MANUFACTURE OF COMPOSITE YARN

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This invention relates to manufacture of composite yarns, such as elastocore yarn.

A primary object of the present invention is production of composite yarns having a component reversibly extensible strand and a component strand not reversibly extensible.

Another object is conversion of the draw section of a conventional spinning frame for use in such production.

A further object is provision of an attachment for such a spinning frame to effect such conversion.

Other objects of the present invention, together with means and methods for attaining the various objects, will be apparent from the following description and the accompanying diagrams.

FIG. 1 is a side elevation of apparatus according to this invention;
FIG. 2 is a front elevation of the apparatus of FIG. 1; and
FIG. 3 is an enlarged perspective view of a portion of the apparatus of the preceding views.

FIG. 4 is a fragmentary transverse section through the apparatus of FIG. 3, taken at IV—IV thereon;
FIG. 5 is a front elevation of part of the same apparatus together with related elements useful in conjunction therewith;
FIG. 6 is a side elevation of a composite yarn according to this invention, shown extended;
FIG. 7 is a side elevation of the same yarn, shown unextended and on a reduced scale; and
FIG. 8 is a transverse section through a short length of the unextended yarn of FIG. 7, on an enlarged scale.

In general, the objects of the present invention are accomplished by extending an irreversibly extensible strand to increased length, extending a reversibly extensible strand to increased length, and combining them by placing them in twisted engagement with one another along essentially the entire length of each at their respective increased lengths. Particular apparatus thereafter is a feature of this invention.

FIGS. 1 and 2 show, in side and front elevation, respectively, apparatus suited to the practice of this invention. Framework 11, shown rather diagrammatically in the interest of simplicity, of a spinning frame supports a conventional draw section, such as is used to draft a roving of staple fibers to increased length and to correspondingly reduced diameter. So supported are trumpet guide 12, pair of back rolls 13, 14 (the former being shown with a serrated surface and the latter with a smooth surface), single intermediate roll 15 (also shown serrated), large and small pairs of belt-supporting rolls 21, 22 and 23, 24, with belts 25 and 26 each passing about one roll in each pair, and pair of front rolls 28, 29.

Roving 10 is shown passing through trumpet guide 12, between back rolls 13, 14, over intermediate roll 15, between belts 25, 26, and (as extended strand 10') to and through the nip of front rolls 28, 29, having been noticeably reduced in diameter (and extended) along the way.

The practice of this invention is self-evident in the light of this specification and the illustrations of apparatus and the resulting composite yarn. The surface speed of rolls 35 and 36, the latter of which is not driven except by contact with the yarn itself, is relatively low because of the lesser diameter of roll 35 as compared with affixed drive wheel 38 and drive member 39 thereon, the latter being in essentially non-slipping contact with front roll 29; consequently, reversibly extensible strand 30 is extended (and then denoted as 30') as it passes from roll 36 to roll 29 and remains essentially so extended upon continuing to the bobbin.

The resulting composite strand (previously denoted as 40 on the bobbin) is shown, in side elevation, so extended as 40e in FIG. 6, and unextended or relaxed as 40r in FIG. 7. Recovery of the component reversibly extensible strand 30 to reduced length (approximating its original length) causes the component irreversibly extensible strand, which covers the component reversibly extensible strand at extended length, as in FIG. 6, to fill outward into new convoluted strand 10", characterized by a multitude of protruding loops, as shown in FIG. 7 on a somewhat reduced scale. FIG. 8 shows that the loops in component strand 10" extend at all compass angles about component strand 30 at the core. In fact, the protruding loops in component strand 10" follow a generally helical path about the core. The representation in FIG. 7 is somewhat stylized as though the loops extend only in the plane of the drawing, and such representation might suggest a greater variation in loop size than the modest variation actually present.

