

[54] **YARN TEXTURIZING APPARATUS AND PROCESS**

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[58] Field of Search **57/34 R, 34 B, 34 HS, 157 F, 57/157 MS; 28/1.4, 72.12**

[56] **References Cited**

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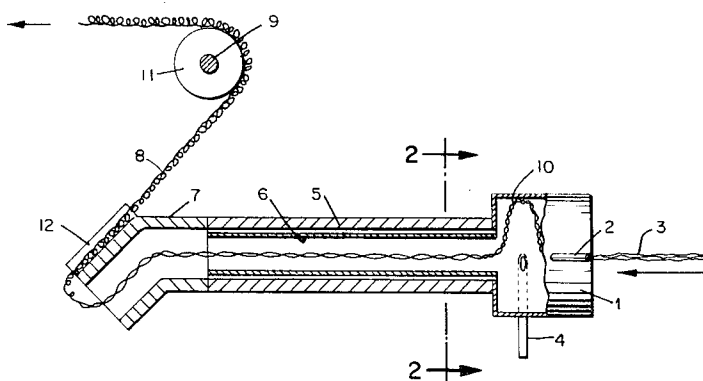
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[57] **ABSTRACT**

Multifilament yarn, such as yarn of continuous glass fibers, synthetic fibers, and the like, is texturized by feeding it rapidly into a chamber in which it encounters a swirling flow of a fluid, preferably a gas such as air, which causes the yarn to rotate in loop form in a manner similar to a skipping rope but at an enormously greater rate. The swirling air blast is introduced tangentially just ahead of the yarn introduction, and the yarn and air then pass out axially at about 90° to the air introduction through a tube or conduit with air escape slots to eliminate swirling substantially. This causes the yarn to assume a false twist, and on untwisting opens up the individual filaments. The yarn is then doubled back on itself, which causes formation of loops, imparting to the yarn a bulk and texture.

