April 15, 1947. A. H. BURKHOLDER ET AL 2,419,055

APPARATUS FOR MAKING CORD AND THE LIKE

Filed May 1, 1944 2 Sheets-Sheet 1

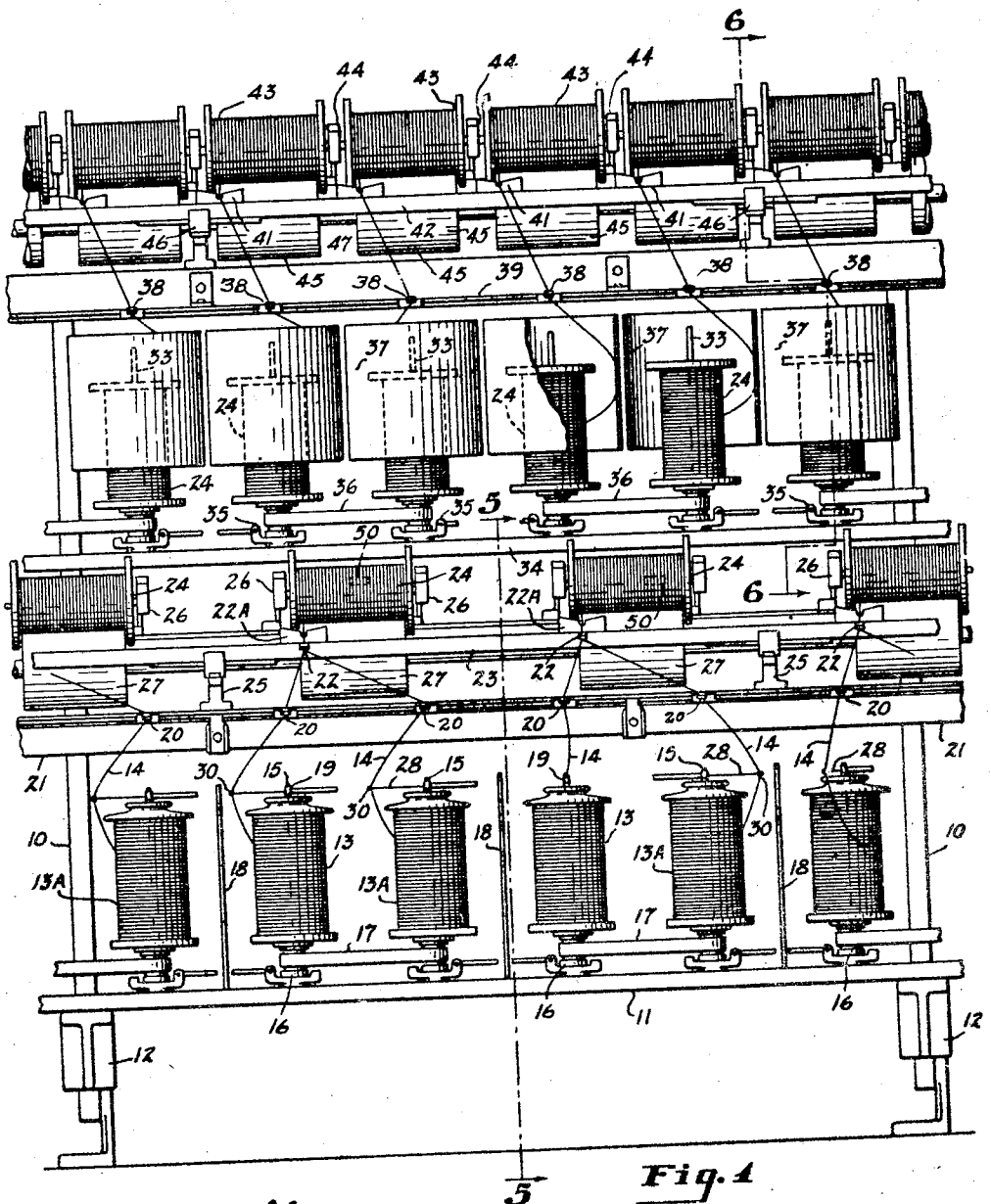


Fig. 1

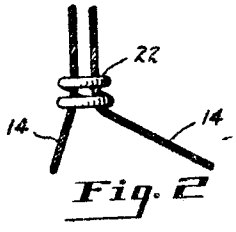


Fig. 2

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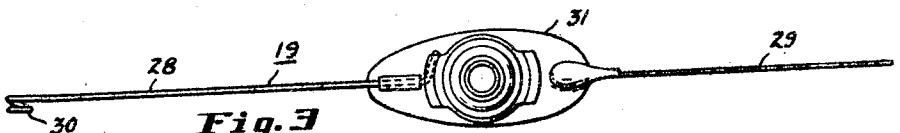


