Patented Jan. 19, 1937 2,067,888

UNITED STATES PATENT OFFICE

2,067,888

PROCESS FOR THE TREATMENT OF TEXTILE FIBERS AND THE RESULTS PRODUCED THEREBY

Dale S. Chamberlin, Bethlehem, Pa., assignor to National Oil Products Company, Harrison, N. J., a corporation of New Jersey

No Drawing. Application January 10, 1934, Serial No. 706,045

14 Claims. (Cl. 91—68)

My invention relates to processes for the treatment of textile fibers, and especially silk yarns suitable for knitting purposes, and the products produced by such processes.

In the converting of gum silk (like raw Japan silk) into hosiery fabrics, it is first necessary to soften the gum silk by soaking the silk in aqueous emulsions and solutions of soaps, oils, raw oils, soluble oils, softening agents, hygroscopic agents, wetting agents, etc., to so lubricate and soften the yarn that the yarn will not cut the guides of the various machines on fabrication and will form a perfect stitch on knitting. The presence of oils further reduces the static of the yarn so that it flows through the various machine processes without being attracted by opposite static electrical forces.

After the silk is soaked, the excess water is thrown off by centrifugal force and the final water is evaporated by natural or forced methods of drying. The silk is then thrown, which means the combining of two or more threads together in a parallel form and twisting these single ends or threads together into the finished thrown thread of yarn. This throwing system consists of several consecutive operations as follows; winding, doubling, spinning, steaming, coning. As all of these operations are necessary, notwithstanding the method of initial soaking, the only operation that will be described is the final operation of coning.

The practice in general is that before winding the silk, it is dried down to possibly 12% or less actual moisture content. This moisture content is rarely exceeded up to and including the coning operation so that the silk usually leaves the throwster or thread fabricating mill at 9.91% or less in actual moisture content.

The reason that the yarn is sold or furnished on a cone is that by placing the finished yarn on a cone, the yarn can be drawn off from the cone in later operations with minimum resistance. Also, the cone is of such an angle (e. g. 11 degrees) that the yarn hangs onto the cone without falling off prior to its actual use. It is to be understood that a cone of an angle greatly exceeding 11 degrees in either direction has definite disadvantages in knitting.

The cone is the package on which the throwster builds the yarn to be shipped to the knitter. The knitter holds this yarn in his plant for indefinite periods before it is removed from the package cases and prepared for ultimate knitting.

At this point the knitter must condition the yarn before it is placed on the knitting machine to be knitted into the hosiery fabric. This "conditioning" of the yarn consists in treating the yarn in such a way that it is in its optimum condition for being "wetted out" uniformly on the knitting machine. The various conditioning methods are:

1.—Backwinding
2.—Humidifying
3.—Dipping
4.—Pressure wetting out
5.—Heater treatment on the knitting machine
6.—Hygroscopic treatments
7.—Direct running treatments

Before these methods are discussed it is to be understood that hosiery is knitted by two methods—(*a*) full-fashioned and (*b*) seamless.

(*a*) Full fashioned hosiery is knitted on a machine which usually knits 18, 20 or 24 legs at one time, each being knitted on a separate head. These legs are knitted as a flat fabric by a back and forth motion of the thread carrier across the needle bar. Later this fabric is closed into a stocking by seaming and looping up the back. The yarn for full fashioned knitting is wetted out on the full fashioned machine after the yarn is conditioned by running the thread through water or over wetted wicks. This results in a knitted wet fabric. This "wetting out" is necessary to give a uniform stitch formation.

(*b*) Seamless hosiery is knitted on a vertical machine by delivering the yarn around a continuous circular needle bar, the yarn usually being knitted without any pre-treatment such as conditioning or wetting out. It might be stated here that conditioning of the yarn or wetting out is beneficial to better seamless knitting.

It is to be understood from the above that the present practice is to condition the yarn in the knitting mill where full fashioned hosiery is knitted.

1.—Backwinding consists in unwinding the cone of yarn as built by the throwster and rewinding onto a new cone, allowing the thread, between these operations, to be drawn over a roll dipping into a "wetting out" solution. The rewound cone is therefore "wetted out" to 50% moisture content or more. This wetted cone when placed on the knitting machine is in a condition for the rapid pick-up of water on the knitting machine wetting out system. This was an expensive system as it requires repeating an operation which already has been well done by the throwster.

2.—Humidifying consists in throwing the yarn

on a cone usually perforated with holes and of special water-resistant construction. These cones are placed in a closed room and submitted to a high relative humidity generally about 95% and a temperature of 90–95° F., for 24 hours or more. This treatment results in raising the moisture content to possibly no more than 13–15% and thus places the yarn in a receptive condition for easy wetting out on the machine.

3.—Dipping is a method for immersing the yarn in an aqueous solution for a few seconds and then placing the yarn in a damp room to equalize the moisture by capillarity.

