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3,438,186

METHOD AND APPARATUS FOR PRODUCING A NOVELTY LOOP YARN

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FIG 1

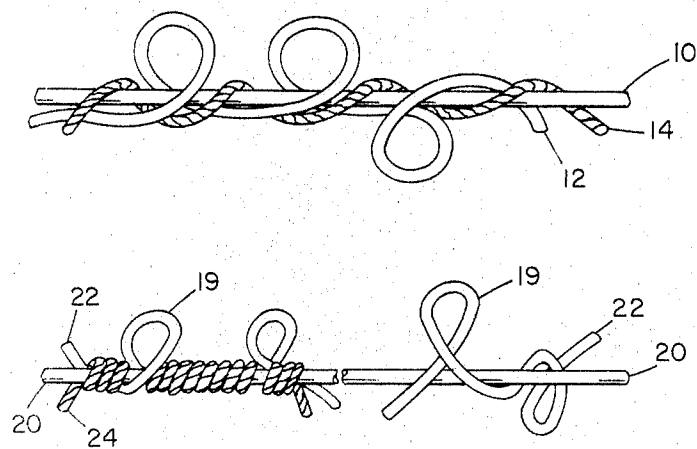
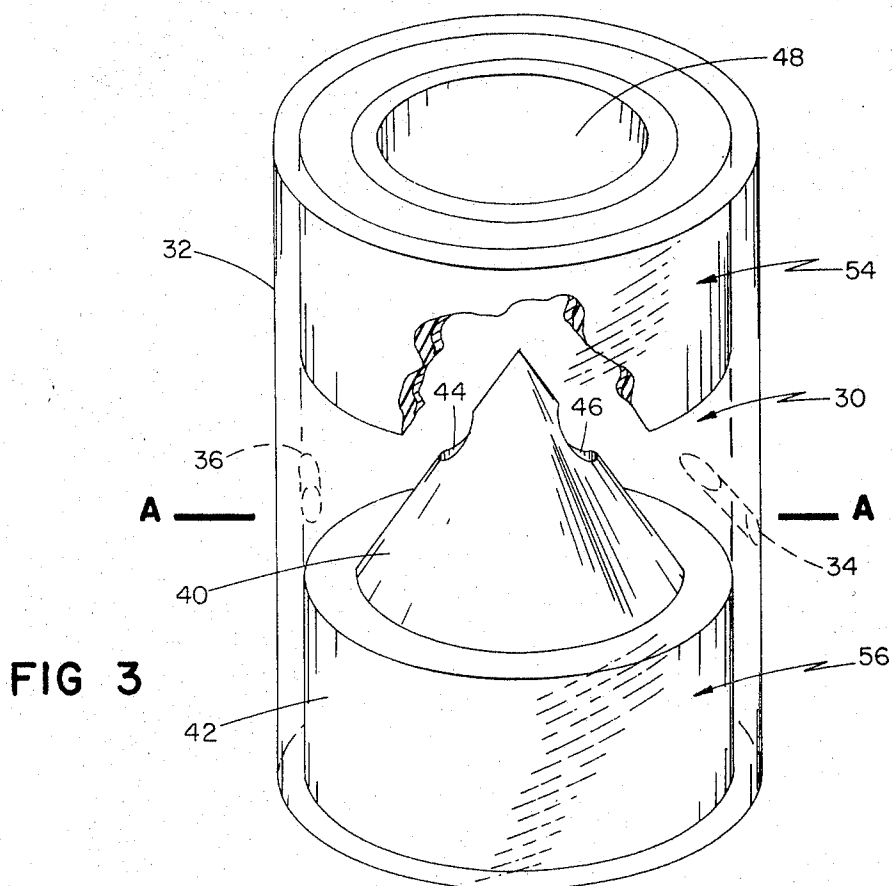