Fig. 3

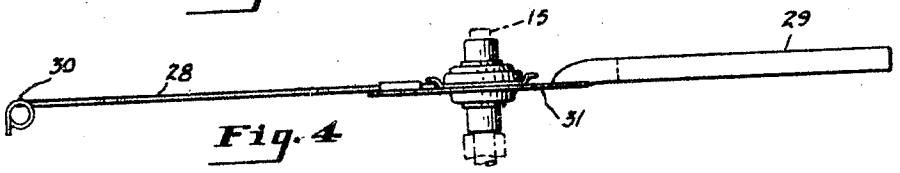


Fig. 4

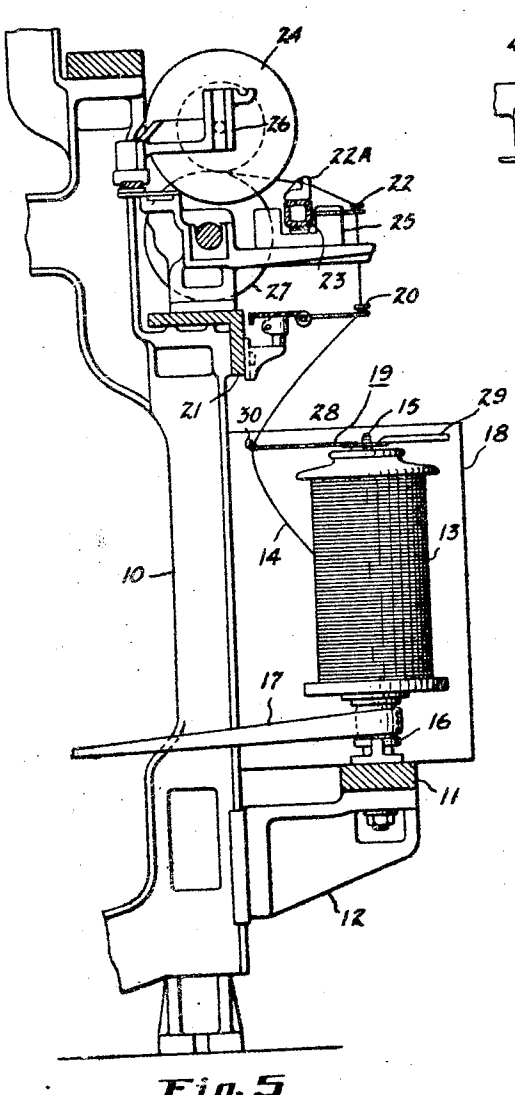


Fig. 5

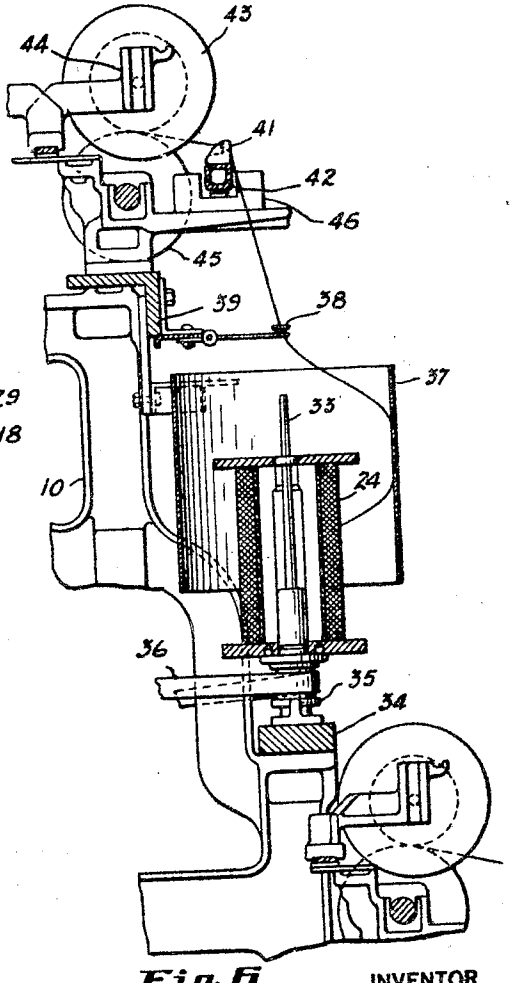


Fig. 6

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UNITED STATES PATENT OFFICE

2,419,055

APPARATUS FOR MAKING CORD AND THE LIKE

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1 Claim. (Cl. 57—62)

1

This invention relates to the manufacture of cord or cordlike products and its provides an apparatus by which such products may be advantageously produced.

Cord and cordlike materials derived from relatively heavy denier yarns, for example, yarns having a denier in excess of about 1,000 are commonly prepared by ring twisting. In producing such cord products, the yarn is given a ply twist of a desired number of turns per inch. Two or more of the resulting twisted strands are then twisted together in the opposite direction a desired number of turns per inch forming what is known as a "cord twist." The use of ring twisters in manufacturing such products, however, subjects the yarn to considerable abrasive wear with the result that the yarn is often substantially weakened by the twisting operation. In addition, ring twisting is performed at relatively low speeds and with relatively small yarn packages.

Uptwisting, on the other hand, may be performed at substantially higher speeds and with substantially larger packages. Furthermore, in uptwisting, the yarn is not in general subjected to as much adverse abrasive action or wear as in the ordinary ring twister. However, attempts to make cord products from relatively heavy denier yarn by uptwisting have involved considerable difficulties.

As an example, in ply-twisting heavy denier yarns by the ordinary uptwisting methods, the twist given the yarn being withdrawn from the supply package frequently becomes ensnarled with the yarn remaining on the package. This often results in breaking of some of the strands of the yarn or sometimes in a complete break of the yarn itself. Naturally, this will result in a weakened cord product. Difficulty is also encountered when two or more strands of the ply-twisted yarn are gathered upon a collecting spool. The twisted strands should be collected in parallel fashion in such a manner that equal lengths of the strands are wound upon the collecting spool since this spool, in turn, is used as the supply package in the cord-twisting operation.

