July 7, 1959 H. A. SCHRENK ET AL 2,893,198

THREAD TWISTING APPARATUS

Filed Dec. 17, 1956

Fig. 1.

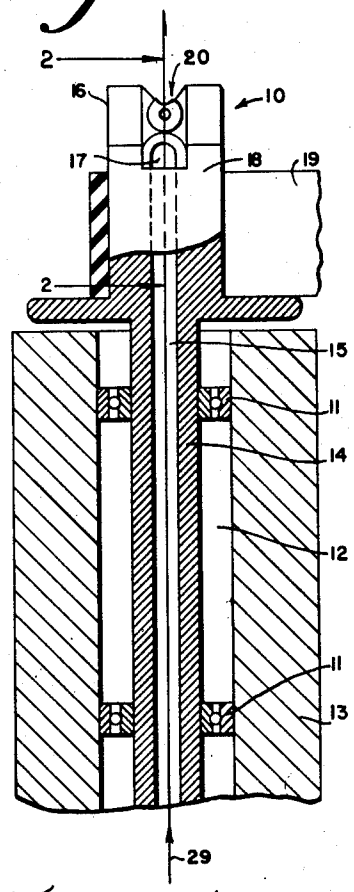


Fig. 2

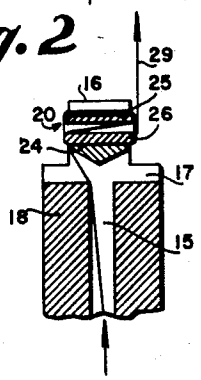
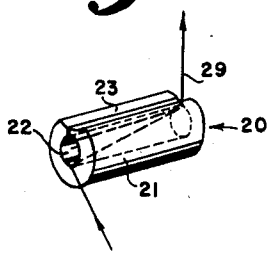


Fig. 3



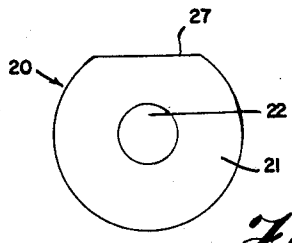


Fig. 4

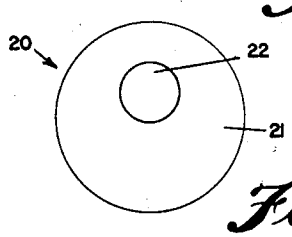


Fig. 5

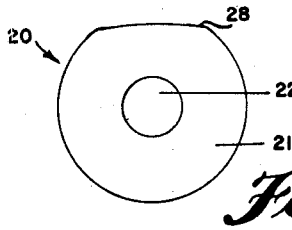


Fig. 6

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THREAD TWISTING APPARATUS

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Claims priority, application Netherlands December 30, 1955

8 Claims. (Cl. 57—77.3)

This invention relates in general to a thread twisting apparatus and more particularly to an improved false twisting device of the rotating tube type.

It is known to impart twist, particularly false twist, to thread by the use of a rotating tube of the type to which this invention generally relates. In utilizing the teachings of the prior art a hollow cylindrical tube is rotatably mounted in bearings which are supported from a stationary housing. The conventional manner of rotating the tube is by the use of a drive belt which engages a pulley section of the outer periphery of the tube and thus imparts rotation thereto. Near the discharge end of the tube a small grooved roller is mounted to rotate about an axis normal to the axis of rotation of the tube. The thread to be twisted is led from a supply source into the cavity of the hollow tube, one or more times around the groove in the small roller and then out of the tube to conventional feed rollers. The small grooved roller is rotated by engagement with the thread as the same is pulled through the rotating tube by the feed rollers. Moreover, the small roller specifically locates the twist imparted to the thread by the rotating tube. An example of a false twisting apparatus of this type is shown in U.S. Patent No. 2,655,781, dated October 20, 1953.

