Sept. 6, 1966 L. H. DE LANGEN 3,270,491

APPARATUS FOR TWISTING YARN

Original Filed Feb. 8, 1962 2 Sheets-Sheet 1

FIG. 1

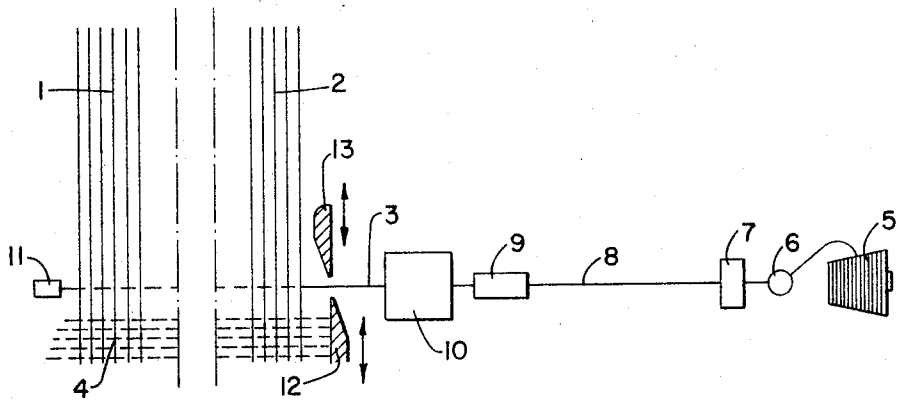
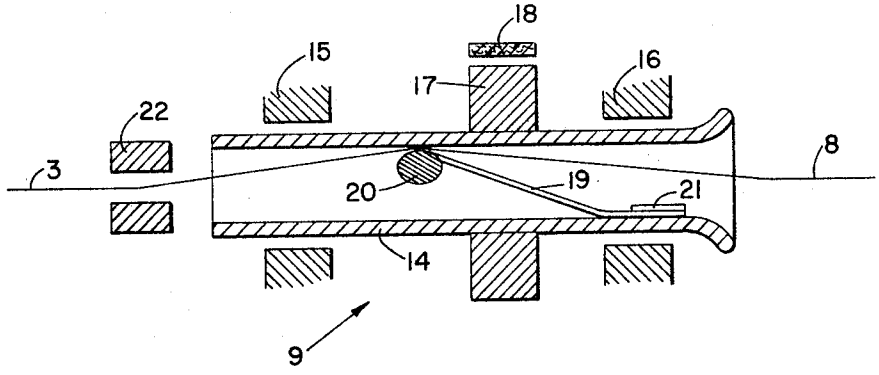


