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APPARATUS FOR TREATING YARN

Filed July 21, 1958

2 Sheets-Sheet 1

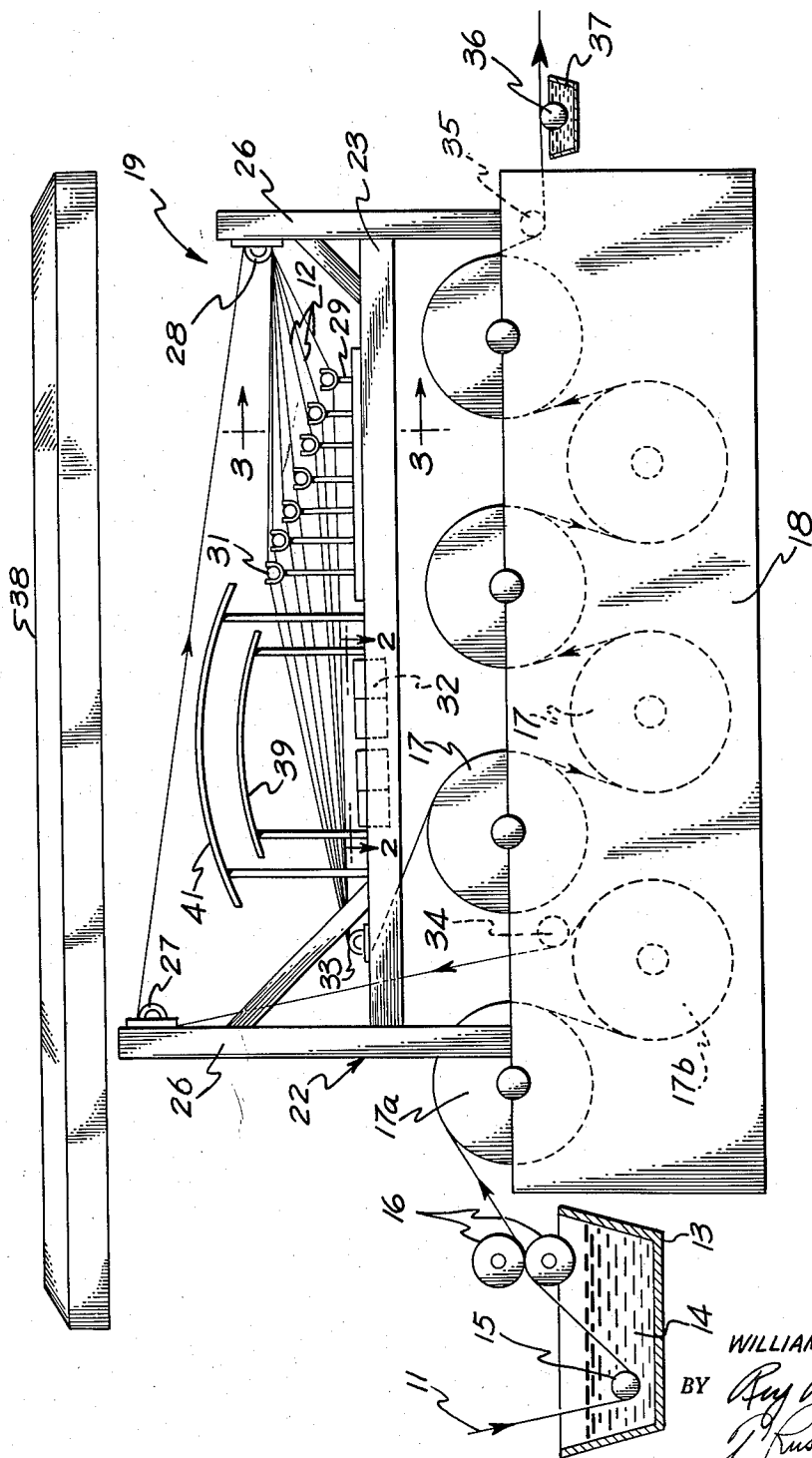


FIG. 1.

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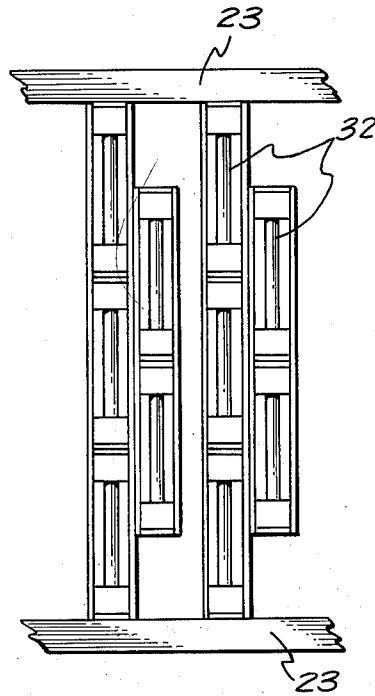


FIG. 2.

