lengths of conductive material may also be integral with and constitute a part of the resistance wire itself or they may be discrete lengths of material which are preferably fitted between the core and resistance wire during the operation of serving the wire about the core. If the lengths of shorting material are integral with the resistance wire, cold sections may be formed during the serving operation by greatly increasing the pitch of the wire. Where the shorting material is in the form of strips, separate from the heating wire, the strips are preferably fitted between the core and the resistance wire during the operation of serving the wire about the core and the resistance wire is wound with sufficient tightness to hold the lengths of shorting material in place on the core. The conductive material used to short the resistance wire may be formed of solid or laminated metallic foil, preferably including a material of good conductivity such as copper or the like and may also include a ferromagnetic material to aid in the detection of the shorted sections in the manufacturing process after the wire has been completely insulated throughout its length. The shorting strips are preferably of a thickness which does not substantially increase the cable diameter nor reduce its flexibility and are of selected length so that the cold sections will properly accomplish the three functions described above. In the embodiment shown, the cold sections may vary from about 2" to 4", depending upon how far the section extends into the tube and the distance between adjacent post elements. It will be noted that the cable including its hot and cold sections is of generally uniform diameter and flexibility which is important since it must be fitted into the post elements and be bent around corners in passing from post to post.

If a length of heating wire constructed as described above, were connected to a source of electrical potential, the coils of the closely spaced helix-wound resistance wire would become heated, except where those coils are shorted by the lengths of conductive material 24 in contact with the turns of the resistance wire. The shorted portions remain substantially unheated or "cold," thus the wire is constituted of alternate "hot" or heat generating and "cold" portions throughout its length. Preferably the resistance wire 22 is served about the core at a constant pitch. Nevertheless, even with constant pitch, the heating cable may be fabricated to generate different power output over equal portions of its length, for example the loop-forming-portions 1 fitted into each heating post. This variable power output may be obtained by varying the length and/or spacing of the shorting strips 24 to leave for each post different length hot sections. In this regard the resistance wire serving machine can be programmed to produce alternate cold and hot sections of varying lengths. The choice of longitudinal spacing between the cold and hot sections depends upon the length of heat emitting wire required for the curler units or other heating harness or apparatus in which the wire is to be used. It will be realized that the serving machine could also be programmed to serve the resistance wire so as to change from one pitch to another as the wire is being wound over a shorting strip. In this way hot sections of equal length can be made to dissipate different power outputs each with cold sections extending from the extremities thereof.

As shown in one illustrative embodiment of the invention, FIGS. 2 and 3, a loop of heating wire extends into each of the post elements. Since each loop includes one length which extends from the mouth or entrance of the post to a point adjacent the upper or closed end of the post and a second length extending downwardly again to the open end of the post. This means that each loop forming portion 1 of the cable is about 6 inches or approximately twice the post height plus one inch to allow for the spacing between posts. Thus, each post with the

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heating wire or cable fully inserted therein contains approximately 5 inches of cable. But, as has been pointed out above, since the surface area of the different size posts vary, the power dissipated by each of the different size posts must also be different in order to achieve uniform heating of the hair setting rolls of different diameter. In the preferred embodiment of this invention this is accomplished by varying, for each loop, the length of the hot 16 and consequently also the length of the cold sections 18 for each post. For example, in a 20 post 10 curler set with 6 large posts, 10 medium size posts and 4 small posts, it was determined, as pointed out above, that in order to heat the rollers to a proper temperature in 5 minutes, the large posts dissipate 17.5 watts, medium posts 15.4 watts and the small posts 11 watts. This means a total power dissipation for the 20 posts of about 300 watts.

Since the curler sets are constructed and particularly adapted for home and travel use, they are usually designed to operate on 115 volts and a thermostat is provided in the heating cable circuit to maintain the curler posts at the proper temperature once it has been attained. The total resistance (R) of the sets is equal to $(115)^2 \text{ v.} / 300 \text{ w.}$ or 44 ohms. It may thus be determined that the current flow in the cable is $115 \text{ v.} / 44 \text{ ohms}$ or 2.6 amps. Based on the total power requirements of these sets, it will be appreciated that the large post must have a resistance of 2.6 ohms or W/I^2 or $17.5/6.8$. Similarly, the resistance of the medium and small posts may be determined for the illustrated embodiment as 2.3 ohms and 1.6 ohms, respectively.

