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METHOD OF TREATING THREADS OF CELLULOSIC MATERIAL AND THE THREADS SO PRODUCED.

APPLICATION FILED AUG. 5, 1916.

1,269,340. Patented June 11, 1918

FIG. 1.

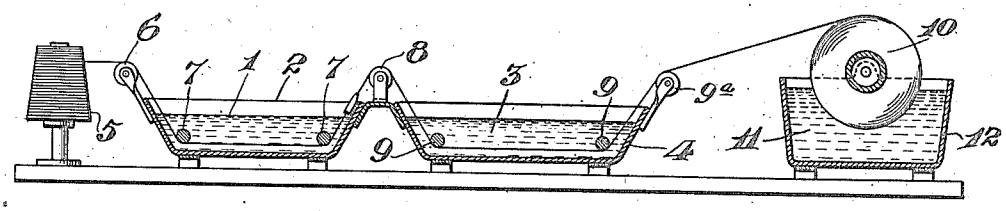
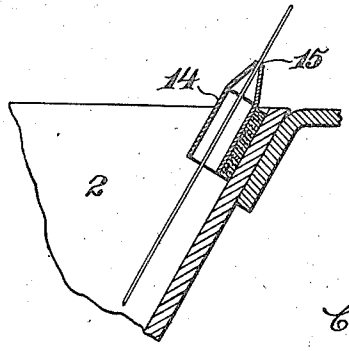


FIG. 2.



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METHOD OF TREATING THREADS OF CELLULOSIC MATERIAL AND THE THREADS SO PRODUCED.

1,269,340. Specification of Letters Patent. Patented June 11, 1918.

Application filed August 5, 1916. Serial No. 113,291.

To all whom it may concern:

Be it known that we, CHARLES E. VANDERKLEED, a citizen of the United States, and a resident of Collingswood, county of Camden, State of New Jersey, and JAMES ED. BREWER, a citizen of the United States, and a resident of Norristown, county of Montgomery, State of Pennsylvania, have invented certain new and useful Improvements in the Method of Treating Threads of Cellulosic Material and the Threads so Produced, of which the following is a specification.

Our invention relates to a new and novel method of treating threads, the principal ingredient of which is cellulose, such, for example, as cotton threads as well as the threads so produced. Our invention may be employed also in the treatment of threads of other material, the principal constituent of which is cellulose, such as hemp and flax.

One of the objects of our invention is to subject threads of cellulosic material (such as cotton threads) to a treatment whereby such threads are rendered very smooth, their luster and also their tensile strength increased.

A further object of our invention is to produce a thread consisting of cellulosic material in which the interior portion thereof is in a natural state, that is to say, remains unaffected by the chemicals and the treatment to which it has been subjected, such central portion constituting in effect a core-like fibrous portion which is surrounded by a thin coating of cellulose or cellulosic material which first has been softened or dissolved by a chemical agent and subsequently precipitated by the action of a suitable chemical agent.

Other objects and advantages of our invention will be referred to and more fully pointed out and described in the detailed description thereof which follows or will be apparent from such description.

Our invention is not limited to any particular form of apparatus by means of which the same may be carried out, but for the purpose of facilitating the description of the same and aiding in its understanding reference may be had to the accompanying drawing in which is indicated one form of apparatus which may be employed.

In the drawing:—

Figure 1, is a transverse vertical sectional view of a form of apparatus which may be employed; and

Fig. 2, is a sectional view showing a detail of construction.

In the carrying out of our invention in the treatment of threads of cellulosic material, we first subject the same to the action of a copper ammonium solution or its equivalent. From this solution the threads are passed through a volume of either sulfuric or acetic acid or some other substance having an equivalent action, after which the threads may be wound upon a spool revolving in water. After the quantity of thread desired has been wound upon such spool, the spool is removed and is further washed in water.

During the passage of the thread through the ammoniacal copper solution (copper ammonium solution) the fine filamental portions projecting therefrom are dissolved and the outer portions of the thread or threads are dissolved or softened. As the thread passes through the acetic or sulfuric acid (let us say sulfuric acid) compounds of ammonium and copper are formed, as ammonium and copper sulfates, leaving the dissolved or softened cellulose as a precipitate or coating upon the central core-like portion of the thread or threads. These compounds and any adhering acid are removed by washing as above described. The proportion of the material of the respective threads which is dissolved by the ammoniacal copper solution may be varied and controlled by varying the speed of travel of said threads through said solution. In other words by varying the time or period during which the threads are subjected to the action of the solvent the amount of material which is softened or dissolved is varied.

