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3,345,993

POLYURETHANE FOAM END WRAP AND PERMANENT WAVING PROCESS EMPLOYING SAME

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ABSTRACT OF THE DISCLOSURE

An end wrap consisting of open-celled polyurethane foam of specified porosity and thickness employed to facilitate the winding of hair tresses on curlers in the cold permanent waving of hair, and a permanent waving process in which the hair is wound upon curlers with the aid of such end wraps.

The so-called "cold permanent waving" of hair is in part accomplished by treating the hair with a reducing composition which will break the disulfide linkages present in keratin and thereby soften and plasticize the hair. The reduced hair is then placed in a desired configuration and the disulfide linkages are replaced by an oxidation (neutralizing) step, and the hair tends to remain in the new configuration.

In commonly used prior art cold waving processes, the hair is saturated with a keratin-reducing composition and wound around curlers or other suitable devices. The wound hair is resaturated with said solution and after sufficient time has elapsed to effect the desired keratin reduction, the hair is rinsed and "neutralized" by chemical or air oxidation. The manipulation of hair saturated with keratin-reducing solutions is messy and difficult. Moreover, some irritation to the hands may occur from contact with the solution if the time required to wind the hair on curlers is excessive.

Difficulty is most often encountered in wrapping the free ends of the hair tress upon the curler. To cope with this problem most commercial permanent waving kits contain small square or rectangular pieces of paper called "end wraps" which are folded, placed about a hair tress, and moved to a position wherein they embrace the hair tress and extend beyond the free end thereof. Although paper end wraps greatly facilitate rolling the hair on the curler, the keratin-reducing agents which are typically used render the hair slippery and the hair tress tends to slide free. Further, paper end wraps can retard circulation of the waving chemicals to the free ends of the hair which are at the center of the rolled tress.

A variety of fabrics have been used for end wraps in place of paper, but these materials too are deficient in one way or another. For example, wool, wool flannel, felt, and cellulose acetate have been used for this purpose; however, these materials react with mercaptans or alkalinizing agents and are not satisfactory. Further, such materials are usually of a thickness such that undesirable "bulking" occurs and too large a curl is formed.

It is an object of this invention to provide an improved end wrap which will facilitate winding hair tresses on a curler in a cold permanent waving process.

It is a further object to provide an end wrap for use with keratin-reducing compositions and neutralizing agents which will not significantly impair the flow nor react chemically therewith.

It is a still further object to provide an improved method for permanently waving hair.

Other objects and advantages features will be apparent from the following detailed description.

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In general, this invention comprises a flexible wafer of porous polyurethane foam having a thickness of from about $\frac{1}{16}$ -inch to about $\frac{1}{4}$ -inch.

The structure of flexible polyurethane foam consists of a network of cells of uniform character which are essentially open and interconnecting. Polyurethanes are divided into two major categories based on the polyols used in their preparation—either polyether or polyester. The polyester urethane foams are especially preferred for the purpose of this invention, since they have better solvent resistance, better color stability in the presence of ultraviolet light and do not develop a static charge to the extent that polyether foams will. The polyurethane foams as a class have a high degree of tear strength and wear resistance compared to other foams. Also the resiliency, elasticity and chemical stability of these foams render them especially suited for use as end wraps in accordance with this invention.

The end wraps of this invention are of a size and shape that they can at least partially encircle tresses of hair. Preferably, they are square or rectangular in shape and have dimensions within the range from $1\frac{3}{8}$ " x $1\frac{3}{8}$ " to 4" x 4". An especially preferred size and configuration is a rectangular shaped wafer having the dimensions 3" x 2".

The thickness of the foam end wraps can vary within the range from $\frac{1}{64}$ " to $\frac{1}{16}$ ". As the length and width are increased, a thinner end wrap should be used. Foam end wraps which are thinner than about $\frac{1}{64}$ " are difficult to process and do not have sufficient tear strength to permit repeated use. End wraps having thicknesses greater than about $\frac{1}{16}$ " yield too large a curl and can unduly impair the flow of waving lotion and neutralizers to the hair ends. The preferred thickness for the purpose of this invention is $\frac{1}{32}$ ".

The degree of porosity of the end wrap must be sufficient to permit substantially unimpeded flow of the waving and neutralizing solutions. An average pore incidence within the range of 30 to 120 pores per linear inch is required to permit sufficient exposure of the free end of the hair tress to the waving solutions. More numerous pores are preferable in the case of thinner end wraps. The preferred end wraps have an average of 80 pores per linear inch.