FIG. 2



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APPARATUS FOR TWISTING YARN

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FIG. 3

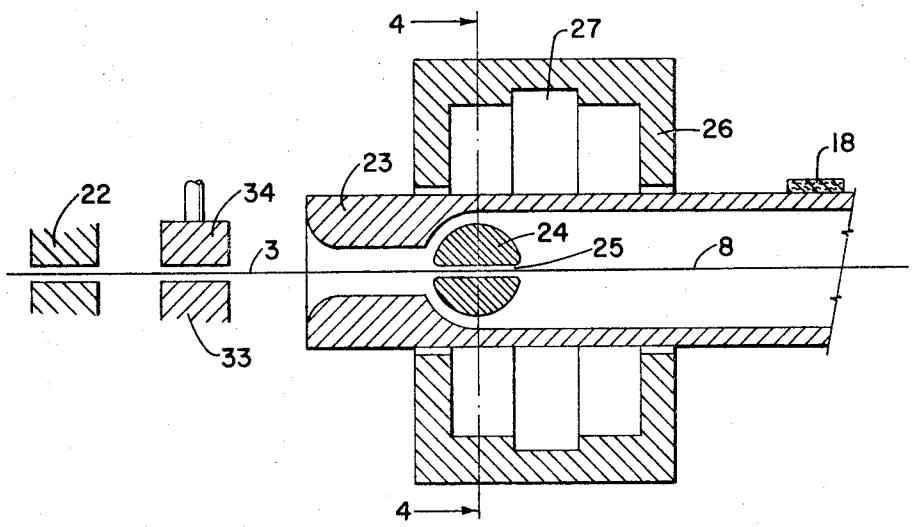


FIG. 4

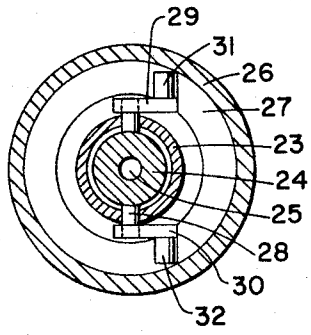


FIG. 5

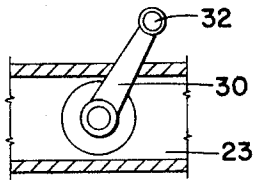
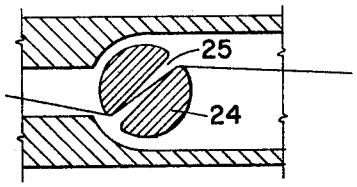


FIG. 6



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APPARATUS FOR TWISTING YARN

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Original application Feb. 8, 1962, Ser. No. 171,901. Divided and this application Sept. 17, 1965, Ser. No. 496,222

Claims priority, application Netherlands, Feb. 13, 1961, 261,181

5 Claims. (Cl. 57—77.45)

This is a division of U.S. application Serial No. 171,901, filed February 8, 1962, and the invention relates to a process and apparatus for the manufacture of fabrics, and more particularly to a process and apparatus for weaving fabrics in which weft threads are unwound from one or more stationary supply packages and cut off after being inserted into a shed.

Processes are known and carried out using a so-called shuttleless loom comprising a device for periodically shooting the free thread end from one or more stationary supply packages into a shed. One such process is a modern version of the conventional weaving system, in which the weft thread is unwound from a pirn or quill mounted for rotation in a shuttle. The shuttle is moved to and fro between the warp threads, the weft thread being unwound from the pirn.

Moving the heavy shuttle and pirn to and fro between the warp threads requires, particularly at high loom speeds, a heavy loom construction and much weaving energy. For economy reasons these two factors necessitate a restriction of the loom speed. This drawback is obviated by using a known process in which it is no longer necessary to move the heavy shuttle and pirn to and fro at high speeds. The weft yarn runs off from one or more supply packages positioned outside the sheet of warp threads, which do not need to be moved through this sheet. A length of yarn periodically leaves these yarn packages always from one side of the warp and is passed between the warp threads and subsequently cut off from the supply package, after which the same operation is repeated.

Various systems have been proposed for passing the length of thread between the warp threads. In one device the length of thread is clamped in a small metal shuttle, which is shot away mechanically. In a different system the thread end is passed through a nozzle through which it is periodically blown into the shed. In all these known processes, the primary consideration was to maintain the conventional weaving process and to introduce only such alternations as were necessary to raise the speed of the loom. Hence, the weft yarn used and the woven fabric produced thereby had very little novel characteristics. However, it would be desirable in most cases if the weft yarn could be subjected to certain changes during the time it is transferred from the supply package and woven into fabric.

As is well known the various rewinding operations preceding the weaving process form one of the major cost-price controlling factors. It is therefore obvious that the elimination of an additional process step would contribute to a substantial reduction of the cost of the fabric. Generally, yarn is twisted while it is being unwound from one package and wound onto another. Either the unwinding package or the freshly forming package is caused to rotate rapidly about its axis, thus imparting twist to the yarn. The yarn also may be twisted on a double twister. The first twisting method usually is carried out on either an uptwister or downtwister, and requires much energy to keep the package rotating and ballooned yarn in motion. With the double twister a high capital outlay is necessary. All things considered, a twisting process is generally a costly treatment.

