Sept. 1, 1936. B. BORZYKOWSKI 2,053,175

METHOD FOR THE DIRECT MANUFACTURE AND EMPLOYMENT OF ARTIFICIAL FIBERS

Filed Jan. 21, 1930 2 Sheets-Sheet 1

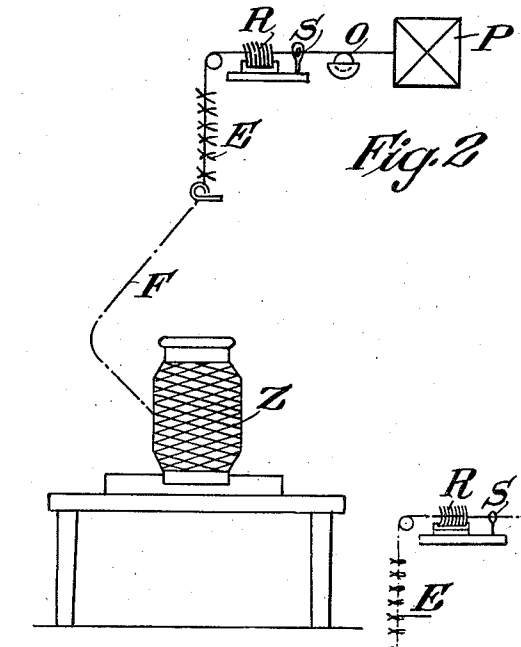
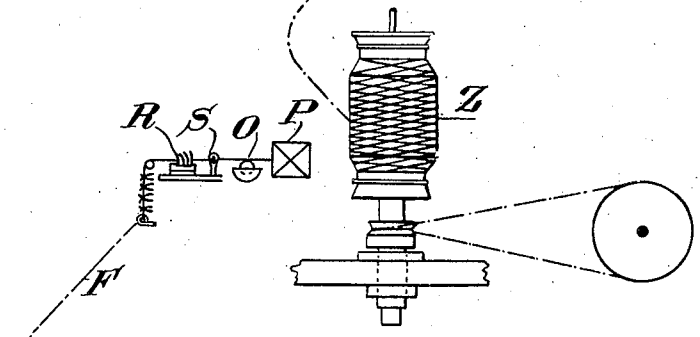


Fig. 2

Fig. 1.



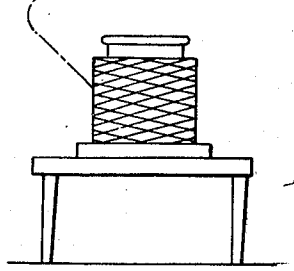


Fig. 3

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Fig. 4.

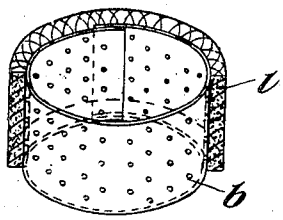


Fig. 8.

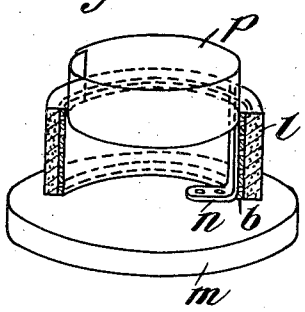


Fig. 5.

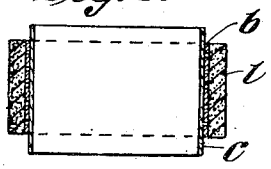


Fig. 9.

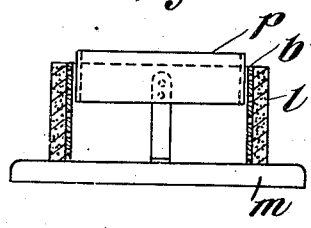


Fig. 6.

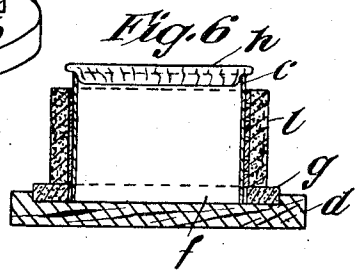


Fig. 7.

