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# UNITED STATES PATENT OFFICE.

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## TREATMENT OF SILK AND COMPOSITION THEREFOR.

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*To all whom it may concern:*

Be it known that EDGAR S. GENSTEIN, a citizen of the United States, residing at 412 West 129th Street, New York city, in the county of New York and State of New York, has invented certain new and useful Improvements in the Treatment of Silk and Composition Therefor, of which the following is a specification.

This invention relates to the treatment of raw silk whereby the silk is made to retain its strength and is prevented from hardening during the manufacturing operations. It relates also to a composition of matter for treating fibres of silk, etc.

Raw silk contains a natural gum to the extent of 18 to 22% introduced by the silk worm during the spinning of the cocoon. It is desirable to retain this gum throughout the manufacturing operations such as winding, spinning, doubling, warping and weaving, due to the fact that it lends to the silk added strength and keeps the fibres closed. This gum must, however, be removed as, for example, by being boiled off previous to the dyeing of the silk in order to obtain level or smooth and even shades. While giving the advantage mentioned, the gum tends, on the other hand, to stiffen the natural fibre and make it wiry which prevents the manufacturing operations from being performed with ease. For this reason, it is customary so to treat some grades of raw silk as to introduce an oil which will soften the gum. The process in vogue for many years has been to immerse raw silk in a bath containing an emulsion of an oil such as neat's-foot oil and soap, for instance, olive oil soap. Other similar baths have been prepared through the use of various compounded oils as, for instance, a compound of animal, vegetable and mineral oils in varying proportions similarly emulsified with which to treat silk, or a direct emulsion of an oil previously treated with ammonia or alcohol or a straight oil or compounded oil emulsified with an alkaline salt such as sodium or potassium carbonate. The direct use of a sulfonated oil has also been attempted without particular success.

In the case of the old method of using neat's-foot oil and soap, the soap performs only one function, namely, that of producing the emulsion and is really an economic waste and interferes with the processing of the silk through depositing soap thereon. The use of an alkaline salt for an emulsification purpose is troublesome owing to the fact that local conditions of water hardness necessitates changes in formula as well as the fact that the type of mechanical equipment used seems to have a bearing upon the quantities necessary. Either ammonia or alcohol are similarly disadvantageous as the emulsion produced is only very temporary and is broken up by the evaporation of the ammonia or alcohol, the former at the same time producing a disagreeable odor and an objectionable condition in the silk. Either of these two products also have a penetrating and solvent action on the gum in the silk which is undesirable. The use of a soluble oil such as a sulfonated oil has not hitherto been successful owing to the fact that sulfonation seems to change a non-drying oil to one of a drying or semi-drying character Upon the evaporation of the physical moisture that was introduced while the silk was in the soaking bath, the oil begins to dry producing a harsh and gluey condition in the silk.

By the present invention raw silk may be so treated that it will retain its strength and will be prevented from becoming wiry during the manufacturing operations. At the same time the disadvantages above enumerated may be overcome. It is desirable for this purpose to use a composition or mixture of ingredients which will overcome the objections heretofore encountered, which will not produce any deleterious effect upon the silk, and which can be readily removed so as not to interfere with the dyeing operation. For this purpose a mixture comprising a hygroscopic agent and a sulfonated vegetable or animal oil or a mixture of two or more of such oils may be used.

The sulfonation of the oil may be effected by treatment with sulfuric acid in ways already well known, which constitutes no part of the present invention. A large variety of oils may be used for this process such, for example, as cocoanut, neat's-foot, olive, soya bean, peanut, corn, palm and lard, preference usually being given to the first three or four just named.

The hygroscopic agent to be employed may likewise present a wide variety of

choices, the most satisfactory thus far employed being glycerine or a glycerol or a mixture of the same. Hygroscopic metallic salts such as magnesium chloride or calcium chloride, for example, give rise to the danger of small crystalline masses of the same being deposited upon and subsequently cutting or injuring the fibres, and for this reason an amorphous hygroscopic agent should be used.

