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YARN TWIST MEASURING INSTRUMENT

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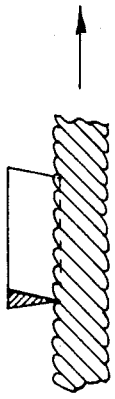


Fig. 2

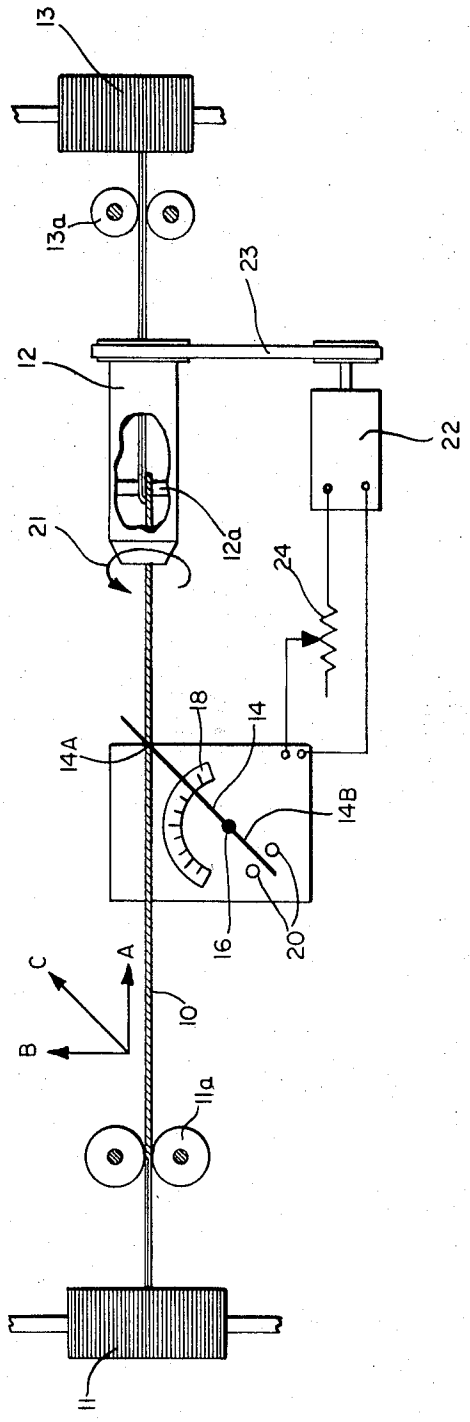


Fig. 1

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YARN TWIST MEASURING INSTRUMENT

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ABSTRACT OF THE DISCLOSURE

Yarn twist measuring instrument comprises a needle which rests on the yarn and is otherwise supported by a low friction bearing permitting the needle to turn freely in a horizontal plane. If the needle is counter-balanced, the yarn and the plane in which the needle turns need not be horizontal. As the yarn moves longitudinally and is rotated to produce twist or false twist, the needle assumes an angular disposition indicative of the amounts of twist being placed in the yarn.

BACKGROUND OF THE INVENTION

This invention pertains to an instrument for sensing the amount of true twist or false twist, referred to generally hereinafter as "twist," being imparted to a yarn in a twisting or false twisting apparatus.

Various forms of apparatus for imparting twist to a multifilament yarn bundle are well known. Examples of such apparatus are disclosed in U.S. Pats. 3,091,908—Carruthers, 3,327,461—Wyatt, 2,803,109—Stoddard et al., 2,946,180—Tessot et al., and 3,094,834—Deeley et al. The apparatus disclosed in the Carruthers patent is useful for imparting false twist to a yarn by winding together two ends of yarn.

Apparatus disclosed in the other patents referenced above imparts false twist to a single-ended yarn. Still another form of apparatus, not disclosed in any of the foregoing patents is a true twister in which, for example, a take-up spool revolves about the axis of yarn as it is fed to the spool, thus permanently twisting the yarn.

In all of these types of apparatus it is desirable to determine the amount of twist in turns or apparent turns (in the case of false twists) per inch being placed in the yarn.

