Oct. 22, 1968 W. W. TEW 3,406,437

PROCESS FOR TREATING YARN

Filed March 29, 1966 2 Sheets-Sheet 1

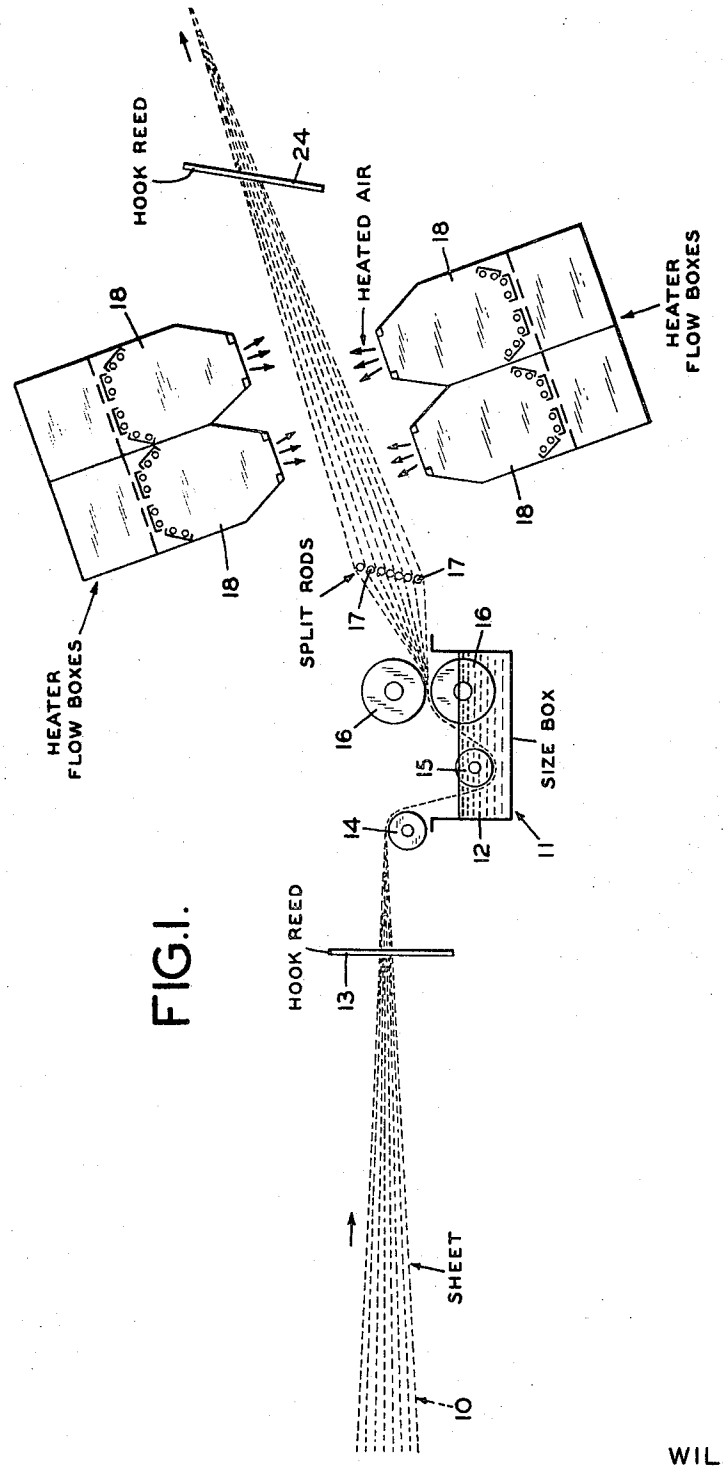


FIG. 1.