Polyurethane foams which are suitable for use in this invention can be prepared by a variety of methods which are well known in the art. Such foams are made by the condensation of organic isocyanates, such as tolylene diisocyanate, with polyols such as polyethylene ether glycol, in the presence of a catalyst and blowing agent. Basic processes and apparatus for preparing such foams are disclosed for example in U.S. Letters Patent 2,764,565, issued Sept. 25, 1956.

In its process aspect, this invention comprises the steps of forming the hair into tresses, wrapping about each tress a permeable, flexible wafer of polyurethane foam having a thickness within the range from about $\frac{1}{16}$ -inch to about $\frac{1}{4}$ -inch, winding each tress about a cylindrical body, i.e., a curler, saturating each tress with a keratin-reducing composition and thereafter neutralizing the action on the hair of said keratin-reducing composition. The keratin-reducing composition is preferably applied to the hair both before and after the hair is rolled upon curlers. However, it may be applied either before or after with good results.

The keratin-reducing compositions which are preferably used in the process of this invention contains a water-soluble, non-volatile mercaptan such as mercapto-alkanoic acids, mercapto-acetic acid, mercapto-propionic acid, mercapto-butyric acid and water-soluble salts thereof. Examples of suitable mercaptans are thioglycolic acid, sodium

thioglycolate, potassium thioglycolate, monoethanolamine thioglycolate, β -mercapto-isobutyric acid, thiohydracrylic acid, β -mercapto-n-butyric acid, α -mercaptocaproic acid, and thiolactic acid.

In addition to the mercaptans, it may be desirable to include in the keratin-reducing composition a water-soluble disulfide of the mercaptan used such as dithiodiglycolic acid, dithiodilactic acid, the disulfides of β -mercaptobutyric acid, β -mercaptoisobutyric acid, dithiodihydracrylic acid, or a water-soluble salt of these to protect against excessive reduction and damage of the hair, in accordance with the disclosures in U.S. Patent 2,719,814 issued to Haefele and U. S. Patent 2,719,815 issued to Sanders on October 4, 1955.

The end wraps of this invention can be used to special advantage in conjunction with pressurized hair waving compositions which are applied to the hair as a fast-breaking foam. Such compositions are highly desirable because they are easy to apply to the hair, reduce exposure of the keratin-reducing agents to the hands of the operator, and do not run-off to the extent characteristic of ordinary liquid waving compositions. However, the foam discharged by pressurized waving compositions is more susceptible to impediments to penetration than ordinary liquid waving compositions. It has been found that the high degree of permeability attained with polyurethane foam end wraps, while maintaining adequate tear strength, permits ready penetration of the foamed waving composition to the wrapped hair ends, thereby assuring a uniform wave. Fast-breaking foam pressurized waving compositions which are particularly useful in the process of this invention are disclosed by Banker et al. in U.S. Patent 3,099,603, issued July 30, 1963 and Shepard et al., in U.S. Patent 3,103,468, issued September 10, 1963.

The action on the hair of the keratin-reducing composition can be neutralized by chemical compounds such as bromates, perborates, hydrogen peroxide or the action of air alone.

The following examples will illustrate the invention with greater particularity.

EXAMPLE I

One hundred parts, by volume of a polyester of the following composition:

	Moles
Adipic acid	16
Diethylene glycol	16
Trimethylol propane	1

is reacted with 47 parts by volume of tolylene diisocyanate in the presence of 10 parts of volume of an activator mixture of the following composition:

	Parts by volume
Adipic acid ester of N-diethyl aminoethanol	3
Ammonium oleate	1
Sulfonated castor oil	1.5
Water	1.5
Paraffin oil	0.5

The polyester is mixed with water and the other activator components and then the tolylene diisocyanate is added. The mixture is placed in a mold and permitted to set. The product is a slab of flexible foam of 2.2 pounds per cubic foot density, having an average of 60 cells per linear inch. The slab is then cut into 3" x 2" wafers having a thickness of $\frac{1}{32}$ ".

EXAMPLE II

The wafers prepared in accordance with Example I are employed as end wraps in a permanent waving process as follows:

The hair is washed and towel dried and a keratin-reducing composition of the following formulation is applied to each hair tress.

