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COATING FOR TEXTILE THREADS.

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This invention relates primarily to the manufacture of artificial silk, the object, in a broad sense, being to produce this material in a form more nearly resembling the natural silk as produced by the worm, than has heretofore been done or been possible to do. The essential and most important mechanical difference between natural silk and artificial silk as heretofore produced, is that natural silk is composed of the silk fibre proper and a gum or wax known as sericin, the silk fibre forming the core and the gum an external coating therefor, the latter comprising approximately one-fifth of the total structure of the filament, whereas artificial silk is composed of the cellulose or artificial silk fibre alone, entirely devoid of the gum or wax layer or coating. It is one object of the present invention to manufacture artificial silk with a coating corresponding to the sericin of natural silk, having not only similar but other functions which are an improvement upon those of the natural silk coating.

The gum of natural silk serves to reinforce and protect the fibre proper and enables it to resist the strains and chafing incidental to a passage through machinery which converts the silk into fabric. Since this reinforcing element is absent from artificial silk as heretofore made it has been necessary to make the fibre or thread of a larger or coarser size so that the inherent strength of the fibre or thread itself will be more nearly sufficient to resist the strains incident to manufacture. But this prohibits the production of fabrics of as fine and beautiful texture as those made of natural silk. Another function performed by the gum is that it binds together the individual filaments composing a thread so that they will not "open" in traversing the machinery and subject the individual filaments to breakage, thus making loose ends in the thread, an excessive amount of which produces "fuzzy" silk or fabric.

Notwithstanding the fact that artificial silk is ordinarily worked up in coarser threads, or in threads containing a larger number of filaments than natural silk, for the reasons stated, it is still usually necessary for the throwster, weaver or knitter who obtains the raw yarn from the artificial silk manufacturer, to apply some kind of sizing or gum material to the raw yarn before attempting to convert it into a fabric, and thus, in a manner, give it the character of raw natural silk. The application of these sizings or gums has been made in either of two ways, first by dipping the skeins of raw silk in a sizing solution, extracting the excess solution and then drying the skeins before using, and second by "slashing" which consists in applying the sizing simultaneously to a number of individual threads running from one beam of a warp, then passing the threads slowly across the surface of a polished hot plate or over rollers to smooth and dry the sizing on the threads, and finally winding them on the second warp beam.

Both of these methods are unsatisfactory because the skein sizing results in matted threads difficult to unwind, while the high heat employed in the slashing injures the silk and the process is very slow. Furthermore all sizing materials yet produced for use in either method have been lacking in some quality desirable in a good sizing.

All gums and sizings must be capable of removal from the silk after the fabric is made, so that the latter will take the dye and disclose the natural beauty of the silk. This is usually accomplished in the "boil-off" when all foreign substances such as oil, dirt and the sizing are removed by boiling the fabric in soapy water, a process which is especially injurious to artificial silk.

My invention contemplates the application of the reinforcing material to the artificial silk preferably by the manufacturer of the silk, so that when he delivers the silk to the throwster, weaver, knitter or other converter into fabric, it will be a completed thread in condition to work up at once. But to accomplish this in a commercially satisfactory way, the reinforcing material itself and its mode of application should be such as not to retard the process of manufacture and not unduly increase the cost thereof, since the silk is manufactured in such enormous quantities that slight delays

or extra cost of the materials or process might easily render them prohibitive from a commercial standpoint.

To this end the sizing should be of such a character that immediately after it is deposited uopn the thread it will congeal, solidify, or "set" so that it can be immediately wound into a skein, bobbin or other compact body without liability of the adjoining threads of such a compact body sticking together.

A good sizing or coating for the fibre should add to its strength, should bind the individual fibres of a thread together and prevent opening in the loom or elsewhere, should add to the elasticity of the thread, prevent the development of static electricity and afford good lubrication to promote the free movement of the thread when travelling in contact with parts of the machine by which it is being converted into a fabric: it should furthermore be capable of easy removal from the fabric after its function is fulfilled, without injury to the fibre. Such a coating should also be proof against changes of climate or temperature and from varying atmospheric moisture conditions, or mere lapse of time.

