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YARN TWISTING DEVICE

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The invention relates to a yarn twisting device and more particularly to a self-threading device for twisting yarn on itself to strengthen it.

At the present time, it is customary to use one large bank of spindles and if the yarn breaks at any spindle in the bank it is necessary to shut down the whole bank in order to stop the operation so that the particular broken yarn can be repaired by tying the loose ends together.

Heretofore it has been proposed to provide an individual yarn twisting device for each thread of yarn, but this form of device is expensive to make and is not free from sharp corners.

An object of the present invention is to simplify and improve the manufacture of the yarn twisting element and more particularly to reduce the cost of manufacture and to provide rounded surfaces which thread the yarn into the device and guide the yarn in a tortuous path, to prevent snagging the yarn.

These objects are accomplished by providing a yarn twisting device some or all of the component parts of which are made of wire. In the preferred form shown, the yarn twisting device is entirely composed of a unitary wire member which has a shape such that it will automatically thread the yarn into the device as the device is rotated and slideably guide the yarn in a tortuous path so that the yarn is twisted on itself as the yarn is pulled through it during rotation of the yarn twisting device.

The yarn twisting device is removably supported and rotated about its axis by engagement of the periphery of the yarn twisting device with a driving drum or pulley and idler pulleys. The particular drive and idler roller arrangement shown forms no part of the present invention, except in combination with my improved yarn twisting element.

Each strand of yarn in passing from one spool to another is provided with one of these yarn twisting devices. If a particular strand breaks, all spools remain in operation and the operator grabs the loose ends of the broken strand, ties them together and passes the tied strand into the yarn twisting device, with the knot at the leading end beyond the twister, and the yarn twisting device by its own rotation threads the strand into it in a tortuous path and proceeds to twist it as before. Hence it is not necessary to shut down a large bank of spools when a particular strand breaks, as the self-threading feature makes it possible to maintain all spools in operation and repair the break in a particular strand of yarn while its yarn twisting device is rotating.

For further details of the invention reference may be made to the drawings wherein Fig. 1 is a bottom plan view of a yarn twisting device according to the present invention.

Fig. 2 is a side view with parts broken away.

Figs. 3, 4 and 5 are enlarged perspective views of the yarn twisting element showing initial, intermediate and complete threading engagement with the yarn.

For convenience of illustration, the yarn twisting device

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is shown on its side with the yarn passing laterally through it although the yarn usually passes from an upper supply spool to a lower take-up spool, the left side of the device shown in Fig. 2 being the top and the yarn 1 passing in the direction indicated by the arrow, although the device will operate in any position. The yarn twisting element itself is indicated at 2 and is shown with the yarn 1 in different positions in Figs. 3 to 5.

The device 2 may be made of any suitable material, preferably steel wire, chrome plated, and ground on a centerless grinder so that the periphery of the device 2 lies on or is tangent to a cylindrical surface, for engagement with the cylindrical surfaces of the driving drum 3 and the idler rollers 4 and 5. The idler roller 4 has a cylindrical surface 6 having a width about the same as the width (or length in an axial direction) of the device 2. Idler roller 5 has a cylindrical surface 7 slightly wider than the device 2 and having end flanges 8 and 9 which overlie a portion of the opposite ends of device 2 to prevent it from shifting endwise while supporting it for rotation about its own axis. The flanges 8 and 9 provide a groove 11 which rotatably supports the yarn twisting element 2. The driving drum 3 has a pulley 10 driven by a belt not shown.

The rollers 4 and 5 are rotatably mounted in a hollow casing 12 having a top 13 and an open bottom 19. The top 13 has a slot 14 which extends through the casing end 15. The rollers 4 and 5 are at opposite sides of slot 14 and the yarn twisting device 2 is at the end of this slot, so that the yarn 1 can be passed into slot 14 to engage with the yarn twisting element 2.

The pulley 10 with its drum 3 is mounted on an arm 16 having a spring 17 which urges the drum 3 toward the rollers 4 and 5, to frictionally hold the device 2 in the position shown. The spring 17 thus provides a force to hold the drum 3 against the device 2 which causes the latter to rotate with the drum 3. The pulley 10 and its drum 3 can be manually moved away from rollers 4 and 5 against the action of spring 17 for a distance such to permit the device 2 to be removed from the groove 11, for insertion or removal of the device 2. The casing 12 has a suitable flange 18 for attaching the device to a suitable support.

As viewed from a position at the left of Fig. 2, the drum 3 is rotated in a clockwise direction and hence the device 2 rotates counterclockwise which is the same as in Figs. 3 to 5 wherein the device rotates counter-clockwise when viewed from a position at the left of these figures.

The device 2 is a unitary wire member, one end of this wire being shown at 20, see Fig. 4, and the other end at 21, although these two ends may be soldered or welded together if so desired. From the end 20, the wire has an arm 22 which extends somewhat in a radial direction to the axis of the device where it has a bend 23, substantially at right angles and proceeding in a guide wire portion 24 which extends along the axis to the opposite or entrance end of the device where it has a right angle bend 25 which provides a radial arm 26 the outer end of which has a bend 27 from which the wire proceeds in an end spiral portion 28 for something less than the circumference, to a point 29, see Fig. 3, where the wire has a reverse bend 30 which continues in a spiral 32 to the wire end 21.

The bend 27 is spaced from the reverse bend 30 to provide an entrance 31 for the yarn 1.