	Percent by weight
Monoethanolammonium thioglycolate	7.6
Monoethanolammonium dithiodiglycolate	3.05
Monoethanolamine (to adjust pH to 9.3)	2.1
5 Isopropyl myristate	4.78
Diffuoroethane	4.35
Polyoxyethylene lauryl ether with an average of 23 oxyethylene groups per lauryl group	0.95
Perfume	0.95
10 SiO ₂ (added as sodium silicate having an SiO ₂ :Na ₂ O ratio of 2.5:1)	0.01
Water	Balance

(This composition was introduced into pressurized aluminum cans provided with valves to control the discharge of the product and with foam nozzles.)

The end wrap is folded over the saturated hair tress so that it covers all of the free hair ends. Each wrapped tress is then wound upon a curler and secured. The waving foam is applied to the wound tresses and after waiting 15 minutes, rinsed with water and blotted. The head is then covered with a towel and after an additional 30 minutes the hair is neutralized with an aqueous solution of sodium perborate monohydrate acidified to a pH of 5.7. The hair is removed from the curlers, again rinsed with water, set in a normal fashion and dried. An excellent uniform wave is obtained.

The step of winding the hair on curlers in the foregoing process is completed quickly and easily. Because of the body, elasticity and "grip" of the foam end wrap it is easier to control the hair ends in initiating the roll on the hair curler. The net result is a notably neater wave than can be attained using paper end wraps, for example.

In applying the waving, rinse, and neutralizing solution, to the wound tresses it is observed that the hair ends inside the wraps are quickly and completely saturated. Moreover, the polyurethane foam end wraps are essentially unaffected by the keratin-reducing composition, alkaline material and reducing oxidizing solutions and can be re-used if desired.

The reactants and conditions employed in the manufacture of the polyurethane foam of Example I can be varied in accordance with the teachings of U.S. Patent 2,764,565 to yield foams having an average of 40, 80, and 100 pores per linear inch, respectively. Wafers having a thickness of $\frac{1}{16}$ " and $\frac{1}{4}$ " cut from said foams are used in the process of Example II with substantially equivalent results.

The process of Example II can be modified to omit the step of applying the keratin-reducing composition to the hair tress prior to winding said tress upon the curler or, alternatively, the step of applying this composition to the wound tress can be omitted with satisfactory results.

What is claimed is:

1. An end wrap for aligning the hair during a cold waving process which comprises a permeable, flexible wafer of open-celled polyurethane foam having a thickness within the range from about $\frac{1}{16}$ inch to about $\frac{1}{4}$ inch and an average pore incidence within the range from about 30 to 120 pores per linear inch, said end wrap facilitating the placement of hair on curlers without impeding the flow of solutions employed in said waving process.

2. An end wrap according to claim 1 wherein the wafer of polyurethane foam has a thickness of $\frac{1}{32}$ inch.

3. An end wrap according to claim 1 wherein the wafer of polyurethane foam has an average pore incidence of 80 pores per linear inch.

4. An end wrap according to claim 1 wherein the polyurethane foam is polyester urethane.

5. The process of imparting a uniform wave to hair which comprises the steps of forming the hair into tresses, wrapping about each tress a permeable, flexible wafer of polyurethane foam having a thickness within the range from about $\frac{1}{16}$ inch to about $\frac{1}{4}$ inch, winding each tress upon a cylindrical body, saturating each wound stress

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with a keratin-reducing composition and thereafter neutralizing the action on the hair of said keratin-reducing composition.

6. A process according to claim 5 wherein the wafer of polyurethane foam has a thickness of $\frac{1}{32}$ inch.

7. A process according to claim 5 wherein the wafer of polyurethane foam has an average pore incidence of 80 pores per linear inch.

8. A process according to claim 5 wherein the polyurethane foam is polyester urethane.

9. The process of imparting a uniform wave to hair which comprises the steps of forming the hair into tresses, saturating each tress with a keratin-reducing composition, wrapping about each saturated tress a permeable, flexible wafer of polyurethane foam having a thickness within the range from about $\frac{1}{16}$ inch to about $\frac{1}{64}$ inch, winding

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each tress upon a cylindrical body, and thereafter neutralizing the action on the hair of said keratin-reducing composition.

References Cited

UNITED STATES PATENTS

3,171,820	3/1965	Volz	-----	260—2.5
3,284,275	11/1966	Nelson	-----	161—168

FOREIGN PATENTS

166,962	4/1954	Australia.
633,955	12/1949	Great Britain.

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