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PROCESS AND APPARATUS FOR THE TREATMENT OF A PLURALITY OF FIBROUS OR FILAMENT-LIKE MATERIALS

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Fig. 1

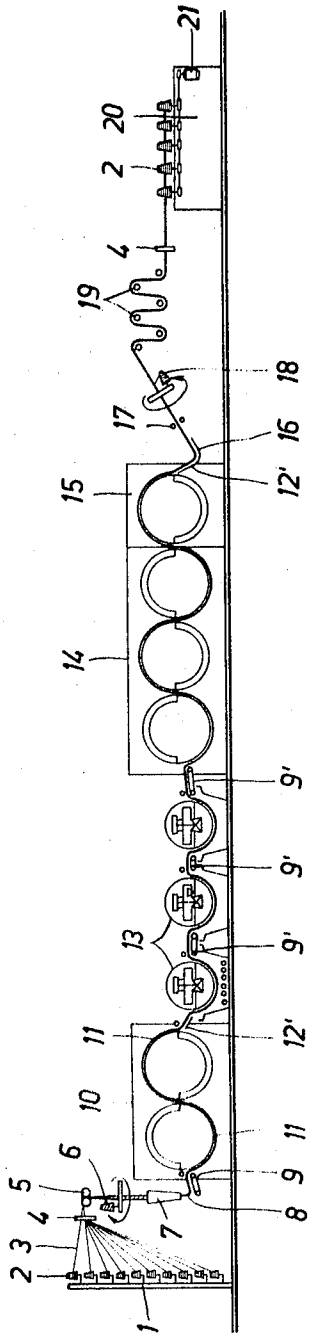
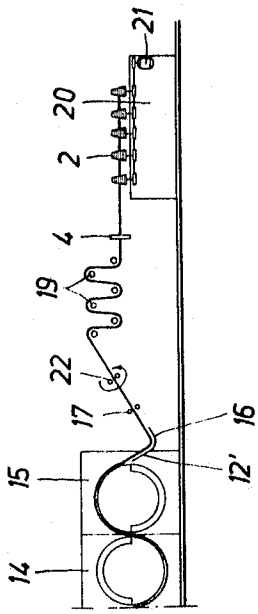


Fig. 2



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PROCESS AND APPARATUS FOR THE TREATMENT OF A PLURALITY OF FIBROUS OR FILAMENT-LIKE MATERIALS

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U.S. Cl. 57—35 33 Claims

ABSTRACT OF THE DISCLOSURE

The present disclosure relates to a process and apparatus for shrinking, dyeing, bleaching, setting, washing, finishing and the like of a plurality of fibrous or filament-like materials. More particularly, the present disclosure is directed to a process for the continuous treatment of a plurality of loose endless fibrous or filament-like materials, for example, textile materials or synthetic fibers which comprises combining said filaments into at least one filament group, steaming said filament group, subjecting said steam filament group to at least one wet-treatment step, drying said filament group in a drying chamber, separating said filament group into a plurality of filaments and recovering said separated filament.

BACKGROUND OF THE INVENTION

The present invention relates to a process and apparatus for the shrinking, dyeing, bleaching, setting, washing, finishing and the like of loose endless fibrous or filament-like materials, preferably twisted yarn, wherein the material is subjected to a series of processing steps, for example, impregnating or printing, squeezing, steaming, washing, drying, and the like. More particularly, the present invention concerns a process and apparatus for the continuous treatment of a plurality of loose endless fibrous or filament-like materials which comprises combining said filaments into at least one filament group, steaming said filament group, subjecting said steamed filament group to at least one wet-treatment step, drying said filament group in a drying chamber, separating said filament group into a plurality of filaments and recovering said separated filaments. Alternatively, the filament groups may be combined into hanks and processed accordingly.

It is well known to treat yarn, for example, to dye yarn discontinuously in hank form or in packages. When treating yarn hanks, the hanks must be put on beams and removed from the beams by hand after treatment. This continuous processing requires many operators and expensive winding devices which renders this process considerably more expensive than that of the present invention.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to avoid these prior art disadvantages in the treatment of fibrous and filament-like materials.

Another object of the present invention is to provide an improved process and apparatus for the continuous treatment of a plurality of loose endless fibrous or filament-like materials which eliminates expensive winding devices and substantially reduces the number of operators required in its operation.

A further object of the present invention is to provide an improved process and apparatus for the continuous shrinking, dyeing, bleaching, setting, washing, finishing and the like of loose endless fibrous or filament-like materials, advantageously twisted yarn.

Other objects and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

Pursuant to the present invention, it has been found that the above-mentioned disadvantages may be eliminated and a much improved process and apparatus for the treatment of loose fibrous or filament-like materials may be obtained by treating a plurality of yarns in parallel as an endless filament group or filament lengths. Depending on the thickness of the yarn, about 100 to 500 or more threads can be combined and treated continuously in one process. By combining a plurality of filaments into a continuous and endless filament group, this filament group, similarly as any material length, may now utilize the individual continuously operating treatment units which are presently known and used for fabrics, knit goods and similar lengths of materials, particularly textile materials.