Assuming that the yarn 1 has broken, the loose ends are tied together with the knot at some position not shown in the leading portion 33 of the yarn so that the knot does not have to pass through the device 2. The lagging yarn portion 34 is held in one hand, the leading portion 33 in the other, with the yarn under tension, and the yarn is passed into the slot 14 against device 2 and held at

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an angle such as shown at the lagging portion 34 in Fig. 3 so that the end spiral portion 28 slides under the yarn portion 34 until the bend 27 is reached, whereupon the yarn will pass under the reverse bend 30, which acts somewhat as a hook, and into the entrance 31, while the device 2 is rotating at high speed. The leading portion 33 in passing beyond the bend 30 enters the space between adjoining turns 37, 38 of the spiral 32 and as the device 2 rotates it threads itself around the yarn until the leading portion 33 leaves the end of the spiral 32 as shown in Fig. 5. Fig. 3 shows the yarn just after it has entered the entrance 31 while Fig. 4 shows the yarn at a later time while its leading end 33 is approaching the end of the spiral 32, while Fig. 5 shows the leading end 33 after it has passed beyond the exit end 35 of the spiral 32. In passing beyond the exit end 35 the yarn slides along the arm 22 to approach a position at the inner end of arm 22 around the guide wire portion 24, the yarn being supported by spools not shown for entrance into and exit from the device 2 through its interior and generally speaking along its axis. At the entrance end of device 2, when the yarn 1 enters the device as above described, the arm 26 at the entrance end rotates counter-counterclockwise from the position shown in Fig. 3 where it is ahead of yarn 34 to the position shown in Figs. 4 and 5 where the arm 26 is at the opposite side of or behind the yarn 34 in a rotational direction. The yarn in passing through the spiral 32 assumes a twist around the guide wire portion 24, the yarn being unable to untwist around the wire portion 24 because when the threading is completed as shown in Fig. 5, the arm 26 is at the lagging side of the yarn portion 34 while the yarn is at the opposite side of the arm 22. The amount of the twist in the yarn around the guide wire portion 24 depends upon the length of the spiral 32 and can be made greater or less than the amount shown. In any event, if a different length is chosen with the wire ends 20 and 21 being arranged as shown in Fig. 4, then if the spiral 32 is to be shorter, the arm 22 will extend at some different angle to meet the end of the spiral 32. The leading end 33 of the yarn is thus twisted on itself as the yarn is pulled through the twisting device 2 while the latter is rotating.

Various other modifications may be made in the invention without departing from the spirit of the following claims. For example, Figs. 1 and 2 show the device in full size, although other sizes may be employed. Also other metals or materials may be employed for the twisting device 2 and as the end portions 20 and 21 are brought together to make in effect an endless wire device, these wire ends may be arranged at some other position in the device.

I claim:

1. A yarn twisting device comprising a unitary wire rotor, the wire of said rotor comprising a helical coil having spaced turns providing a spiral threading path for the yarn, said wire having a reversely bent portion defining one side of a yarn entrance to said path at one end of said rotor, said wire having an end turn having a transversely inwardly extending portion defining the other side of said entrance, a longitudinal yarn guide wire portion extending inside of said coil as a continuation of the inner end of said transversely extending portion, and another transversely extending portion at the other end of said longitudinal guide wire portion and intercepting the yarn path around said guide wire portion at the exit of said path.

2. A yarn twisting device according to claim 1, said

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guide wire portion slidably supporting the yarn in a convolution and said transversely extending portions having an angular separation determining the extent of such convolution and maintaining such convolution as the yarn slides along said guide wire portion.

3. A yarn twisting device comprising a coil of wire having spaced turns defining a spiral threading path for a yarn, said coil having a guide stem and means for maintaining the yarn wrapped around said stem, said turns having an outer periphery which lies substantially on a cylindrical surface, and a driving drum having a cylindrical surface engageable with the periphery of said turns for rotating said yarn twisting device.

4. A yarn twisting device comprising a unitary wire rotor, the wire of said rotor comprising a helical coil having spaced turns providing a spiral threading path for a yarn, said wire having a reversely bent portion defining one side of the yarn entrance to said path at one end of said rotor, said wire having an end turn having a transversely inwardly extending portion defining the other side of said entrance, a longitudinal yarn guide wire portion extending inside of said coil as a continuation of the inner end of said transversely extending portion and another transversely extending portion at the other end of said longitudinal guide wire portion and intercepting the yarn path around said guide wire portion at the exit of said path, said guide wire portion comprising means slideably supporting the yarn in a convolution and said transversely extending portions having an angular separation determining the extent of such convolution and comprising means for maintaining such convolution as the yarn slides along said guide wire portion, said turns having an outer periphery which lies substantially on a cylindrical surface, and a driving drum engageable therewith.

5. A yarn twisting device comprising an inner longitudinally extending guide stem for the yarn, means providing a spiral threading path surrounding said guide stem to lead the yarn in a convolution around said stem, and a transverse arm at each end of said stem to maintain said convolution, said guide stem, said means and said arms each having a convex yarn engaging surface in the path of the yarn.

6. A yarn twisting device comprising a rotor having a guide wire for slidably supporting the yarn in a convolution, the opposite ends of said guide wire each having a laterally extending wire portion at opposite ends of said rotor, said laterally extending wire portions being engageable with the yarn to maintain a convolution therein around said guide wire, and means providing a self-threading spiral path surrounding said guide wire and open at opposite ends of said rotor for leading the yarn to said guide wire, said spiral path means lying on a cylindrical surface substantially coaxial with the rotary axis of said rotor.

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