22 Claims, 6 Drawing Figures



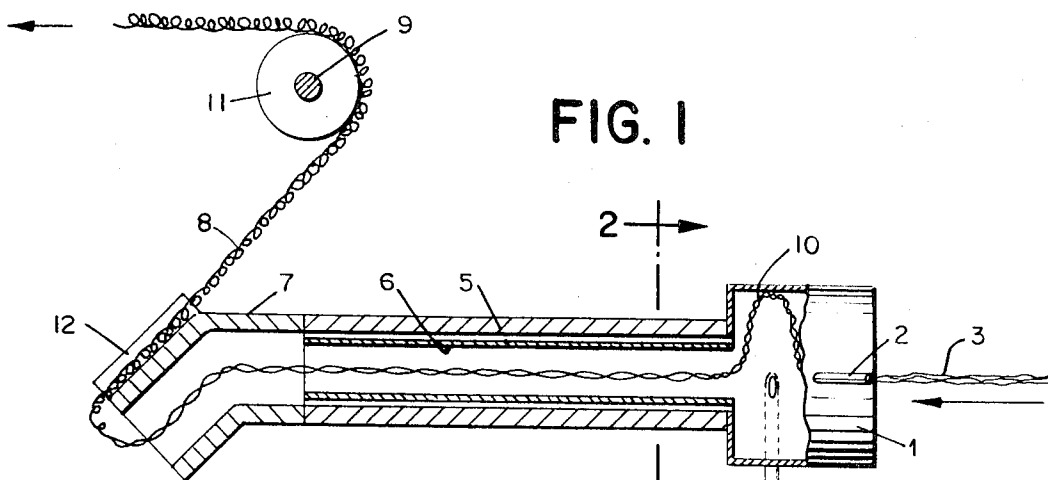


FIG. 1

FIG. 2

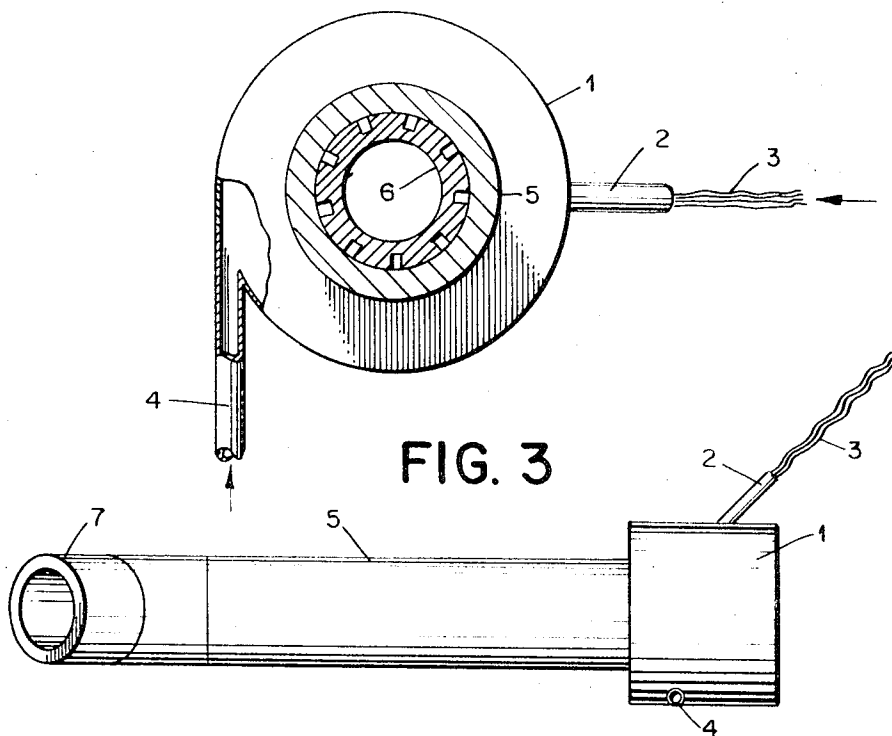


FIG. 3

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FIG. 4

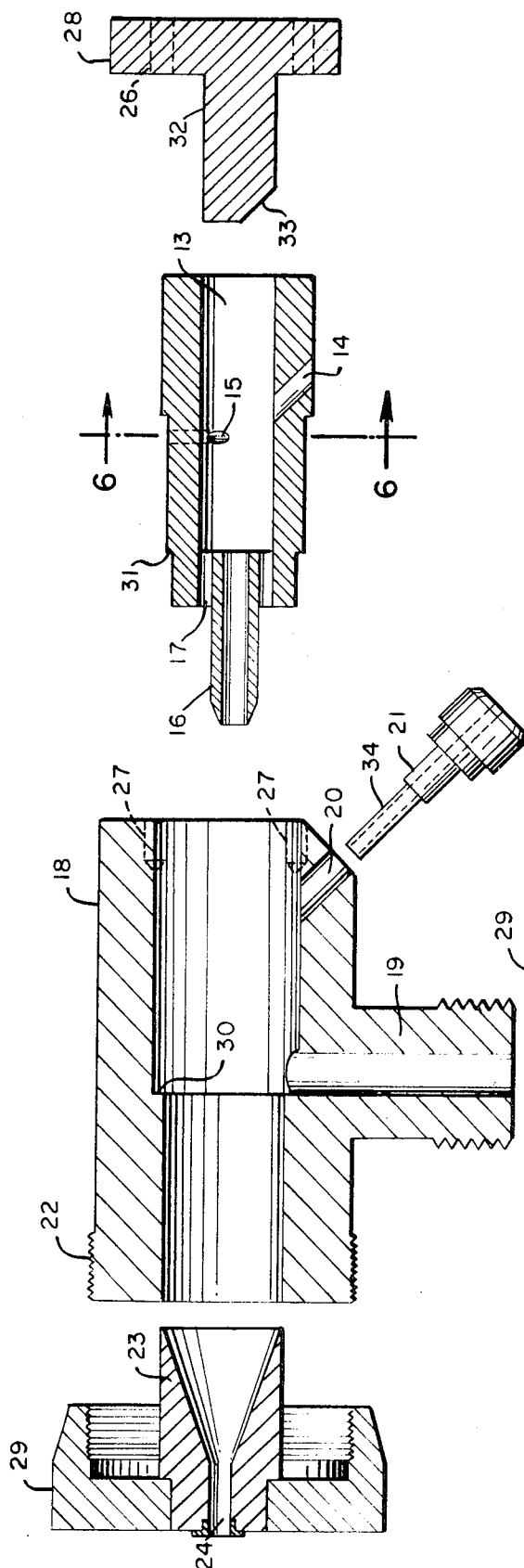


FIG. 6

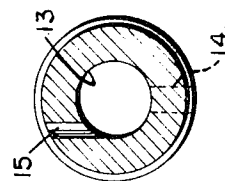
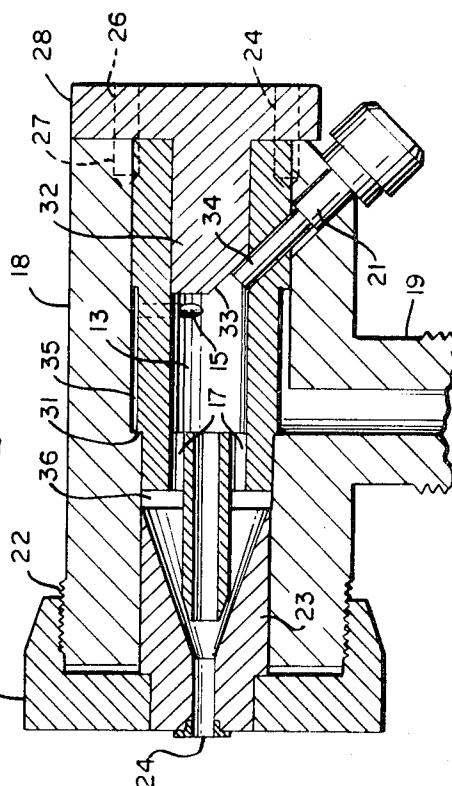


FIG. 5



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YARN TEXTURIZING APPARATUS AND PROCESS

BACKGROUND OF THE INVENTION

Texturizing of multifilament yarns is extensively used as the bulky textured yarns are popular in many fabrics both woven and knitted. The texturizing involves giving the multifilament yarn a false twist, that is to say, a twist in which the ends do not move freely. The yarn is then run back on itself, and loops of individual filaments cause the yarn to become bulky and textured, as it is referred to in the art.