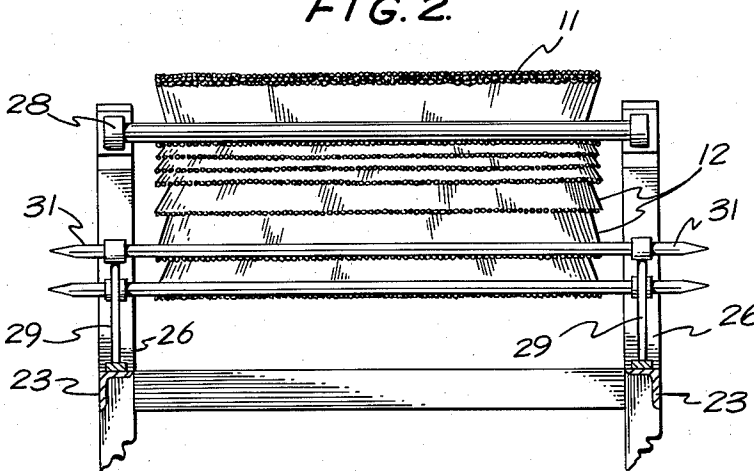


FIG. 3.

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APPARATUS FOR TREATING YARN

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1 Claim. (Cl. 28—28)

This invention relates to a method and apparatus for treating textile material and more particularly to a method and apparatus for slashing yarn. The term yarn as referred to hereinafter includes any type of flexible, rod-like strand which may be formed from natural, artificial, or synthetic compositions and includes both yarn formed from staple or continuous filament yarn either monofilamentary or multifilamentary.

As is well known in the textile industry, it is highly desirable that many types of yarn receive a coating of size such as orthocryl, gelatin, resins, starch or the like in order to provide the yarn with a rugged and protective exterior surface. As a result of this layer of size the yarn is able to withstand the rigors of operations such as handling, winding, weaving, and other processes commonly performed on yarn by such textile machinery as looms and the like. In one example of this coating or "slashing" operation, one or more sheets of substantially parallel warp yarns are continuously advanced through a size bath and subsequently dried by drying means common to slashing apparatus employed today. In this method of slashing warp yarns, unless corrective provisions are made, contiguous yarns in the sheets often become glued or stuck together when the size is dried, and the yarns must be broken apart prior to subsequent processing.

For instance, in the slashing of spun yarn composed of natural fibers such as cotton and the like, the subsequent tearing apart by split rods or the like of adjacent yarns which have become stuck together after drying in the slashing apparatus breaks up the size coating on the yarns causing shedding (granules of size dropping to the floor as fine powder). Furthermore, the separation of the stuck yarns raises or pulls up fibers on the outer surface of the yarn giving the yarns a highly undesirable fuzzy surface. As is well known, these upstanding surface fibers create a manufacturing problem when the yarn is subjected to subsequent fabric forming operations and the like.

Further difficulty from yarn sticking arises in the slashing of continuous filament yarn formed from material such as nylon or the like. As these newly formed continuous filament yarns often contain relatively little or no twist, extended portions of adjacent yarns are brought into intimate contact. When sticking occurs between closely contacting yarns, the subsequent separation of the individual yarns not only breaks up the size coating but in the case of multifilamentary yarns transfer or "pickup" of filaments between adjacent yarns occurs. These transferred filaments ultimately break interfering with subsequent textile operations by causing fluff balls, split ends, strip backs, and floats in fabric formed therefrom.

Consequently, a common practice in the processing of continuous filament yarn has been to introduce a considerable amount of twist into such yarns prior to slashing in order to limit the length of continuous contact between contacting portions of adjacent yarns. As a result of this twist, therefore, this contacting length is reduced and sticking between adjacent yarns is held to a mini-

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mum. The yarns may, therefore, be readily separated subsequent to drying with relatively little damage to the protective size coat.

However, in order to introduce such twist into such continuous filament yarns, an additional operation which is both expensive and time-consuming is involved. As is well known newly manufactured, drawn, continuous filament yarn generally contains only a relatively small degree of twist ($\frac{1}{2}$ turn per inch or less) or what is generally referred to as "producer's twist." In order to impart to this "producer's twist" yarn the required amount of twist so that the yarn can be satisfactorily slashed in conventional slashing apparatus the yarn must be processed in conventional throwing or twisting apparatus necessitating an additional expensive step in a fabric forming operation.