4.—Pressure wetting out is a method by which aqueous solutions are pressed through the yarn by forced methods.

5.—Heater treatment is a device that is actuated directly on the "wetting out" trough on the machine and thus blends conditioning and "wetting-out" in one operation. This consists of electric heaters that raise the temperature of the water in the wetting out troughs of the machines to an average of 135° F.

6.—Hygroscopic treatments do not require conditioning as various "water demanding agents" are soaked into the silk in the initial treatment which when the yarn is run over the "wetting-out" troughs on the machine, pick up water with great ease.

7.—Direct running treatments are rather late developments which differ from hygroscopic treatments in that various materials are incorporated in the soaking treatment that do not necessarily make the yarn hygroscopic but leave the yarn in such a condition that the silk can be wetted out on the knitting machine.

It must be understood that the present practice is to so condition the yarn that when it is placed on the knitting machine it is in such a condition that it will be completely wetted out by running through or in contact with water, or aqueous oil emulsions or solutions.

There are many objections to conditioning yarns prior to wetting out on the machine.

(*a*) The yarn dries out after conditioning, resulting in uneven knitting due to variations in wetting out.

(*b*) The growth of mildew or fungi in the wetted yarn.

(*c*) The wet yarn often degums, or pasty substances rub off, which gums up the needles, causing holes, sticking and even breaks.

(*d*) Unequal lengths due to too great a stretch in wetted yarn. On "wetting out" these conditioned yarns by adding a high moisture content, or by running through the troughs on the machine, all the foregoing faults are further exaggerated.

The ultimate goal is a good flat hosiery fabric of perfect stitch construction. Any condition that will allow the yarn to be formed into a fabric in the most natural way will result in the best fabric.

I have thus given the present practice in the throwing, conditioning, and knitting of hosiery yarns.

My method is novel and unique in that it eliminates the above disadvantages derived from wet yarn and has a highly economical feature in that conditioning is completely eliminated.

My method consists, as does the present practice, in soaking, winding, doubling, spinning and coning. The cone is made in the plant of the throwster and taken directly from the packing case of the throwster by the knitter and placed directly on the knitting machine. It is here knitted dry, without any wetting out through troughs on the machine, directly into a dry clear fabric.

By my method the moisture content of the yarn does not vary from throwster to knitter to the final knitted stocking by more than the one to two percent due to variation in atmospheric conditions. In this way fungi growths, stripping, sticking, degumming, machine rusting, corrosion, uneven lengths, et cetera, are entirely eliminated.

The novel part of my process to fabricate such a dry running yarn is accomplished in the soaking operation.

Usually the silk is softened with oil emulsions with the addition of such agents that will penetrate the gums and soften them so that the silk can actually be wetted throughout its fiber.

I use a soluble oil or a soap and oil emulsion for treating the silk with such agents as acids, alkalies, wetting-out agents, penetrating agents, surface tension reducing agents, et cetera, to properly soften the silk and make it soft and flexible for knitting. In addition to these normal recognized materials, I add a wax, preferably a mineral wax like paraffin wax, in a quantity to help in lubrication as well as to cover the silk in a lubricating coating. This wax causes silk hairs, broken filaments, loops and such defects to be wound into the thread composition and result in a smooth flexible thread that will knit into a fabric without any wetting out at any time.

In order that the wax may be adapted to my process it must be properly emulsified, and without limiting myself to any particular wax emulsion, I have found that a most suitable emulsion base, capable of emulsifying waxes, is produced from a soap made from mineral oil sulfonic acids and a member of the group consisting of sulfonated animal oils and fats, sulfonated vegetable oils and sulfonated fish oils, and if desirable a higher alcohol containing more than ten carbon atoms.

Among the sulfonated animal, vegetable and fish oils, I have found of special usefulness sulfonated sperm oil, sulfonated cod oil, sulfonated tallow, sulfonated lard oil, sulfonated olive oil and sulfonated peanut oil, and among the higher alcohols I have found lauryl alcohol and myristic alcohol of value in my process.

This emulsion base, when combined with the wax and built into an emulsion, gives a particle size and a stability of dispersed particle that is desirable in the proper penetration of the silk. The wax emulsion is stable in contact with other emulsions, but breaks slowly and continuously when in contact with the silk mass.

I give the following as examples of the application of the process of my invention:—

Example 1

100 pounds of silk yarn are soaked for 10 hours at a temperature of 90° F. in a solution containing
16 pounds wax emulsion
8 pounds soluble soaking oil
8 ounces potassium carbonate
60 gallons water

The excess of water is removed, preferably by centrifuging the yarn being then air or force dried to a normal moisture content in the air of 7% to 11% wound, spun, coned and placed in shipping package for use on hosiery machine.

Example 2

For 100 pounds of silk yarn use
12 pounds wax emulsion
14 pounds sulfonated castor oil

Example 3

As Example 1, substituting sulfonated olive oil for the soluble soaking oil.