While texturizing can be effected in many ways by imparting mechanically a false twist, these processes are relatively slow, and hence the yarn is quite expensive. An air texturizing device has also been developed in which yarn flows co-currently with a large volume of relatively high pressure air. This causes the yarn to flutter much as a light flag or ribbon will flutter in a heavy wind where it is restrained at one end. This fluttering tends to open up multifilament yarns and imparts a false twist. The yarn is then transformed into loops when its direction is changed. While the false twist from the fluttering effect does not impart a very large number of twists per inch, it still is sufficient to produce texturized yarn which is acceptable in the trade. The air texturing referred to above not only requires large volumes of fairly high pressure air, for example 60 to 100 p.s.i.g., but there are also some additional drawbacks. There is a fairly definite limit to the speed at which yarn can be texturized. Speeds of much over 100 yards a minute are impractical. Another drawback is that the large volume of air and the violence of the flutter sometimes result in breakages of certain of the filaments, particularly with materials, such as glass, which are fairly brittle. This is one of the principal reasons why the rate of texturizing has to be kept moderate. Another respect in which the air texturizing process is not ideal is that, at reasonably high speeds, the degree of texturizing is not as great as could be wished.

It has also been proposed to feed yarn axially into the center of a texturizing chamber and to introduce air tangentially to produce a swirl. The yarn and air outlet is through a straight axial outlet conduit directly into the atmosphere. The swirling air in the chamber causes the yarn to spin in the form of a loop, somewhat like a skipping rope or cranks on a crankshaft. This results in imparting to the yarn a false twist, which eventually, after escape to the air, can untwist, but does not produce a satisfactory texturizing because the untwisted false twist is not followed by change in direction of the yarn, which may be as great as almost 180°, which opens up multifilament yarn in the form of loops which bulk the yarn and texturize it. The straight axial flow, while not inoperable and incapable of imparting some false twist, does not produce untwisting in the apparatus because the swirling air through the narrow axial discharge retains the false twist in the yarn and it does not untwist until the yarn is blown out into the free atmosphere.

It has also been proposed to twist a plurality of threads to form a plied or core spun yarn. The threads pass through a small bore, with swirling air introduced tangentially through multiple outlets at various inclinations. At the end of the bore there is a continuation of the chamber with an outlet opening at right angle to the bore, so that the twist imparted, which is not a normal false twist, is retained and produces the normal texturized plied or core spun yarn. The texturizing, however, is different from that produced by untwisting a false twist in a single yarn, and such texturizing as takes place is purely as a result of the plying of the two or more yarns. If a single multifilament yarn is passed through the apparatus, there will be no opening up from untwisting before change of direction of the yarn.

SUMMARY OF THE INVENTION

The present invention, while it uses a swirling fluid as one, and only one, element, is combined with other features which produce a high degree of texturization. The first of the features is that yarn is introduced into the swirling fluid at an angle instead of axially. The second feature is that the swirl is

dissipated more or less entirely by air bypass holes, grooves, and the like so that the false twist produced untwists while still in the apparatus, and then the final element is an abrupt change of direction of the yarn, which may be as much as almost 180°. This results in the opened-up multifilaments forming loops and other structures which bulk the yarn and impart to it the desired texture. It should be noted that the present invention uses a process in which plied yarn or core spun yarn is not producible, as is the case when the twist is retained by swirling until after the yarn has changed its direction as has been described above. If several threads are introduced into the apparatus of the present invention, as will be described in more detail below and in which the air swirl is dissipated before there is any change of direction of the yarn, a plied yarn is not produced, but two threads would simply be opened up and come out texturized but lying side by side.

The fluid which forms a swirling vortex in the chamber of the present invention, and in performing its process, which is also an aspect of the invention, may be a liquid or a gas, such as air or steam. Gases are preferred, particularly air. In order to simplify the remaining description, operation with air will be described as a preferred illustration.

The swirling air into which the yarn is introduced at an angle causes the yarn to spin like a skipping rope; in other words, a loop forms which is spun around like a crank on a crankshaft. The rate of spin is very high; the amount of false twist is much greater than in the cocurrent processes described above, and the speed is increased by at least three to five times, speeds of 500 to 600 yards or more per minute being obtainable. At the same time there is not the sharp snapping effect that occurs in a fluttering process and so relatively brittle yarns, such as glass yarns, even at the greatly increased rate of speed show reduced filament breakage. Because of the much greater amount of false twist imparted by the present invention, this permits a product, after the swirl has been eliminated or greatly reduced and the direction of the yarn has been changed, which is an improved product with a greater degree of texturizing and bulking than was obtained before with the same yarn compositions. Reduced filament breakage, especially with brittle yarn, such as glass yarn, is also obtained.