The enlarged representation of swing arm 32 in FIG. 3 shows mounting aperture 34 into which the end of guide 33 is inserted. That showing of the swing arm and the corresponding showing of component and related parts on an alike scale in FIGS. 4 and 5 show that drive wheel 38, which is affixed at one end of roll 35, has rim 37 on which driving mem-
ber 39 seats. The driving member is in toroidal form, and as shown in FIG. 5 it may have different cross-sectional diameters, the internal diameters of rolls, the driving member thereby remaining the same. In addition to member 39 previously illustrated, FIG. 5 shows similar toroidal members 39a and 39b having larger and smaller sectional diameters, respectively, and the same internal ring diameter as member 39, which equals the least diameter of rim 37, of course—the rim being transversely accurate, with a radius of curvature corresponding to an intermediate size (with reference to transverse section) of driving member. It will be apparent that by substitution of driving members of different sizes the degree to which the reversibly extensible strand is extended before combination with the extended reversibly extensible strand may be changed to provide the desired degree of extension.

In general, the reversibly extensible strand is extended approximately ten times as much as the reversibly extensible strand is extended; the former being drafted to about thirty times its original unextended length, for example, and the latter stretched temporarily to about three times its original unextended length. Suitable as the reversibly extensible component are natural fiber compositions, such as wool or cotton, and various synthetic fiber compositions, such as rayon, nylon, polyacryl, polyester, polyolefin, etc. Suitable as the reversibly extensible component are also extrusion compositions such as rubber or synthetic spandex compositions.

This invention provides a most convenient process for making composite yarns, such as of elastic core type. The particular apparatus illustrated and described, although preferred, may be varied by addition, combination, or subdivision of parts or substitution of equivalents while retaining all or many of the advantages and benefits of the invention. Additional strands may be included as components of the composite yarn also without involving a departure from the invention, which is defined in the following claims.

The claimed invention:

1. Apparatus for manufacturing a composite yarn, comprising means including a first pair of rolls driven at a given surface speed and a second pair of rolls driven at a greater surface speed, the first and second pairs of rolls being effective to extend an irreversibly extensible strand to increased length, means including a third pair of rolls driven at a given intermediate surface speed by yarn passing in driving contact from the one roll to the other roll, the three second pairs of rolls being effective for forming the strands at their respective increased lengths by placing them in twisted engagement with one another along essentially the entire length of each.

2. Apparatus for manufacturing a composite yarn, comprising means including a first pair of rolls driven at a given surface speed and a second pair of rolls driven at a greater surface speed, the first pair of rolls being the back rolls in the draw section of a spinning frame and the second pair of rolls being the front rolls in the same draw section, the first and second pairs of rolls being effective together to extend an irreversibly extensible strand to increased length, means including a third pair of rolls one roll of which is driven at a given intermediate surface speed by interconnection with the second pair of rolls and the other roll of which is driven at a given intermediate surface speed by yarn passing in driving contact from the one roll to the other roll, the first second pair of rolls also being effective for forming the strands at their respective increased lengths by placing them in twisted engagement with one another along essentially the entire length of each.
from the one roll to the other roll, the third pair of rolls being mounted on a swing arm attached to the frame. said swing arm being pivotal to maintain said one roll driven by said second pair of rolls in interconnection with said second pair of rolls, said roll in the third pair having affixed at one end thereof a drive wheel of greater diameter biased into engagement at its peripheral surface with the peripheral surface of one of the rolls in the second pair, said drive wheel being effective to drive said roll to which it is affixed at said intermediate surface speed, the third and second pair of rolls thereby being effective together to extend a reversibly extensible strand to increased length, said second pair of rolls also being effective for combining the strands at their respective increased lengths by placing them in twisted engagement with one another along essentially the entire length of each.

6. In a spinning frame having in a draw section thereof a pair of first rolls driven at a given surface speed and a second pair of rolls driven at a greater surface speed, the improvement comprising a swing arm attached to the frame for pivoting movement with respect thereto and carrying a third pair of rolls, one of the rolls in the third pair having affixed at one end thereof a drive wheel of greater diameter located to engage at its peripheral surface the peripheral surface of one of the rolls in the second pair, said swing arm and drive wheel being effective to drive said roll to which the drive wheel is affixed at a given intermediate surface speed and said third and second pairs of rolls thereby being effective together to extend a reversibly extensible strand to increased length.

7. In a spinning frame having in a draw section thereof a pair of first rolls driven at a given surface speed and a second pair of rolls driven at a greater surface speed, the improvement comprising a swing arm attached to the frame at an intermediate location thereon and extending to and over the second pair of rolls, the swing arm carrying a third pair of rolls, one of the rolls in the third pair hav-