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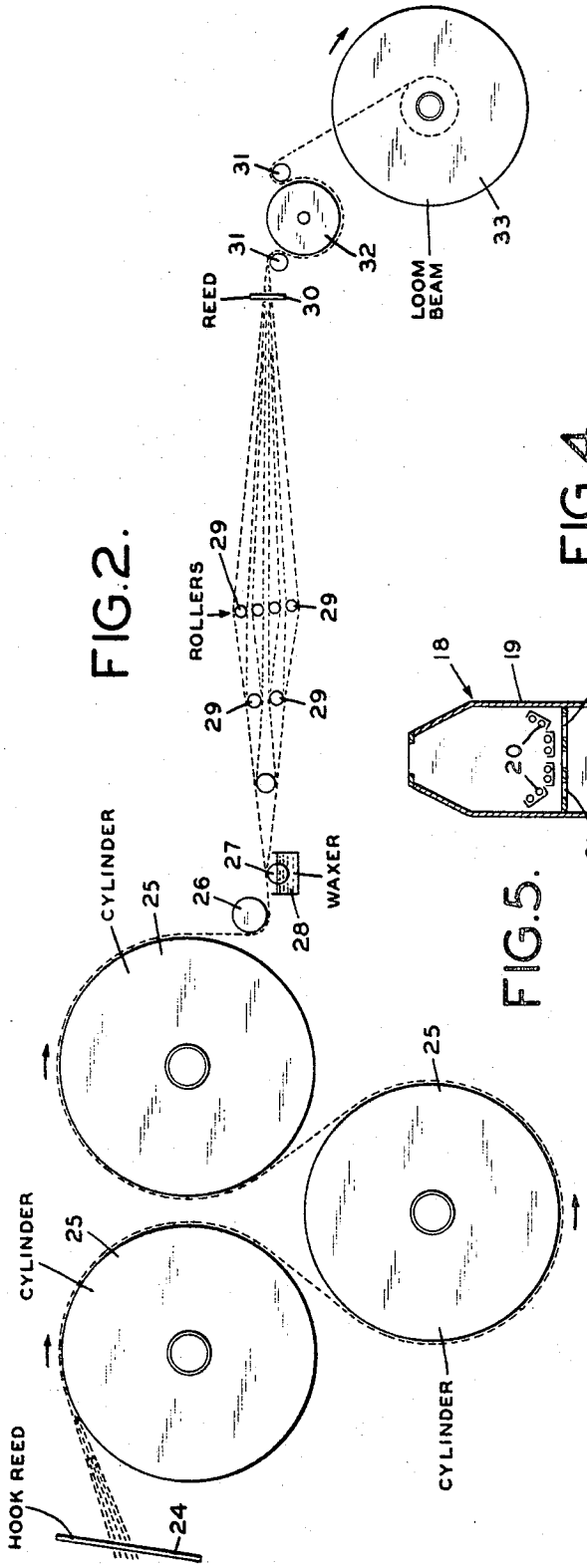


FIG. 2.

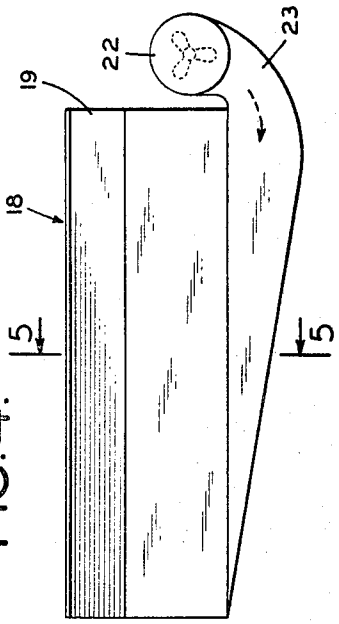


FIG. 4.

FIG. 5.

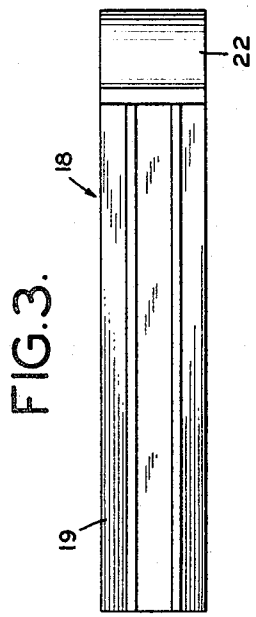


FIG. 3.