Another advantage of the present invention, in addition to the greatly increased speed and improved product, is that air pressure and volume can be lower than was required in cocurrent processes before. For example, air pressures as low as about 5 p.s.i.g. are sufficient and the volume of air can be reduced considerably. Actually, the lower limit on air pressure is that which will spin the loop. This more gentle but also more complete texturizing treatment is probably the main reason why filament breakage is reduced in yarns having brittle filaments.

After the spinning of the crank-like loops in the chamber where the yarn encounters the swirling air, the yarn passes out through an axial conduit with air escape means, such as slots, holes or grooves, and its direction is changed. It is essential that air escape means substantially reduce or eliminate the swirl before the direction is changed. It should be noted that the present invention is a combination of the features, either steps in a process or elements in apparatus, and not one single feature alone. Thus the swirling to produce crank-like loops, while an essential and extremely important part of the invention, is not enough alone, without the combination of the other features.

In general the swirling air vortex must be located slightly beyond the yarn entrance point, for example one-sixteenth of an inch. If it is too far beyond, for example over one-fourth inch or more, the spinning is decreased and texturizing is not satisfactory. The yarn should be fed in at an angle at or near the center of the swirling air. The length of the axial outlet conduit is also not critical, but, again, it must not be too short so that the yarn is badly blown as it leaves it. In general the length will vary from a minimum of about one-half inch to several inches, the range from $\frac{3}{4}$ inch to $1\frac{1}{2}$ inches being very

satisfactory. The particular length of course varies somewhat with the cross-sectional area of the air escape slots or holes and the air pressure and volume used. The particular shape of the axial conduit may vary. It may be a conduit with grooves or escape bypass holes around its periphery, or it may be an annular chamber surrounding a yarn outlet of much smaller diameter. In the latter case the reduction in diameter results in a plate or flange through which air from the swirling vortex passes into the annular chamber and the swirl is dissipated. The two general forms mentioned, and which will be described in more detail in the specific description below, are preferred forms, but it should be understood that any design which will result in eliminating the swirl before the yarn leaves the axial discharge outlet may be used. Of course from a process standpoint all such means are included.

The feed of the yarn in and the takeup, including the change of direction of the false twisted yarn, can be effected by known mechanisms. For example, the feed can be between two rapidly spinning rolls. This is a practical advantage as certain portions of the whole apparatus can be of more or less standard design, which reduces substantially apparatus cost. From a process standpoint, of course, the invention is not at all limited to the mechanical design of the feed, windup and other elements. It is desirable to feed the yarn in at an angle, for example about 45°, though this angle is not very critical, which is an additional operating advantage.

The opening up of the multifilament yarn and untwisting of its false twist with change of direction of the yarn produces a texturized yarn in which the bulking or texture is reasonably stable and permanent. Greater permanence can be obtained by applying a binder or size to the texturized yarn. It is perfectly feasible to operate at ordinary temperatures, and for many purposes this represents a definitely preferred embodiment. However, the invention can also be used with thermoplastic or other types of multifilament yarn and can provide heat setting, for example by using steam or other hot fluid, which further increases the permanence of the texturing and bulking, and so is included. It would be possible also to heat set textured glass yarn, but the temperatures required are so high that ordinarily the additional cost and manufacturing complexity are not warranted by any improvement in product which can be obtained. Therefore, particularly for such high softening temperature material as glass, operation at about room temperature presents many advantages and is definitely preferred.

Reference has been made to changing the direction of the yarn after it has left the texturizer and the false twist proceeds to untwist. It is not necessary that this change of direction be 180°, but it should be a substantial change in direction. The fact that the exact angle of direction change is not critical represents an additional operating advantage.

The present invention from an apparatus standpoint includes two major forms or types. In the first, the texturizing chamber and yarn inlet and exit conduits are formed as a separate piece of apparatus. In the second modification the present invention is in the form of an insert in a standard nozzle used in the machines which texturize by causing fluttering of the yarn in a cocurrent flow. The insert transforms this portion or fitting of the standard and well known cocurrent machine into one which has a chamber, in the insert, in which the yarn encounters the swirling air, and the air bypass or escape after swirling is in the form of narrow passages or holes into an annular chamber between fitting and insert rather than long slots or grooves. Each of the two modifications referred to has its advantages, and the modification to be used in any particular commercial operation will be chosen in accordance with the requirements of the operation. The possibility of quite different mechanical design permits a wide degree of flexibility and versatility. From a process standpoint it will be seen that both modifications perform the same essential process, and this process is a part of the present invention regardless of the particular mechanical design of the apparatus.