FIG 2



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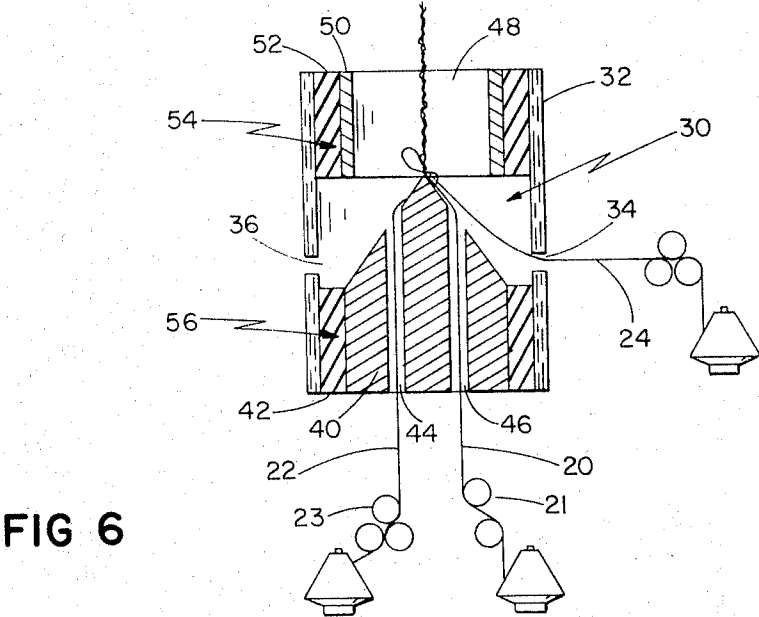
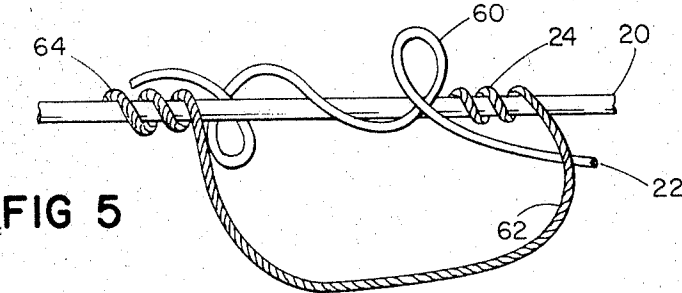
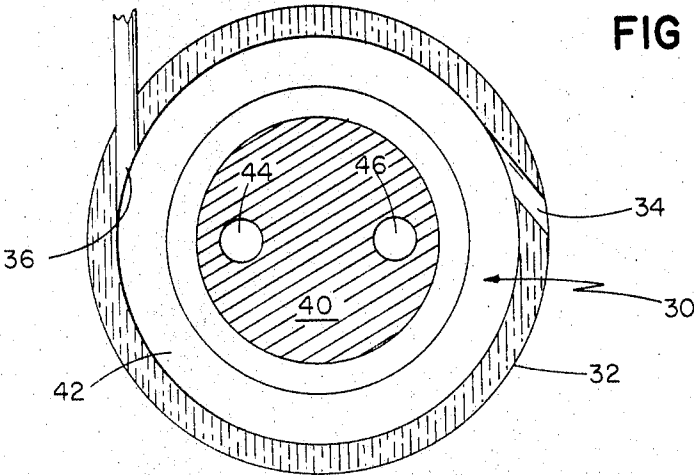
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Sheet 2 of 2



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METHOD AND APPARATUS FOR PRODUCING A NOVELTY LOOP YARN

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4 Claims

ABSTRACT OF THE DISCLOSURE

A whirling body of fluid such as air is created by admitting air under pressure into a generally cylindrical vortex tube. At least three strands of yarn are drawn into the tube by the air-stream at different speeds, each strand having a linear velocity at least twice the velocity of the next fastest strand. The two or more faster strands are thereby falsely-wrapped around the slowest strand in a variety of novel configurations. Since there is no true twisting of one strand around another, loop and boucle yarns are made in an inexpensive and expeditious manner.

This invention relates to novelty wrapped yarns, and more particularly to yarns of the loop or boucle type wherein two or more textile strands are wrapped around a third strand in an aerodynamic wrapping process which does not involve the true twisting of one strand around another.