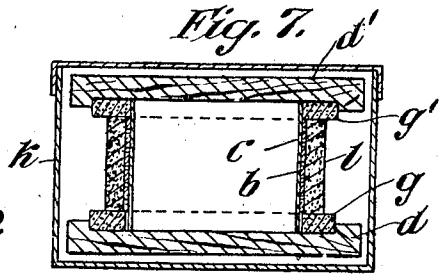
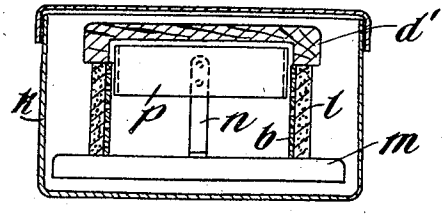


Fig. 10.



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2,053,175

METHOD FOR THE DIRECT MANUFACTURE AND EMPLOYMENT OF ARTIFICIAL FIBERS

Benno Borzykowski, Paris, France

Application January 21, 1930, Serial No. 422,467
In Germany December 22, 1928

10 Claims. (Cl. 28—1)

This invention is concerned with methods and apparatus for the manufacture and working up of artificial silk spun on bobbins or as cakes in centrifuges, one object being the reduction to a minimum of the number of steps or stages involved, thereby shortening the time required, cheapening the products and sparing the material.

Another object of the invention is to enable the introduction of untwisted, so-called "slack" or "floss" silk, which has a large covering capacity and great softness, into fabric without any rewinding, that is directly from the supporting bodies upon which it has been wound in the formation of the thread. For this purpose use is preferably made of perforated spinning bobbins of larger diameter or of greater length than the normal, in order to be able to wind as large a metric count as possible for the spinning. As the yarn can be washed, and if desired, also improved upon said perforated supporting bodies, the bobbins may be placed for example on a shuttleless loom and be introduced, as weft, direct from the spinning bobbin into the fabric.

However, such untwisted "slack yarn" may, before being so worked up directly into woven or knitted materials be passed through an appropriate solution (for instance readily removable size, gelatine or oil emulsions or other suitable solutions), which holds the capillary filaments together on their way from the supporting body to the fabric. This manner of manufacturing fabrics from untwisted artificial threads yields far softer and better "covering" material and saves, moreover, all the rewinding and twisting of the easily damaged loose untwisted capillary filaments.

A further object of the invention is to enable the direct working into fabrics also of artificial silk which has been twisted.

Another important purpose of the invention is to bring artificial silk spun on bobbins or in spinning pots from the form to which it is spun, and in which it has undergone the necessary wet treatment and drying, directly into the wound form required by the textile industry, that is without rewinding the silk or reducing it to hank or skein form, at the same time, however, eliminating deficiencies which have arisen in practice in carrying out prior proposals.

As is well known, artificial silk, irrespective of whether it has been produced by the centrifugal or bobbin spinning processes and whether the wet treatments have been shortened or not, is generally supplied to the weaving or knitting industries in a condition which is still unsuitable for weaving or knitting in spite of the fact that there is a so-called sorting of the hanks or skeins in the artificial silk factory before despatch. In the hitherto usual mode of sorting, at most only visible thread breaks in the skein can be removed by the manual labour of the sorter, or if said faults cannot be entirely removed the silk in question is allotted to a lower quality. Before being woven or knitted the silk thus sorted must in most cases first be treated with agents suitable for those purposes. For the knitting of hose, for instance, it must be dipped in oil emulsions or the like and for warp purposes the skein must be sized or treated with similar means, re-dried and drawn or stretched, the threads being naturally further damaged thereby. Only after this can the weaving or knitting operative bring the silk, thus preliminarily treated, on special winding or bobbin machines into the wound form required for its working up.

Further objects of the invention will appear from the following description of specific embodiments and modes of execution thereof:

(1) *The bobbin-spinning process.*—In this process, the untwisted threads running off from the perforated spinning bobbin may, according to the applicant's French Patent No. 634,044, be wound directly to a wound form (bobbin) suitable for the textile industry. However, any capillary filaments broken in spinning or any impurities adhering to the silk are carried along during the further treatment and the winding of the thread and give the weaving or knitting operative trouble in the working up. Moreover, the weaving and knitting industries are no longer able to subject the silk, already wound on the bobbin, to the usual after-treatment (e. g. sizing or oiling).

The difficulties are overcome by the present invention in a simple manner and with simple apparatus, in a single operation, and moreover with a uniformity and thoroughness such as the weaving and knitting industries could never attain upon artificial silk in the hitherto usual hank or skein form.

In the accompanying drawings:

Figure 1 shows how a bundle of capillary filaments running off from the perforated spinning bobbin is passed through a thread guide and a tensioning device to a cleaning device on its way to the bobbin or other winding device such as is suitable for use in the textile industry.