This invention provides an apparatus for uptwisting heavy denier yarns to produce cord or cordlike materials in which the foregoing difficulties are obviated. The cord produced is remarkably uniform in the degree of twist imparted thereto and in consequence has improved fatigue resistance and more uniform strength characteristics. Such cord may be used with particular advantage in the construction of rubber tires although it may also be used for other purposes.

2

In accordance with this invention, cord or cordlike materials are produced by uptwisting heavy denier yarns having an initial twist, these yarns being subjected to a ply-twisting operation which is performed in such a manner as to prevent the twist, which is being imparted to the yarn, from running back to the supply package; two or more strands of ply-twisted yarn are then wound in parallel fashion upon a suitable collecting package from which they are withdrawn and uptwisted in a direction opposite to the ply twist to produce the finished cord product.

By ply-twisting a yarn having an initial degree of twist, it has been found that the ensnarling of yarn being withdrawn from the supply package with the yarn remaining on the package can be considerably minimized. The amount of such twist may vary from about one half to about 4.5 turns per inch and, in general, it is particularly advantageous to have the twist in excess of one turn per inch.

It further has been found that prevention of the additional twist from running back to the yarn on the supply package also minimized ensnarling of the yarn being withdrawn with the yarn remaining on the supply package. The twist advantageously may be prevented from running back by restraining it to a definite zone as by using a suitable flier, such as that to be hereinafter described.

The invention will be more fully described by reference to the accompanying drawings in which:

Figure 1 is a sectional elevation of an uptwisting apparatus;

Figure 2 illustrates the convergence of two ply-twisted strands into substantially parallel relationship;

Figures 3 and 4 are plan and elevation views of a flier suitable for practising the invention;

Fig. 5 is an elevation partly in section along the line 5—5 of Figure 1; and

Figure 6 is an elevation partly in section taken along line 6—6 of Figure 1.