Fashion dictates that in the preparation of certain items of apparel, upholstery, and drapery art, the plain, flat-surfaced effect of plain-woven fabrics be avoided. In addition to creating novel textured effects in fabrics by the use of intricate weaving or knitting patterns, recourse is had to the use of novelty yarns of the type wherein a multiplicity of strands are plied together in an irregular fashion, the different strands frequently varying in color, thickness, lustre, or other attributes. One class of such novelty yarns includes yarns known as loop, boucle, and ratine yarns, comprising yarns which have curled, looped, bunched, or crimped effects interspersed along their length, to give an irregularly twisted effect. The particular effect obtained depends on the denier and relative stiffness of the yarns involved.

Such textured wrapped yarns are commonly prepared by the well-known textile devices known as twisters. An effect yarn is fed simultaneously with but at a greater speed than a base or core yarn, and the twister physically twists the effect yarn irregularly around the core yarn. In a second twisting operation, a binder yarn is twisted around the effect yarn and core yarn, to help hold the desired irregularities in place. The mechanical twisting devices employed have a relatively low output and are subject to the known deficiencies inherent in rotating mechanical devices, wherein problems of friction, maintenance and supervision are constant.

In my U.S. Patent 3,082,591 of Mar. 26, 1963, there is described a process and an apparatus in which one or more wrapping strands are disposed with no true net twist around one or more core strands, by means of a whirling body of fluid operating in a cylindrical cell. The subject matter of said U.S. Patent 3,082,591 is hereby incorporated into this application by reference.

It is with improvements in the art of producing novelty falsely-wrapped yarns that the present invention is concerned, and it is a primary object of this invention to provide a falsely-wrapped yarn of the loop, boucle, or ratine type at low cost and high efficiency.

It is another object of this invention to provide an apparatus and method for producing such yarns.

Other objects of the invention will appear more fully in the following specifications and drawings, in which: FIGURE 1 is a perspective view of a loop yarn of the conventional or prior art type.

FIGURE 2 is a perspective view of a loop yarn made according to this invention, partially broken away.

FIGURE 3 is a perspective view of a vortex cell suitable for producing the yarns of this invention.

FIGURE 4 is an enlarged cross-sectional view looking down through the cell of FIGURE 3 at the level A—A.

FIGURE 5 is a perspective view of a stage in the production of a typical yarn of this invention.

FIGURE 6 is an idealized schematic view of the apparatus during the formation of a yarn.

In my above-mentioned U.S. Patent 3,082,591 and in my U.S. Patent 3,041,812 there are described processes and apparatus for falsely wrapping a wrapping strand around a core strand by means of a whirling body of air operating in a generally cylindrical vortex tube. It has now been found that if three separate strands are fed to a vortex tube, each at a controlled rate as set forth below, a new class of falsely-twisted yarns can be produced which resemble loop, boucle or ratine yarns, but which are produced at a speed and a consequent economy which cannot be approached by conventional twisting processes.

Referring to FIGURE 1, a conventional loop yarn is shown as consisting of a core strand 10, an effect strand 12 twisted in an irregular looped fashion around the core strand, and a binder strand 14 serving to hold the effect strand in place.

FIGURE 2, a loop yarn of the present invention at the left shows a core strand 20, a first wrapping strand 22 disposed around the core strand, and a second wrapping strand 24 disposed around both the core strand and the first wrapping strand.

For the sake of clarity in revealing structural detail, the right-hand part of the yarn of FIGURE 2 has been shown without the superimposition of the second wrapping strand 24. As explained below, strand 24 is at least twice the length of strand 22, and a typical product appears tightly wrapped as in the left-hand section of FIGURE 2.

In FIGURE 3 a perspective view is shown of a vortex cell which has been found suitable for making the yarns of the present invention. The apparatus comprises a chamber 30 having a cylindrical side wall 32 and end walls 54 and 56, said end walls being provided with an upper opening or exit 48 and a pair of lower openings. The lower end of the chamber is provided with a plug, 40 conveniently of brass or other durable material. The plug 40 is set into a gasket or seal 42, which caps the lower end of the chamber, said gasket conveniently being made of rubber. The portion of the plug 40 which extends upwardly into the vortex chamber above the upper end of the gasket 42 is tapered to a conical configuration. The lower portion of the plug 40, which is buried in the gasket 42, may be left straight-walled for convenience. A pair of yarn inlets 44 and 46 extend all the way through the plug 40, opening into the chamber 30. A pair of openings 34 and 36 in the cell wall 32 are so disposed as to open tangentially to the inner wall of the cylindrical cell. The nature and position of the yarn inlets 44 and 46 in the plug 40 will be better understood by referring to both FIGURES 3 and 6, the latter being a cross-sectional view of the former.

