

# UNITED STATES PATENT OFFICE

2,183,894

## COLD PERMANENT WAVING OF HAIR

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No Drawing. Application July 26, 1937,  
Serial No. 155,737

7 Claims. (Cl. 132—31)

The present invention relates to the cold permanent waving of hair, and to a novel composition for effecting the permanent waving of hair.

At present, there are two different methods of producing so-called "permanent waves" in hair upon the human head. The first, which I will term the "thermoplastic method", includes wetting the hair with a mild alkaline solution and applying heat to the hair while in a deformed position. The heat applied in this method is above 140° F. and frequently as high as 300° F. at which temperature accidental contact with the body by the hot instruments of waving will cause serious burns or, at least, extreme discomfort. The wave is fixed in the hair by permitting it to cool. Such an operation is typical of the process and apparatus disclosed in the Squerso Patent No. 1,884,890, of October 25, 1932.

The second method of permanent waving is typified by that process disclosed in Malone Patent No. 2,056,358, of October 6, 1936, and No. 2,061,709, of November 24, 1936. This method includes softening the hair to a moldable consistency within a few minutes at room temperature, after which the hair is molded to the configuration desired. This process I term a hydrolytic one.

Up to the present time there have been no attempts to describe the actions taking place during the permanent waving operation. A series of microscopic tests and waving tests made on a large number of solutions have borne out the facts presented below.

A single fibre of hair may be likened to a piece of spring wire which, in order to be reformed to a desired shape, must be softened while in that shape and then rehardened. The wire will then retain its new shape and will not have lost any of its original resiliency. Likewise, a fibre of hair must be softened with the aid of heat or a chemical solution or a combination of both, after which it may be rehardened by removing the softening solution or the heat. In the thermoplastic process the hair is softened while in a deformed position on the curler by means of heat in the presence of a solution. When the heat is removed, the hair regains its resiliency while retaining its new configuration which will be permanent as long as the hair is not subjected again to such heat and solution.

All hair softening processes are accompanied to varying extents by a swelling of the fibre. Even the application of water alone will swell the hair slightly, thus making possible the so-called "finger wave".

I have determined that swelling is dependent on the type of compounds used in the solution and, to a very great extent, on the pH of the solution, the swelling being proportional to the pH. It is desirable to keep the swelling to a minimum since it results in a condition known as "dryness" in the finished waved hair. This term "dryness", though commonly used in the thermoplastic art, is misleading as it is due not to a lack of oil or moisture in the hair, but to a roughened surface of the hair fibre caused by a lifting of the "shingles" so that these plates project outward from the surface of the hair, whereas they normally lie flat and smooth. Such a condition causes the hair to be dull in appearance and feel rough and coarse to the touch. Also, when the hair is swelled excessively the tensile strength is so greatly reduced during the treatment that the hair is in danger of being removed by breakage and the action of such a solution approaches that of a true depilatory.

The processes as described by Malone suffer the disadvantage of swelling the hair to such an extent that the waved hair has a very dull appearance and a rough, hemplike feel when the wave is completed. By excessive swelling, I mean that the softened hair is in the order of magnitude of twice its original diameter.

In accordance with the present invention herein disclosed, I am enabled to impart a permanent wave to hair upon the human head in the cold in as short a time as is required by the thermoplastic process, while avoiding undesirable excessive swelling. In my process the hair is treated while in a deformed condition with the waving composition of the present invention at room temperature and is permitted to remain in contact with it for from five to twenty minutes, depending on the type of hair and the type of wave desired. The waving composition is then washed out with water while the hair is still in its deformed condition and the curl is then treated similarly with a solution designed to remove the residual waving composition from within the hair so that the hair will remain in its deformed position after the mechanical support is removed. This solution may then be washed out with water either before or after the hair is removed from its mechanical support, the hair now being in a permanently waved condition. By the term "permanently waved" I mean that the hair may be washed and shampooed repeatedly during the life of the waved hair, by any of the ordinary methods without relaxing the wave. In other words, growth and not relaxation is the reason

for rewaving. The hair, after drying, presents a truly natural appearance and is thoroughly soft and silky to the touch.

I have determined that alkali metal sulfides and organic sulfides when adjusted in pH to below 11.0 will soften the hair without jellification or excessive swelling. I have also found that the presence of ammonia or amino groups greatly enhances the softening action of the composition. I have found that if the pH of such solutions of sulfur and amino compounds is allowed to fall below pH 9.0-9.5 decomposition takes place and the odor becomes very objectionable. This odor is usually that of ammonium sulfide which in itself is an excellent hair softener but is limited in its practical application by its strong odor. Although I have successfully used many solutions containing sulfur and amino groups adjusted in pH so that the odor is not objectionable, I prefer to use a solution prepared by dissolving 50 grams of potassium hydroxide and 100 cc. of triethanolamine in 900 cc. of water and absorbing in that solution approximately 28 grams of hydrogen sulfide gas so that the pH of the resulting solution after dilution to 1000 cc. is pH 10.0. This solution is then filtered to remove any insoluble metal sulfides which may have been formed due to impurities in the reagents. The pH of the solution is adjusted by carefully controlling the amount of hydrogen sulfide used or by the addition of some acid of weakly alkaline material as sodium bicarbonate.

Both sodium and potassium sulfide are useful and are included in the term alkali metal sulfides. Other compounds containing amino groups may also be used such as mono, and diethanolamines, the propanol amines, butanol amines, pentanol amines, the ethyl amines, etc. The ethanalamine xanthates and other such amino-organic sulfur compounds may also be used.

