YARN-TWISTING APPARATUS FOR FORMATION OF MULTIPLE-PLY THREAD

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Filed: Oct. 12, 1971

Foreign Application Priority Data
Oct. 14, 1970 Germany....................... P 20 50 490.9

U.S. Cl................................. 57/58.86, 57/58.52
Int. Cl.............................. D01h 1/10, D01h 7/86
Field of Search......................... 57/58.86, 58.53, 57/58.52, 58.54, 58.49, 58.72, 58.78; 242/149

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ABSTRACT
A yarn-twisting apparatus for formation of multiple-ply thread has a nonrotatable spindle carrying at least one spool from which two strands are drawn. The strands or threads pass down through the hollow interior of the spindle and out a radial opening in a rotating storage disk, thence up around the spool or spools to a bobbin. A first brake comprising a ball received in a conical or funnel-shaped seat is provided in the top or inlet end of the spindle and a second brake in the form of a compressible body with semispherical ends received between two conical seats is provided in the lower or yarn-outlet region of the spindle. The upper seat of the lower brake is formed on the end of a hollow element threaded into the spindle and provided with a scale so that the axial position of its seat can be read off and set according to how much tension is to be imparted to the threads by the second brake.

1 Claim, 1 Drawing Figure
YARN-TWISTING APPARATUS FOR FORMATION OF MULTIPLE-PLY THREAD  
FIELD OF THE INVENTION  
The present invention relates to a yarn-spinning or yarn-twisting apparatus. More particularly this invention concerns an arrangement for drawing a pair of strands or threads off at least one spool and tensioning these strands or threads in the twining of them to form yarn.

BACKGROUND OF THE INVENTION  
In the manufacture of two-ply and other multiple-ply yarns it is common practice to draw the yarns up/off a single spool or off several coaxially arranged spools. Thence the yarns are fed axially downwardly through a hollow spindle carrying the spools and out a radial opening in a yarn-turn storage disk. The spools are prevented from rotating but the storage disk is rotated at high speed, with the threads being pulled up off the storage disk to form a so-called balloon around the spools and then wound on another bobbin. This imparts a twist to the individual yarns and simultaneously twists them about each other to form a thread having a strength many times the combined strength of the individual yarns.

A major problem in such devices lies in the difficulty of drawing the same amount of yarn off each spool. This of course necessitates applying the same amount of tension to all of the yarns at least at the rotating storage disk. It has been the common practice to provide in the hollow spindle a so-called thread brake to adjust these tensions. This system is sufficient to twist a single yarn, but with more than one yarn it has been found to be unsatisfactory.

Various devices have been mounted atop the spindle to overcome this difficulty. In one such device a flexible disk is provided which is bent to tension the frictionally engaged threads upstream of the thread brake. Such an arrangement has been found to work as long as both threads are being pulled off the spools at approximately the same axial distance from the disk, and as long as the spool diameters correspond somewhat to the disk diameter. However when the spools are mainly empty or when the yarn is being pulled off the upper region of the upper spool, such a device is almost completely ineffective.

In another similar arrangement a spring is provided which is fitted over the upper end of the spindle and which is shaped as a cone or a mushroom. Such a spring can deflect to the side to make up for changing tension in the yarns, but like the above-mentioned arrangement, is only effective under certain conditions.

With heavy yarns it is possible to provide a flyer which has a pair of eyes that run around the spindle and through which the yarns pass. Such an arrangement, however, cannot be used with fine filaments.

With all such arrangements it is necessary in order to change or replace the spools to at least partially disassemble the device. The device which is intended to equalize tensions upstream of the thread brake must be removed, the empty bobbins lifted off, and then full bobbins slipped on and the device replaced.

OBJECTS OF THE INVENTION  
It is, therefore, an object of the present invention to provide an improved thread twisting apparatus.

Another object is the provision of an improved arrangement for tensioning the two or more yarns for proper twisting.

SUMMARY OF THE INVENTION  
The above objects are attained according to the present invention by the provision of a second independent thread brake in the upper end of the spindle. Such a brake comprises a gravity-loaded ball resting in a conical seat to pinch and tension the yarns as they are pulled between the ball and the seat. The yarns are further tensioned in the lower region of the spindle by a second thread brake comprising a bullet-shaped body having a pair of rounded ends which is compressed between two opposite and axially directed conical seats, the yarns being pinched at each end of the body between it and the seats.

Advancing to further features of this invention the compressed body comprises a pair of telescoping cylindrical sleeves with hemispherical ends and a compression spring received between these sleeves to urge them outwardly toward their respective seats. In addition the upper seat is formed on the lower end of an elongated element threaded into the nonrotatable spindle, the upper end of the element being provided with markings cooperating with a scale. The element is threaded in the spindle so that rotation of it relative to the spindle moves the upper seat axially relative to the lower seat, compressing the spring in the brake body more or less to vary the braking effect. The upper brake is mounted on this adjustment element, which itself is hollow.

DESCRIPTION OF THE DRAWING  
The above and other objects, features, and advantages will become apparent from the following description, reference being made to the accompanying drawing whose sole FIGURE is an axial section through a device according to the present invention.

SPECIFIC DESCRIPTION  
The spinning apparatus shown in the FIGURE (see the commonly assigned copending application Ser. No. 34,007 filed May 4, 1970, now U.S. Pat. No. 3,648,449) has a motor 3 driving a shaft 2 on which is mounted a storage drum 4 and a storage disk 6. A rectangular orifice 8 opens radially from the drum and communicates with the interior of the device.

