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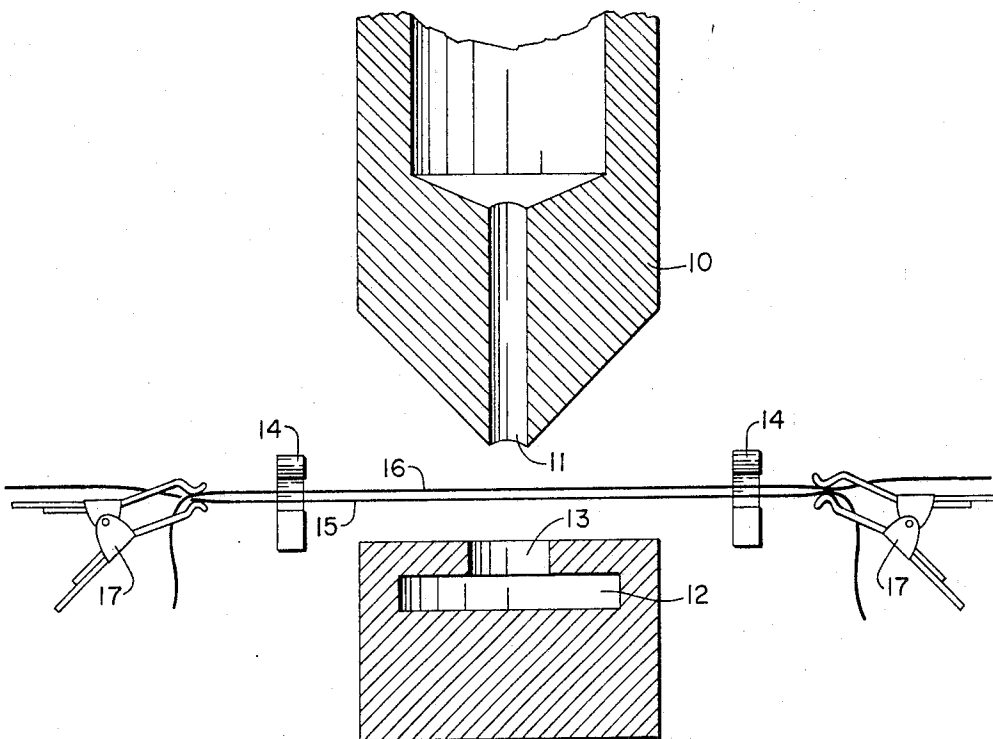
3,274,764

THREAD JOINT

Original Filed Nov. 4, 1963

2 Sheets-Sheet 1

FIG. 1



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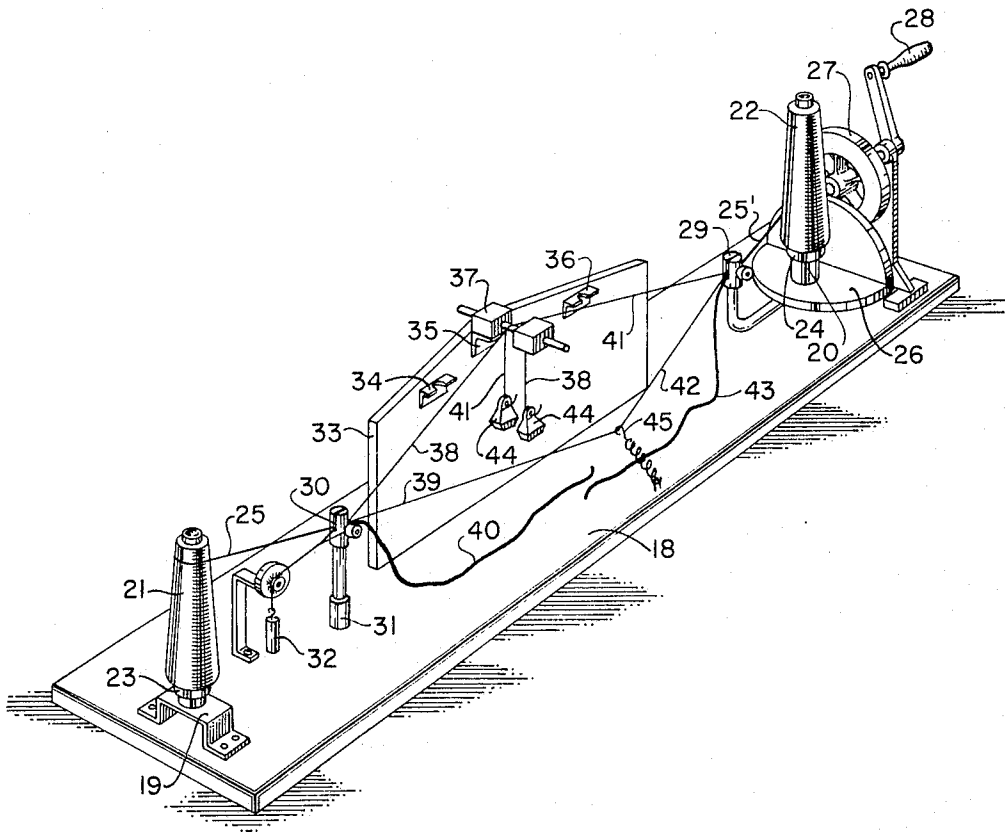
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FIG. 2