Example 4

As Example 1, substituting sulfonated sperm oil for the soluble soaking oil.

Example 5

As Example 2, adding 1 pound of oleyl alcohol.

It is to be understood that the proportions can be varied to suit conditions, and that various agents can be added to give some additional characteristic to the silk, such as penetrating agents, softening agents, et cetera. Further, this application of wax as an important part in the soaking of silk is not to be confined to paraffin wax alone, as other light colored waxes such as carnauba, Japan, beeswax, Montan, et cetera, are useful in this application.

Among the advantages of my method and system over present practice, in point of economy, superior results, ease of application, et cetera, the following may be mentioned:

1. The thread is not wetted after soaking and throwing to prepare it for proper knitting.

2. The yarn package will not yield a base for growth of bacteria and fungi when kept in a dry condition.

3. The dry fabric formed can be stored indefinitely without any fear of bacterial growths, rancidity or oxidation.

4. The yarn knitted dry will not stretch or elongate when made into fabric. This insures even hosiery lengths.

5. The prohibition of water in the yarn and fabric insures more uniform conditions of knitting than heretofore obtained.

6. The non-wetting of yarn by conditioning or wetting-out on the machine prevents stripping of the gums which interferes with the proper knitting of the yarn.

7. The prohibition of water from the yarn prevents corrosion and pitting of metal knitting parts.

8. The presence of a wax on the yarn helps to bind the thread complex together, whereas the presence of water tends to open up the yarn and make fuzzy and imperfect fabrics.

9. Wax coated on and in the surface of the yarn repels the normal moisture exchange between yarn and air and therefore keeps it in a uniform condition.

10. The economy of operation, when conditioning and wetting out equipment are entirely omitted, is of such importance that it will amount to as much as 15 cents per pound of silk.

11. The non-disturbance of the cone package as made by the throwster insures better yarn for knitting.

12. The economy in the soaking formula is important, as special agents are not required to help in better wetting out.

13. The economy in the soaking formula is important, as the wax has a great affinity to take up in the silk and add definitely to its weight for clearance purposes.

It will thus be seen that my invention presents a great advance in the art of preparing silk yarns for knitting purposes, in that it allows of a great saving in time, labor and material over the previously known processes and produces a finished product of improved properties.

I do not limit myself to the particular materials, quantities, times, temperatures and steps of procedure specifically mentioned, as these are given simply as a means for clearly describing my invention.

What I claim is:—

1. A composition of matter adapted for the treatment of silk in oil-in-water emulsion, comprising a mixture of a water-insoluble wax, a soap of a mineral oil sulfonic acid and a sulfonated fatty oil.

2. A composition of matter adapted for the treatment of silk in oil-in-water emulsion, comprising a mixture of paraffin wax, a soap of a mineral oil sulfonic acid and a sulfonated fatty oil.

3. A composition of matter adapted for the treatment of silk in oil-in-water emulsion comprising a mixture of a water-insoluble wax, a soap of a mineral oil sulfonic acid and sulfonated castor oil.

4. A composition of matter adapted for the treatment of silk in oil-in-water emulsion, comprising mixture of a paraffin wax, a soap of a mineral oil sulfonic acid and sulfonated castor oil.

5. A composition of matter adapted for the treatment of silk in oil-in-water emulsion comprising a mixture of a water-insoluble wax, a soap of a mineral oil sulfonic acid and sulfonated sperm oil.

6. A composition of matter adapted for the treatment of silk in oil-in-water emulsion comprising a mixture of paraffin wax, a soap of a mineral oil sulfonic acid and sulfonated sperm oil.

7. A composition of matter adapted for the treatment of silk in oil-in-water emulsion comprising a mixture of a water-insoluble wax, a fatty alcohol, a soap of a mineral oil sulfonic acid and a sulfonated fatty oil.

8. In a process for treating silk yarn, the step which consists in treating said yarn with an oil-in-water emulsion containing the composition of matter of claim 1.

9. In a process for treating silk yarn, the step which consists in treating said yarn with an oil-in-water emulsion containing the composition of matter of claim 2.

10. In a process for treating silk yarn, the step which consists in treating said yarn with an oil-in-water emulsion containing the composition of matter of claim 3.

11. In a process for treating silk yarn, the step which consists in treating said yarn with an oil-in-water emulsion containing the composition of matter of claim 4.

12. In a process for treating silk yarn, the step which consists in treating said yarn with an oil-in-water emulsion containing the composition of matter of claim 5.

13. In a process for treating silk yarn, the step which consists in treating said yarn with an oil-in-water emulsion containing the composition of matter of claim 6.

14. In a process for treating silk yarn, the step which consists in treating said yarn with an oil-in-water emulsion containing the composition of matter of claim 7.

DALE S. CHAMBERLIN.