While the false twisting device described above has been used commercially for crimping threads, the same has certain inherent disadvantages which heretofore were thought to be insurmountable notwithstanding the undesirability thereof. For example, threads of the type which usually receive false twist or crimp are treated with a sizing material, which material becomes deposited on the shaft and bearings of the small roller. This sizing material gums the bearings and consequently increases the frictional force required to rotate the roller. Since the roller derives rotation from the running thread wrapped thereabout, any impediment to rotation thereof directly affects the tension imparted to the thread. Thus it is seen that undesirable variations in thread tension may occur when the conventional false twisting device is used with sized thread.

Additionally, as pointed out supra, the thread is wrapped one or more times around the small roller in order that slippage between the roller and thread may be prevented. One turn of the thread about the roller is always situated on the preceding turn and therefore the turn discharging from the roller must be pulled from underneath or at least beside the preceding turn, which results in an abrasive action leading to damage of the thread filaments. This is particularly noticeable when the device is used for imparting a high temporary twist to the thread.

A further disadvantage connected with the use of a grooved roller is that the rotatable tube is frequently unbalanced as a result of the large size of the roller with respect thereto. This unbalanced condition leads to undesirable vibrations producing variations in thread tension and also limits the effective speed at which the device may be rotated.

One of the objects of the present invention is to provide a false twisting device not having the aforesaid disadvantages of known devices.

A further object of this invention is to provide a false twisting device capable of imparting a uniform and more fixed crimp to threads.

Another object of this invention is to provide a thread twisting device having fewer moving parts than known devices of the same type.

Still a further object of this invention is to provide a false twisting device having wear-resistant thread contacting surfaces less likely to damage the filaments comprising the thread but more likely to positively define and maintain a fixed thread passageway.

In accordance with the present invention an encircling body consisting of a hard material and provided with an axial bore is rigidly mounted at the discharge end of the rotatable tube. The axis of the encircling body extends normal to the axis of the rotatable tube and the thread passes through the longitudinal opening in the tube, outward of the tube, longtudinally through the bore of the encircling body, one or more times around the outermost portion of the encircling body and then to conventional feed rollers. The tube is rotated by conventional means and a uniform twist is imparted to the thread fed therethrough.

The favorable result obtained by the use of the device described more specifically hereinbelow is attributable, among other things, to the rigid mounting of the encircling body on the rotatable tube, the rigid mounting producing less variations in thread tension than that produced by a comparable grooved roller.

Moreover, even if it is wrapped about the outermost portion of the encircling body several times after first having been led through the longitudinal bore of the rotatable tube, the thread will not be subjected to the abrasive action of one wrap against another concomitant with the use of a grooved roller. The reason for this is that, as a result of the use of a rigidly mounted encircling body, the thread lays on the body in a helical fashion with adjacent wraps separated slightly.

Further, the use of an encircling body of hard and wear-resistant material not only reduces but practically eliminates wear imparted by the running thread to the relatively stationary body. This results in more prolonged use of the encircling body with less waste thread incurred due to the tearing or breaking of filaments by sharp edges of the encircling body.

Other objects and advantages of the present invention will be apparent from the following detailed description taken in conjunction with the attached drawings, wherein:

Figure 1 is a partial sectional view taken along the axis of rotation of a false twisting device constructed in accordance with the present invention;

Figure 2 is a sectional view taken along the lines 2—2 of Figure 1 and showing the manner in which the instant encircling body is mounted on the rotatable tube, as well as the thread path through the tube and encircling body;

Figure 3 is a perspective view of a preferred type of encircling body and showing also the path of travel of the thread therethrough;

Figure 4 is an end view of a modified type of encircling body constructed in accordance with the present invention;

Figure 5 is an end view of a second modification; and

Figure 6 is an end view of a third modification.

With attention now directed to the drawings wherein preferred embodiments of the present invention are shown, the false twisting device indicated generally by reference numeral **10** is rotatably supported by bearings **11** within the core **12** of a stationary housing **13**. This

housing may be attached in any conventional manner to the frame of a thread processing machine (not shown).