Accordingly, a primary object of this invention is to provide a new and novel method and apparatus for slashing yarn.

Another object of this invention is to provide a new and novel method and apparatus for applying a uniform warp yarn which contain only producer's twist and which consequently eliminates the need for any further yarn twisting operation prior to slashing.

A further object of this invention is to provide a new and novel method and apparatus for applying uniform coating of size to one or more sheets of warp yarn, while producing the effect of single end sizing.

A still further object of this invention is to provide a new and novel method and apparatus for slashing one or more sheets of staple yarn which eliminates the raising of surface fibers on the yarn.

Still another object of this invention is to provide a new and novel method and apparatus for slashing yarn which is inexpensive in operation, produces a relatively high loom efficiency, and which utilizes existing conventional slashing equipment with relatively little modification.

A still further object of this invention is to provide a new and novel method and apparatus for slashing sheets of warp yarn composed of synthetic material such as nylon containing only producer's twist which eliminates sticking between adjacent yarn sheets and produces a size coating on the yarns which is characterized by a high degree of uniformity and abrasion resistance.

Other objects and advantages of the invention will become apparent from the following description taken in connection with the accompanying drawings.

In general, the objects of the invention and other related objects are accomplished by providing an assembly of substantially parallel continuous yarns. This assembly of yarn is moved through a bath containing a suitable sizing liquid with which the yarns are impregnated. This wet yarn assembly is subsequently split into individual sheets which are moved in heat transfer relationship with size drying means while in the split condition so as to partially dry the size on the sheets and form a non-tacky surface layer of substantially dry size on the yarns in each of the sheets. The sheets are then reassembled and moved through additional drying means so as to completely dry the size on the yarns.

The novel features which are believed to be characteristic of the invention are set forth with particularity in the appended claim. The invention itself, both as to its organization and method of operation may be best understood by reference to the following description taken in conjunction with the accompanying drawings in which:

Figure 1 is a side elevation view of yarn slashing apparatus constructed in accordance with the invention;

Figure 2 is a sectional view taken substantially along line 2—2 of Figure 1 in the direction of the arrows; and Figure 3 is a sectional view taken substantially along line 3—3 of Figure 1 in the direction of the arrows.

An assembly of yarns 11 has been shown in Figure 1 which comprises a plurality of substantially parallel continuous yarns. The yarns in assembly 11 may be staple yarns composed of natural fibers such as cotton or the like or may be continuous filament yarn formed from a synthetic composition such as nylon as will be described hereinafter. It should be understood, however, that the invention may be employed to slash any type of yarn suitable for treatment in a slashing operation. Although the yarn assembly 11 may be a single sheet of substantially parallel continuous yarns wound on a yarn holder such as a beam or the like it is preferably formed from a plurality of yarn sheets 12 which are shown split out of the assembly 11 in Figure 1 in a manner to be explained hereinafter. Each of the individual sheets 12 of yarn is preferably drawn from suitably supported section beams or the like, all of which are arranged in the well known manner in a suitable supporting device such as a creel (not shown). Each of the sheets 12 is unwound from its respective beam and all of the sheets (seven being illustrated in Figure 1) are collected and positioned in overlying relationship by means of any suitable arrangement to form the yarn assembly 11.

In order to apply size to the yarn assembly 11, a vat or trough 13 is provided which is filled to the desired level with a bath 14 of size liquid such as a starch solution or the like. The yarn assembly 11 is advanced around a guide roll 15 positioned within the bath 14 and the yarns are impregnated with size liquid during their passage through the bath. The yarn assembly 11 is subsequently removed from the bath 14 and is passed between a pair of cooperating squeeze rolls 16 which squeeze or press excessive size from the yarns.

As is well known, the size absorbed by the yarns in a slashing operation is subsequently dried so as to form a protective coating throughout the entire external surface of the yarns and imparts to the yarns sufficient abrasion resistance to enable the yarns to withstand subsequent textile operations, such as weaving and the like, to which the yarns are subjected. In the typical slashing apparatus, this size drying operation is carried out by passing the yarn assembly 11 around a plurality of drying drums such as the rolls or drums 17 shown in Figure 1. These drying drums 17 are generally arranged in an over and under relationship by means such as a frame 18 as shown and are heated internally in any suitable manner such as by steam or the like. The yarn assembly 11 is thus progressively dried so that it emerges from the slashing apparatus with its size coated yarns in a completely dried condition.

