Nov. 18, 1958 C. J. PRICE 2,860,844

THREAD TENSIONER

Filed Oct. 27, 1955

Fig. 2

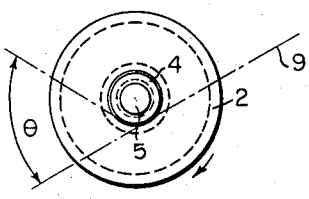
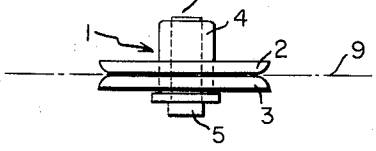


Fig. 1



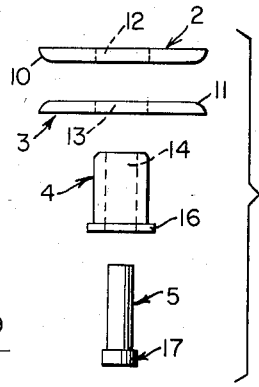


Fig. 3

Fig. 4

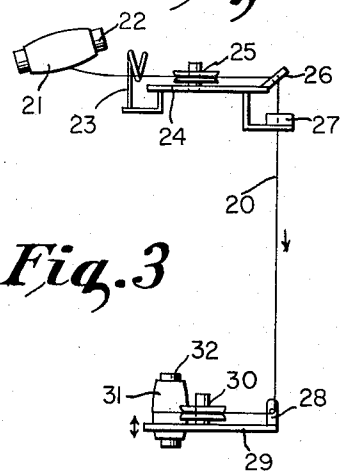


Fig. 5a

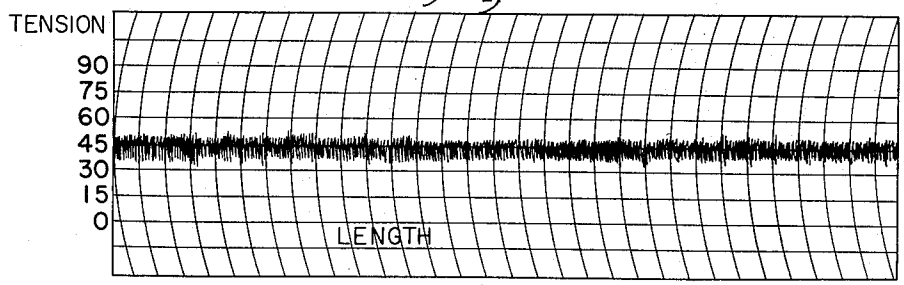


Fig. 5b

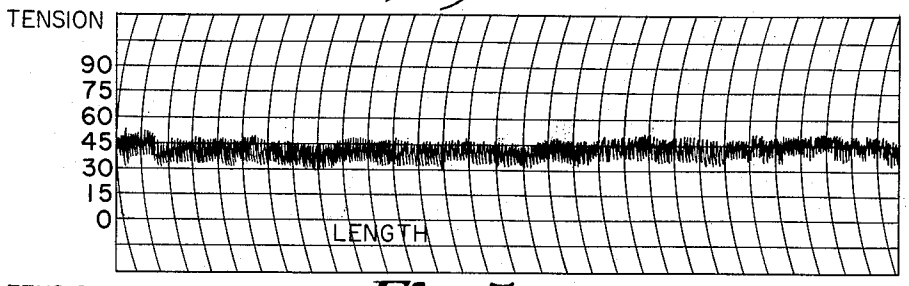
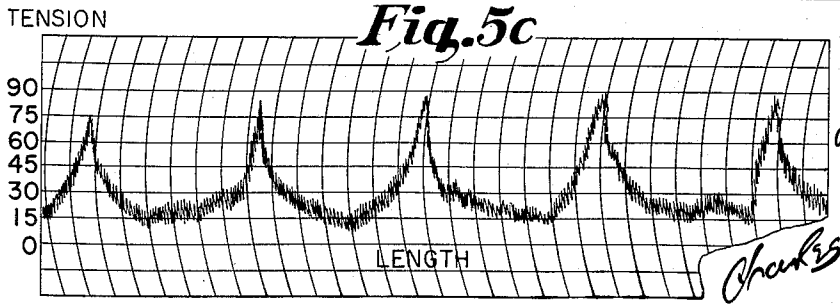


Fig. 5c



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THREAD TENSIONER

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This invention relates to winding of yarn, concerning particularly tensioning apparatus useful therein.