Fig. 2 shows an apparatus similar to Fig. 1;

Fig. 3 illustrates the pot spinning process;

Figs. 4 to 10 illustrate further developments of the applicant's method.

The cleaning device R consists preferably of hairy material and is so designed that any impurities in the thread are arrested in this material. The device S, which may take the form of an eyelet or an adjustable slit, cleans the thread by retaining all foreign bodies and only allows a perfect, smooth thread to pass. Thus the thread is not only cleaned but also every millimetre thereof is mechanically tested, in respect to thickness and so forth, in a quasi-automatic or mechanical fashion which is impossible with skein-sorting. If the thread is not quite perfect, it tears, the defective portion is removed and the two good ends are knotted together again. If any particular bobbin has several knots, then it belongs to a lower quality. Obviously the cleaning and sorting of the thread may also be performed in the manner described, if the thread running off from the spinning bobbin, Figs. 1 and 2, twisting bobbin, or spun cake (Fig. 3) is caused to run on to a reel instead of on to a winding device suited to the textile industry without the essence of the invention, that is the simultaneous cleaning and sorting of the thread during its production, being affected in any way. By this means not only is a thread of really I*a* quality achieved but also a yield of about 98% of I*a* quality even in the case of bobbins or cakes well spun with the finest threads. With sorts of yarn which require a special preliminary preparation for the purpose of their better working up, this also is provided for in a very simple manner in one operation simultaneously with the cleaning and sorting. Thus in Fig. 1, O is an arrangement comprising, for instance, a trough in which there is a rotating roller. This rotating roller carries a suitable amount of oil or other preparation liquids to the thread so that the thread is treated with the requisite preparation and is then wound at once on a bobbin T. This bobbin is driven in known manner through a friction shaft W or the like. The weaving or knitting industry thus receives a completely cleaned thread, treated with a preparation appropriate to the purpose, on a bobbin which can be worked up direct on the loom or knitting machine.

In Fig. 2 the bobbin Z, however, is not rotated. The supple, untwisted slack thread is, if necessary, passed through the cleaning devices R and S to the above described preparation device O wherein there is a suitable agent (such as size) for, by way of example, holding the filaments together. It is then worked up directly on P, which may represent a winding device, a loom or any other machine for working up the thread. P might also represent a shuttleless loom wherein the slack threads are used by the hook or gripper as weft (filling). Fig. 3 shows that the cleaning and oiling or other preparation may also be applied to thread from a spun cake I as produced by the centrifugal or spinning pot process, then passing, for example, directly to P as before.

(2) *The pot spinning process.*—In the manufacture of silk by the pot-spinning process, the applicant has already shown by his French Patent No. 661,781 that the silk spun in cake form may be washed and improved in the centrifuge if a flexible perforated sleeve, which prevents the thread being damaged during the wet treatment and at the same time tensions the thread, is inserted in the interior of the cake still in the centrifuge. The cake can be dried without removing the sleeve therefrom and then brought directly into the winding machine to be reduced to a form suitable for the textile industry, or it may be converted into hank or skein form. In carrying out the process in practice it has proved that other methods and apparatus must also be employed in order to be able to work successfully on a manufacturing basis. The further developments will be described with reference to Figs. 4 to 10. In the above mentioned French Patent 661,781, the applicant has shown that for the purpose of drying the cake under tension, the perforated ring *b* inserted for the washing may remain in the cake *l* also during the drying as seen in Fig. 4. Said drying is performed by hanging the cakes, disposed on the rings *b*, on rods and feeding them through a drying passage. It has been found that in drying, the edge threads slip off from the perforated ring *b*, which is only of the depth of the spun cake and does not project at either end of the cake, and are damaged, this being due more particularly to the air circulation in the drying passage. This makes the subsequent working up of the thread difficult. Further damage is caused by the placing of the cakes on the rods and their removal therefrom.

According to the invention, this defect is overcome Fig. 5 by the insertion in the interior of the perforated sleeve *b* after the withdrawal of the washed and, if desired, after-treated cake from the spinning pot, of a second sleeve *c*, also flexible, which projects top and bottom from the cake. Any edge threads slipping off are caught by this extension sleeve *c*, rest thereon, and are thus protected against further damage. After drying, the cake is placed, for the purpose of taking off the thread from the cake, on a support Fig. 6. This support may comprise, for example, a wooden plate or disc *d* of a size somewhat greater than the diameter of the cake and provided with a circular recess *f* of about the diameter of the sleeve *c* in the cake. The recess is preferably formed in or bounded by a soft washer *g*, of felt or hide for example, which is glued or nailed to the wooden tablet *d*. This provides a soft support which permits better unwinding of the thread from the cake, for if the unwinding of the thread should be interrupted, the thread will be unable to get a footing under the bottom edge of the cake and become caught up or break when unwinding is continued.

