Patented Feb. 22, 1938 2,109,087

UNITED STATES PATENT OFFICE

2,109,087

PROCESS OF IMPROVING THE ELECTRICAL RESISTANCE OF ANIMAL FIBERS

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No Drawing. Application June 12, 1936, Serial No. 84,978

12 Claims. (Cl. 28—58)

This invention relates especially to the treatment of threads or yarns of silk or wool used in covering electrical wires and cables. In such coverings high resistance to the passage of electric currents is of great importance in order that a maximum of resistance may be obtained with as small an amount of material as possible.

Animal fibers, such as natural silk and wool, are comparatively good insulators, but it has been found that their natural resistance can be very greatly increased by subjecting the material to an acid treatment which removes a considerable part of the natural ionizable salts contained therein and which are detrimental to its electrical resistance. Such acid treatment processes are well known in the art and I make no claim to the same.

I have, however, discovered that the electrical resistance of such materials can also be greatly increased by treating it with dry steam as hereinafter described. While the steam treatment has a very marked effect in increasing the resistance of material which has not undergone any treatment to remove the natural salts, its greatest value lies in the treatment of material which has undergone an acid treatment or other treatment for the above purpose.

The essential feature of the steam treatment is that it must be carried out under such conditions that condensation of water on the material is prevented.

The process may be carried out in a closable chamber adapted to be heated and provided with an inlet for the introduction of steam and an outlet for air or steam. Automatic means will be provided for controlling the heating means so that any desired temperature may be maintained in the chamber.

The following is a detailed description of the procedure in treating silk yarn, either true silk or "wild" silk such as tussah.

The chamber is heated to approximately 150° F., the silk in skeins placed therein in their normal air-dry condition and the chamber closed. The temperature is then raised to a point above the boiling point of water, say 220° F. Steam is then allowed to enter and the temperature of approximately 220° F. maintained during the treatment. Under such conditions all condensation of water on the silk is entirely prevented. The flow of steam is continued till all air is forced out of the chamber and preferably for some time thereafter. About twenty minutes is usually sufficient. The supply of steam is then cut off and any steam remaining in the chamber removed through the outlet, as, for example, by means of an exhaust fan.

The silk is then dried out in the heated chamber to get rid of entrained steam, allowed to cool and then removed.

Throughout the process the pressure inside the chamber will be maintained substantially at that of the atmosphere, though higher and lower pressures may be used. It has previously been stated that the steam should be "dry". By "dry" is meant that it should be free of any entrained moisture likely to be deposited on the material being treated.

Some results of the treatment of materials which have not been previously subjected to an acid treatment are as follows: In all cases the electrical resistance figures are for ¾" lengths of yarn under conditions of 85% relative humidity at a temperature of 100° F.

Material	Electrical resistance		Increase in resistance
	Before steam treatment	After steam treatment	
	Kilomegohms	*Kilomegohms*	*Times*
Wool	82	1470	17
Silk (ordinary)	44.5	640	13½

Tussah silk previously acid treated showed the following results:

Material	Electrical resistance		Increase in resistance
	Before steam treatment	After steam treatment	
	Kilomegohms	*Kilomegohms*	*Times*
Tussah silk (purified)	2400	12,800	4½

From the above the tremendous increase in the electrical resistance of silk and wool, either acid treated or not, and due to my steam treatment will be evident.

While I do not desire to limit myself to any particular process of treating the silk or wool to reduce its content of objectionable salts before steam treating, the following treatment has proven satisfactory:

A bath is made up containing a 1% aqueous solution of acetic acid, the volume of liquid being approximately 1 gallon per pound of silk to be treated and the temperature approximately 70° F.

The silk in the form of skeins is immersed in the solution and soaked, with gentle agitation for

about 20 minutes. The skeins are then removed, drained and thoroughly rinsed with water until liquid squeezed out shows only a slightly acid reaction (pH about 5). The material is then dried.

Other acids, such as hydrochloric, may also be employed. So also any method may be employed, other than the acid treatment for removing ionizable impurities from the silk or wool.

What I claim as my invention is:

1. A process of treating animal fibers to increase their electrical resistance which consists in subjecting the material to the action of an atmosphere of dry steam.

2. A process of treating animal fibers to increase their electrical resistance which consists in heating the material to a temperature above the boiling point of water and thereafter subjecting the material to the action of an atmosphere of dry steam.

3. A process of treating animal fibers to increase their electrical resistance which consists in heating the material to a temperature above the boiling point of water and thereafter subjecting the material to the action of an atmosphere of dry steam, removing the steam and thereafter for a short time maintaining the temperature of the material above the boiling point of water.

4. A process of treating animal fibers to increase their electrical resistance which consists in treating the material to remove at least part of any natural salts contained therein which are detrimental to the insulating properties of the material and thereafter subjecting the material to the action of an atmosphere of dry steam.

5. A process of treating animal fibers to increase their electrical resistance which consists in treating the material to remove at least part of any natural salts contained therein which are detrimental to the insulating properties of the material and thereafter subjecting the material to the action of an atmosphere of dry steam under conditions inhibiting the condensation of steam on the material.

6. A process of treating animal fibers to increase their electrical resistance which consists in treating the material with dilute acid to remove at least part of any natural salts contained therein which are detrimental to the insulating properties of the material and thereafter subjecting the material to the action of an atmosphere of dry steam.

7. A process of treating animal fibers to increase their electrical resistance which consists in treating the material with dilute acid to remove at least part of any natural salts contained therein which are detrimental to the insulating properties of the material and thereafter subjecting the material to the action of an atmosphere of dry steam under conditions inhibiting the condensation of steam on the material.

8. A process of treating animal fibers to increase their electrical resistance which consists in treating the material to remove at least part of any natural salts contained therein which are detrimental to the insulating properties of the material, heating the material; thereafter subjecting the material to the action of an atmosphere of dry steam; removing the steam and thereafter for a short time maintaining the temperature of the material above the boiling point of water.

9. A process of treating natural silk yarns to increase their electrical resistance which consists in subjecting the material to the action of an atmosphere of dry steam.

10. A process of treating wool yarns to increase their electrical resistance which consists in subjecting the material to the action of an atmosphere of dry steam.

11. A process of treating natural silk yarns to increase their electrical resistance which consists in treating the material to remove at least part of any natural salts contained therein which are detrimental to the insulating properties of the material, and thereafter subjecting the material to the action of an atmosphere of dry steam.

12. A process of treating wool yarns to increase their electrical resistance which consists in treating the material to remove at least part of any natural salts contained therein which are detrimental to the insulating properties of the material, and thereafter subjecting the material to the action of an atmosphere of dry steam.

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