In the drawings, the frame structure 10 is provided with a transverse rail 11 mounted on angular frame supports 12. A plurality of yarn supply packages 13 and 13A containing yarn having an initial twist is mounted on spindles 15 which are supported by the transverse rail 11. Each spindle is provided with a pulley and brake arrangement generally shown at 16 to enable the operator to stop and start the rotation of bobbins

mounted upon the spindle. The spindles are rotated by means of belts 17 which, in turn, are actuated by a suitable source of power (not shown). Separating shields 18 are provided between some of the supply packages.

The yarn 14 from each rotating bobbin is withdrawn at substantially the same rate, traveling through eye 30 of flier arm 28, being part of flier 19 rotatably mounted at the top of each bobbin, and on the extensions of protruding spindles 15. The yarn is then led through a pigtail guide 20, fixed to the transversely positioned angular supporting bar 21; thence, through another pigtail converging guide 22 and an open-slotted guide 22A, both fixed to a laterally traversing bar 23 which, through its lateral motion, spreads the grouped substantially parallel plied yarns evenly over the core of the horizontally positioned rotating bobbin 24. The yarns 14 from companion bobbins 13 and 13A are grouped or collected through converging guide 22 into a substantially parallel relation as shown in Figure 2 and in this condition are wound on the collecting bobbin 24 to be later twisted oppositely into cord on the upper deck. The traverse bar 23 moves laterally in supporting members 25 fixed to the angular support 21 which is fastened to frame 10. The collecting bobbins 24 rotate in suitable bracket bearings generally designated at 26 and are actuated by rotating take-up drums 27 upon which the bobbins substantially ride. The speeds of the supply bobbins 13 and 13A and of collecting bobbins 24 are correlated in order that the correct amount of twist is given to each yarn.

One suitable means for preventing twist which is imparted to the yarn 14 from running back to the yarn on the supply packages 13 or 13A is a flier such as that illustrated by Figures 3 and 4. The flier 19 has an eye 30 through which the yarn passes. This eye is positioned substantially vertically and in the plane of its arm 28 when the flier is mounted on the spindle 15. As a result, the yarn in passing through this eye will be subjected to sufficient frictional resistance so that the twist imparted to the yarn will be substantially prevented from traveling back through the eye 30 to the yarn on the supply packages 13 or 13A.

The arm 28 of the flier which is mounted on the body portion 31 is counterbalanced by a substantially vertical vane 29 also mounted on the body portion 31. As the flier is being rotated, the vanelike arm 29, due to the wind resistance which it causes, will tend to retard the rotation of the flier and further serve to keep the yarn 14 in frictional engagement with the flier eye 30. It thus serves to aid in preventing the twist which is being imparted to the yarn 14 from traveling back beyond the eye 30 to the yarn on the supply package.

Since the frictional engagement of the yarn with eye 30 prevents the twist from backing up to the bobbins, the deleterious effects which would be encountered due to backing up of the twist are eliminated. In addition, the uniformity of twist in turns per inch is improved for substantially all twisting takes place away from the bobbins and in a defined zone between the eyes of the fliers and guides 20 which distance remains substantially constant, whereas in conventional twisters the twisting takes place throughout the variable distance between the point where the yarn leaves the bobbin and a fixed guide.

Referring to Figures 1 and 6, after collecting bobbins 24 are substantially full they are taken

off and placed on spindles 33 positioned on the second deck of the twisting machine. The spindles are mounted in the same manner as described with reference to spindles 15, on a transverse bar 34 and have similar pulley-brake mounting arrangements 35, as at 16, and operated in a like but opposite direction by belts 36. From bobbin 24 the twisted yarn strands are conducted through pigtail guides 38, fixed to the transverse bar 39; then through an open porcelain guide 41, fixed on the laterally traversing bar 42 whose lateral motion evenly distributes the twisted cord on collecting spools or bobbins 43, frictionally rotated by take-up drums 45.

Each bobbin or collecting package 24 rotates within a balloon-restricting cylinder 37. The twist imparted to the parallel strands which are being withdrawn from the package 24 in this operation desirably travels back to the yarn package itself in contradistinction to the twisting operation performed in imparting the ply twist to the individual strands. Having the twist take place on the package prevents the possible separation of the parallel yarns due to centrifugal force and prevents any "corkscrew" effect from being imparted to the cord.