To these ends the material I have invented for coating the fibre consists of a compound of waxes, one of which, preferably is beeswax, this compound being treated in a manner to render it soluble in water of certain temperature, and to which is added a small quantity of oil. As a concrete formula which will serve the purpose very well, I cite the following:—3 parts of beeswax, 3½ parts of Japan wax, 3½ parts of stearic acid and one part oleic acid or red oil. These materials are placed in a melting pot and reduced to fluidity by heat, whereupon they are thoroughly agitated until most finely and intimately mixed. I then dissolve one part of commercial dry caustic soda in 20 parts of water and thoroughly mix this solution with the wax and oil compound. This causes the complete saponification of the Japan wax, stearic acid and oil and the partial, if not complete saponification of the beeswax. On allowing the mass to cool it becomes solid, in which condition it remains until wanted for use. It is a characteristic of this material that while it is in fluid condition it persists as a stable emulsion until it solidifies, i. e. the ingredients do not separate while cooling.

The mode of application to the artificial silk thread or other fibre is to first reduce the solid material to fluid form by heat. This requires a temperature of approximately 100 deg. F. above ordinary room temperature, but the actual working temperature of the material is dependent somewhat upon the thickness of the coating it is desired to deposit on the thread. The hotter the material the thinner it is and consequently the thinner will be the deposited coating. The material after melting may be used full strength or it may be diluted with water to further control the thickness of the deposited coating, and in this diluted condition the emulsion remains stable also, thus insuring that the ingredients of the material will be evenly applied to the thread in any liquid form in which they may be used. The essential characteristic of the material is, however, that its melting temperature or the temperature at which it is applied to the textile fibre is considerably above ordinary room temperatures; so that when applied in liquid form in a thin film, to the thread, the contrast in temperature, when immediately thereafter exposed to room or specially provided low temperature, will be sufficient to cause the immediate solidifying or setting of the film on the thread. The congealing is so rapid in fact, that when it is applied to a thread while running upwards of 1500 feet per minute, the thread can be wound directly upon a reel located a few inches only from the point of application of the material to the thread, without any stickiness or adhesion of adjoining threads in the finished treated skein on the reel.

This feature renders the material commercially practicable for the manufacture of artificial silk, because he can make the coating process a part of, or a continuation of, the process of manufacturing the cellulose into fibre and thread, which involves a lineal movement of the fibres and thread at a very high speed from the moment the paste is exuded from the dies. The coating material can obviously be applied to the silk as an independent process at any time after the yarn has been made, either by the manufacturer of the silk yarn, or by the one who makes the yarn into fabric. The mechanical means for applying the material to the linearly running thread is not an essential part of my invention, since any known device such as a roller rotating partially submerged in a body of the hot material, may be utilized by leading the thread across and in contact with the roller and thence immediately to a reel upon which it is wound as a finished thread. The nature of the coating material is also such that it can be applied to a thread or yarn while in skein form by adopting special apparatus and methods for that purpose. If it were necessary to move the thread slowly in its passage from the applying devices to the reel, or to allow the thread to travel a long distance before winding it upon the reel in order to give the applied film time to solidify or "set" before it was wound up, the commercial practicability of the treatment would be much lessened and this is one

of the objections to the sizings heretofore used.

Among the ingredients of this coating material, the beeswax is the most important, for it not only affords the characteristics of a good coating as heretofore enumerated, but it prevents the coating from being affected by changes of temperature and moisture conditions so that it will not experience physical change in any climate or locality before the silk is used. For instance a moist atmosphere will not make the coating soft and sticky because water has no effect on beeswax, nor will the highest temperature of the torrid zone soften the sizing because heat below approximately 150 deg. F. has no effect on beeswax. The quantity of beeswax in the compound is or should be sufficient to prevent the coating as a whole from yielding to any moisture or heat condition which it would ordinarily encounter notwithstanding that the other waxes alone might not be immune from their attack. Japan wax, among other things, is used to furnish a certain amount of stickiness to bind the fibres of a thread together and stearic acid affords and imparts elasticity to the treated thread, while the oil ensures no brittleness of the coating at any time. A characteristic of this compound is that when in its hot fluid condition it is very penetrative and sticky, so that at the moment it touches the thread in this condition it enters the pores of the fibres and into the interstices of the thread and upon immediately solidifying thereafter, it becomes firmly anchored to the thread and presents a firm non-sticky and smooth surface coating thereon.