In the particular set herein being described by way of illustration, all the heating posts have a height of about $2\frac{1}{2}$ inches, as discussed above, each with a more or less equal length of heating wire of about 5 inches. It has been learned that it is desirable to have a cold terminal portion on the end of each hot section of at least about $\frac{1}{2}$ inch. This leaves a maximum effective heating length or a hot section 16 of about 4 inches for the large size posts. With a 4 inch length the resistance per unit length of the heating wire may be computed as $2.6 \text{ ohms} / 4 \text{ in.}$ or .65 ohms per inch. In this way the maximum watt density of the cable has been established and from this, the length of the hot sections for each of the other size posts can be readily determined as follows:

Length of hot sections for medium posts— $2.5 \text{ ohms} / .65 \text{ ohms per inch} = 3.5 \text{ inch}$ (approx.)

Length of hot sections for small posts— $1.6 / .65 = 2.5 \text{ in.}$ (approx.)

Thus for a cable having loop-forming-portions 1 of about 6", it has been computed that the hot sections be 4", 3.5" and 2.5", respectively, for a the large, medium and small posts.

Having established the watt density of the cable and the length of hot sections required for each heating post, the heating wire serving apparatus may be programmed to wind the heating wire uniformly about a core and apply shorting strips as appropriate. For this example, the proper pitch would be set to achieve a constant resistance of .65 ohms per inch (7.8 ohms per foot).

In the embodiment shown the five inch length of wire may be installed in each heating post without the necessity of changing the type of resistance wire used or the pitch at which it is wound on the supporting core. Instead, a cable of variable power output per unit length is obtainable by the placement of longitudinally extending strips 24 which electrically interconnect the turns of the resistance wire with which each strip is in contact. The strips are of such length and spacing so as to provide not only the desired hot sections for each post, but also unheated, terminal sections which will extend from within to without each of the post elements and also traverse the distance between adjacent posts. Thus for each loop-forming-portion 1 of the cable which in the example shown 75

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is approximately 6" in length, the hot section 16 dissipates different wattages. By varying the lengths of the cold sections, a cable has been provided with hot sections of 2.5", 3.5" or 4" in length. In this way, exactly the desired power is generated by the heating cable for each particular size post and the heat is confined to within the heating posts where heat transfer to the curlers or rollers 6 is sufficiently rapid to eliminate the possibility of overheating. Thus a cable of integral construction and uniform diameter and flexibility throughout its length may be used in a heating unit having a plurality of posts of different power requirements without the necessity of making any "connections," "couplings" or "splices" to terminal pins, rods or wires, as was heretofore common practice in the manufacture and assembly of such units and in the preferred form of the invention without changing resistance or winding pitch for different size curler posts. Furthermore, when the wire is wound in a program for the proper placement and length of a shorting strip, it may also be insulated over its entire length as a continuous operation.

As described, the heating cable 14 is composed of the flexible core and helically wound lengths of conductive material interconnecting the lengths of resistance wire to provide unheated or shorted sections and provided with an insulating cover 26 circumferentially enclosing the core, resistance wire and shorting strips. The cover 26 extends from end to end of the core and is of uniform cross-sectional size throughout its length. The cover may be formed of insulating material which is capable of withstanding relatively high temperatures, such as fiberglass braid or other suitable material. For lower power requirements than the unit described, it may be feasible to employ an extruded insulating coating of polyvinyl chloride or silicone rubber. The type of insulation selected depends upon the requirement of the apparatus in which the wire is to be used. One method of coating the core and resistance wire is to lead the wire through an extruder or braiding machine. After the insulation is applied, the wire may be again wound on a spool, but before doing so it is preferable that the shorting portions of the heating wire be located by a suitable detection system, such as an induction coil and clearly marked as at 19, so that the hot and cold sections are positively identified, which is important in the fabrication or assembly of heating harnesses, such as curler sets.

Having thus disclosed the invention, what is claimed is:

1. Hair setting apparatus comprising a plurality of tubular heating posts of generally uniform height, at least some of which are of different diameters for removably receiving and uniformly heating hair setting curlers of different diameters to fit closely on each heating post, an integral, insulated electrical heating cable including a flexible core, a resistance wire of uniform resistivity wound helically about said core with a generally uniform pitch, electrically conductive material of different lengths extending along said core at spaced locations and shorting out the turns of the resistance wire to provide cold sections and between adjacent lengths thereof alternate hot sections, at least some of which vary in length, and a continuous covering of insulation about said hot and cold sections, said cable arranged to form a series of loops of generally the same length, at least one of said loops extending into each of said posts and comprising a hot section and cold sections extending continuously from the outer ends of the hot section in one post to another hot section disposed within another of said posts, the shorter hot sections of said cable being disposed within the tubular posts of smaller diameter and the longer of said hot sections being disposed within the posts of larger diameter, whereby the resultant power generated during energization of the said heating cable by posts of different surface area varies as a function of the length of said hot sections.

(References on following page)