The false twisting device **10** consists of a tube **14** having a bore **15** disposed axially thereof and extending in this manner from the entrance substantially to the discharge end **16** of the tube, at which end the axial bore terminates into radial bore **17**, thus forming a T-shaped thread passageway, as shown in Figure 2. The enlarged portion **18** of tube **14** serves as a pulley about which belt **19** is entrained. The belt is driven by any suitable means (not shown) in order to impart the desired rotation to tube **14**, this drive means being conventional in the art.

Applicants' novel thread encircling body, which is identified generally by reference numeral **20**, is rigidly mounted in the outermost or discharge end **16** of the enlarged portion **18** of tube **14**, as can be seen from Figures 1 and 2 of the drawings. The preferred encircling body is shown in Figure 3 and consists of a cylindrical element **21** of hard material which has an axial bore or thread passageway **22** drilled or otherwise formed therein. A longitudinal groove **23** is ground, cut or otherwise formed in the surface of the cylindrical element **21** and serves also as a thread path-defining means. The encircling body **20** is positioned in discharge end **16** in such a manner that groove **23** faces outwardly or in the direction of travel of the thread. Preferably, the encircling body **20** is cemented into position within channel **24** at the discharge end **16** of the tube **14**.

It has been found that by the use of the above described encircling body the path of thread travel is positively defined and that less thread ruptures or breaks occur as a result of this improved thread passageway. The longitudinal groove **23** and axial bore **22**, which extend parallel one to the other, define a reduced wall section having less thickness than that on either side of the groove, as demonstrated clearly in Figure 2 at wall section **25** of minimum thickness and wall section **26** of maximum thickness. Since the thread wrapped around the wall section **25** is placed under slight tension due to frictional engagement with body **20**, the same has an inherent tendency to remain in the lower portion of the groove, which has been found to fix the path more definitely than when the thread is wrapped about a freely rotatable roller.

Other embodiments of a false twisting device according to the present invention will now be described in connection with Figures 4, 5 and 6, wherein like reference numerals have been used to identify parts corresponding to those of the embodiment shown in Figure 3.

In the embodiment of Figure 4 the encircling body **20** is provided with a concentric bore **22** similar to the bore of Figure 3 but for the groove **23** a flat face **27** is substituted. The face **27** is formed in the outer surface of the body and extends chordwise through the cylindrical element **21** in a plane substantially parallel with the axis of bore **22**.

In Figure 5 the bore **22** is formed eccentric to the cylindrical element **21** and the minimum thickness wall section resulting from this arrangement is positioned outwardly of the discharge end **16** in the same manner of operation as discussed in connection with the groove **23**.

In the embodiments of Figure 6 the bore **22** is concentric with the cylindrical element **21** and a face **28** having a radius of curvature greater than that of the cylindrical element is formed in the outer surface thereof. Again, the bore **22** and curved face **28** define a definite minimum wall thickness to which the thread is attracted during the passage thereof around the outer wall of the encircling body **20**.

It is preferred that the rigidly mounted encircling bodies described above be manufactured from wear-resistant synthetic sapphire, diamond or agate. Small cylinders of synthetic sapphire provided with an axial bore are presently available on the market and have proved to be very satisfactory, these cylinders having a length of approximately 2 mm. and a diameter of approximately 1.5 mm., with the diameter of the bore approximately 0.7 mm. As mentioned hereinabove, these cylinders have an advantage of lightness in weight and by the use of which the false twisting device may easily be brought into balance.

In constructing an encircling body from commercially available cylinders, the groove **23**, flat face **27** or curved face **28** may be ground, cut or otherwise formed in the outer surface. In order to produce the embodiment of Figure 5, an eccentric bore may be drilled or otherwise formed in a solid cylinder of material similar to that discussed above. Each embodiment has been found to provide a fixed encirclement of the thread around the wall of the cylindrical element.