With treatments which require an extended treatment time, for example, steaming processes for dyestuff setting, it is desirable to fold the filament group and to treat it in the folded state. By folding the filament group it is possible to pile up the filament group in a 20-fold layer onto the conveying element and/or conveying elements of the respective treatment unit and thus increase the treatment time in this manner. Even thicker folded layers can be processed without difficulty.

For dyeing, it is suggested either to impregnate the material as a loose filament group with the dyeing liquor and remove excessive dyeing liquor by squeezing or to print the material with dyeing liquor, subject it, in a folded condition to further processing, for example, dyestuff setting under steam, and then wash out the unfixed dyestuff and the auxiliary agents, and dry the loose filament group. Washing and drying can be effected in straight-through passage or also while the material is still folded, depending on the treatment unit used. After drying, the filament group can be separated and the individual filaments can be reeled, or the filament group can be wound on a beam and fed from the beam to a reeling device.

The treatment of a loose filament group is only effective on devices in which the material can be guided tensionless and safely and wherein entangling of the individual filaments can be safely avoided. Many of the known treatment devicse do not come up to this requirement. According to the present invention, it is suggested to combine the loose filament group into at least one endless hank and to treat it continuously in hank form. In addition, it is frequently expedient to give the hank more strength. This can be achieved, for example, by incorporating a false twist in the hank or by circumtwisting it.

However, a consolidation of the loose filament group before treatment can be advantageously effected similarly as in weaving, by subdividing the filament group into two partial filament groups whereby, and preferably alternately, one filament each is allocated to one partial filament group and the adjacent filament to the other partial filament group, and whereby the filament group is consolidated by inserting and returning at least one filling yarn, for example, at distances at about 1 to 10 m. The filament group is then passed through the individual treatment devices in this consolidated state. After the treatment, separation of the filaments can be facilitated by drawing out the filling yarns.

It is also possible to feed the filament group combined to a hank in a zig-zag or helical manner and to combine the individual zig-zag or helical layers at, at least two points, preferably near the knees or bends of the layers and to subject them to the individual processes in this consolidated form.

With synthetic yarns which have not been fixed and which are to be treated in a fold condition, it is especially advantageous to subject the yarn, before dyeing, as a loose filament group to a shrinking and/or setting treatment, so that fixing of the bends and entangling due to too high of a shrinkage capacity is avoided. However, it is also possible to effect the setting and/or shrinking treatment during the drying process, for example, in the beginning of the dyestuff setting.

It is of particular advantage with respect to a proper material guidance as well as a reduction of the treatment times to pass, preferably to draw the various treatment media through the filament group, except during the impregnating or printing stage of the process.

For yarns of hydrophobic textile fibers or for fiber blends containing hydrophobic textile fibers, it is suggested to dye the yarns according to the Thermosol process with disperse dyestuffs and/or with other dyestuffs which are fixed in hot air.

An apparatus for carrying out the process according to the present invention comprises, in combination,

(a) A stand for several bobbins or packages;

(b) At least one impregnating or printing device, in front of which a comb-like guiding element for the orderly parallel feeding of the yarns may advantageously be disposed; however, it is also possible to arrange several impregnating devices for applying several colors;

(c) In some cases a consolidation device, for example, a circum-twisting device or a device for producing a false twist is used if the filament group is combined to a hank. If a loose filament group is involved a knitting or weaving device may also be used. However, in most cases a consolidation of the filament group is not necessary;

(d) A steaming device;

(e) One or more sieve drum bowls with squeezer means connected therebehind, said bowls being utilized for rinsing, washing, neutralizing and possibly finishing;

(f) A dryer means, especially a sieve drum dryer;

(g) Desirably a folding device which is correlated to one of the aforementioned units. For example, the folding device may be set up in front of the steaming device and may fold the filament group loop-like or in zig-zag folds onto the conveying element of the steamer; and

(h) A winding, reeling or packing means, in front of which a deconsolidation and/or separating means is set up, that is, a device for removing the twist in the yarn. Of course, such a device is only required if the filament group was consolidated before or during the treatment.

In order to compensate for differences caused by material shrinkage or by slight speed differences of the individual units, it is suggested to associate a material store, possibly in the form of a chute or a trough, with at least one of the individual units, or to a group of individual units, for example behind the steamer. However, instead of a material store, compensating rollers may be correlated to the individual units or to certain individual units, for example, to the steamer or to the sieve drum dryer.