Accordingly, it is an object of this invention to provide a process and apparatus for manufacturing fabrics in which production costs are lower, than for fabrics produced by known processes and apparatus.

Another object of this invention is to provide a process and apparatus for the manufacture of fabrics in which the weft yarn is subjected to a finishing treatment between unwinding from the supply package and weaving.

A further object of this invention is to provide a process and apparatus for the manufacture of fabrics in which the weft yarn is twisted between unwinding from the supply package and weaving.

A still further object of this invention is to provide a novel yarn twisting device.

These and other objects of this invention will become apparent from the following detailed description.

In accordance with this invention weft threads are subjected to a finishing treatment after leaving the supply package and just before being inserted into the shed.

The finishing treatment combined with the weaving process may be of a widely varying nature. For example, it may consist of as simple an operation as the application of a size or some other finishing agent, or the treatment may consist of an additional drawing, shrinking or dyeing operation. Another application of the process could involve subjecting the yarn to a crimping process immediately before being inserted into the shed, such as the crimping of the yarn in a stuffing operation, or by blowing it by means of compressed air, or pulling it over a sharp edge, or setting it in a false-twist state. In all of these finishing treatments the weft yarn woven into the fabric is different from the yarn as it emerges from the supply package.

It has been found to be particularly advantageous if the finishing treatment consists of a twisting process. In accordance with this invention, only the free length of thread of the weft yarn is twisted, thus eliminating all other costly twisting methods. Using simple means the twist is imparted to the yarn from the free end after each section of weft yarn is cut off. Such a system takes advantage of the periodic cutting off of the lengths of yarn.

Although the invention is particularly applicable if the yarn is to receive a high twist, it is also equally successful when used to untwist or increase the twist of already twisted weft yarn.

The process may be carried out so that the twisting operation is combined with weaving the thread and preferably employs pneumatic means. A jet of gas, for example air, normally provided for driving the thread, may be caused to whirl and as a result thereof the thread may be simultaneously twisted and entrained. Such a system is extremely simple. However, the practicable application thereof has been found to be limited to a rather narrow range of yarn types and twist levels. This is partly due to the short period of time available for imparting twist during picking of the thread.

An embodiment which has wider applicability is one in which the weft thread is periodically entrained by a mechanically driven twisting device. Such a device is more suitable for periodically imparting a reproducible and equal degree of twist to each thread portion.

The mechanically driven twisting device may consist of two rollers, disks, or belts, or of a combination of these means, arranged to periodically clamp a thread between their surfaces. By causing these surfaces to move in opposite directions, the thread clamped therebetween is rolled, and consequently twisted.

After the thread portion has been twisted, it is attached to a small metal shuttle in a known manner and shot through the warp threads. To enable such an operation, the thread must be released from between the surfaces of the rollers, disks, or belts, in the interval between the fastening of the thread to the shuttle and the shooting away of the thread.

A preferred embodiment of this invention is that in which the twisting device comprises a twisting tube. The thread is continuously passed through this twisting tube, and periodically caused to rotate by the latter. Between alternate cycles of such twisting operations the weft thread is pulled through the twisting tube. A single loom may be provided with several twisting tubes in such manner that each of the twisting tubes in parts twist to a thread emerging from a different supply package during several weft periods of the loom. In addition, a twist barrier should be placed at approximately one sheet width from the twisting tube.

The mechanism for twisting the weft threads forms part of the device for periodically shooting the threads through the warp threads. The device for periodically shooting the weft threads must simultaneously impart an advancing as well as a rotating motion to the small metal thread holder or shuttle. This can be accomplished by employing a shuttle provided at its outer surface with helical grooves or with projections such that the shuttle can be discharged like a missile from a gun barrel provided with riflings and lands. Another solution is to first cause the shuttle to rotate and then discharge it.