The objection to the use of beeswax ordinarily as a coating for silk is that it cannot be completely removed from the thread by any practical means after it has served its purpose as a fibre coating. Beeswax is not sufficiently saponifiable to be fully dissolved by any ordinary agent, but my invention provides for the intimate association of the beeswax with other waxes or materials, which are easily saponifiable and are in a saponified condition by reason of the action thereupon of the caustic soda, so that upon subjecting the treated thread to a hot water bath the coating is converted into an emulsion in which the fine particles of beeswax are suspended, the bulk of the emulsion being taken from the silk or fibre by the water and the remainder being carried away by one or more subsequent rinsings. This operation is most effectively and rapidly performed in water at 160 deg. F. or over. The naked fibre is thus left clean for dyeing without the necessity of any injurious treatment such as hard boiling.

This coating material is applicable to both natural and artificial silk and in fact to any textile fibre or yarn and can be applied by any desired means. It is also an improvement on natural sericin since the latter varies in quality and quantity with the health of the silk worm and the quality of the mulberry leaf on which it feeds, whereas the coating described herein can always be made uniform in quality and applied in a uniform controlled thickness to the thread. Furthermore on account of its oil content it will not become hard or brittle whereas natural sericin is often found in one or the other of these conditions in which it is far less effective in performing its functions.

It has been pointed out that the material I have herein described is not a mere sizing of the character commonly used to fortify artificial silk yarn such as starch, gelatin, glues and so forth, which are sensitive to moisture and weather conditions and thus lose their efficiency but is probably as near a synthetic sericin as can be produced, judging by its functions and performance. Natural sericin cannot be mechanically removed from the fibre, as by scraping the yarn with the finger nail or across the edge of a knife and this is true also of the coating which is the subject of this application; whereas any of the ordinary sizings can be easily scraped from the thread and are not in any sense an integral part of the thread or fibre. Therefore when the naked cellulose fibre or thread, now known as "artificial silk", is provided with a coating of the material I have invented, it becomes a perfected and complete artificial silk fibre or thread corresponding in structure throughout to the structure of raw natural silk.

I claim:

1. A coating for textile thread comprising beeswax and a saponified wax intimately mixed therewith.

2. A textile fibre or thread having a coating comprising finely divided beeswax intimately mixed with a saponified wax.

3. A textile fibre or thread having a coating comprising finely divided beeswax intimately mixed with a saponified wax and saponified stearic acid.

4. A textile fibre or thread having a coating comprising the reaction product of wax, stearic acid and oleic acid with a saponifying agent.

5. A textile fibre or thread having a coating comprising finely divided beeswax intimately mixed with saponified stearic acid.

6. A textile fibre or thread having a coating comprising finely divided and partially saponified wax intimately mixed with a fully saponified wax.

7. A textile thread having a coating comprising the reaction product of a plurality of waxes, one of which is beeswax, with a saponifying agent.

8. A coating for textile threads compris-

ing the reaction product of beeswax, Japan wax and stearic acid with a saponifying agent.

9. A coating for textile thread comprising the reaction product of beeswax, Japan wax, stearic acid and oleic acid with a saponifying agent.

10. A coating for textile thread comprising the reaction product of substantially three parts of beeswax, 3½ parts of Japan wax, 3½ parts stearic acid, 1 part oleic acid and 20 parts of water with a saponifying agent.

11. A coating for textile thread comprising a plurality of saponified waxes and saponified oleic acid to prevent the coating from becoming brittle.

In witness whereof, I hereunto subscribe my signature.

EDWARD POHL.