As a steaming chamber, a J-box, a sieve drum steamer, a sieve belt steamer or any other known type of steamer can be used. However, it is advantageous if with steaming, washing and drying, the steam, the washing liquor and the air are passed through the material as a result of a suction draft, since in this way an extremely uniform and intense treatment is ensured. At the same time, the filament group is safely held to the conveying element by the suction draft and an entangling of the filaments is substantially avoided. By the shock-like heating up process of the present invention, substantially shorter treatment times can be obtained.

If a sieve drum steamer and/or a sieve drum dryer is used, the intake may be sealed by a pair of rollers made of soft rubber. It is advantageous if the pair of rollers can be driven at a higher speed than the subsequent sieve drums, so that the loops can be pushed closer together and/or a loop formation is possible when the material is passed onto the sieve drums. However, instead of a pair of rollers, an intake conveyor belt can also be used, and this belt can be driven at a higher speed than the first sieve drum whereby the zig-zag folds and/or the loops are also pushed closer together when being passed onto the sieve drum.

If the yarn hank is to be consolidiated and protected against entangling by circumtwisting it, this can be effected behind the impregnating and/or printing unit by means of a circumtwisting device which rotates around the yarn hank. A similar device can be used for detwisting after the treatment, behind the dryer and/or before the reeling device. After removing the consolidation, the filament group is still hank-like. Spreading and separating the filament hank in front of the winding-up device can be effected, for example, by means of several bent or bulky rollers over which the filament hank is guided or by means of bent rods over which said filament hank is guided.

In finishing processes, for example, in dyeing, it is advantageous if at least the first wash bowl behind the steamer is equipped with a heating device and if the washing liquor is heated to nearly the boiling temperature.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become fully understood from the detailed description hereinbelow and the accompanying drawings which are given by way of illustration only and thus are not limitative of the present invention and wherein,

FIGURE 1 shows a schematic design of a continuous yarn treatment plant; and

FIGURE 2 is the outlet means of a slightly different yarn treatment plant according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings wherein like reference numerals are used throughout the various views to designate like parts, the apparatus of the present invention comprises a bobbin stand **1** containing bobbins **2** from which yarns **3** are drawn off and fed to a padder **5** by means of a rake-like means **4** in a well ordered condition. Behind the padder **5** the yarns **3** are combined to a hank **8** and consolidated by circumtwisting the hank by means of a circumtwisting device **6**. The hank **8** is then folded in a zig-zag manner onto an inlet conveyor belt **9** by means of folding device **7** and fed in this condition to a setting chamber **10** with sieve drums **11** subjected to a suction draft. Behind the setting chamber **10** the folded hank **8** is conveyed via a chute **12'** to sieve drum wash bowls **13** in a folded condition. At least the first bowl **13** is equipped with a heating device **23** for heating up the washing liquor to nearly the boiling temperature. Behind each bowl the material is squeezed and passed on to the next sieve drum bowl **13** by means of a conveyor belt **9'**. After the washing process the yarn is fed in zig-

zag folds to a sieve drum dryer **14** behind which a conditioning compartment **15** is connected. The outlet from the sieve drum dryer comprises a chute **12'** which ends in a trough **16** which serves as a material store. By means of a pair of rollers **17** which are connected therebehind, the zig-zag folds are straightened out and the material is detwisted by means of a detwisting device **18** of a similar design as the twisting device **6**. The detwisted hank is then spread by being passed over bent or bulky rollers **19**, and the individual yarns are separated from each other by means of a rake **4**. After separation of the yarns **3**, they are passed on a winding-up device **20** and wound up individually onto bobbins **2**. All bobbins are driven by means of a joint bobbin drive **21**.

In FIGURE 2 the outlet of the dryer **14** with the conditioning chamber **15** is of similar design as that in the apparatus according to FIGURE 1. Of course, the rotating pair of rollers **22** which are provided for detwisting the hank is only required in an apparatus which is provided with a device which enables a consolidation of the hank by a false twist at the inlet and/or behind the padder. The rotating pair of rollers **22** serves for detwisting hank **8**. The separation of hank **8** and reeling of the yarns **3** is effected as in the apparatus according to FIGURE 1.

Although the process and apparatus of the present invention is advantageously used in the treatment of textile materials, synthetic fibers, for example, certain synthetic polymers such as polyesters and nylon can also be effectively processed by the process and apparatus of the present invention.

Since modifications of this invention will be apparent to those skilled in the art, it is not desired to limit the invention to the exact constitution shown and described. Accordingly, all suitable modifications and equivalents may be resorted to which fall within the scope of the appended claims.

It is claimed:

1. A process for the continuous treatment of a plurality of loose endless fibrous or filament-like materials which comprises consolidating loose filament groups into at least one endless consolidated hank, folding said hank and introducing it in a serpentine manner to a steam treatment stage on at least one sieve drum subjected to a suction draft, washing the steam-treated material by conveying said material through at least one wash bowl on sieve drums subjected to a suction draft, drying said hank on at least one sieve drum subjected to a suction draft, conveying the hank through roller means to remove the folds and separating said hank into a plurality of filaments and recovering said separated filaments.