As previously explained, the yarns slashed in this manner were prone to stick together after drying so that when the yarns were broken apart not only was the size coating flaked off or broken away along portions of the yarn but outer fibers of staple yarn were pulled up to create a fuzzy surface and continuous filament yarn was subjected to "pickup" or transfer of filaments between adjacent multifilamentary yarns.

In the case of continuous filament yarn formed from material such as nylon or the like, the introduction of additional twist by an additional and expensive twisting operation partially overcame the problem of filament transfer between adjacent yarns but materially increased the cost of yarn production. Means have therefore been provided with this invention to produce a protective size coat on both staple and continuous filament yarn which is characterized by a high degree of uniformity and in which the problem of staple pull up and filament transfer is virtually eliminated.

As generally illustrative of the invention, wet splitting

and drying means, designated generally by the numeral 19, have been provided which splits the yarn assembly 11 advancing from the size bath 14 into the separate yarn sheets 12 while in the wet condition. Preferably, these sheets 12 are separated into the form in which they were originally prior to their assembly into the yarn assembly 11. The yarns in the sheets are then partially dried to a limited extent to form a non-tacky external or surface layer of size on the yarns so that when the sheets are reassembled into the yarn assembly 11 complete drying of the size coating may be accomplished without encountering the problem of yarn sticking described above.

As specifically illustrative of the invention, the wet splitting and drying means 19 comprises a support frame designated generally by the numeral 22 which includes a pair of substantially parallel frame members 23 supported at each end by upstanding leg members 26. As shown best in Figure 3, the leg members 26 are arranged to support freely rotatable guide rolls 27, 28 respectively over which the yarn assembly 11 is advanced as shown in Figure 1.

In order to split the yarn assembly 11 into the individual yarn sheets 12 and permit the sheets to be advanced in the split condition, conventional support posts 29 are provided which are supported in any suitable well known manner on the frame members 23 and are arranged to accommodate split rods 31. The posts are spaced along each of the frame members 23 and may be adjusted vertically so as to position the split rods 31 in the relationship of Figure 1.

Thus the yarn assembly 11 may be opened up into the individual yarn sheets 12 each of which pass over or under an associated split rod 31 in the manner shown so that the sheets are maintained for a limited time in the separated condition. As previously explained, the yarn sheets 12 consist of a plurality of substantially parallel ends of yarn. In one example of such a sheet suitable for processing in the apparatus of Figure 1, approximately 600 ends of continuous filament nylon yarn are laterally spaced to form a sheet which is approximately 54 inches wide.

In accordance with the novel construction of the invention, means have been provided for partially drying the yarn sheets 12 while in the wet split condition. As shown best in Figure 2, heating means such as a plurality of high intensity quartz lamps 32 have been provided which are preferably supported between the frame members 23 in heat transfer relationship with the separated yarn sheets 12. As a result of heat produced by the lamps 32 the wet size on the sheets 12 is partially dried to form a substantially non-tacky surface layer of size on the yarns within the sheets. In the preferred embodiment, ten of such quartz lamps have been provided which are arranged as shown in Figure 2 in four parallel rows so that uniform heating of the sheets both laterally as well as in the direction of yarn advance may be obtained. The quartz lamps are readily available commercially and are one of any suitable type of heating device which may be employed. The partially dried sheets 12 are subsequently reassembled after moving past the lamps 32 and are advanced around a roll 33 to be completely dried in the conventional manner explained hereinafter.

In the operation of the apparatus of Figure 1, the yarn assembly 11 is impregnated with size in bath 14 and is initially advanced, over one or more drying drums 17 prior to entering the wet splitting and drying portion 19 of the slashing apparatus shown in Figure 1. It should be understood that it is within the scope of the invention to move the yarn assembly 11 directly from the squeeze rolls 16 to roll 27 and into the wet splitting and drying portion 19 as sufficient drying of the sheets 12 to form the above-mentioned non-tacky size layer may be obtained with the use of the lamps 32 only.

However, where a high rate of slashing is desired

with an attendant high speed of travel of the yarn assembly 11, the capacity of lamps 32 may not be sufficient to produce the desired drying action within the limitations of space common to such slashing apparatus. Therefore, the wet yarn assembly 11 is initially passed over drying drums identified by the numerals 17a, 17b, and guide roll 34 so that a limited amount of drying of the size on the yarns is initially obtained while the sheets are in the assembled condition and prior to wet splitting.

It should be understood that this preliminary drying by means of rolls 17a, 17b is not carried out to the extent that the yarn assembly is no longer in a wet condition or, in other words, in a condition wherein the individual yarn ends could not be readily separated without some adherence between adjacent yarns from partially dried size.