Rotatably mounted on the shaft is a sleeve 22 to which is secured a disk 10. A rotationally fixed cylindrical sleeve 84 surrounds the disk 10 and carries magnets 12 which coat with magnets 12' in the disk 10 to prevent this latter from rotating. Two yarn spools 14 and 14', one above the other and wound on respective sleeves 15 and 15', are received on a synthetic-resin sleeve 16 surrounding a tube in turn formed with an end region of enlarged diameter in which are fitted the sleeve 22 and a ring 28. The upper end of the ring 28 is formed as a conical seat 30 and the lower end 32 engages the support sleeve 22. An upright rod 18 supports a horizontal wire ring 20 which surrounds the upper edge of spool 14'.

A thread 34 is formed in the upper end of the guide tube terminating in a semicircular shoulder 36 in which O-ring 60 is mounted. A threaded portion 38 of a hollow spindle or sleeve 40 is received in the threaded region 34. The lower end of the spindle or sleeve 40 carries a ring 42 formed with a downwardly directed
3,742,693

3. conical seat 44. A bullet-shaped braking element 46 comprising two telescoping cylindrical shells 48 and 48' with rounded ends 50 and 50' and a compression spring 52 is compressed between the two seats 44 and 30. The O-ring 60 frictionally retains the spindle or sleeve 40 relative to the sleeve 26.

An adjustment ring 54 is fixed on the spindle or sleeve 40 above the sleeve 26 and is provided with a scale 56 registering with similar indicia 58 on the sleeve 26 to allow accurate setting of the braking effect of the element 46 as will be described hereinafter.

A further metal sleeve 62 is formed with a central internal shoulder 70 that defines in its interior two opposite axially opening cylindrical recesses 68, the former receiving a ring 72 formed with an upwardly open conical seat 74 and the latter fitting over the upper end 64 of the spindle or sleeve 40. The recess is formed at its mouth with threads 80 in which is screwed a guide ring 78. A steel ball 76 of greater diameter than the axial hole 79 through the ring 78 is received in the recess between the rings 72 and 78.

Directly above the spindle or sleeve 40 is a guide eye 86 along with a motor-driven takeup spool 88. Virtually all of the elements described above are coaxial on the rotation axis A.

In operation filaments 82 and 82' are drawn off their respective spools 14 and 14' and threaded longitudinally through the sleeves 62, 40 and 22 and passed outwardly through the port 8 and then up through the sleeve 84, through the eye 86, and onto the spool 88. The motor-driven spool 88 is started rotating and the motor 3 is actuated to rotate the conical disk 6 and the storage drum 4, the remaining structure being prevented from rotating by the magnets 12 and 12'. As the two filaments 82 and 82' are drawn off their spools 14 and 14' they form a first balloon whose shape is limited by the ring 20. As they pass down through the body 62 they must slip between the ball 76 and the seat 74, which action puts a predetermined pretension in the yarn upstream from the ball 76. In order to adjust the extent of pretensioning the ring 78 can be removed and the ball 76 replaced with another ball of different weight.

As the filaments 82 and 82' pass down through the tube 40 they again must slip between the ends 50 and 50' of the braking element 46 and the seats 44 and 30. This braking effect is determined by how far the spindle or sleeve 40 is screwed into the sleeve 26. At this region exactly the same amount of stress is applied to both filaments 82 and 82' so that upstream therefrom they can be twisted with absolutely no difficulty.

On issuing from the orifice 8 the filaments wrap part way around the drum 4 and then pass out across the disk 6 to form a second balloon within the sleeve 84 from whence they pass through the eye 86 onto the spool 88.

The prebraking carried out at the upper end of tube 40 permits the yarns to feed at a uniform rate into the lower brake. If no such upper brake were provided the lower brake 46 would have to make up for the varying resistances of the filaments as they pull off their spools and would therefore do only a mediocre job at braking the throughpassage velocity so that the proper amount of tension is present in the yarn as it is twisted.

We claim:

1. An apparatus for twisting a pair of yarns comprising:
   an upright hollow spindle;
   means for mounting a pair of axially spaced spools coaxially with said spindle, each of said spools providing one of said yarns;
   a rotatable disk at the base of said spindle having a radial opening communicating with the interior thereof, said yarns passing longitudinally upwardly to the top of said spindle along the exterior thereof, in through the top of said spindle, downwardly through said spindle and outwardly through said opening;
   a first thread brake at said top of said spindle comprising a downwardly converging ball seat, a ball received in said seat, and an annulace having rounded ribs retaining said ball and guiding said yarns between said ball and said seat;
   a second thread brake in said hollow spindel axially spaced from said first thread brake and close to said base, said second thread brake comprising a pair of axially open conical seats converging away from one another and a compressible body engaged between said seats of said second thread brake and pressing said yarns thereagainst, said body being formed with a pair of telescoping cylindrical sleeves having hemispherical end surfaces contacting the respective seats, and a compression spring axially urging said sleeves apart, said spindle including a tubular base portion receiving said second thread brake and an inner portion threaded into said base portion at the top thereof and carrying said first thread brake, said inner portion bearing axially against one of the seats of said second thread brake;
   indicating means connected to said spindle for displacing the relative angular positions of said portions corresponding to the force applied by said sleeves against the respective seats; and
   an eye axially aligned with said spindle and disposed thereabove, said yarns passing from said opening upwardly through said eye.