Broadly, the effective hair waving compositions of this invention are compounds wherein sulfur has a negative valence of two. These can be inorganic as the alkali metal sulfides (including ammonia) or organic. The sulfur does not have to be associated with nitrogen, but it is preferable that nitrogen be present, either in actual combination in a compound or else in solution with a sulfur containing compound. The nitrogen should have a negative valence of three. The Missbach Patent No. 2,043,257 of June 9, 1936, contains a list of nitrogen compounds useful in the practice of this invention.

After the hair has been softened on suitable curling devices with the waving solution and has been rinsed out, it is treated with a fixing solution to destroy any residual waving solution present. Any acid medium, such as the organic acids as acetic acid, propionic acid, etc., or dilute mineral as hydrochloric and sulfuric acids, may be used. Inorganic salts which hydrolyze to give acidic solutions as magnesium sulfate, zinc chloride, ammonium chloride, etc., may also be used. Though these compounds in water alone at dilute concentrations are successful, it has been found advantageous to add a large amount of some inorganic salt or a heavy molecule organic substance, such as sugar, in order to promote the fixing action by supplying an osmotic pressure to drive the fixing agent into the hair fibre and remove the softening agent from the hair.

I prefer to use a 4% acetic acid solution saturated with ordinary cane sugar.

In utilizing the permanent waving solution of my invention, the hair is handled in the same

manner as in the ordinary thermoplastic process, the hair being blocked off neatly in suitable strands of about 1 inch by 3 inch rectangles at the scalp and then wound on suitable curlers. The solution is then introduced throughout the hair mass on the curler and is allowed to remain there for a suitable length of time. The solution is then removed with water and the fixing solution is introduced into the hair mass and allowed to remain for a similar period of time. The hair is then rinsed with water and the hair is removed from the curlers, thoroughly rinsed out and set into an artistic wave.

The term "cold" as used herein and in the claims is intended to include temperatures below the upper limit of body tolerance and above the lower limit of body tolerance. The term particularly includes temperatures far below those used in thermoplastic waving operations. But gentle heating to body temperature and above can be practiced and is included in the term.

Though the minimum pH, required for stability of most of the solutions of this invention, is between 9.0 and 9.5, this is entirely a characteristic peculiar to the individual compound used. It will be found that the pH limits of 8-11 broadly covers the range in which the compounds are odorless, although some will be found which are odorless at pH values as low as 8.0 and even lower. Such compounds are still effective in the waving of hair.

A variation of this process may be employed in which the wound hair is subjected to a solution of 1-10% of alkali metal sulfide adjusted to pH 8-11 for a period of 1-5 hours before removal from the support. Due to the longer softening period no special fixing solution is required. The hair is merely rinsed in plain water to insure permanency of the wave by removing residual waving solution.

The specific examples and details disclosed herein do not represent the limits of this disclosure, and it is intended that the protection afforded shall extend to the full spirit of this invention as defined by the claims.

I claim:

1. The method of permanent waving hair on the human head which consists in dividing the hair into compact strands, wetting the hair with an aqueous solution of an alkali metal sulfide at a pH of 8 to 11, winding the hair strands and securing the hair in wound form to impart a permanent wave to the hair while the wound hair is cold and at a temperature closely approximating atmospheric temperature.

2. A method of waving hair upon the human head consisting in dividing the hair into compact strands, wetting the hair with an aqueous solution of an alkali metal sulfide at a pH of 8 to 11, winding the hair strands and securing the wound strands to impart a permanent wave in about five minutes to the hair, and finally removing any of said aqueous solution remaining on the hair to ensure permanence of the wave.

3. A method of waving hair upon the human head consisting in dividing the hair into compact strands, wetting the hair with an aqueous solution containing as an effective hair waving agent a compound containing nitrogen bonded to hydrogen and sulfur with a negative valence of two at a pH of 8 to 11, winding the hair strands and securing the wound strands to impart a permanent wave in about five minutes to the hair, and

finally removing any of said aqueous solution remaining on the hair to ensure permanence of the wave.

4. A method of waving hair upon the human head consisting in dividing the hair into compact strands, wetting the hair with an aqueous solution containing as an effective hair waving agent a compound containing sulfur with a negative valence of two at a pH of 8 to 11, winding the hair strands and securing the wound strands to impart a permanent wave in about five minutes to the hair, and finally removing any of said aqueous solution remaining on the hair to ensure permanence of the wave.

5. A method of waving hair upon the human head consisting in dividing the hair into compact strands, wetting the hair with an aqueous solution containing as an effective hair waving agent the reaction product of an alkali metal sulfide and an amino compound at a pH of 8 to 11, winding the hair strands and securing the wound strands to impart a permanent wave in about five minutes to the hair, and finally removing any of said aqueous solution remaining on the hair to ensure permanence of the wave.

6. A method of waving hair upon the human head comprising dividing the hair into compact strands, wetting the hair with an aqueous solution containing as an effective hair waving agent a compound containing sulfur with a negative valence of two at a pH of 8 to 11, winding the hair strands and securing the wound strands to impart a permanent wave in about five minutes to the hair, while the hair is substantially unheated and is at a temperature approximating atmospheric as compared to the conventional practice of heating the hair to about 212° F. and higher, and finally removing any of said aqueous solution remaining on the hair to ensure permanence of the wave.

7. The method of cold permanent waving of hair upon the human head, comprising dividing the hair into compact strands, winding the hair strands into rolls, wetting the hair with an alkaline sulfide solution having a pH between 8 to 11, retaining the so wet hair wet and in wound form until a permanent curl is fixed therein, and rinsing out any remaining sulfide solution.

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