For a smooth running of the thread through the bore **22** and around wall section **25**, it has been found that the thread contacting edges of the cylindrical element **21** should be rounded, as by grinding or any other suitable means. On the other hand, in order to prevent slipping of the twist imparted to the thread it is necessary that these thread contacting edges be as sharp as possible. It has been found that both functions are satisfactorily performed if the curvature of these edges is limited to a radius of curvature of not more than 0.2 mm., with a radius of 0.02 mm. being preferred. Satisfactory crimping results have been obtained with the thread contacting edges rounded in this manner and with the thread passed at least twice through the bore of the encircling body **20**. The total encircling angle of the thread about wall section **25** should be between 400 and 500 degrees, approximately, although this depends upon the diameter of the bore in the encircling body as well as upon the angle between the bore **22** and the axis of rotation of the tube **14**. Under usual circumstances, an encircling angle of approximately 500 degrees has been found to be quite satisfactory.

In the operation of the false twisting device described herein a continuous thread **29** is passed from a thread supply source (not shown) to a twist stop (not shown), through the bore **15** of tube **14**, outwardly through one leg of radial bore **17** and twice through the bore **22** of encircling body **20** in order that the encircling angle about wall section **25** may amount to approximately 500 degrees; see Figures 2 and 3. Finally, the thread **29** is led to a thread discharge device comprising conventional feed rollers (also not shown).

After the thread supply, thread discharge device and drive means for belt **19** are brought up to desired operating speeds, the portion of thread **29** which extends between the twist stop and the encircling body **20** is twisted. This twist is released from the thread after the same passes through the discharge device. In the case of thermoplastic threads, however, the twist may be retained or fixed in the thread as a crimp by the use of known heating means followed by cooling, this producing an extremely crimpy or elastic thread even after untwisting.

Although the encircling bodies **20** have been described as of cylindrical shape, it is understood that this invention is not limited to such an expediency and that the same could be rectangular, triangular or of any other cross-sectional configuration. Moreover, the bodies **20** could be attached to discharge end **16** of tube **14** by means other than adhesive, for example, by screws or bolts, and the discharge end **16** could be removably attached by similar means to tube **14**. Moreover, the angle between the bore **22** of encircling body **20** and bore **15** of tube **14** might be varied from the 90 degrees shown in the drawing without departing from the spirit of this invention.

It is further understood that the description of the above embodiments is for purposes of illustration only

and is not intended to limit the scope of this invention except to the extent defined in the following claims.

What is claimed is:

1. A thread twisting apparatus comprising a rotatable tube having an entrance portion, a discharge end and a thread passageway extending axially through said tube from the entrance portion substantially to the discharge end, an elongated encircling body of wear-resistant material rigidly mounted on the discharge end of said tube, means defining a thread receiving bore extending longitudinally of the encircling body, the bore forming an angle with said axially extending thread passageway, and means defining a reduced wall section between said bore and the outer surface of said body for fixing the encirclement of thread therearound.

2. A thread twisting apparatus as defined in claim 1 where in said encircling body is formed of a material selected from the group consisting of synthetic sapphire, diamond and agate.

3. A thread twisting apparatus as defined in claim 1 wherein the thread contacting edges of said encircling body are rounded by a radius of curvature not exceeding 0.2 mm.

4. A thread twisting apparatus as defined in claim 1 wherein said last named means includes a longitudinal thread receiving groove formed in the outer surface of said encircling body and extending parallel to said bore defining means.

5. A thread twisting apparatus as defined in claim 1 wherein said last named means includes a flat face formed in the outer surface of said encircling body and extending in a plane parallel to said bore defining means.

6. A thread twisting apparatus as defined in claim 1 wherein said last named means includes eccentric location of said bore within said body.

7. A thread twisting apparatus as defined in claim 1 wherein said last named means includes a curved face formed in the outer surface of said encircling body, the radius of curvature of said face exceeding the radius of curvature of said body.

8. A thread twisting apparatus comprising a rotatable tube having an entrance portion, a discharge end and a thread passageway extending from the entrance portion substantially to the discharge end, a wear-resistant elongated encircling body rigidly mounted on the discharge end of said tube, means defining a thread receiving bore extending longitudinally of said encircling body, and means defining a longitudinal thread passageway in the outer surface of said body and extending parallel to the bore defining means.

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