Variation in tension under which yarn is wound onto a package is conducive to density non-uniformity in the package and possible variation in physical characteristics and dye-receptivity of the yarn. A known type of yarn-tensioning device involves two or more closely spaced solid surfaces against which the yarn rubs during passage through the device, the frictional resistance being added to the force required to forward the yarn. Despite substantial constancy of winding speed, it is known that yarn moves through conventional guides with an erratic or jerky motion between successive fairly well defined maximum and minimum speeds, with corresponding low and high tensions.

A primary object of the present invention is uniform tensioning of a traveling yarn. An object is formation of a wound yarn package of improved uniformity by virtue of even winding tension. Other objects of this invention, together with means and methods for attaining the various objects, will be apparent from the following description and the accompanying diagrams.

Figure 1 is an elevation of apparatus of this invention. Figure 2 is a plan view of the apparatus of Figure 1. Figure 3 is an exploded view of the apparatus of Figure 1. Figure 4 is a schematic elevation of apparatus, including that of Figure 1, useful according to this invention. Figure 5 is a sequence of three graphical representations of the relationship between tension and length for yarn tensioned according to this invention and, alternatively, by conventional means.

In general, the objects of this invention are accomplished by means of a yarn-tensioning device comprising a cylindrical supporting element mounted rotatably with its axis vertical and two discs having identical central bores extending from face to face supported thereby free to rotate with respect thereto in mutual contact and adapted to receive a traveling yarn between adjacent disc faces and against the supporting element. The invention comprehends yarn-winding apparatus including such a device located on a reciprocable traverse arm between a yarn guide carried on the arm and a yarn-receiving bobbin mounted upon a vertical axis parallel to the direction of reciprocation of the traverse arm particularly with location of the tensioning device out of line with the yarn guide and the bobbin so that the angle defined by yarn in passage through the device from the yarn guide to accumulate on the bobbin becomes less the more yarn accumulates on the bobbin. The invention extends to such yarn-winding apparatus to which yarn is fed through a pretensioning device of this kind located before the mentioned guide in the path from yarn source to the windup bobbin.

Figure 1 shows yarn-tensioning device or "disc-tensioner" **1** composed of upper disc **2** and like lower disc **3** assembled face to face on vertical hollow supporting cylinder **4** carried on pin **5**. Broken line **9** represents the path of yarn between the upper and lower discs which

have their adjacent faces flared outward at the edge. Figure 2 is a corresponding plan view of the same elements showing diversion of the yarn path through angle θ about the cylinder, which it contacts during the portion of its path at the innermost edges of the discs.

The appearance of each individual element of the device just described is somewhat more apparent in the view of Figure 3, which represents them "exploded" or separated vertically from one another. The upper disc, which has central bore **12**, is oriented with rounded edge **10** downward; while the lower disc, which has like central bore **13**, is oriented with rounded edge **11** upward to provide the flaring previously mentioned. The bore diameter is slightly greater than the outside diameter of the supporting cylinder (shown below the discs), which is of uniform diameter throughout except for enlarged portion **16** stepped outward near the bottom, the horizontal surface of the step constituting a support for part of the lower face of the lower disc. Hollow **14** of the cylinder has slightly greater diameter than the body of pin **5**, which is the bottommost element of the drawing, but complete telescoping of the hollow cylinder onto the pin is prevented by boss **17** at the base of the pin.

Figure 4 shows the winding of yarn from one bobbin to another, utilizing (twice) the kind of yarn-tensioning device just described and illustrated in the previous diagrams. Traveling yarn **20** unrolls from package (accumulation of yarn) **21** carried on yarn-delivery bobbin **22** supported on a creel or the like (not shown) and passes through pigtail **23** carried on platform **24** and successively through disc-tensioner **25**, guide **26**, and slub cleaner **27** (all supported on the same platform). From the slub cleaner the yarn passes about pin guide **28** carried on traverse arm **29** (reciprocable as indicated by the double arrow) and through disc-tensioner **30**, also carried upon the arm, and winds up as package **31** carried on yarn-receiving bobbin **32**.

The angle θ (see the representative plan view in Figure 2) through which the yarn passes about the supporting cylinder remains substantially constant at a suitable value, such as about 60°, for the pretensioner on the fixed platform; however, for the tensioner on the traverse arm the angle varies with the build-up of the package surface. In the latter arrangement, it is apparent that, on the one hand, the side of the angle defined by the portion of the yarn path to the right of the hollow cylinder remains fixed because the guide pin does not change position with respect to the cylinder but, on the other hand, the side of the angle defined by the portion of the path to the left of the hollow cylinder moves counterclockwise to decrease the angle as the surface of the wound yarn package expands in that direction and moves the terminal point of the path.