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1

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THREAD JOINT

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Original application Nov. 4, 1963, Ser. No. 321,244. Divided and this application Feb. 4, 1966, Ser. No. 525,179

Claims priority, application Netherlands, Nov. 14, 1962, 285,518

1 Claim. (Cl. 57—142)

This application is a division of application Serial No. 321,244, filed November 4, 1963.

The present invention relates to joining or uniting at least two ends of multifilament threads and the joint per se.

In the textile industry, it is the practice to join thread ends by tying some form of knot and while such knots may be satisfactory for some purposes, they still have disadvantages. In the first place, the tensile strength of the thread in the knot is lower than that of the thread per se, so that the overall strength of the knotted thread is only as great as the breaking point at the knot. Another disadvantage is that in processing knotted threads on textile machines, the continuity of the process may be impaired because the knots may be detained by slub catchers or get stuck while being drawn off from a thread package. When crimping a heavy denier thread, e.g. in a stuffer box, the thread is guided into the stuffer box by means of two rollers and knots may prevent the yarn from passing between the rollers in an unimpeded manner.

It is the object of the present invention to form a thread joint or connection which does not have the foregoing disadvantages.

The method according to the present invention for joining at least two ends of multifilament thread is carried out by arranging two thread ends parallel to each other in an overlapping manner and the overlapped portion thus obtained is clamped in at least two places and one or more jets of gas are directed across the overlapped thread portion between the clamping points while the thread is maintained under tension. The blast of gas across the thread bundle results in entanglement of its filaments and thereby causes the thread ends to be in effect "gas spliced" which retains the joined thread ends in permanent engagement. The friction between the engaged filaments results in a joint that has substantially the tensile strength of the thread per se.

The gas splicing is normally referred to as tangling and the entire operation may be conducted in an enclosed system or in the open. The thread bundle may be passed continuously through the gas jet stream, but in most cases, this is not necessary. Directing a jet of gas successively across a few points of the thread bundle will usually insure satisfactory coherence. Such a method is hereinafter referred to as "spot tangling" and means that a joint or connection is obtained which has a strength equal to that of continuous tangling along the axis of the thread.

Spot tangling can also be conducted in a one stage operation, i.e., by simultaneously directing a plurality of gas jet streams onto the stationary thread bundle at several points. If the number of tangled spots is sufficiently high, the strength of the joint may be equal to or even higher than the strength of the threads themselves. After the spot tangling operation has been completed, the free ends of the thread which were clamped during the process are cut off. Of course, more than two ends may be joined in the same manner.

The threads to be united may have some twist, although

2

they should not be twisted over one turn per inch, because a twist of higher than that magnitude prevents the filaments from becoming sufficiently dispersed in the gas jet stream, with the result that they are not entangled.

Although the gas jet stream may be directed across the thread bundles at any angle, for providing the most satisfactory joint and in order to obtain the optimum tangled effect, the gas jet stream should be directed at right angles or normal to the thread axis. The tension on the thread during tangling may vary between wide limits, although the best results are obtained when using a thread tension between 0.05 and 0.3 gram per denier. Any type of gas may be employed in the jet assembly, for example, carbon dioxide, nitrogen, and saturated or unsaturated steam, but for reasons of economy the use of air is preferred.

Any type of man-made thread may be utilized in accordance with this invention, for example, regenerated cellulose, cellulose acetate, polyamides, polyesters, polyalkylenes, polyacrylonitrile, etc. When splicing regenerated cellulose thread ends, they should be moistened with, for example water, before the tangling operation is effected.

The method may be carried out by clamping the thread bundle and keeping it under tension during tangling either by hand or by mechanical means.

FIGURE 1 is a section through a known jet tangling device as disclosed in U.S. Patent No. 3,167,847. The thread ends are shown in overlapping parallel relationship and the thread clamped at two points in the overlapped portions; and

FIGURE 2 is a perspective view showing a system for joining or uniting three differently colored yarns to produce a moulinee effect.

Referring to FIGURE 1, air or other gas is supplied from any suitable source to a nozzle 10 and is directed under pressure outwardly through exit 11 and thence into a resonance chamber 12 via opening 13. The opening 13 is opposite to, and directly aligned with, the exit 11 in nozzle 10. Two thread guides 14 are disposed on each side of the jet assembly so that overlapping threads 15 and 16 intersect the center line of the nozzle exit 11 and opening 13. The ends of threads 15 and 16 are held under tension by clamps 17. When gas is directed across the double thread or thread bundle, the filaments are entangled with the result that a tangled spot or joint is produced.