The sulfonated oil and the hygroscopic agent are introduced into an aqueous vehicle and become dissolved with a portion of the oil remaining very probably in colloidal suspension therein. The raw silk which may be about one fifth natural gum, more or less, is immersed in the solution and retained therein for a period of time sufficiently long to enable the desired amount of sulfonated oil and hygroscopic agent to become adsorbed on the fibres, this period varying somewhat with the nature or quality of the silk and the concentration of the bath.

After the silk has remained in the bath the desired length of time, it is removed and the surplus water is allowed to drain off or is whizzed off in a centrifuge. The fibres are then carried through the usual winding, spinning, weaving, etc., manufacturing operations to make the cloth, while they retain their tensile strength. The presence of the sulfonated oil keeps the gum soft so that the fibres do not become wiry and the presence of the hygroscopic material overcomes the tendency of the sulfonated oil to dry or oxidize, thus causing the silk to retain sufficient moisture to prevent the silk from hardening. The gum and other material that might interfere with the dyeing operation are removed in the usual way before the dyeing is caused to take place.

The following is given as a specific illustration of the invention without an intention to limit the invention to the particular details or proportions set forth:

One hundred pounds of raw hard-gummed china silk containing about 20% by weight of gum is introduced into a water solution of about 10 pounds of sulfonated cocoanut oil and three pounds of glycerine, and maintained at about 80° F., more or less. The amount of water may vary from that just sufficient to cover the silk to several times that amount and the silk may remain immersed therein from about 30 minutes to twenty hours, the longer periods of time being used with the greater dilutions of the bath, etc. For warp stock a lower temperature and a shorter time of immersion is preferred. In the case of ordinary Japan silk about 5% by weight of the sulfonated oil will be found to give good results. In all cases it is generally preferable to enclose the silk in bags to soak it as such a procedure will in large measure prevent mechanical damage to the fibres.

Some of the advantages of this invention are: The natural gum is retained in the silk and kept soft during the manufacturing operations, the natural fibre retains its pliability and elasticity and is prevented from becoming stiff; the weakening of the fibres and their tendency to become wiry is prevented; the treating agent can be readily prepared without excessive cost; no unstable emulsion with attendant danger of breaking down the emulsion is present; the thread is prevented from hardening on the bobbins; the fibres retain their soft and silky feel regardless of weather conditions; the silk fibres can be kept moist and pliable for as long a time as is desired; the necessity of producing oil emulsions is eliminated; the influence of changing temperature and humidity is minimized; and the treating agent and the gum may be readily removed by a boiling soap solution prior to the dyeing of the silk so as to obtain even shades without splotches in the usual way.

I claim:

1. The process of treating raw silk which comprises applying to it a sulfonated oil and a hygroscopic agent.

2. The process of treating raw silk which comprises applying to it a sulfonated oil and a water soluble, amorphous hygroscopic agent.

3. The process of treating raw silk which comprises applying to it a sulfonated oil and a hygroscopic agent of the fatty acid series.

4. The process of treating raw silk which comprises applying to it a sulfonated oil and glycerine.

5. The process of treating raw silk which comprises immersing it in an aqueous bath containing a sulfonated oil and a hygroscopic agent.

6. The process of treating raw silk which comprises immersing it in an aqueous bath containing a sulfonated organic oil and a hygroscopic agent.

7. The process of treating raw silk which comprises immersing it in an aqueous bath containing a sulfonated oil, vegetable oil and glycerine.

8. The process of treating raw silk which comprises immersing it in an aqueous bath containing a sulfonated oil, cocoanut oil and glycerine.

9. The process of treating raw silk which comprises immersing it in an aqueous bath containing a sulfonated oil, cocoanut oil and glycerine, the quantity of said oil being about 10% by weight of the quantity of said silk.

10. A composition for treating fibres which comprises a sulfonated oil and a hygroscopic agent.

11. A composition for treating fibres

which comprises a sulfonated oil and a water soluble, amorphous hygroscopic agent.

12. A composition for treating fibres which comprises a sulfonated organic oil and a hygroscopic agent.

13. A composition for treating fibres which comprises a sulfonated vegetable oil and a hygroscopic agent of the aliphatic series of compounds.

14. A composition for treating fibres which comprises a sulfonated vegetable oil and glycerine.

In testimony whereof I affix my signature.

EDGAR S. GENSTEIN.