The independent or separate texturizing chambers will first be described. Because the exact structural design of the independent texturizing chamber is not the principal feature of the present invention, the drawings which follow and which relate to this modification are semi-diagrammatic in nature. The material of the chamber itself may be metal, plastic, or plastic with metal inserts. For development work there is some advantage in having the actual texturizing chamber transparent. For example, the container can be made of transparent plastic, such as poly-methylmethacrylate. A transparent chamber has the advantage that the operation can be checked by illumination with a stroboscopic light and, if necessary, air pressure adjusted, which, in combination with the speed of yarn feed, determines the relative throw and width of the crank-like loop. As the crank-shaped loop, which is very rapidly spun, is an essential and very important feature of the present invention, the ratio between crank loop throw and width is somewhat exaggerated in the drawings for clarity. The ratio is in no sense critical, and in actual operations somewhat shorter throw loops will ordinarily be spun than is indicated in the semi-diagrammatic drawings. The length of the texturizing chamber may also vary. A longer chamber sometimes results in forming more than one spinning loop.

The use of plastic in considerable wall thickness for the container also has a further advantage that the holes for the yarn feed and air can easily be drilled out and angled yarn and air feed can readily be molded into the final texturizing chamber. While it is an advantage that the exact dimensions of the openings are not extremely critical, this is not to say that they can be completely disregarded; for of course if the openings are too small for the yarn there is excessive friction, and if too large, some of the air may blow back. A typical range is yarn feed opening from $\frac{1}{8}$ to $\frac{1}{32}$ inch. The air introducing opening is likewise not critical, but it should be sufficiently small to produce a very rapid movement of the air. If the opening is too large, excessive air volume and pressure are needed. However, operation is not at all critical, and variations in air orifice size and air pressure during operation can vary somewhat without adversely affecting the efficiency of the process or the quality of the product.

Normally a single tangential air introducing vortex is preferred as it makes for a very simple apparatus. However, the invention is not limited thereto, and particularly in its process phase is concerned only with there being a sufficient swirl of air to spin the crank-shaped loops rapidly. The axial outlet conduit is likewise not critical. This has been brought out above with respect to length, and the internal diameter can also vary over considerable ranges. It, however, is much larger than the diameter of the textured yarn. The effect is to reduce air swirl so that as the yarn leaves the axial outlet, the false twist can untwist as the yarn direction is changed.

In the second embodiment the production of the swirl of air which strikes the yarn introduced at an angle takes place in an insert. This insert carries an angled entrance hole for the yarn, and the tangential opening to produce the swirl is also formed in the insert. The cocurrent machine fitting is slightly bored out in addition to having an angled hole drilled to mate with the angled entrance hole for the yarn in the insert. This results in a shoulder and an annular space. The annular space receives air from the normal 90° air inlet used for producing a cocurrent flow in the known apparatus and processes above referred to, but of course the tangential opening results in a positive and definite swirl of air instead of a cocurrent flow. As the yarn comes in at an angle, the more or less central opening for yarn in the known machine is closed by a plug with a guiding slot mating and extending the angled yarn inlet conduit.

The portion of the insert constituting the texturizing chamber proper abuts against the shoulder in the bored out portion of the standard fitting to prevent air leakage at this point. Also, preferably, the tangential opening in the insert is substantially opposite the side of the insert into which the yarn enters. The location is not critical, but if the tangential air inlet is on the same side as the yarn, it causes a very violent loop

spinning, which is not preferred for most types of texturized yarn. The insert has one end developed into an axial conduit through which the yarn leaves the chamber. This conduit is of much smaller cross-section than the chamber itself and also of the normal cocurrent machine fitting at the point where it is not bored out, i.e., beyond the shoulder. As a result, there is an end wall or flange at one end of the texturizing chamber. Through this flange there are several air escape holes which discharge into the annular chamber surrounding the axial yarn outlet conduit. This annular chamber is of quite substantial cross-section so that the air entering into it through the holes in the flange rapidly loses its swirl.

As the standard nozzle for the cocurrent fluttering texturizing machines is threaded, advantage is taken of the fact that the more or less central yarn exit therefrom can be moved nearer or further from the end of the axial yarn outlet, which permits adjustment that results in some modifications of the texturized yarn. This is an additional flexibility. The end of the axial yarn conduit should not be tightly pressed into the yarn outlet so as to constitute an airtight seal, otherwise the air which leaves the texturizing chamber through the bypass holes cannot escape. However, adjustment possible, which in effect is varying the cross-section of the final yarn outlet as far as air is concerned, adds an advantage to the modification in which the texturizing chamber proper is in an insert.