For the purpose of avoiding damage to the thread by the upper edge of the sleeve *c* whilst running off from the cake, a plate *h* of smooth or polished material may be fitted at the top of the sleeve with its edge projecting beyond the outer surface of the sleeve. The spinning cake thus arranged and provided with the support *d* and plate *h*, can be placed directly on a knitting machine, warping machine or frame or even on a shuttleless loom, in order to be converted into textiles of any kind directly, that is to say without re-winding.

Since a cake contains, as is well-known, a length of 10,000 metres or more of thread, it follows, that apart from the protection of the material, the cost of re-winding is saved and a warp or weft practically free from knots and thus a fabric free from knots is obtained. This represents a particularly important advance in the case of closely set warps made from artificial silk and needle goods of large span made with close-set needles, for it is well-known that even the finest so-called weaver's knots cause frequent

breakages of threads and the so-called jumping off in hose knitting and other machines and therefore considerable waste.

If desired, the cake with sleeve *c* (shown in Fig. 6) can be further protected for the purpose of transport within the silk spinning works or to the places of use, by employing instead of the disc *h*, a cover disc or plate *d'* Fig. 7 similar to the plate *d* aforesaid and provided, if required, with a felt, plush or other soft-facing which protects the upper layers of thread of the "cross wound" cake bobbin, as the cake provided with the sleeve *c* may best be termed, from damage during transport. The cakes may also be packed, for instance, into cardboard boxes such as *k* Fig. 7 and even sent by post or in boxes or cases for long distances without damaging the threads.

It has further been found that cakes spun by the centrifugal spinning process may be even better improved and further worked up if the method and apparatus described below is employed.

In the form illustrated in Fig. 5, the cake is suspended with the internal sleeves *b* and *c* upon horizontal rods and is dried in the drying passage. This method and apparatus are applicable to certain purposes and certain classes of thread, e. g. thick yarn-numbers of thick capillary filaments. With fine capillary filaments and thin yarn members, particularly in cases where it is desired to work direct from the finished spun cakes, it is preferable for the cakes, instead of being suspended on rods horizontally in the drying passage, to be set on a support such as that of Fig. 6, or even better Fig. 8, and dried standing. If the support and arrangement of Figure 3 of Sheet II are employed, it is necessary to use cakes of a certain internal diameter in order that the sleeve *c* shall just fit in the recess *f* in the support *d*. If, however, cakes of varying internal diameter are to be dealt with, as often happens, then it is to be recommended that use should be made of the support *m*, Fig. 8 having no recess. Said support *m* comprises a flat surface preferably with a somewhat larger diameter than the cake and is advantageously covered with a long-fiber material such as plush or hide (as described in Fig. 6) which prevents any filaments which may have become loose and fallen on the support from getting between the cake and support and breaking. To this support *m* (Figs. 8 and 9), for instance, an angle piece *n* is attached and the resilient sleeve *p* is mounted on the latter. The dimensions of said sleeve *p* are so chosen that the upper edge projects sufficiently far above the upper edge of the cake. The cover plate *h* of Fig. 6, or, for transport, the cover *d'* of Fig. 7 or of Fig. 10 may be placed on the upper edge of the sleeve *p*.

With this process of drying in a standing position and with the mechanical arrangements described with reference to Figs. 8 and 10, the entire edge of the cake rests solidly on the support. Slipping off of the thread layers into a recess, such as might happen in the case of Fig. 6 with cakes of variable internal diameter cannot occur with such arrangement.

As, moreover, the upper edge of the sleeve *p* projects above the upper edge of the cake, slipping of any layers of thread which may have become loose from the upper edge of the cake into the interior of the cake is obviated. Furthermore by the attachment of the tensioning sleeve *p* to the support *m* Figs. 8–10, secure seating of the cake is ensured and thus slipping of the thread layers and damage to the fine capillary threads avoided.