2. The process of claim **1** wherein the loose filament groups are consolidated by circumtwisting the hank to strengthen it, and subsequent to removing the folds, deconsolidated by unwrapping said hank.

3. The process of claim **1**, wherein the loose filament groups are consolidated by knitting.

4. The process of claim **1**, wherein the loose filament groups are consolidated by weaving.

5. The process of claim **1**, wherein prior to steaming the material being treated is impregnated as a loose filament group with a dyeing liquor and subsequently squeezed to remove the excess dyeing liquor.

6. The process of claim **1**, wherein the loose fibrous filament group is consolidated before treatment by subdividing the filament group into at least two partial filament groups by allocating alternate filaments to each group, whereby each filament group is consolidated by inserting and returning at least one filling yarn at distances of about 1 to 10 m., the separation of said filaments after treatment being facilitated by removing the filling yarn.

7. The process of claim **1**, wherein the hank is consolidated and strengthened by incorporating in it a false twist.

8. The process of claim **1**, wherein a plurality of filaments are combined to a hank and folded into a series of short turns, said individual turns being combined with each other at least at two points.

9. The process of claim **8**, wherein the individual short turns are combined at their bends.

10. The process of claim **5**, wherein before dyeing, the loose filament-like materials are subjected in a folded condition to a shrinking and setting treatment.

11. The process of claim **10**, wherein said shrinking and setting treatment is effected during the drying process.

12. The process of claim **7**, wherein after the drying stage and before separating the fibers, the false twist is removed from the hank.

13. The process of claim **5**, wherein the fibers to be treated are hydrophobic textile fibers or fiber blends containing textile fibers and said fibers are dyed according to the Thermosol process with dyestuffs which are dried and fixed in hot air.

14. The process of claim **1**, wherein the fibrous or filament-like materials are synthetic fibers.

15. The process of claim **1**, wherein the plurality of loose endless filaments comprises about 100 to 500 or more threads.

16. The process of claim **1**, wherein during the washing stage of the process the hank is conveyed only on that portion of the sieve drums which are disposed in the wash bowls.

17. The process of claim **16**, wherein more than one sieve drum is utilized in the washing stage, the wash liquid in the first of said sieve drums being heated.

18. The process of claim **12**, wherein the false twist is removed from hank by a pair of rotating rollers.

19. The process of claim **12**, wherein the untwisted hank is spread by being passed in a serpentine manner over rollers before the filaments are separated.

20. An apparatus for the continuous treatment of a plurality of loose endless fibrous or filament-like materials which comprises, in combination, means for combining said filaments in an orderly manner into at least one endless filament group, means for folding the filament group, a steam chamber containing at least one sieve drum means subjected to a suction draft, means for introducing said folded filament group to the steam chamber, at least one wash bath means disposed behind said steam chamber, said wash bath means containing at least on sieve drum means subjected to a suction draft, a drying chamber disposed behind the wash bath means for drying said filament groups, said drying chamber containing at least one sieve drum means subjected to a suction draft, means for unfolding the filament group, means for separating said filament groups into a plurality of filaments and means for recovering the separated filaments by winding-up said treated, separated filaments.

21. The apparatus of claim **20**, wherein after the filaments are combined into at least one endless filament group, means are provided for consolidating said filament group into at least one endless consolidated hank, and before separating said hank into a plurality of filaments, means are provided for deconsolidating said consolidated hank.

22. The apparatus of claim **20**, wherein the filaments are guided for the orderly parallel feeding of the yarns by a rake-like means.

23. The apparatus of claim **22**, wherein dye-stuff application means are provided after said rake means.

24. The apparatus of claim **21**, wherein the consolidating means is a circumtwisting device and the deconsolidating means is an unwrapping means.

25. The apparatus of claim **21**, wherein the consolidating means is a device which is effective in incorporating a false twist into the filament group.

26. The apparatus of claim **25**, wherein the false twist is removed by a pair of rotating rollers.

27. The apparatus of claim **20**, wherein a chute means provides the communication between the steam chamber and the wash bath means.

28. The apparatus of claim **27**, wherein a heating means is disposed in the wash bath means.

29. The apparatus of claim **20**, wherein squeezer means are provided behind the wash bath means.

30. The apparatus of claim **20**, wherein material store means are provided after the dryer means.

31. The apparatus of claim **30**, wherein trough means provides the communication between the dryer means and the material store.

32. The apparatus of claim **20**, wherein dyestuff application means are provided prior to the steam chamber.

33. The apparatus of claim **20**, wherein bobbin means are provided to feed the filaments to the treatment apparatus and for winding up the treated, separated filaments.

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