As a means for maintaining a longitudinally-extended whirling body of fluid in the chamber 30, the opening 36 in the cell wall 32 is connected to a source of fluid pressure not shown, so that a convergent air stream enters the cell in a direction tangential to the interior cell wall.

It is important that the direction of the fluid jet be substantially tangential to the inner wall of the cylindrical cell, and that the jet enter the cell through a convergent

opening in which the ratio of length to diameter is at least 6 to 1. By this means the fluid jet is operating always at about sonic velocity, a smooth jet stream is caused to flow around the cell wall, and turbulence is minimized. This, in turn, leads to greater uniformity in the false wrapping operation. A convenient method of delivering such a jet stream is to seal into the opening 36 a No. 18 hypodermic needle with an exit mouth curved to fit the curvature of the inside wall of the cell, as shown in FIGURE 4. As seen in FIGURE 6, in the operation of the apparatus to produce novelty yarns, at least three separate strands are fed into the chamber at different and independently controlled linear velocities. As an example, the core strand 20, from a conventional package, is fed to the chamber of the cell by means of the star wheels 21. A first wrapping strand 22 is simultaneously fed to the cell by the roll-off device 23 at a rate which is at least twice the linear rate of the strand 20. A second wrapping strand, 24, is simultaneously fed to the cell by means of the roll-off device 25, at a linear rate which is at least twice the linear rate of strand 22 and at least four times the rate of the core-strand 20. Although the first two strands are shown as being fed to the cell parallel to its main axis, and the third strand tangentially thereto, this arrangement is for convenience in the particular cell illustrated. Various modifications of feeding three strands to a vortex cell at different and controlled rates will suggest themselves to those skilled in the art.

It is characteristic of the yarns of this invention that in the composite novelty yarn product, the strand fed at the slowest rate is the tensile-bearing element of the structure, extending in a substantially straight and unconvoluted configuration. The first wrapping strand is disposed around the core-strand by a false wrapping operation: that is, there is no true twisting of the end of the second strand around the core strand. Although sections of the first wrapping strand may appear to be truly twisted around the core strand, the number of right-hand turns must equal the number of left-hand turns, so that there is no true net twist of one strand around another. By the same reasoning, there is no true net twist of the second wrapping strand around either of the other strands. The formation and nature of this second wrap may be more fully understood with reference to FIGURE 5, which is a hypothecated perspective view of the composite yarn during a wrapping operation, by way of setting forth the structure more clearly. It represents the intermediate wrapping strand 22 disposed around the generally straight core strand 20 in the form of loops of strand 60. The second wrapping strand 24 has been applied to the core strand and intermediate strands, and is now being wrapped. Since there is no true twisting of one strand around another, the second wrapping strand is shown as formed into a loop 62. This loop 62 in toto is being wrapped with true twist depending on the rotation of the fluid in the cell. However, since a loop is bifilar, and since the core strand is in motion, its deposition around the other strands is accompanied by the deposition of single strand right-hand turns as at 64, and the wrapping of the second or exterior wrapping strand appears unidirectional.

The core strand is fed under tension, being drawn into the cell by the compressed fluid exhaust. Since the whirling fluid tends to twist the core strand around its own axis, the core strand is temporarily tightened and shortened in the process of forming the composite yarn, and it is common to find a transient contraction of 10%-20% in the core strand during its dwell in the cell. This is a transient state, however, and at the winding operation it will be found that one yard of core strand input yields one yard of final product.

As mentioned above, the first wrapping strand 22 is fed to the cell at a rate which is at least twice the rate of feed of the core strand. It therefore is slack enough to be formed into a loop or bight, and tends to wrap around

the apex of the cone, from which it is constantly removed by the rapid progression of the total yarn, and perhaps by the wrapping action of the second wrapping strand 24, which is fed to the cell at a controlled rate which is at least twice the rate of the first wrapping strand.