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3,406,437

PROCESS FOR TREATING YARN

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6 Claims. (Cl. 28—72.6)

ABSTRACT OF THE DISCLOSURE

A process for slashing yarns which comprises passing said yarns through a sizing bath, removing excess sizing liquid, wet-splitting said yarns, passing said wet-split yarns through a heating zone of hot turbulent air established by impinging hot air streams directed toward said wet-split yarns at an air stream velocity sufficient to agitate the individual yarns and produce momentary separation but insufficient to cause yarn entanglement, until said yarns are dried, passing said dried yarns through a separating zone and thereafter through a tensioning zone.

This invention relates to a process for treating a textile material and more particularly to a process for slashing an assembly of substantially parallel yarn ends.

As is known in the art, the placing of a protective film around a textile fiber, e.g., a warp end, is usually referred to as sizing or slashing and is normally performed on a machine termed a slasher. A slasher lays warp yarn ends parallel, and coats or sizes the yarn with a sizing agent such as starch, resins, and the like, to strengthen the yarn to enable it to withstand the rigors of weaving and/or related textile operations. In a typical operation, the required number of beams to make the complete warp, usually 4 to 8, are placed in a creel at the back of the slashing machine and all yarn ends from these beams are drawn together into one sheet, and passed around rollers through a size box containing a sizing liquid with which the yarns are impregnated. The yarns are withdrawn from the size box and passed through squeeze rollers wherein excess sizing liquid is removed from the yarns. The yarns are thereafter dried by passing them around a series of cylinders equipped with heating means whereby the temperature of the cylinder surfaces are regulated so that the yarns leaving the last cylinder are in a completely dry state. At this point, the yarns may be directed through a combing device and then orderly arranged on a loom beam, or if desired, the yarns may be further treated, such as with a waxing agent, prior to take-up on the beam.

Although the basic slashing procedure explained above has been employed in a generally satisfactory manner for a number of years, there are, however, certain inherent disadvantages which arise. More specifically, there is a tendency for continuous yarns to "stick together," particularly adjacently disposed yarns, when the moving assembly of yarns are passed around the cylinders during the heat treatment of the yarns. For subsequent processing, efforts must be made to break apart these yarns and by virtue of the known procedures employed for this purpose, some of the size coating on the stuck yarns break away causing processing difficulties. Attempts to alleviate this problem have been directed toward the employment of devices which would radiate heat to partially dry the yarn sheet in a wet-split condition and thereafter re-assembling the yarns for drying in the conventional manner, i.e., by the use of a series of drying cylinders. These devices for partially drying the size-impregnated yarn sheet include, for example, high intensity quartz lamps disposed so as to provide heating of the sheets both laterally as well as in the direction of yarn advance.

Other type devices include infra-red units which partially dry the sized impregnated yarn sheets.

Although these devices have offered limited success in alleviating the major disadvantages of the basic slashing process, there still remained disadvantages and indeed, in some cases, new problems were created. When the yarn sheets are in overlying relation, such as when they are wet-split, it is difficult to obtain the same degree of drying of the inner sheets as the outer sheets of yarn. Moreover, the drying elements e.g., the quartz lamps, require periodic replacement and such replacement is not convenient during the time when the apparatus is in operation.

An object of the present invention is to provide a new and novel method for slashing yarn. Another object is to provide a new and novel method for applying a uniform coating of size to one or more sheets of warp yarn while producing the effect of single end sizing. Another object is to provide a new and novel method for slashing yarn which is inexpensive in operation and which utilizes conventional slashing equipment with relatively little modification. Other objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings.

In accordance with the invention, there is provided a process for slashing an assembly of substantially parallel yarns which comprises passing said yarns through a sizing zone which includes a bath containing a sizing liquid with which the yarns are impregnated, removing excess sizing liquid from said yarns, wet-splitting said yarns into sections arranged in overlying relation, passing said wet-split yarns through a heating zone intermediate oppositely directed hot air streams directed from above and below said wet-split yarns at an air stream velocity sufficient to agitate the individual yarns and thus produce momentary separation but insufficient to cause yarn entanglement until completely drying said yarns, passing said dried yarns through a separating zone wherein said individual yarns are separated one from the other and thereafter passing said separated dried yarns through a tensioning zone wherein the tension of the yarns is adjusted for further processing.