Such amount may be varied also by varying the strength of the solvent.

In the drawing, the ammoniacal copper solution is shown at 1 in a container 2. The sulfuric acid or acetic acid, as the case may be, or their equivalent, is shown at 3 in a container 4.

Each thread to be treated is taken from a spool such as 5, and passes over a guide roll 6 and underneath guide-rods 7, near the bottom of the container 2. Only one thread is shown, but it will be understood that as many threads as desired may be treated simultaneously. From the second rod 7 the threads pass forwardly over the guide roll 8 and thence underneath the guide rods 9 near the bottom of the container 4. The threads are carried or drawn forward from the precipitating liquid 3 over a guide roll 9^a to a spool 10 and are wound upon the latter which projects into a volume of water 11 held in a container 12, so that as the threads are wound upon the spool they are preliminarily washed and partially freed from the copper sulfate (or acetate as the case may be) and ammonium sulfate. To completely remove these compounds the threads are subjected to additional washing in a further quantity of fresh water. It will be understood that if the precipitating bath or liquid does not consist of sulfuric acid or of acetic acid but of some other substance, the resulting compounds will be different.

It is desirable that the threads treated in the manner indicated should be smooth and of uniform diameter at all points. This condition is effected and brought about by causing the threads to pass through small capillary-like openings situated intermediate the ammoniacal copper solution and the precipitant; that is, the sulfuric or acetic acid. In the construction as illustrated the device employed for this purpose consists of a short section of tube 14, one end of which is reduced to form a small capillary-like opening 15 as indicated. It will be understood that the diameter of the tube as shown in Fig. 2 of the drawing is greatly enlarged; also that there are as many of these devices as there are threads being treated. Another advantage of passing the threads through such small openings is that any excess of solvent is removed from the threads and caused to fall back into the container 2,—thus constituting a saving of the solvent and preventing the unnecessary transference of the same to the container 4 and the consequent contamination of the precipitant 3.

We have found also that the resulting product is somewhat improved if the copper ammonium solution through which the threads are caused to pass is provided previously with a quantity of purified cellulose in solution. When such cellulose is present in solution it penetrates into and is deposited upon the surface of the threads as they are passed through the copper ammonium solution. These threads are rendered smooth and of uniform diameter by being passed through small capillary-like openings as previously described and by subsequently passing the same through the precipitant consisting of sulfuric acid, acetic acid or some other equivalent material and thereafter washing, the copper and the ammonium are removed also as previously described, leaving a coating of precipitated and hardened cellulose. It will be seen that by this latter method there is what may be termed and described a step in addition to that employed in carrying out the method and process as first described. That is to say, not only are the filamental projecting portions from the thread dissolved or softened but there is added to the thread as a deposit a coating of pure cellulose. By such addition both the luster and the tensile strength of the threads are somewhat increased.

Our invention may also be applied to the treatment of fabric consisting of woven threads of cellulosic material. As described in connection with the treatment of threads of such material the fabric may be passed through a solvent consisting of ammoniacal copper (copper ammonium) solution which acts to dissolve or soften the outer surfaces of the threads of which the fabric is composed. Such fabric preferably, in order to lessen or remove the interstices between the threads, should be subjected to compression, as by means of revolving compression rollers, after which it is subjected to the action of a precipitating substance, such as sulfuric acid or acetic acid or their equivalent, and should then be washed in water so as to remove the compounds of copper and ammonium as described in connection with the treatment of the threads.

As a result of the method above described, whether in connection with the treatment of the threads or in connection with the treatment of a fabric composed of threads, the threads of the final product consist of a central core-like portion of what may be termed raw or untreated fibrous cellulosic material surrounded by a coating of cellulose produced by first treating the threads, as threads *per se* or as a fabric, in copper ammonium solution, thereafter subjecting the same to the action of a precipitant (such as sulfuric acid or acetic acid) and finally washing the same thoroughly in water so as to remove therefrom such compounds of copper and ammonium as may have been formed.

We claim:—

1. The art of treating threads of cellulosic

material which comprises the softening or dissolving of the outer portions of such threads, depositing a coating of dissolved cellulose upon such threads, and thereafter subjecting the same to the action of a precipitant.