This arrangement of elements on the traverse arm is advantageous in offsetting the tendency to increased winding tension as the yarn package builds up, assuming constant rotational velocity of the yarn-receiving bobbin (which is conventional); the tension applied by the disc-tensioner decreases with package build-up because of the decreasing angle described by the yarn about the disc-supporting element. Thus, these two effects tend to cancel one another, maintaining more even winding tension and improving the uniformity of the wound package.

The elements of the tensioning device of this invention should be constructed of abrasion-resistant materials, of course. Preferably, the discs and the supporting cylinder, all of which contact the yarn, are composed of suitable ceramic (Alsimag, Heanium, or the like) for minimum wear. A matte surface is preferred on the ceramic elements for optimum frictional relationship with the contacting yarn. The pin upon which the hollow

cylinder rotates may be made of metal, glass, plastic, or other material offering little resistance to the rotation of the cylinder. If desired, the pin and the cylinder may be formed integrally and mounted in a bearing race or other means permitting rotation of the resulting cylindrical disc-supporting element.

During operation with a traveling yarn introduced between adjacent disc faces, the top disc rotates more rapidly than the lower disc because of the additional drag imposed by the step of the supporting cylinder on the lower disc, and the supporting cylinder itself rotates at a still slower speed. The tension imposed upon the yarn by this arrangement is substantially independent of the linear speed of the yarn, which is especially beneficial where winding of a tapered package at constant rotational velocity continually varies the winding speed. Rotation of all these yarn-contacting elements minimizes accumulation of fluff or broken pieces of yarn. The applied tension is easily changed by substitution of discs of different weight, and no spring or other element than the discs themselves determines the tension applied to the yarn. For example, in Figure 4 the pretensioner is constructed with discs of lighter weight than those of the disc-tensioner on the traverse arm, so as to apply only sufficient tension to maintain the traveling yarn in uniform contact with the intervening elements.

Figure 5A shows graphically the uniform relationship of tension (indicated in grams) and yarn length (units representing 9.6 yards) obtained using apparatus of this invention, as compared with the more erratic tension variation shown in Figure 5B obtained in similar use of a previously existing disc type of tensioner. While the improvement is less than that represented by substitution of either disc-tensioner for a gate-tensioner, which provides violent recurrent tension peaks as shown in Figure 5C, low-twist synthetic multifilament yarn rewound under the conditions represented by Figure 5A formed slough-resistant packages of markedly more uniform density and dye-receptivity than like yarn wound under the conditions represented by Figure 5B. Other advantages of the present invention will become apparent to those undertaking to practice it.

The claimed invention:

1. Yarn-winding apparatus comprising a yarn-receiving bobbin mounted upon a vertical axis, a traverse arm reciprocable vertically near the bobbin, a yarn guide carried on the traverse arm, and a yarn-tensioning device comprising a cylindrical supporting element mounted rotatably with its axis vertical and two discs having identical central bores extending from face to face supported thereby free to rotate with respect thereto in mutual contact and adapted to receive a traveling yarn between adjacent disc faces and against the supporting element, said device located on the traverse arm between the yarn guide and the bobbin.

2. The apparatus of claim 1 in which the yarn-tensioning device is located out of line with the yarn guide and the bobbin so that the angle defined by yarn in passage through the yarn-tensioning device from the yarn guide to accumulate on the bobbin is less the greater is the accumulation of yarn on the bobbin.

3. The apparatus of claim 2 in which a like kind of yarn-tensioning device located in fixed position with respect to the yarn-receiving bobbin precedes the yarn guide in the path of yarn to the bobbin.

4. Yarn-winding apparatus comprising a yarn-delivery bobbin, a first yarn-tensioning device as defined in claim 1 adapted to receive yarn from the yarn-delivery bobbin, a yarn guide mounted on a reciprocating traverse arm and adapted to receive yarn from the first yarn-tensioning device, a second yarn-tensioning device as defined in claim 1 mounted on the traverse arm adapted to receive yarn from the yarn guide, and a yarn-receiving bobbin rotatably mounted on an axis parallel to the direction of reciprocation of the traverse arm and adapted to receive yarn from the second yarn-tensioning device during reciprocation of the traverse arm.

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