Needless to say, the provision of an insert so that the texturizing chamber with the swirling fluid can be introduced into the standard nozzles of the cocurrent machines is a decided practical advantage as it makes it possible to modify such machines without the necessity for rebuilding them or replacing them. On the other hand, the cocurrent air flow and fluttering of yarn type of machines have so much lower throughput capabilities that their other equipment, such as yarn feed and yarn takeup, in some cases is insufficient to permit the maximum speed of operation which the present invention permits. A very considerable increase in output is, however, possible, but in some cases this does not reach the extreme speeds and outputs which are readily obtainable with the first modification, in which the texturizing chamber is an independent element. Nevertheless, the possibility of introducing, at low cost, the insert of the present invention into the many standard cocurrent air flow machines which are already in existence constitutes an important additional application of the present invention. Each modification has its own special advantages, and the choice can, therefore, be dictated by economic and other considerations.

In the second modification of the invention, in which the texturizing chamber proper is in the form of an insert, the other features of a cocurrent air flow machine are not radically changed except for boring out and drilling the yarn inlet hole. The change in direction of the yarn takeup and the like can be used without further modification. As a result, in the drawings showing the second modification these other auxiliary elements will not be shown as they are not changed, and the advantages of the improved texturizing process of the present invention are obtained without requiring any extensive rebuilding of existing machines.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a horizontal elevation, partly in section, through the texturizing chamber and outlet tube;

FIG. 2 is a vertical section through the yarn feed end of the texturizing chamber, taken along the line 2—2 of FIG. 1;

FIG. 3 is a plan view of the texturing chamber proper showing the yarn feed at an angle;

FIG. 4 is an exploded sectional view of a fitting for a cocurrent air machine with inserts;

FIG. 5 is similar to FIG. 4 but shows the various elements assembled together, and

FIG. 6 is a section through the insert along the line 6—6 of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 to 3 illustrate the embodiment of the invention utilizing an independent or separate texturizing chamber. FIG. 1 shows a texturizing chamber 1 with an angled yarn introduction tube 2, the angle being best seen in FIG. 3, and a multifilament yarn is shown at 3. The angle of yarn introduction in FIG. 3 is shown as 45°, which is very suitable but in no sense critical and can be varied. Air at 20 p.s.i.g. is introduced between 1/16 inch and 3/32 inch beyond the yarn feed entrance, the introduction being substantially tangential, as can be seen clearly in FIG. 2. A rapid swirl takes place, which causes a crank-shaped loop 10 in the yarn to spin rapidly. Yarn feed is rapid and positive, so that the crank-shaped loop 10 is under no tension, and this rapid overfeed is effected by known feed mechanisms and is, therefore, not shown. The yarn passing through the spinning crank-shaped loop 10 then enters an axial outlet pipe 5, which may be, for example, from ¾ inch to 1 inch long, and the length may be made variable. This outlet tube is provided with a series of air escape slots 6 which bypass the air so that at the end of the straight portion of the outlet swirl is substantially eliminated, and air velocity may or may not be reduced, depending on the relative size of the outlet tube opening and the opening of the air inlet tube. The end of the axial tube extends in a 45° elbow section 7, and the direction of the yarn leaving it is changed and the yarn moves through a groove 12. Takeup is by a takeup mechanism of standard design, which is, therefore, not shown, the textured yarn 8 passing over the roller 11 rotatable on an axle 9. The effect of the direction change is to cause the yarn which has been false twisted by the spinning of the loop and is untwisting to open up and form loops in the filaments, as shown on FIG. 1. It is these loops primarily which give the textured effect to the final yarn.

In a typical operation a glass yarn, 37—1/0, composed of 1,632 continuous filaments is fed through the apparatus at about 530 yards per minute. As described above, the yarn 3 is fed in at a somewhat faster rate than it is wound up, and this permits both the formation of the spinning crank-shaped loops and also the shortening of the textured yarn as a result of loop formation.

The drawings show an axial discharge tube with an air end opening much larger than the air inlet opening into the texturizing chamber. Its size, however, can vary and can even be about the same as the air inlet opening, in which case a somewhat different product is obtained with much smaller loops. For some purposes this different yarn is desired in the trade.

One multifilament yarn is shown, diagrammatically, as having only two filaments instead of the much larger number referred to above, but it is possible to introduce several multifilament yarns, side by side, in which case an entangled yarn results. The yarns may be the same or they may be different, either in composition, color or other characteristics, which makes possible a number of additional attractive products.

The second modification of the present invention, in which the texturizing chamber is in an insert for a standard fitting in a cocurrent air texturizing device, which has been described above, is shown in FIGS. 4 to 6. FIG. 4 is an exploded view of the insert fitting into a normal fitting for a cocurrent machine. The insert forms a texturizing chamber proper at 13 and is developed into an axial yarn outlet 16, which, as can be seen, is provided with a tapered end. The fitting itself is shown at 18 and has been bored out somewhat, producing a shoulder 30. The insert is smaller in cross-section and forms with the bored out portion of the fitting 18 an annular space 35 into which air is introduced through the standard air inlet conduit 19, which is at right angles to the bored out portion of the central chamber of the fitting 18 and is provided with threads.