It has been found that, apparently due to the relatively high speed of rotation of the bobbins 24 containing the parallel strands of ply-twisted yarn, the free ends of the yarn first collected on this bobbin may interfere with the proper withdrawal of the parallel strands therefrom. Difficulties are sometimes encountered due to ensnarling of the parallel strands with free ends which, due apparently to centrifugal action, project out radially from the core of the bobbin when substantially all of the yarn has been withdrawn therefrom. This protrusion of free ends frequently causes the loss of the last few turns of yarn on the bobbin. To obviate this difficulty, it is important to secure the free ends of the parallel strands to the core of the collecting bobbin 24 as shown, for example, at 50 in Figure 1. As there shown, the parallel strands of twisted yarn have their ends secured to the core of the bobbin by any suitable means 50 such as, for example, cellulose adhesive tape or other types of adhesive materials. Mechanical locking means may also be used, if desired. By this method, it is then possible to withdraw all of the yarn from the bobbin in the cord-twisting operation without difficulty due to ensnarlment of the cord with free ends of the strands on the bobbin.

It is also important to insure proper parallel collection of the twisted strands upon the collecting bobbins 24 to have the slotted guide 22A of the proper size. The yarn-supporting portion of the slot should not be any greater than about ten times the width of each of the individual strands passing therethrough and preferably of a slightly arcuate construction so as to "nest" the yarn going therethrough to the collecting package.

The invention will be further illustrated by reference to the following example for producing a tire cord by the apparatus of this invention. It is to be understood, however, that the invention is not limited thereto.

Example

Two bobbins, as illustrated at 13 and 13A, each containing about 4.5 pounds of 1100 denier, 480 filament, high tenacity viscose rayon yarn having an initial twist of about 1.4 turns per inch

are placed upon the spindles 15. After threading the ends of the yarn through the flier eyes 30 and the guides 20, 22 and 22A, the ends of the yarn are secured in a parallel relation by means of adhesive tape to the core of the collecting bobbin 24. The bobbins are rotated at a speed such as to give a final total twist of 14 turns per inch to the yarn. Due to the action of the flier 18, the twisting of the yarn will occur between the flier eye 30 and the guide 20 with substantially no twist running back beyond the eye 30 to the supply packages 13 or 13A.

When the collecting bobbin 24 is filled, the bobbin is transferred to the upper deck of the apparatus and after threading the yarn through the various guides and securing it to the collecting spool 43, the bobbins are rotated to impart a final twist of 11.5 turns per inch, in a direction opposite to the additional 12.6 turns per inch, given the individual yarns. The finished cord product will be remarkably uniform in twist characteristics and will have excellent strength and other physical properties.

Instead of imparting a total ply twist of 14 turns per inch, as indicated in the preceding example, total twists ranging from 11 to 18 turns per inch may be used. Similarly, the cable twist need not be 11.5 turns per inch but may range from 11 to 13 turns per inch.

We claim:

An up-twisting apparatus comprising a structure having at least two decks, a lower deck and and upper deck, at least two spindles on said lower deck adapted to hold yarn supply packages, means for simultaneously rotating said packages at identical speeds, fliers for frictionally engaging the yarns as they are withdrawn from said supply packages, said fliers being positioned on said spindles above said supply packages and being adapted to substantially prevent the twist imparted to said yarns from backing up to the supply packages, yarn guides axially disposed above said supply packages, said yarn guides and said fliers determining the twisting zone of the yarns from said supply packages, a traverse bar above said supply packages, a guide on said traverse bar being adapted to collect said separately simultaneously up-twisted yarns, a traversing guide on said traverse bar through which said collected yarns pass in a substantially parallel relation, a collecting package for said collected yarns, means for peripherally rotating said collecting package, said traversing guide being adapted to direct the winding of the collected substantially parallel up-twisted yarns on said collecting package, a spindle on said upper deck for mounting said collecting package, means for rotating said collecting package in an opposite direction for imparting a ply twist to the collected yarn, a cylinder surrounding said rotating package for substantially restraining the ballooning of the collected up-twisted yarn, an axially disposed guide above said collecting package, the twisting of said collected yarn occurring substantially between said guide and the yarn take-off point on said collecting package, a peripherally driven take-up package for said up-twisted yarn, a traverse bar above said collected yarn package, and a traversing guide on said traverse bar for directing the winding of the up-twisted yarn on said take-up package.

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