The support *m* may be formed with one or more perforations or bores to permit the warm air to pass from below through the sleeves and thus into the interior thread layers of the cake. Obviously, the cover *d'* need not be used during the drying as the purpose of that cover is to protect the thread during unreeling or unwinding.

It is obvious that the devices for carrying out the method described herein and illustrated diagrammatically in the drawings may also be constructed and arranged in a manner different from that shown without departing from the essence of the invention.

It is also to be understood that some parts of the invention are applicable not only to wet spinning processes but also, appropriately modified, to all kinds of dry spinning processes. Thus, for example, nitro-cellulose silk may be freed from excess solvent, denitrated and washed on a perforated spinning bobbin or as a cake in the spinning pot, as in the present methods and apparatus, thereafter to be worked up directly or subjected to further mechanical operations (twisting, rewinding and reduction to wound forms suitable for the textile industry) after any necessary further treatment performed on the bobbin or in the spinning pot in cake form and, naturally, after the necessary drying. Not only do the methods and apparatus described spare the threads as far as possible and give high yields, but there is the more important advantage that the easily inflammable thread, which presents a great danger to the material and to human life whenever mechanically strained, can be denitrated before any mechanical treatment, i. e. in the wound form spun.

Formations produced from cellulose or other solutions by the dry spinning process may also be further treated in an analogous manner by the present methods and apparatus. Thus, for instance, cellulose acetate formations may, on the perforated spinning bobbin or in the spinning pot, be free from excess solvent, and saponified or the like, if necessary superficially, with suitable liquids before being finally treated in the described manner with necessary preparations.

I claim:—

1. Method for the production of textile goods of artificial silk, which comprises forming a body of artificial silk by a spinning process, subjecting said body to wet treatment while maintaining the original shape of said body, inserting a support in said body, drying said body on said support, and converting the silk of said body on said support directly into fabric.

2. Method for the production of textile goods of artificial silk, which comprises forming a body of artificial silk by a spinning process, subjecting said body to wet treatment while maintaining the original shape of said body, inserting a support in said body, drying said body on said support, transporting said body on said support, and converting the silk of said body on said support directly into fabric.

3. Method for the production of textile goods of artificial silk, which comprises forming a body of artificial silk by a spinning process, subjecting said body to wet treatment while maintaining the original shape of said body, inserting a support in said body, drying said body on said support and converting the silk directly into

fabric by unwinding the same from said support, subjecting it to after treatment without rewinding, and introducing it directly into the fabric-producing machine.

4. Method for the production of textile goods of artificial silk, which comprises wet spinning a body of artificial silk upon an internal support, after-treating said body upon said support while maintaining the original shape of said body and unwinding said body from the same support for direct conversion into textile goods.

5. Method for the direct manufacture and working up of artificial fibrous material, comprising forming a spun cheese or cake of the material by a spinning process inserting a support in the spun cheese or cake to maintain the original shape of said cheese or cake, drying the same on said support and coverting the material of this spun body directly into fabric with avoidance of rewinding.

6. Method for the direct manufacture and working up of artificial fibrous material, comprising forming a spun cheese or cake of the material by a spinning process and inserting a support in the spun cheese or cake to maintain the original shape of said cheese or cake, drying the same on said support, and converting the spun material from this cheese or cake on said support directly into fabric, with avoidance of rewinding.

7. Method for the manufacture of fabrics from artificial fibrous material, comprising winding this material on supporting bodies during thread formation by a spinning process and applying additional internal support thereto to maintain the shape of the winding so formed, drying the material while internally supported, and weaving or knitting the said material directly from said internally supported bodies.

8. Method for the manufacture of artificial fibrous material comprising spinning the material to the wound formation, supporting said formation internally, unwinding said material from the wound formation upon the support, and in the same operation mechanically cleaning and testing the material and passing the material directly to a weaving operation without rewinding.

9. Method for the manufacture of artificial fibrous material, comprising spinning the material to a wound formation, causing said material to undergo liquid treatment, such as washing, in said wound formation, inserting a support in said formation, and then subjecting said material to mechanical cleaning and testing in a single operation simultaneously with the unwinding of said formation from said support and passing the thread to a loom for working into fabric without rewinding.

10. Method for the manufacture and working-up of artificial fibrous material, comprising forming a spun cake of the material, introducing a support into said cake for maintaining the original shape of said cake of material, drying the material in cake form upon said support while free of rotary motion unwinding said spun material from the cake upon said support and passing the thread directly to a textile weaving operation without rewinding.

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