The end of the insert is provided with a shoulder 31 which abuts against the shoulder 30 in the bored out portion of the fitting 18 and forms a seal. The insert is pressed into a stan-

dard fitting for cocurrent air flow texturizing machines, as shown in FIG. 5. The fitting 18 is provided with external threads 22 at one end. The only change in the fitting 18, apart from the small boring out, is the drilling of an inclined hole 20 into which a yarn introducing conduit 21 projects, which is provided with an end of reduced outer diameter 34. End 34 extends into the insert, which is provided with an inclined hole 14 which mates with the hole 20 in the fitting 18. The insert 13 is provided with a tangential opening 15, which is preferably located opposite the opening 14. Air passes into the insert 13 through the annular space 35 between the insert 13 and the bored out portion of the fitting 18 and thence flows into the insert through the opening 15, producing a rapid swirl. The insert forms the texturizing chamber proper and the swirl causes yarn introduced through the conduit 21 to spin in the form of a loop, imparting a false twist at high speed. The various elements are shown separated in the exploded view in FIG. 4 and assembled in FIG. 5 and include an additional element which is a plug 32 sliding into the insert 13. This plug is provided with an inclined guiding slot 33 which abuts with and supports the reduced portion 34 of the yarn introducing conduit 21. As the plug 32 slides into the insert 13, it performs the dual function of sealing off the back of the insert and guiding and supporting the portion 34. The plug 32 is also provided with a flange 28 and bolt holes 26 through which cap screws, (not shown), screw into tapped holes 27 in the fitting 18.

It will be apparent that the yarn is introduced substantially at the center of the swirl and just back of it in exactly the same manner as is shown in FIGS. 1 to 3 for the independent unit texturizing chamber embodiment. In order to simplify the drawing, the yarn is not shown and neither is the spinning loop which appears at 10 in FIG. 1. Of course such a loop is formed in the texturizing chamber in the insert 13 in exactly the same manner. The yarn of course passes out through the outlet conduit 16.

Actually, the fitting 18 is reversed as in the standard cocurrent machine the yarn would be introduced from the left through a conduit with a yarn introducing opening 24 with the conventional smooth ceramic edge, which also is present in the angled yarn introducing conduit 21 in FIGS. 4 and 5. This opening is developed into a tapered extension 23, and the cap 29 is internally threaded and screws onto the end of the fitting 18, the threads mating with the external threads 22. Actually, the yarn outlet 24 is larger than the yarn inlet conduit 21 as texturizing air has to flow out with the yarn through this same opening and the yarn is often bulked by the false twist which is partially untwisted in passing out through the conduit 16 and opening 24. From the opening 24 the direction of the yarn is then changed to produce the final texture, precisely as described in the first embodiment illustrated in FIGS. 1 to 3. Since this portion of the device is not changed in the second embodiment, it is not shown.

In operation, the yarn is overfed and passes in through the inlet conduit 21 into the chamber in the insert 13 where it meets the rapidly swirling air coming in through the tangential opening 15. Loop spinning results in the same manner as has been described in conjunction with the first variant in FIGS. 1 to 3. The yarn passes out through the conduit 16 and loses its false twist as it untwists. The rapidly swirling air passes out through the holes 17 into the fairly large annular chamber 36 between the outer walls of fitting 18 and the yarn outlet conduit 16. Thence it flows out through the tapered section 23 and the yarn exit opening 24. Swirl is removed in substantially the same manner as in the long grooves 6 in FIGS. 1 and 2. However, the passageways 17 are somewhat shorter as the air passes into the annular chamber where the swirl is further reduced or substantially entirely eliminated. The end cap 29 is only screwed into the fitting 18 part way so that the taper of the outlet conduit 16 does not form a tight seal. This, of course, would be undesirable as otherwise there would be no place for the texturizing air to escape. In the embodiment shown in FIGS. 4 to 6 the fact that the cap 29 can be screwed in various distances on the fitting 18 gives an additional con-

trol possibility, and it can vary somewhat the structure of the texturized yarn. This is an advantage of the second embodiment shown in FIGS. 4 to 6 in addition to the fact that this embodiment can be introduced into the standard fitting on an existing cocurrent air flow texturizing machine.

From a process standpoint, both the embodiment of FIGS. 1 to 3 and FIGS. 4 to 6 perform the same texturizing process, though the product produced may be somewhat different depending on the dimensions of the chambers, air flow, point at which the cap 29 is screwed onto the fitting 18, and the like.

I claim:

1. A process of texturizing and bulking multifilament yarn which comprises producing a zone of swirling fluid, over feeding the yarn at an angle relative to an axis of said swirling fluid into the central portion of said zone, the zone being located slightly beyond the entrance point of the yarn, whereby at least one spinning loop in the yarn is produced by the swirling fluid, and the yarn is given a false twist, discharging the yarn and fluid axially, bypassing a portion of the swirling fluid past the yarn in an amount sufficient to eliminate swirling substantially, untwisting the yarn, and changing the direction of the yarn, whereby loops of individual filaments are formed, and winding up the thus textured and bulked yarn.