The invention will be illustrated by the following example:

Example 1

As a core strand, a 300 denier 44 filament rayon yarn was fed to the cell of FIGURE 3 at a rate of 229 feet per minute, using air pressure of 80 pounds p.s.i.g. applied to the side opening 36. The first wrapping strand was a similar continuous filament rayon yarn, fed to the cell at a controlled rate of 540 feet per minute, or 2.36 times the rate of the core strand. The second wrapping strand, fed to the cell at the controlled rate of 2534 feet per minute or 11 times the core strand rate, was 75 denier 19 filament acetate. The composite yarn, resembling the yarn of FIGURE 2, was produced at a rate of 211 feet per minute, and had a denier of 1980. A wide variety of strand structures, including both continuous filament and spun yarns, of varied colors if desired, may thus be combined to form novelty yarns in a simple and economical process.

If spun yarns are used, they must have a structure sufficiently tight to resist disintegration or disruption under the force of the whirling body of fluid.

An especially attractive type of yarn, with generally circular loops of wrapping strand extending outwardly from the principal axis of the yarn, is produced when one of the wrapping strands is too stiff to collapse around the core strand. In such case the wrapping strand develops what have been called crunodal loops, wherein the wrapping strand doubles back on itself to form a generally circular loop and then continues on in the same direction. Such crunodal loops are shown at 19 in FIGURE 2, and are characteristic of the yarn made according to example 1.

The operation of a cell of the type shown in FIGURES 3 and 6 is essentially one which allows two core strands to be wrapped in a manner which differs from the case of two strands being processed through a single inlet. In the latter case, the torque exerted on the core strands by the fluid vortex causes the two strands to twist together. This twist is propagated upstream of the tube, causing the strands to enter the tube as a plied yarn. By providing two strand inlets, each core strand may be handled independently.

The vortex cell of this invention is typically compact, being for example, formed from a piece of $\frac{9}{16}$ inch Pyrex tubing $\frac{3}{4}$ inch in height. The top opening or yarn exit 48 is conveniently formed from a piece of thin walled copper tubing of $\frac{1}{4}$ inch inside diameter. In the case of such compact dimensions, the plug 40 is typically $\frac{1}{2}$ inch in length and $\frac{5}{16}$ inch in diameter, the upper $\frac{1}{4}$ inch of the plug being tapered to a cone. The wrapping strand inlet 34 need be no larger than .03 inch, and the fluid inlet 36 should be of a size to accommodate a No. 18 hypodermic needle, which has been found to be a convenient device for coupling the cell to a source of fluid pressure.

A convenient spacing of the air opening 36 and wrap yarn opening 34 in the cell wall is shown in FIGURE 4, where the air (delivered through opening 36) leads the yarn (delivered through opening 34) by 140° .

These dimensions are illustrative only, and are not to be regarded as restrictions on the cell structure.

I claim:

1. The process for producing a wrapped novelty yarn which comprises:

continuously passing, simultaneously but separately, at least three strands through a body of whirling fluid, each of said strands being fed to the process at a linear rate which is no more than one half the feed rate of the next fastest strand,

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and wrapping at least two of said strands around at least one of said strands in multiplicity of wrappings, said wrappings including both left-hand wrappings and right-hand wrappings, the mathematical sum of said left-hand wrappings equaling the mathematical sum of said right-hand wrappings.

2. The process according to claim 1 in which at least one of said wrapping strands is wrapped around the strand with the lowest feed rate in the form of crunodal loops.

3. The process according to claim 1 in which at least one of said strands is a continuous filament strand.

4. Apparatus for manufacturing a false-wrapped yarn from a plurality of textile strands which comprises:

a generally cylindrical chamber,
a conically-tapered plug projecting for a substantial distance into said cylindrical chamber and concentric therewith,

said plug containing a pair of strand inlet passages extending longitudinally the length of said plug,

at least one of said strand inlet passages constituting means for passing a core strand axially along the major axis of said chamber,

means for creating a whirling body of fluid in said chamber including an opening in the side wall of said chamber tangential to the inner wall of said

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chamber and means for applying a pressurized fluid to said opening,
means for feeding a wrapping strand into said chamber including a second tangential opening in the side wall of said chamber,
and means for removing said false-wrapped yarn from said chamber.

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U.S. Cl. X.R.

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