However, a much simpler loom is known in which the device for inserting the weft threads through the warp threads comprises a nozzle for guiding in a substantially axial direction a propelling gas having a rotary motion and a device for periodically closing the driving gas nozzle, said nozzle being provided with an axial passage for the weft threads. Such a nozzle causes the weft thread to be twisted while the latter is being inserted into the shed by the driving gas. As has been stated before, however, this device is only suitable for a narrow range of yarn deniers and twist levels because it is difficult to impart to a strong air jet a permanent whirl.

The present invention includes a loom and a twisting mechanism comprising a hollow twisting tube, and a driving device therefor, the twisting tube being provided with means for periodically clamping the weft thread.

Various constructions of this twisting tube are conceivable and can be divided into two groups. In the first group, the twisting tube is driven continuously and entrains the thread only periodically. With the other group, the twisting tube is set in motion periodically and at the same time the weft thread is automatically clamped thereby.

Obviously, several such twisting tubes may form part of one loom. The greater the number of twisting tubes, the lower the individual speed required in order to produce a twisted thread portion within the available time. For example, two twisting tubes may be attached to a sliding mechanism, which alternately places them in the weft position. If several twisting tubes are provided, then it is preferable to use a turret head in which the twisting tubes are mounted in a circle.

It has been found that a loom provided with such twisting tubes is capable of processing a wide variety of weft yarns in a wide range of twist levels.

As previously mentioned, a twisting barrier is located a sheet width from the twisting mechanism thus limiting the twist to a short length of yarn. When this twisted thread portion is inserted in the warp, another yarn portion which has a different twist or no twist at all passes through the twist barrier. The twist present in the twisted portion will then be imparted to the fresh thread portion.

It has been found that under normal circumstances the twist thus obtained in the thread is sufficiently uniform that the woven fabric does not show any variations in twist. However, there may be circumstances in which variations in twist may result. Several methods are available for counteracting these variations. For example, the twist barrier may comprise two hyperboloid-shaped rollers, the axes of which cross each other with the rollers touching along a straight generatrix. When the weft thread is pulled between these rollers, it is subjected to a false-twisting action. If immediately after the weft thread is pulled through, and the preceding thread portion inserted, the rollers are moved away from each other for a very short while, the twist before and after the pair of rollers is temporarily equal. As a result, the state of twist before and after the rollers is periodically subject to a starting phenomenon. While this starting phenomenon may serve to reduce the afore-mentioned variations in the degree of twist, in practice it has not always proved effective.

A preferred and simpler solution is to use a twist barrier of the type adapted to periodically move along with the thread as it passes through it. If the twist barrier moves along with the thread while the latter is being inserted, there is no decrease in the degree of twist. Upon completion of each picking movement, and before the following thread portion is twisted, the twist barrier must be moved back to its initial position.

In order to smooth the movement of the twist barrier, the twisted thread portion may be passed around a dancer roll, or the twist barrier may consist of a slightly springy clip which will move along a guide member together with the thread portion while the latter is being inserted into the warp.

The clip on the thread portion prevents slippage of the twist and permits simple disengagement upon each picking movement. It may be constructed in the form of a soft steel disk brake which is excited periodically by an electromagnet.

The invention will be more clearly understood from the following detailed description of several preferred embodiments thereof taken in conjunction with the accompanying drawings.

FIGURE 1 is a diagrammatic plan view of a loom designed according to the invention.

FIGURE 2 represents a twisting tube provided on the loom, shown in longitudinal section.

FIGURE 3 is another embodiment of this twisting tube shown in longitudinal section.

FIGURE 4 is a cross sectional view taken along line 4, 4 of the tube shown in FIGURE 3.

FIGURES 5 and 6 are detailed views of the ball and crank clamping mechanism used in the tube shown in FIGURES 3 and 4.

In FIGURE 1 the reference numerals 1 and 2 represent the margins of a sheet of warp threads. Alternate threads are raised and lowered in a known manner in permanent or varying combinations, each movement resulting in a free space into which a weft thread 3 may be inserted. After the thread 3 has been inserted it is pushed against the fabric 4 by a reed (not shown).