For a clearer understanding of the invention, reference is made to the following drawings in which FIGURES 1 and 2 are a side elevation view of yarn slashing apparatus constructed in accordance with the invention, shown schematically.

FIGURE 3 is a top view of the heater and flow boxes shown in FIGURE 1;

FIGURE 4 is a side view of the heater and flow boxes shown in FIGURE 1; and

FIGURE 5 is a view in cross section of the heater box, said view being taken along the lines 5—5 of FIGURE 4.

Referring to FIGURE 1, reference numeral **10** generally designates an assembly of advancing yarn sheets from a source, not shown, such as from a plurality of sections beams or the like, all of which are arranged in a well-known manner. Although it will be seen that the yarn assembly comprises eight sheets which are subsequently collected and arranged in subjacent or overlying relation, it will be obvious that the process is operable on a single sheet of substantially parallel continuous yarns. Generally, the character of these yarns are such that they may be formed from natural fibers such as cotton, or from a synthetic composition such as nylon, the former being in the form of staple yarns whereas the latter being in the form of continuous filament or multifilament yarn.

The size is applied to the yarn by conventional procedure employing conventional equipment. As shown in FIGURE 1, this equipment includes a vat **11** which contains a sizing liquid **12**, such as starch solution or the like,

which is maintained in the vat **11** at a level convenient for applying a proper size coating to the yarns.

The yarn assembly is size impregnated in the vat **11** by first advancing the yarn assembly through a hook reed **13** and thence around guide roll **14** and into the sizing liquid **12**. The yarn assembly, as shown in FIGURE 1, traverses a path under guide roll **15** which has a lower portion submerged beneath the level of the sizing liquid. The yarn assembly then passes through a pair of cooperating squeeze rollers **16—16** which squeezes or presses excess size from the yarns.

After the yarns are size impregnated, it is customary, as in prior art procedures, to subject the yarns to a drying process so that the size may form a protective coating on the surface of the yarns. As explained previously, in prior art techniques employing typical slashing apparatus, the drying operation is carried out by passing the yarn assembly around a plurality of drying drums which are heated internally to dry the advancing assembly in progressive stages. In still another prior art technique, the assembly of yarns are passed through a heating zone containing high intensity quartz lamps and by heat radiation the yarns are partially dried and the drying completed by passing the partially dried yarns over a series of heated drums usually numbering five or more. The disadvantages of these prior art techniques have been explained previously. According to the present technique, the assembly of yarns which leave the sizing zone are wet-split to the form in which they were originally prior to their passage into the sizing zone. Provision is made for wet-splitting the yarn assembly by means of split rods **17** vertically arranged on the other side of the sizing zone as shown in FIGURE 1. The wet-split yarns thereafter pass into a heating zone wherein they are completely dried prior to any subsequent processing. The complete drying of the wet-split yarn assembly is effected by directing opposed air streams above and below the wet-split yarns at a velocity and at an air temperature which is dependent on the type of yarn being processed.

Means are provided for completely drying the yarn sheets **10** while in the wet-split condition and these means include heater flow boxes which are adapted to deliver an air stream at a specified measured velocity and at specified controlled temperatures.

In a preferred embodiment, four of such heater flow boxes **18** are provided which are arranged as shown in FIGURE 1, two above the advancing sheets, and two below the advancing sheets and these heater boxes are positioned so that the advancing yarn sheets pass intermediate air streams delivered from the heater flow boxes. The heater flow boxes are readily available commercially and are of the type which contain a heating element and means for delivering a gas such as air which passes over and around the heating element through the heater box, being discharged from the unit in the form of an air stream. Referring to FIGURES 3 and 5, it will be seen that the heater box employed in the present invention includes a housing **19** which contains a series of such heating elements **20** internally disposed within the housing and which are positioned below a series of slits or openings **21**. As will be seen with reference to FIGURES 4 and 5, the air flow is provided by a fan **22** located near one end of the heater box **18**, and the air flow generated by the revolving fan passes through conduit **23** and through the openings **21** positioned as explained previously. The over-all length of the heater box **18** is of sufficient dimension so as to extend on both sides of the yarn sheets.