Referring now to FIGURE 2, a system is shown in which three sets of thread ends are joined and later twisted to form a composite yarn and, if a moulinee type yarn is desired, each of the threads may be a different color. This system has the advantage that the threads may be joined in such a manner that the connections or joints are invisible. This is accomplished in the following manner.

The apparatus of FIGURE 2 is mounted on a platform generally indicated at 18 which is provided at each end thereof with rotatable spindles 19 and 20. Thread packages 21 and 22, which have been wound on tubes 23 and 24, are mounted on the rotatable spindles 19 and 20, respectively. The composite yarns 25 and 25' are of identical construction and are obtained by twisting together three threads each having different colors which when processed in a stuffer box provides a composite moulinee yarn.

The rotatable spindle 20 is mounted on a support 26 and is attached to wheel 27 provided with a handle 28. When the wheel is rotated by hand, the rotatable spindle rotates about an axis which is perpendicular to the axis of rotation of spindle 20; also mounted on support 26 is a fixed thread clamp 29.

3

On the lefthand side of platform 18 is mounted a tiltable thread clamp 30 which is normally retained in a vertical position by means of a sleeve 31. When the sleeve 31 is moved upwardly, the thread clamp 30 is tilted under the influence of weight 32.

An upright wall 33 is rigidly mounted near the rear of platform 18, which wall is provided with three jet assembly supports 34, 35, and 36 spaced longitudinally with respect to the axis of the thread. A tangling device 37, such as that shown in FIGURE 1, may be mounted on any one of the supports 34, 35, and 36 during each tangling operation.

The ends of composite yarn 25 and 25' may be joined or gas spliced in the following manner. A portion of composite yarn 25 is unwound from the package 21 and at the required distance from its end fastened in clamp 30. The twist is removed from the composite yarn portion 25 by hand, to provide three separate threads 38, 39 and 40, which threads may be of different colors in case a moulinee type yarn is desired.

In a similar manner, a portion of composite yarn 25' is unwound from package 22, fastened in clamp 29, and untwisted by hand so that three separate threads 41, 42, and 43 are obtained.

Each of the three sets of threads 38, 41; 39, 42; and 40, 43 are shown in three stages of the process. The first set 38, 41 is shown in the gas jet device in readiness to be joined or united by the gas jet stream. The second set 39, 42 has been joined and removed from the gas jet stream and is being held under tension while the loose ends are being cut. The third set 40, 43 is shown separated and before it has been placed in the gas jet device for joining.

In FIGURE 2, the tangling device 37 is mounted on support 35, and threads 38 and 41 are disposed in the tangling zone of the tangling device 37 in parallel, overlapping fashion. Attached to the ends of threads 38, 41 are weights 44 in order to impose a tension on the threads. The thread ends 38, 41 are gas spliced and joined by means of the intertangling of the filaments as a result of directing a gas jet stream across the overlapped portions of the threads. After the weights have been removed, the joined thread is removed from the tangling zone and pulled out of the path of the other threads by means of spring hook member 45. Finally, the end portions of thread beyond the joint are cut off.

The same procedure was used when thread end 39 was joined to thread end 42, with the exception that the tangling device 37 was utilized at the first location, namely, mounted on support 34. The third thread end 40 is joined to thread end 43 in the same manner when the tangling device is mounted on support 36. In this way, three tangled connections are provided which are in-

4

visible because of the different locations of the tangling jet. If the tangling device is not shifted, the connections would be at the same lineal point and cause it to be visible and possibly objectionable. Shifting the tangling connections along the axis of the separate threads has the additional advantage that the tensile strength of the connection is usually higher than when the connections are at one point.

Finally, the sleeve 31 is moved upwardly in order to impose a tension on the joined threads, which tension is preferably equal to the tension on the threads when they were originally twisted together. After the threads have been removed from the spring hook member 45, the support 26 is rotated whereby the joined threads are twisted together in such a way that the joint shows the same number of turns per inch as in the original composite yarn 25-25'.

If the moulinee yarn has a low twist, it is as a rule not necessary to twist the joined threads together, especially if the distance between the thread clamps 29 and 30 is small.

Even if the moulinee yarn has a high twist, it is not always necessary to twist the joined threads together. In that case, the de-twisting of the moulinee yarn by hand should be carried out by pulling the component threads apart, as a result of which the twist in the yarn is shifted in the direction of the package. After making the connections in the above-described way, the joined threads are automatically twisted together.

What is claimed is:

A thread joint formed solely by the ends of at least two multifilament threads having a low twist equal to or less than one turn per inch, said filaments of each thread being entangled with the filaments of the other thread in permanent engagement therewith and without further twist whereby the tensile strength of the joint is substantially the same as that of the thread.

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