The weft thread 3 is unwound from a stationary package 5 which is positioned adjacent the loom. In addition to this yarn package 5 there may be several identical yarn packages, the threads of which are inserted in any order desired. The weft thread passes through the thread guiding eyelet 6 and the twist barrier 7 and covers the section 8 which has a length slightly greater than the width of the fabric 4.

Section 8 of the weft thread is twisted by tube 9 in a manner to be explained before being inserted through the shed. In the picking mechanism 10 the free end of the weft thread 3 is clamped in a metal clip 11, a "shuttle" which functions like the shuttle in conventional looms, namely, to pull the weft thread through the shed.

In FIGURE 1 the shuttle 11 is shown in its end position. While it is in this position, the weft thread 3 is pushed against the fabric by the reed and clamped in its place by the warp threads. Not until this has been done is the weft 3 cut off by the knives 12 and 13 which are mounted for movement in the direction indicated by the arrows. Alternatively, however, only one of the two knives may be movable if desired.

The picking mechanism 10 is a known type, in which the weft thread is first clamped in the shuttle 11 which is then shot away mechanically. At the end of this passage shuttle 11 is detached from the weft thread and in a known manner passed outside the warp threads back to the picking mechanism 10. Several shuttles are provided for continuous operation.

The twisting tube 9 operates to twist thread 3 immediately prior to thread clamping by shuttle 11. Said twisting tube 9 is caused to rotate rapidly in the interval between the moment knives 12 and 13 cut off the weft thread and the moment the free thread portion of the weft thread is clamped in the shuttle 11. While the tube rotates it clamps the free thread portion of the weft thread, so that the latter rotates therewith and accordingly is twisted. The resulting twist is only produced in section 8 because of the twist barrier 7.

When the weft thread in section 8 has received a sufficient amount of twist, the twisting tube 9 stops, after which the free end of the weft thread projecting from the twisting tube is seized by the shuttle 11 and another twisted thread portion 8 of the weft thread 3 is inserted through the warp thread.

FIGURE 2 is a detailed longitudinal sectional view of the twisting tube 9. It consists of tubular body 14 having at one end a flared opening to simplify threading-in of the thread. Tubular body 14 is supported near each end by two bearings 15 and 16. Any conventional ball, roller, or strap type bearing may be used. High speed disk type bearings such as shown in Schrenk et al. Patent No. 2,855,750 may also be used if desired.

Pressed approximately around the middle of tubular body 14 is a ring 17 which serves as a driving wheel. A continuously moving driving belt 18 is periodically pressed against the ring 17, causing twisting tube 9 to rotate intermittently.

The leaf spring 19 and weight 20 supported by the end thereof serve to clamp the weft thread 3 against the twisting tube. The leaf spring 19 is secured to the twisting tube at the point 21. When the twisting tube is stationary the thread 3 can be pulled through without any difficulty because spring 19 exerts very little pressure. However, as soon as the twisting tube reaches a sufficiently high speed of rotation, the weight 20 is urged against the inner wall of the twisting tube by centrifugal force, which closes off the thread passage. The weft thread being clamped between the weight 20 and the inner wall of the twisting tube consequently must adopt the rotating motion of the tube. Accordingly, twist is imparted to section 8 of the weft thread. A thread guiding eyelet 22 ensures that part of the weft thread 3 will project from twisting apparatus so that it may be seized by the shuttle 11.

FIGURES 3 to 6 show a twisting tube based on a somewhat different principle. In this embodiment the twisting tube rotates continuously but is so constructed that it permits the weft thread to take part in this rotary motion only periodically. To accomplish this the tubular section 23 of the twisting tube is provided with a relatively movable ball 24 having a bore 25 and an actuating bushing 26 adapted to move axially on the tube. The bushing is provided with a cam groove 27 for converting sliding

motion of the bushing into rotary motion for the ball. Additionally, the bushing must be able to adopt the rotary motion of the tube. For this purpose the tube 23 is provided with a key and the bushing with a slot (neither shown). By shifting the bushing 26 axially along the tube 23, the ball 24 is caused to tilt as will be explained presently.