2. The art of treating a thread of cellulosic material which consists in dissolving a thin outer layer thereof, depositing a thin layer of cellulose upon such thread and thereafter subjecting the said thread with the thin layer of cellulose deposited thereon to the action of a precipitant and finally washing the said thread in water.

3. The art of treating material consisting of cellulose which comprises the softening or dissolving of the outer portions of such material, depositing a coating of dissolved cellulose upon such material, and thereafter subjecting the same to the action of a precipitant to harden and precipitate the said softened and dissolved cellulose.

4. The art of treating a thread composed of cellulosic material which consists in subjecting the said thread to the action of a copper ammonium solution containing cellulose in solution and softening or dissolving a thin outer portion of the said thread, leaving a fibrous central portion, thereafter subjecting the said thread to an acid to form soluble compounds of copper and ammonium and precipitate and harden the layer of dissolved and softened cellulose upon said thread and thereafter washing in water to remove said compounds.

5. The art of treating a thread composed of cellulosic material which consists in subjecting the said thread to the action of a copper ammonium solution containing cellulose in solution and depositing a thin layer of such cellulose upon said thread, next subjecting it to the action of an acid precipitant to precipitate and harden the dissolved cellulose and to form compounds of copper and ammonium and thereafter washing the said thread in water to remove the said copper and ammonium compounds and acid if any should have adhered to the said thread.

6. The art of treating cotton threads which consists in passing the same through a volume of copper ammonium solution containing cellulose in solution and dissolving a thin outer layer of the said thread and depositing a portion of the collulose upon said threads, next passing the same through a precipitant having the capacity of precipitating the dissolved cellulose and of forming copper and ammonium compounds and subsequently washing the said thread to remove the said copper and ammonium compounds and leaving the dissolved cellulose material as a coating surrounding the undissolved core-like portion of the said thread.

7. The art of treating cotton thread which consists in passing the same through a volume of copper ammonium solution containing cellulose in solution and thereby softening or dissolving a thin outer layer of the said thread and also depositing a coating of cellulose from said solution upon such thread, next passing the same through a volume of sulfuric acid to precipitate and harden the dissolved and softened cellulose and form compounds consisting of copper sulfate and ammonium sulfate and subsequently washing the said thread to remove the said compounds, leaving the precipitated and hardened cellulose material as a coating upon the undissolved central core-like portion of the said thread.

8. The art of treating threads composed of cellulosic material, which consists in passing the same through a quantity of copper ammonium solution containing cellulose in solution, thereafter smoothing the surfaces of said threads and rendering them of uniform diameter throughout their length, subsequently subjecting the said threads to the action of an acid to precipitate and fix the dissolved cellulose thereon and to form compounds of ammonium and copper and thereafter washing the said threads to remove said compounds.

9. The art of treating threads composed of cellulosic material which consists in passing the said thread through a copper ammonium solution having therein a quantity of pure cellulose in solution, softening or dissolving a thin layer of the said thread and simultaneously depositing thereon a thin coating of pure cellulose, subsequently passing the said thread through a precipitant to precipitate the dissolved cellulose and to form compounds of copper and ammonium and thereafter washing the said thread to remove the said compounds therefrom and leaving a coating of said precipitated cellulose surrounding the now unaffected portion of said thread.

10. The art of treating fabrics composed of cellulose threads which consists in passing the said fabric through a copper ammonium solution containing cellulose in solution and depositing a portion of said cellulose as a layer upon the threads of said fabric, thereafter passing the said fabric through a liquid which precipitates and fixes dissolved and softened cellulose upon said fabric and which acts upon the copper ammonium solution held upon the said fabric to form compounds of copper and ammonium and thereafter washing the said fabric to remove the said compounds.

11. The art of treating a fabric composed of threads of cellulosic material which consists in passing the said fabric through a copper ammonium solution containing cellulose in solution and depositing a portion of said cellulose as a layer upon the threads of

said fabric, thereafter subjecting the said fabric to compression, next passing the same through sulfuric acid to precipitate and fix dissolved and softened cellulose upon said fabric and to form copper and ammonium sulfates and subsequently washing the said fabric to remove the said sulfates and leaving the threads of the said fabric surrounded with a coating of previously precipitated cellulose.

In testimony that we claim the foregoing as our invention we have hereunto signed our names this 3rd day of August, A. D. 1916.

CHARLES E. VANDERKLEED.
JAMES ED. BREWER.