As the yarn assembly 11 is moved over roll 27 it advances to the opposite end of frame 22 where its direction is reversed by means of roll 28, and it is subsequently split into the separate yarn sheets 12 by means of the split rods 31. The sheets 12 then advance over the lamps 32 and are dried to the extent necessary to form the above-described non-tacky surface layer of size on the yarns in each of the sheets. After this drying step the yarn sheets 12 are reassembled and are passed over the roll 33 which is suitably supported as shown on the frame members 23. From the roll 33 the yarn assembly 11 then advances over one or more drying drums 17 in frame 18 in the well known manner, so that the size on the yarns in assembly 11 is completely dried. Five of such drums 17 are shown in the embodiment of Figure 1, but it should be understood that any desired number of drums may be employed in accordance with the yarn drying requirements.

After drying, the yarn assembly 11 is then passed over a guide roll 35 and is preferably given a wax coating by passing the yarn assembly over an applicator roll 36 partially immersed in a wax bath 37. The yarn assembly 11 may now be advanced in any desired manner and passed through a comb or the like (not shown) which segregates the individual yarns. No sticking between the yarns or yarn sheets is present as each of the yarns now contains a thoroughly dried and uniform protective coat of size. As is well known, the yarns in assembly 11 are subsequently wound on a holder such as a loom beam or the like which has not been shown for the purpose of clarity.

If desired, a hood 38, common to conventional slashing equipment, may be employed to remove the volatile products of reaction such as steam or the like formed during the slashing operation. In addition, the intensity of the heat produced by the lamps 32 may be somewhat concentrated, if desired, so as to increase the rate of size drying by the use of a suitable heat reflecting device such as an arcuate reflector or the like 39 which redirects the heat generated by the lamps against the yarn sheets. Furthermore, if it appears necessary to avoid any drying of the size on the yarn assembly 11 prior to the wet splitting step, an asbestos shield or the like 41 may be provided above the lamps 32 as shown in Figure 1 which prevents the radiation of heat onto the yarn assembly 11 passing overhead.

It can be seen with the novel apparatus of the invention, one or more sheets of yarn may be uniformly coated with size to provide yarns which may be woven into high quality fabric with a minimum of manufacturing prob-

lems. The size coating completely protects the yarn and confines the staple or filaments of which the yarn is composed within the interior of the surface layer of size. Sticking between adjacent yarns when the size is dried is eliminated with the attendant avoidance of such textile problems as pulling up of surface fibers on staple yarn and the transfer of filaments between adjacent multifilamentary continuous filament yarns. As a result of the novel improvement of this invention, continuous filament yarn formed from a synthetic composition such as nylon or the like containing only producer's twist may be successfully slashed in a highly efficient manner. In slashing operations utilizing the apparatus of the invention, loom efficiency has approached 100 percent consistently. Heretofore conventional slashing apparatus limited yarn slashing speeds to a low figure, approximately 25 yards per minute being a normal rate, whereas yarn slashing speeds of 50 to 75 yards per minute and up are obtainable with the apparatus of the invention.

While there has been described what at present is considered to be the preferred embodiment of the invention, it will be understood by those skilled in the art that various changes and modifications may be made therein without departing from the invention and, therefore, it is the aim of the appended claim to cover all such changes and modifications as fall within the true spirit and scope of the invention.

Having thus described the invention, what is claimed is:

An apparatus for treating a continuously advancing assembly of yarns, comprising a frame, means adjacent to the frame for applying size to the assembly of yarns, a pair of heated drums rotatably mounted on one end of the frame and adapted to engage the sized yarns for partially drying the size on the yarns, a first guide roll rotatably mounted above said one end, a second guide roll rotatably mounted above the frame at the other end thereof, said guide rolls being arranged to receive the yarns from said pair of heated drums and advance the yarns from said one end to said other end along an elevated path, a plurality of split rods mounted above the frame and beneath said elevated path, said split rods being adapted to receive the assembly of yarns from the second guide roll and separate said assembly of yarns into a plurality of yarn sheets, a third guide roll mounted on the frame at said one end for receiving the yarn sheets from the split rods, a plurality of heat-producing lamps mounted on the frame beneath the yarn sheets and adapted to direct concentrated heat upward onto and dry the yarn sheets, an arcuate reflector mounted on the frame above the yarn sheets for reflecting concentrated heat from the lamps downward onto the yarn sheets, and a shield mounted on the frame between the reflector and said elevated path to prevent drying of the assembly of yarns moving along said elevated path.

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