The velocity of the air stream as well as the temperature of the air stream at the area of contact of the air stream with the moving assembly of yarns is dependent on the type of yarns being processed and the number of vertically aligned yarn sheets which comprise the yarn assembly as it moves through the heating zone.

As a general rule, the velocity of the air stream should be such as to cause a very mild area of turbulence within the area of the moving yarn assembly. I have found that a minimum velocity of 3 feet per second is required to treat most of the known yarns including yarns made from natural fibers as well as from synthetic compositions such as nylon. On the other hand, the velocity of the air stream should not be in excess of 20 feet per second at the area of impingement since a velocity substantially in excess of this amount would cause excessive yarn entangling and an excessive amount of size loss from the treated yarn. It is preferred that the velocity of the air stream from the heater flow boxes be within a range of about 10 to 15 feet per second.

The temperature of the air stream is also variable within a wide range such as about from 200° F. to 600° F. The specific temperatures selected, however, depends upon the type of yarns being processed, with the preferred temperature range being within a range of about 200 to 300° F.

An important advantage over prior art procedures is the elimination of the drying drums previously employed. These drums generally occupied considerable space in the slashing apparatus and required individual heating means in order to control the temperatures of the advancing yarns. In the present invention, the heating of the yarn assembly is performed in a limited area and the yarns are completely dried without the aid of drying cylinders.

The yarn assembly after leaving the heating zone is thereafter directed through a comb or hook reed **24** positioned immediately after the heating zone. This procedure is beneficial because it gives the effect of a complete single end wet-split since, as previously explained, the yarn assembly is split in sheets corresponding to section beams by the split rods **17** after leaving the sizing zone.

After the yarns have been sized, completely dried, and passed through the hook reed to separate the yarns one from the other, it is desirable that the tension of the moving yarn assembly be adjusted and/or monitored so that any subsequent textile operation may be performed in an efficient manner. Thus, as shown in FIGURE 2, the yarn assembly after passing through the hook reed **24** thereafter enters a tensioning zone wherein the tension of the yarns are regulated and/or adjusted in conventional manner employing conventional equipment. This conventional equipment includes a series of tensioning cylinders **25** which are generally arranged in an over and under relationship as shown in FIGURE 2. For most purposes, all that is required to adjust the tension of the yarn assembly after the treatment according to the invention, are three tensioning cylinders positioned as shown in FIGURE 2. As shown therein, the yarn assembly traverses a path over the first cylinder under the second cylinder and thence over the last cylinder so that the tension of the yarn assembly is progressively regulated and emerges from the last cylinder with the yarn ends under substantially even tension.

It should be understood that the yarn assembly is substantially completely dried before it contacts the first tensioning cylinder and that the tensioning cylinders need not be heated since, according to the process of the invention, the complete drying of the yarns is effected by regulating the air velocity and temperature in the heating zone. Thus, the yarns are passed in contact with the tensioning cylinders without a tendency of the yarns to stick together as in prior art procedures.

After treatment of the yarns according to the described process, the yarn assembly may then be given further treatment as desired. Merely as illustrative, the yarns may be given a wax coating which is shown in FIGURE 2 as being accomplished by passing the yarn from the last tensioning cylinder under a guide roll **26** thence over an applicator roll **27** which is partially immersed in a wax bath **28**. The yarn assembly may then be advanced in any desired manner, separated into sections by means of rollers **29**, and passed through a reed **30** or the like which separates the individual yarns. As is known, the yarns in

assembly **10** are thereafter subsequently wound on a holder such as a loom beam or the like which is represented by reference numeral **33** in FIGURE 2 of the drawings. The tension of the yarn assembly may be further regulated just prior to put up on the beam **33** by means of guide rolls **31** and tension drum **32** in a manner well known in the art.