2. A process according to claim 1 in which the swirling fluid is air.

3. A process according to claim 2 in which the yarn is a multifilament glass yarn.

4. A process according to claim 3 in which the rate of yarn feed is more than 200 yards per minute.

5. A process according to claim 1 in which the rate of yarn feed is more than 200 yards per minute.

6. A process according to claim 2 in which the rate of yarn feed is more than 200 yards per minute.

7. A process according to claim 2 in which the bypassing of the swirling air is in a multiplicity of relatively long streams flowing substantially axially.

8. A process according to claim 2 in which the bypassing of the swirling air is in short separated streams into an expanded annular zone.

9. An apparatus for texturing and bulking yarn comprising a texturizing chamber, a yarn feed opening therein at an angle relative to an axis of said chamber, fluid introducing means located tangentially to said axis and near but just beyond the point of yarn feed opening to produce a rotating, helical, swirling fluid motion, the rotation of the fluid being in a plane substantially at right angles to the passage of yarn through the texturizing chamber, means for feeding the yarn through the yarn feed opening substantially into the center of the swirling fluid, an axial outlet conduit for the yarn and a portion of the fluid, means for bypassing the remainder of the fluid, the length of the outlet conduit being sufficient to effect a substantial degree of untwisting of the yarn, and the bypassing means having a sufficient volume substantially to eliminate fluid swirl, and means for changing the direction of the travel of the yarn leaving the outlet conduit, whereby loops are formed in the final texturized yarn.

10. An apparatus according to claim 9 in which the tangential fluid introducing means is substantially opposite the yarn feed opening.

11. An apparatus according to claim 9 in which the yarn feed opening diameter is sufficiently greater than that of the yarn so that no undue friction takes place but smaller than that permitting substantial blowback of fluid through the yarn feed opening.

12. An apparatus according to claim 10 in which the yarn feed opening diameter is sufficiently greater than that of the yarn so that no undue friction takes place but smaller than that permitting substantial blowback of fluid through the yarn feed opening.

13. An apparatus according to claim 9 in which peripheral axial bypass passages are provided in the outlet conduit through which swirling fluid passes.

14. An apparatus according to claim 10 in which peripheral axial bypass passages are provided in the outlet conduit through which swirling fluid passes.

15. An apparatus according to claim 11 in which peripheral axial bypass passages are provided in the outlet conduit through which swirling fluid passes.

16. An apparatus according to claim 9 in which the axial outlet conduit is of smaller cross-section than the texturizing chamber and the outlet end of the texturizing chamber is provided with an extension surrounding the outlet conduit and forming therewith an annular chamber, said annular chamber communicating with said axial outlet conduit end, whereby fluid passes out said end with the yarn.

17. An apparatus according to claim 10 in which the axial outlet conduit is of smaller cross-section than the texturizing chamber and the outlet end of the texturizing chamber is provided with an extension surrounding the outlet conduit and forming therewith an annular chamber, said annular chamber communicating with said axial outlet conduit end, whereby fluid passes out said end with the yarn.

18. An insert capable of being inserted into the texturizing chamber of a cocurrent air texturizing apparatus, the insert having an exterior surface smaller than the interior surface of said texturizing chamber, whereby on inserting the insert a space is formed between the exterior surface of the insert and the interior surface of the texturizing chamber, a texturizing chamber in said insert, said insert being provided with an axial outlet of smaller cross-section than the insert texturizing

chamber, an end flange around the axial outlet conduit and forming an end wall of the insert texturizing chamber, air escape holes through said flange from the insert texturizing chamber to the end of the flange, at least one opening into the insert texturizing chamber located tangentially with respect to an axis of said chamber and communicating with said space, and a yarn inlet opening into the insert texturizing chamber at an angle relative to said axis and positioned so that when yarn is introduced it enters the chamber slightly behind the tangential openings.

19. An insert according to claim 18 in which the end of the insert texturizing chamber opposite the flange is provided with a plug carrying an angled groove mating with the angled yarn inlet opening.

20. A modified cocurrent air texturizing apparatus with an insert according to claim 18 inserted therein, the apparatus being provided with a yarn and air outlet, an air inlet means into the side of said space, and an angled yarn inlet hole in said apparatus mating with the angled yarn inlet hole in the insert.

21. An apparatus according to claim 20 provided with means for regulating the relative flow of air through the air escape holes and the insert axial outlet.

22. An apparatus according to claim 21 in which said regulating means comprises an end cap having a yarn outlet, said cap having internal threads and mating internal threads on the apparatus, the cap being provided with a tapered portion aligned with the insert axial outlet.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,653,196 Dated April 4, 1972

Inventor(s) Herbert J. Pike

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

72 Martinsville, N. J.

Signed and sealed this 12th day of February 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents