May 31, 1960 E. K. BAUER 2,938,257

BULKED YARN MANUFACTURE

Filed July 23, 1957

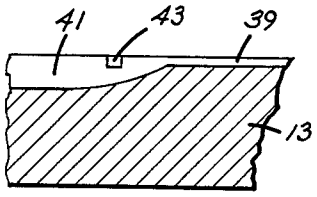


Fig. 4

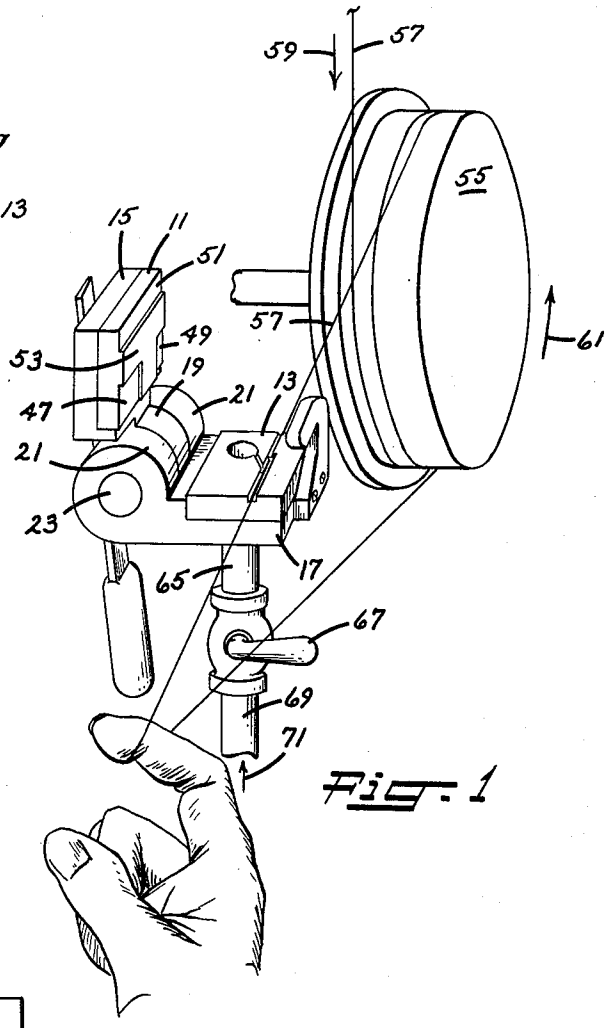


Fig. 1

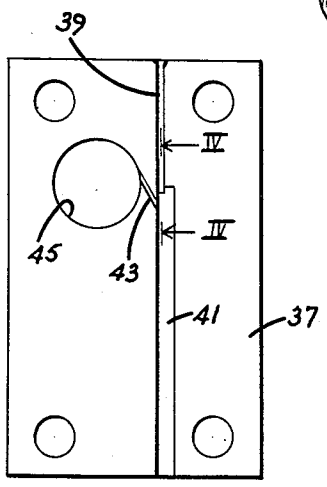


Fig. 3

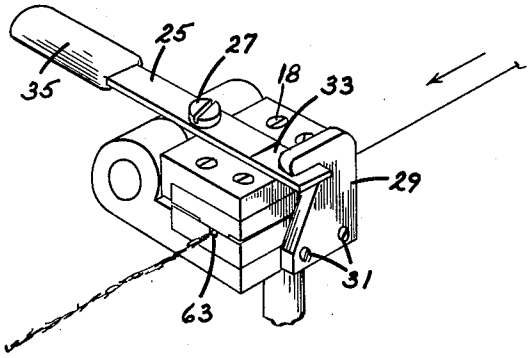


Fig. 2

United States Patent Office 2,938,257 Patented May 31, 1960

2,938,257

BULKED YARN MANUFACTURE

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Filed July 23, 1957, Ser. No. 673,716

11 Claims. (Cl. 28—1)

The invention relates to the manufacture of bulked yarn, and more particularly to a rapidly laced apparatus adapted for swirling or whipping, into convolutions or ring-like loops or coils, the individual continuous and substantially straight filaments of an endless multi-filament yarn delivered to the bulking apparatus at a relatively high speed.

As described in the United States patent application of Ernest K. Bauer et al., Method and Apparatus for Making Bulked Yarn, Serial No. 644,308, filed March 6, 1957, bulking of a continuous multi-filament yarn is accomplished by passing the yarn through confined delivery and bulking chambers. These delivery and bulking chambers form a continuous passage through the device, but are offset laterally from each other. This construction thus requires that the yarn alter its course in passing from one chamber to the other and it is within this area that a jet of compressed fluid impinges against the yarn to swirl or whip the individual yarn filaments into a mass of snarled or entangled ring-like loops which extend at random intervals along the yarn length.

In the bulking apparatus disclosed in said application, the yarn delivery and bulking chambers are formed in the opposing surfaces of a pair of plates which are fixed rigidly to each other when assembled. Thus, initial lacing of the device is effected by placing the leading end of the yarn adjacent to the inlet of the delivery chamber so that the suction or vacuum effect, as created by the jet of compressed fluid, pulls the same through the device. An alternative procedure is to thread the yarn through the chambers with a fine wire. Both of these lacing procedures are satisfactory when the delivery rate of the yarn is rather slow and can be controlled, as when drawing the yarn from a package. With high speed operations, however, as for example when the yarn is advanced directly from a spinning machine, lacing of the bulking mechanism is practically impossible with the lacing systems mentioned, and moreover involves a considerable waste of materials. Accordingly, it is the primary object of this invention to provide an improved and generally more satisfactory method and apparatus for bulking continuous multi-filament yarns.

Another object is the provision of an improved bulking apparatus including a pair of separable members shaped to provide chambers within which the individual filaments of a continuous rapidly advancing multi-filament yarn are separated from each other and concomitantly swirled or whipped into a bulked or looped formation by an expanding fluid stream.

Still another object is to provide a yarn bulking device having yarn delivery and bulking chambers formed between the opposing surfaces of a pair of plates which are hingedly mounted, for movement away from each other during initial lacing of the device, and which may be clamped snugly against each other during operation.

These and other objects and advantages of the invention will be apparent from the following description and accompanying drawings in which:

Figure 1 is a perspective view illustrating the apparatus of the present invention during the lacing operation;

Figure 2 is also a perspective view showing the device of the present invention in use;

Figure 3 is a plan view of one of the plates of the device illustrated in Figures 1 and 2; and

Figure 4 is a fragmentary longitudinal sectional view taken along the line IV—IV of Figure 3.

In general, the improved bulking apparatus of the present invention includes yarn delivery and bulking chambers which together form a continuous passage through the apparatus but are disposed in laterally offset relationship. These chambers are formed between the opposing surfaces of a pair of cooperating hinged plates which are normally clamped together during the bulking procedure, but which are readily movable away from each other to facilitate easy lacing of the device regardless of the yarn delivery speed. A yarn traveling through the device must therefore alter its axial course as it moves from one chamber into the other, and it is within this area that the yarn is impinged with a compressed fluid to cause the individual yarn filaments to be swirled or whipped into a mass of snarled or entangled ring-like loops extending at random intervals along the yarn length.

While the structural arrangement of the present invention, as hereafter described, differs somewhat from that disclosed in the above noted copending application, it will be understood that the yarn bulking process itself is accomplished in a manner similar to that described in said application. Thus, the streamlined flow of compressible fluid directed into the yarn bulking chamber expands and is disrupted into a turbulent flow which impinges against the filaments as the yarn alters its axial course in moving from the delivery chamber into the bulking chamber. The direct impact and turbulence of the fluid serves to violently vibrate the yarn filaments apart from each other and swirl or whip the same into a plurality of entangled convolutions or ring-like loops which are spaced randomly along the length of the yarn. To maintain and reinforce the turbulent effect of the fluid stream on the yarn filaments throughout their travel in the bulking chamber, the walls of this chamber may be provided with longitudinal spaced projections, as disclosed in the above noted application, which in effect serve as deflectors or obstructions for both the compressible fluid and the traveling yarn.

With reference to the drawing, the yarn bulking apparatus of the present invention includes plates 11 and 13 rigidly secured to the opposing surfaces of a pair of clamp blocks 15 and 17, as by screws 18. Among one edge, the blocks 15 and 17 are provided with interdigitating bearing portions 19 and 21, respectively, which are formed with aligned openings for the reception of a hinge pin 23. As best seen in Fig. 2, a locking blade 25 is swingably attached to the uppermost surface of the clamp block 15 by a stud 27. A retainer or catch 29 is fixed as by the screws 31, to the edge of the block 17 opposite its bearing portions 21. The free end of the locking blade 25 is tapered upwardly from its leading edge as shown at 33, while its opposite end is provided with a suitable handle 35. From the structure thus far described, it will be apparent that the clamp blocks 15 and 17 may be selectively locked in their positions shown in Fig. 2 by merely swinging the blade 25 to wedgingly engage its free end with the retainer 29.

From the plan view of plate 13 shown in Fig. 3 it will be noted that its uppermost face 37 is formed with a pair of substantially straight channels 39 and 41 which are disposed in axially offset relationship but together provide a continuous passage between opposite edges of the plate. The channel 41 is of larger cross-section than the channel 39, both in width and depth, so that

the yarn is displaced both laterally and vertically as it advances into the channel 41 from the channel 39, as more fully described hereafter. Formed also in the face 37 of the plate 3 is a groove 43 which interconnects the channel 41 with a fluid inlet opening 45, and extends at an acute angle to the axis of the channel 39.

The face of the plate 11, opposite the plate 13 is recessed at 47, 49 and 51 to provide an elevated surface 53 which is adapted to overlie the channels 39 and 41, groove 43 and the inlet opening 45. Preferably, the surfaces 37 and 53 of the plates 11 and 13 are ground true to insure that a fluid tight and uniform contact exists between these members. It will be evident, however, that the recessed portions of the plate 11 permit the same to flex slightly during the clamping or locking operation so that a snug contact may be obtained between the plates without in any manner impairing their fluid tight engagement. It will be noted that the plates 11 and 13 require relatively simple machining which can be accomplished with conventional equipment. Further, while the channels 39 and 41 and the groove 43 have been illustrated as being rectangular in cross-section, their configuration may be varied without departing from the spirit and scope of the invention.

After the plates 11 and 13 are affixed to their respective plates 15 and 17, and the latter are assembled as shown in Fig. 1, the bulking apparatus is in condition for use. The device of the present invention has utility in bulking yarn delivered at a relatively slow speed, as from a yarn package, but is especially suited for high speed operation such as when the yarn is advanced from a spinning machine. Accordingly, the bulking device is illustrated in Fig. 1 as being supported adjacent to a godet 55 about which a number of turns of yarn 57 are coiled as the yarn leaves a conventional spinning machine. For the sake of clarity in understanding the operation, arrows 59 and 61 are shown to indicate the path of yarn travel and godet rotation.

Initially, the clamping blade 25 is swung away from the retainer 29 and the block 15 is moved into an elevated position to expose the channels and groove in the plate 13. After a sufficient number of turns of yarn have been accumulated on the godet 55, the operator needs merely to gradually pull one advancing yarn loop away from the godet and lay the same within the aligned channels 39 and 41 as shown in Fig. 1. This procedure can well be performed with the operator's right hand as illustrated, leaving his left hand free to swing the block 15 downwardly to contact the plates 11 and 13 and to move the locking blade (counterclockwise as viewed in Fig. 2) into wedging engagement with its retainer 29.

In their clamped position, the elevated surface 53 of the plate 11, overlies the channels 39 and 41 and the groove 43 to form respectively, a yarn delivery chamber, a yarn bulking chamber (the terminal portion of which is shown at 63 in Fig. 2), and a fluid delivery duct. The surface 53 of the plate 11 also covers one end of fluid inlet opening 45 which is connected by the nipple 65 and valve 67 to a source of compressed fluid, as for example air, delivered by the pipe 69, as shown by the arrow 71. The valve 67 is preferably kept closed until the yarn 57 is placed in the channels 39 and 41 and the plates 11 and 13 are clamped against each other.

The yarn of filaments, as heretofore mentioned, is displaced laterally and vertically as it is advanced from the yarn delivery chamber and moves into the bulking chamber. Once the valve 67 is turned into an open position, the yarn of filaments is additionally subjected to the direct impingement of air or other compressed fluid issuing from the fluid delivery duct. Thus, somewhat concomitantly, the yarn of filaments is caused to alter its generally straight line course and is directly impinged by a blast of compressed fluid. Attention is called to Figs. 3 and 4 from which it will be noted that the groove 43 is smaller in cross-section than the channel 41 and that its axis is positioned above that of the channel 41. This relationship between the groove 43 and the channel 41 permits the delivered compressed fluid to expand rapidly as it enters the channel 41, and, in addition, causes the expanding fluid to impinge against the yarn of filaments at an area offset from the yarn axis.

The expansion and impact of the delivered fluid against the yarn filaments serves to disrupt the fluid stream into a turbulent flow, which when taken with the off-center delivery of the fluid, as described above, effects a violent vibratory separation of the yarn filaments and swirls the same in a haphazard fashion into convolutions or ring-like loops which are located at random intervals along the length of filaments. It will be noted that the angular disposition of the groove 43, relative to the channel 41, provides the delivered fluid with a component which serves to assist in carrying the yarn toward the exit of the yarn bulking chamber.

In view of the turbulent condition of the fluid as it flows towards the exit of the bulking channel, the initial ring-like loops formed in the filaments tend to become snarled or entangled with each other and thus the loops are securely locked in place. It will of course be apparent that the velocity of the compressed air or other compressible fluid must be adjusted for the particular bulking effect desired and may be even varied or delivered at a pulsating rate to form a novel yarn bulked at intermittent intervals. Moreover, it will be recognized that the yarn withdrawal rate must be so correlated with the rapid delivery pace so as to prevent the filaments from being pulled into a straight condition before the filament loops have become snarled or before the yarn is given a twist.

As heretofore noted, the bulking channel 41 may be provided with longitudinally spaced projections or deflectors, in a manner as disclosed in the above noted copending application, so that the fluid will be maintained in a turbulent condition and to insure that the yarn filaments will undergo a similar vibratory separation and swirling into ring-like loops as the yarn travels through the entire bulking channel. As is apparent from the described apparatus, the lacing of the bulking device is in no way dependent upon the suction effect produced by the compressible fluid nor upon manual wire lacing procedures, but can be practiced with ease regardless of the speed with which the yarn is advanced to the bulking apparatus. Further, it will be noted that the mode of yarn treatment described entails a highly efficient use of the compressed fluid while the apparatus is compact, simple, and economical in construction and use.

It is seen from the above description that the objects of the invention are well fulfilled by the method and apparatus described. The description is intended to be illustrative only and it is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. Apparatus for making bulky continuous filament yarn from a yarn of continuous substantially straight filaments including a pair of plates together cooperating to form an enclosed passage having a yarn inlet and exit opening, means connecting said plates for relative movement to permit the same to be separated for lacing of the yarn within and through said passage and means operatively connected with said enclosed passage between said inlet and exit openings for separating the yarn filaments and distorting the same into a plurality of ring-like loops formed at random intervals along the length of the filaments.

2. Apparatus for making bulky continuous filament yarn from a yarn of continuous substantially straight filaments including a pair of plates together cooperating to form an enclosed passage having an inlet and exit opening through which the yarn of filaments is adapted to

travel, means connecting said plates for relative movement to permit the same to be separated for lacing of the yarn within and through said passage, a duct for delivering a stream of compressible fluid into the enclosed passage at an area located between said inlet and outlet openings, and means within said passage for disrupting the stream of fluid into a turbulent flow.

3. Apparatus as defined in claim 2 further including means for locking said plates in engaged relationship.

4. Apparatus for making bulky continuous filament yarn from a yarn of continuous substantially straight filaments including a bulking device having a continuous confined passage extending therethrough and opening at opposite ends thereof, said passage having a first and a second portion, the axes of said first and second portions of said passage lying within substantially parallel planes and being offset from each other in both vertical and horizontal directions, said first portion opening into said second portion and providing a continuous path for the yarn of filaments from said first portion into said second portion, an inlet for introducing a stream of compressible fluid into said bulking device, and a duct extending from said inlet to said second portion of the passage for impinging the yarn of filaments with the stream of compressible fluid as the yarn enters said passage second portion.

5. Apparatus as defined in claim 4 wherein the axis of said duct is disposed at an acute angle to the direction of yarn travel from said first portion to said second portion and extends along a plane offset from but parallel to a similar plane passing through the axis of said second portion.

6. Apparatus for making bulky continuous filament yarn from a yarn of continuous substantially straight filaments including a pair of clamp blocks, a plate secured to each of said clamp blocks, means hingedly connecting said clamp blocks for movement toward and away from each other, a first and second channel formed in the surface of one of said plates and cooperating with the opposing surface of the other of said plates to provide

an enclosed passage extending through the apparatus and having inlet and outlet openings, the axes of said channels being substantially parallel but offset from each other in both horizontal and vertical directions, means for introducing a fluid under pressure into said enclosed passage at an area between said inlet and outlet openings, and means for locking said blocks in clamped position.

7. Apparatus as defined in claim 6 wherein said last mentioned means includes a locking blade swingably attached to one of said clamp blocks and a retainer secured to the other of said clamp block in position for engagement with the free end of said locking blade.

8. Apparatus as defined in claim 7 wherein the free end of said locking blade is tapered upwardly from its leading edge.

9. Apparatus as defined in claim 6 wherein the opposing surface of the other of said plates is provided with a projecting surface which overlies said channels when said blocks are in clamped position.

10. A process for making bulking continuous filament yarn from a continuous multi-filament yarn advancing from a source and passing about a godet including the steps of drawing a yarn turn away from the godet concomitantly with its advancement, lacing a portion of said yarn turn within a continuous channel, closing the open side of said channel to provide an enclosed passage having inlet and outlet openings, separating and distorting the filaments within said enclosed passage into a plurality of loops randomly spaced along the length of the filaments, and simultaneously advancing the yarn of filaments axially and along a generally straight path during the distortion thereof.

11. A process as defined in claim 10 wherein said filaments are separated from each other and distorted by a turbulent fluid stream.

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