Two different positions of the ball 24 are shown in the FIGURES 3 and 6. In the position shown in FIGURE 3 the weft thread passes through the bore 25 along a straight path and is not clamped or influenced by the rotation of the twisting tube. In the position shown in FIGURE 6, the ball is turned through approximately 45°, so that the total magnitude of the angles made by the weft thread is approximately 90°. When the ball is in this position, the thread is clamped within the tube. As a result, the rotary motion of the twisting tube imparts twist to thread section 8. Belt 18 is provided for continuously rotating the tube.

The axial displacement of the bushing 26 causing ball 24 to tilt is effected by means of the aforesaid groove 27 and members 28 to 32. The numeral 28 refers to a shaft on which the ball 24 is secured. The shaft extends through the wall of the tube 23 as shown in FIGURE 4. This figure also shows the manner in which two cranks 29 and 30 are attached to the ends of the shaft 28. The cranks 29 and 30 have at their free ends two pins 31 and 32 which are positioned in the groove 27 of the bushing 26 as cam followers. When the bushing 26 is displaced axially, pins 31 and 32 rotate shaft 28 and consequently ball 24. The periodic displacement of the bushing 26 is effected electromagnetically by a well-known switching circuit (not shown). Alternatively, the bushing may be displaced mechanically by means of other cams or it may be effected pneumatically or hydraulically.

FIGURE 5 is a side view partly in section of the crank 30 with the pin 32 secured thereto. In this position, bore 25 of ball 24 is aligned axially with tubular body 23.

Positioned on the side of the loom is a twist brake 33, 34. This twist brake consists of a plate 33 and an electromagnetically excited block 34. By means of this brake the free end of the weft thread can be clamped in the shuttle 11 during the period elapsing between the end of the twisting process and the next clamping of the thread. This prevents the thread from being untwisted.

Several variations in and additions to the embodiments described will be apparent to those skilled in the art. For the twisting tube especially, many embodiments may be designed based on the disclosed principles. Moreover, several twisting tubes may be combined with a sliding mechanism or a turret head and this entire unit may be placed before the picking mechanism 10.

While preferred embodiments of the invention have been shown, it is to be understood that changes and variations may be made herein without departing from the spirit and scope of the invention which is to be limited only as defined by the following claims.

What is claimed is:

1. A twist apparatus comprising an elongated tubular body provided with a longitudinal thread passageway, means mounting said tubular body for rotation, a thread clamp supported within said longitudinal thread passageway for rotation with and for turning with respect to said tubular body, said thread clamp operating to grip thread passing through said tubular body only in one position of said clamp relative to said body, a bushing slidably supported by the external surface of said tubular body, means transposing sliding movement of said bushing into rotation of said thread clamp relative to the tubular body, and means for rotating said tubular body.

2. A twist apparatus as set forth in claim 1 wherein said slidably mounted bushing is locked for rotation with said tubular body.

3. A twist apparatus as set forth in claim 1 wherein said transposing means comprises a cam groove formed

in an inner surface of said bushing, a shaft rigidly secured to said thread clamp and projecting through the wall of said tubular body, an actuating arm rigidly secured to the projecting end of said shaft, and a cam follower supported by said actuating arm for engagement with said cam groove.

4. A twist apparatus as set forth in claim 3 wherein said thread clamp comprises a spherical member having a thread bore formed diametrically therethrough.

5. A twist apparatus comprising an elongated tubular body provided with a longitudinal thread passageway, means mounting said tubular body for rotation, a thread clamp supported within said longitudinal thread passageway for rotation both with and with respect to said tubular body, said thread clamp operating to grip thread passing through said tubular body only in one position of clamp rotation relative to said body, and means operable

during rotation of said tubular body for turning said thread clamp between thread gripping and thread releasing positions.

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