In a representative technique, an assembly of advancing yarn sheets comprised of a plurality of continuous nylon filament yarns are advanced from eight section beams to form the yarn assembly **10** arranged in overlying relation, and thence to a sizing zone wherein the yarn sheets are impregnated with size in vat **11**. Excess size is removed from the yarns by means of cooperating rollers **16**.

The yarn assembly **10** is thereafter wet split into individual yarn sheets each of which pass over or under an associated split rod **17** in a manner as shown in FIGURE 1 so that the sheets are maintained for a time sufficient to pass the heating zone in a split condition. The nylon yarn sheets then pass through the heating zone wherein they are subjected to opposed air streams directed above and below the advancing yarn sheets.

The velocity of the air stream is about 10 to 15 feet per second at the area of contact of the air stream with the advancing nylon yarn sheets and the temperature is within the range of about 200 to 300° F. This velocity causes a "mild turbulence" of all the yarns in the yarn sheets, and is of a degree sufficient to dry the yarns, but not to a degree whereby sizing is removed or shaken from the yarns. Moreover, within this velocity range, the air stream is permitted to permeate through the yarn sheets thereby exposing the middle yarn sheets to the same type of drying action as the outer yarn sheets.

The velocities and temperatures of the air streams may be regulated by means of the strategically positioned heater flow boxes **18** described previously.

The nylon yarn sheets are thereafter passed through the hook reed and kept apart one from the other. The tension of the nylon yarn sheets is thereafter adjusted by passing the sheets over the cylinders **25** in a manner as shown in FIGURE 2 of the drawings.

The yarns at this point have the desired size coating and are ready for subsequent treatments which for purposes of illustration as shown in FIGURE 2 involves a waxing procedure to lubricate the sized yarn and to reduce static. The yarns may thereafter be put up on a loom beam in a manner as shown in FIGURE 2.

It can be seen that according to the process of the invention, that one or more sheets of yarn may be uniformly coated with size in a highly efficient and economical manner. Fibers may be woven from these sized yarns with substantially all the disadvantages of the prior art procedures eliminated. For example, the tendency for the yarns to stick together when being heat treated is eliminated. Moreover, the other problems incident to prior art heat treatment are also eliminated such as, the breaking up of the sizing when it is attempted to separate the yarn ends after the drying procedure. In addition, the employment of drying drums with their separate heating means are not required as in prior art techniques, thereby saving space and the cost of processing.

Although certain preferred embodiments of the invention have been disclosed for purpose of illustration, it will be evident that various changes and modifications may be made therein without departing from the scope and spirit of the invention.

I claim:

1. A process for slashing an assembly of substantially parallel yarns which comprises passing said yarns through a sizing zone which includes a bath containing a sizing liquid with which the yarns are impregnated, removing excess sizing liquid from said yarns, wet-splitting said yarns into sections arranged in overlying relation, passing said wet-split yarns through a heating zone of hot turbulent air established by impinging hot air streams directed toward said wet-split yarns at an air stream velocity sufficient to agitate the individual yarns and thus produce momentary separation but insufficient to cause yarn entanglement, until said yarns are dried, passing said dried yarns through a separating zone wherein said individual yarns are separated one from the other and thereafter passing said separated dried yarns through a tensioning zone wherein the tension of the yarns is adjusted for further processing.

2. A process according to claim **1** wherein the velocity of said oppositely directed hot air streams is within the range of about 3 to 20 feet per second at the area of contact of said air stream with said yarns and wherein the air temperature of said air streams is within the range of about 200 to 600° F.

3. A process according to claim **2** wherein the velocity of the air stream is within the range of about 10 to 15 feet per second.

4. A process according to claim **2** wherein the temperature of the air stream is within the range of about 200 to 300° F.

5. A process according to claim **1** wherein said yarns are nylon yarns, the velocity of the air stream is within the range of about 10 to 15 feet per second, and wherein the temperature of the air stream is within the range of about 200 to 300° F.

6. A process according to claim **1** wherein said yarns are continuous filament yarns.

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