Accurate and simple means for sensing the amount of twist being imparted to a multifilament yarn bundle in a twisting or false twisting apparatus and/or for controlling such apparatus in response to the amount of twist being imparted to such yarn bundles, has heretofore been unavailable to the best of my knowledge.

It is therefore the general object of the present invention to provide a simple, compact, accurate device for sensing, recording, and/or indicating, either visually or mechanically, the amount of twist being imparted to a multifilament yarn bundle in a yarn twisting or false twisting apparatus.

BRIEF DESCRIPTION OF THE INVENTION

The foregoing object is met in accordance with the present invention by an instrument comprised of a needle element, one end of which rests on a segment of the yarn to be measured as the yarn is moved longitudinally and rotationally through the twisting or false twisting apparatus. This needle element is otherwise supported by a low friction bearing which permits a large degree of angular movement in the horizontal plane. The needle element resting on the yarn tends to assume an angular disposition corresponding to the direction of movement of the top surface of the yarn. This direction is, of course, a resultant of the yarn's longitudinal and rotational movement

and is coincident with the twist helix angle, i.e., the angle between the twisted yarn filaments and the yarn axis. The angular disposition of the needle element is therefore directly related to and indicative of twist, considered either in terms of turns per inch or helix angle. The use of a graduated scale with the needle element provides a quantitative indication of this twist. Alternatively, photosensitive cells, variable resistors or pneumatically or hydraulically responsive chambers may be used to provide a mechanical output responsive to the twist measurement, which may in turn be used to control the twisting or false twisting apparatus.

If the needle element is counter-balanced about the low friction bearing, the yarn being tested and the coincident plane of movement of the needle may be any plane, horizontal or otherwise.

DETAILED DESCRIPTION OF THE INVENTION

This invention, which is specifically set forth in the claims appended hereto, may be better understood by reference to the following detailed description taken in conjunction with the accompanying drawing which is a horizontal plan view of the instrument of the present invention.

Referring more specifically to the accompanying drawings, FIG. 1 represents a view in side elevation of an apparatus embodying features of this invention, and FIG. 2 represents an enlarged sectional view showing a sensing device comprising one component of the apparatus.

FIG. 1 shows a horizontally disposed multifilament yarn bundle **10**, moving longitudinally, as indicated by arrow A, from supply reel **11** and nip rolls **11***a* to nip rolls **13***a* and take-up reel **13**, and a false twist spindle **12** which rotates yarn bundle **10**. Spindle **12** rotates counterclockwise looking in the direction of yarn travel as indicated by the arrow **21**. Each filament in the yarn progresses and rolls, thus moving in the direction shown by the arrow C. False twist spindle **12** is shown in partial section to expose twisting member **12***a* about which yarn **10** is turned and passes. Spindle **12** rotates with twisting member **12***a* about the longitudinal yarn axis, being driven by a motor **22** operating through a pulley **23** connected to drive the spindle.

A needle element **14**, which may consist of any lightweight elongated element, is disposed generally in the same plane as yarn **10** with one end **14***a* resting on the yarn **10**. Needle element **14** is also supported by bearing **16**, spaced from yarn **10** in a direction such that the rotational movement of yarn **10** causes the top surface thereof to move away from bearing **16**. Bearing **16** provides a low friction support which permits angular displacement of needle element **14**, in a plane approximating a plane occupied by the yarn around bearing **16**, at least through a sufficiently great angular arc to permit a portion **14***a* of needle **14** to engage yarn **10** throughout a length thereof dependent on the maximum amount of twist expected to be imparted by twisting spindle **12**.

Needle **14** may also include a counter-balancing portion **14***b* to assist in minimizing friction at bearing **16** and/or to provide the output indication of twist measured by the device of the present invention. This indication may be visually observed from, for example, a graduated scale **18** disposed below needle **14**. Any of a variety of optical, electrical or fluid sensing devices may also be used in combination with the present invention to provide a mechanical output responsive to twist as measured by the device of the present invention, which mechanical output can then be used to control the amount of twist applied by the twisting apparatus. One such mechanism for providing such a mechanical output is a pair of photosensitive cells **20** disposed so as to produce an electrical signal whenever needle **14** assumes an angular posi-

tion either greater than or less than that indicative of the amount of twist which it is desired to impart to the yarn bundle. Such cells **20** are connected to a rheostat **24** which is connected electrically to the electrical supply circuit for the motor **22**. Thus, cells **20** provide signals causing the motor **22** to accelerate or to slow down to provide the required degree of twist.

Twisting apparatus **12** may be any form of twister or false twister, many varieties of which are well known. Regardless of the form of twisting apparatus **12**, the present invention is useful because it determines the number of turns or apparent turns per inch being placed in the yarn without interfering with the running of the apparatus. Further, this device may be used to control the number of turns or apparent turns per unit length being put into the running yarn.

It will be appreciated that the portion **14***a* of needle **14** resting on yarn **10** is in frictional engagement with the surface of yarn **10** which surface, as it moves through the twisting or false twisting apparatus, actually moves in the direction shown by arrow C, which is the resultant of the longitudinal and rotational movement of the yarn bundle. The frictional force exerted by yarn **10** on needle **14** in direction C therefore has two components, one lengthwise of the needle and one perpendicular thereto, the latter of which exerts a turning moment on the needle in a horizontal plane until the needle itself points in direction C and the magnitude of the perpendicular force vector on needle **14** becomes zero. The angle, then, assumed by needle **14** depends on the direction C which, in turn, depends on the relative magnitude of the longitudinal and rotational movement of the yarn. The rest position of needle **14** is therefore directly related to the number of turns or apparent turns per unit length being imparted to the yarn by the apparatus. In order for the force vector perpendicular to needle **14** to rotate needle **14** toward its rest position, needle **14** with bearing **16** must be located with respect to yarn bundle **10** so that the rotational movement thereof causes the top surface of yarn bundle **10** to move away from bearing **16**.

For some purposes, it is desirable to provide the needle portion **14***a* with a knife edge as shown in FIG. 2 which rides upon the yarn **10**. This knife edge penetrates into the bundle of filaments of which the yarn is composed, giving especially accurate and sensitive response to changes of twist level.

For convenience of illustration and understanding, the present invention has been described and illustrated with reference only to the embodiment thereof in which the yarn and needle are disposed in a substantially common plane. It should be understood that counter-balancing of needle element **14** permits use of the invention with the yarn and needle element in any plane, horizontal or otherwise.

What is claimed is:

1. An instrument for measuring the degree of twist being imparted to a continuous yarn by an apparatus causing said yarn to move both longitudinally and rotationally with respect to the axis of said yarn, said instrument comprising

(a) a needle disposed in a plane generally coincident with said yarn, one end of said needle resting on said yarn during the course of its longitudinal and rotational movement, said needle also supported by

(b) a low friction bearing permitting free rotational movement of said needle in a plane coincident with said yarn about an axis spaced from said yarn in a direction such that the rotational movement of said yarn causes the surface thereof in contact with said needle to move away from said bearing, and

(c) means for sensing the angular disposition of said needle with respect to said yarn axis in the coincident plane of said needle and yarn bundle.

2. An instrument, as recited in claim **1**, wherein said sensing means comprises an indicating means having a graduated scale over which said needle passes during the course of its rotational movement.

3. An instrument, as recited in claim **1**, wherein said indication means comprises a sensing means providing a signal output proportional and responsive to the angular disposition of said needle.

4. An instrument, as recited in claim **1**, wherein said yarn bundle and said needle are disposed generally in a common plane.

5. An instrument, as recited in claim **1**, wherein said sensing means is connected to a controlling means for controlling the amount of twist imparted to said yarn in response to determinations made by said sensing means.

6. An instrument, as recited in claim **1**, wherein said needle is provided with a knife edge arranged in contact with the yarn.

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