Sept. 26, 1950 H. J. WOODS 2,523,854

MANUFACTURE OF STAPLE YARN FROM CONTINUOUS FILAMENTS

Filed Feb. 4, 1946

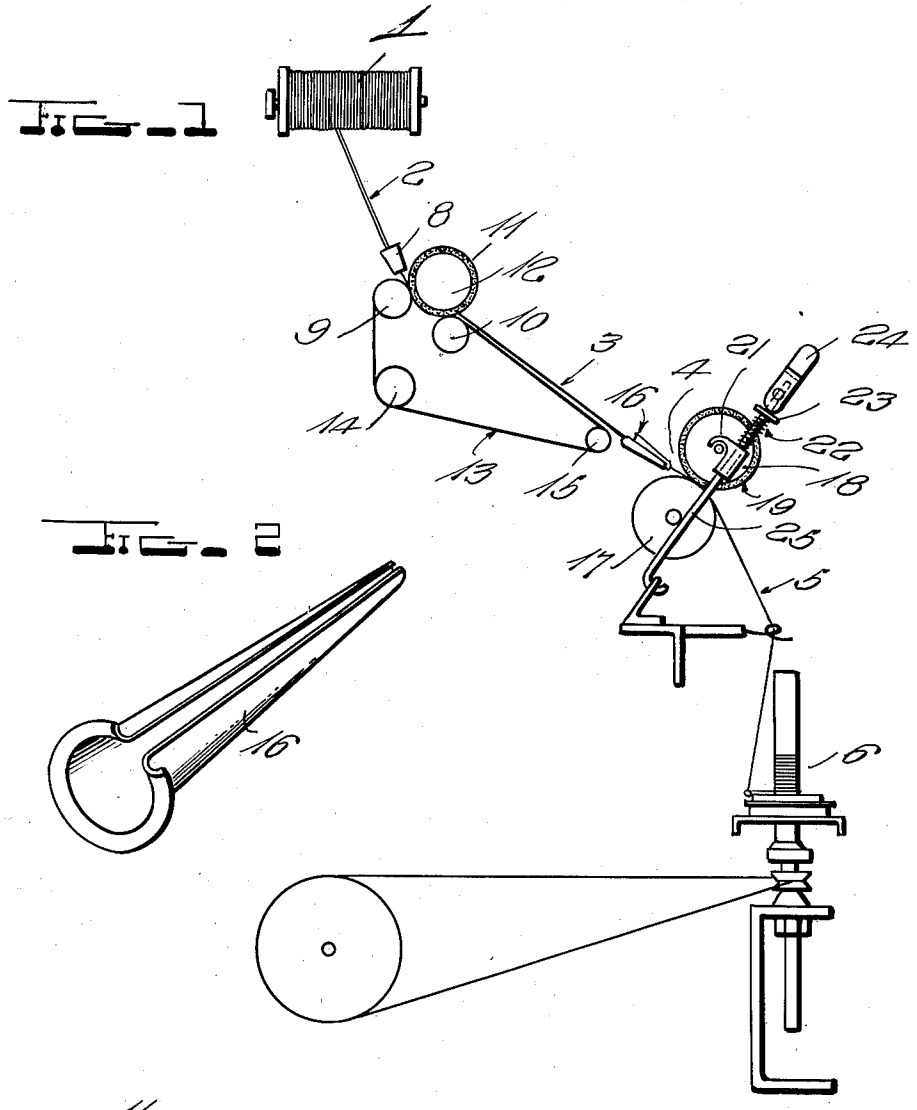


FIG. 1

FIG. 2

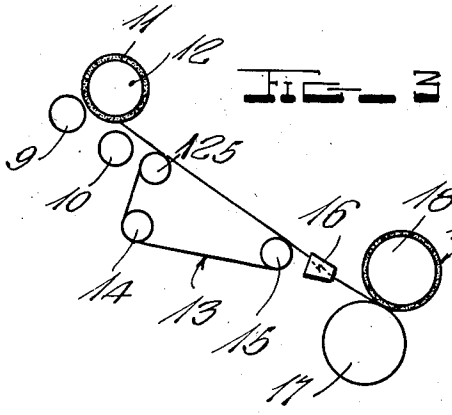


FIG. 3

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Patented Sept. 26, 1950 2,523,854

UNITED STATES PATENT OFFICE

2,523,854

MANUFACTURE OF STAPLE YARN FROM CONTINUOUS FILAMENTS

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Application February 4, 1946, Serial No. 645,378

2 Claims. (Cl. 57—157)

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The invention relates to improvements in a process and apparatus for the manufacture of staple yarns from continuous filaments preferably formed of synthetic material.

The process involves the drawing of tow of continuous filaments so as to break the filaments while spinning them into a staple yarn. The apparatus, in common with other spinning devices wherein yarn is spun by machinery, includes a multiplicity of weighted rollers, succeeding sets of rollers being operated at higher surface speeds than the preceding rollers. A characteristic feature of the present invention resides in the inclusion of process steps and mechanical means whereby tow may be continuously broken and drafted into filament yarns having a relative fineness in relation to the tow in the order of from two to one to several hundred to one.

In my experiments with continuous filaments I have found that great difficulty is encountered in securing a high degree of uniformity of evenness with respect to the number of fibers in cross sections of the spun yarn and it is one of the objects of the present invention to produce such uniformity.

I have also found that the difficulty in securing uniformity in the spun yarn may be overcome by conveying the undrafted (that is to say the unbroken) tow from the slow moving back or holding rollers to fast moving front rollers in such a manner as to permit unrestricted breaking of the individual fibers in the tow while preventing the free ends thereof from being moved from their proper positions. In accordance with my invention a tow of continuous synthetic filaments is broken into numerous short length filaments, preferably between two sets of rollers operating at different speeds, which short length filaments are then separated and conveyed by an apron through a self-feeding funnel or concentrator directly to the spinning machines.

In the preferred arrangement the means for holding the tow while it is being broken may include a pair of lower rollers operating at the same speed or with a slight differential in speed, the back roller of the pair operating somewhat more slowly than the front roller, these two lower rollers supporting an upper roller preferably covered with a soft roller covering material, said upper roller being weighted upon the lower drafting rollers and being driven by them due to frictional contact. The conveyor apron may, if desired, be actuated by one or both of these lower rollers so that material passing underneath the

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rolls will be conveyed to the breaking rollers, which latter rollers are arranged at a suitable distance apart from the holding and feeding rollers. This distance may be varied from several inches to several feet, depending upon the character of the yarn desired. It has been found that this distance has a direct bearing upon the distribution of fiber length within the finished yarn, and therefore the wooliness characteristic of spun yarn may be increased or decreased by varying this distance. The conveyor apron may, however, be operated independently of either set of rollers and in many cases it will be found desirable to operate the same independently.

The invention will be more readily understood by reference to the accompanying drawing and the following detailed description, in which illustrative embodiments of the inventive thought are set forth by way of example and not by way of limitation.

In the drawings:

Fig. 1 is a diagrammatic view of a preferred apparatus for carrying out the improved process;

Fig. 2 is a detail view on a larger scale than Fig. 1 showing a self-threading guiding or concentrating tube in the form of a hollow, slotted, truncated cone; and

Fig. 3 is a diagrammatic view similar to Fig. 1 showing a modified form of apparatus wherein the conveyor apron is driven independently of the feeding rolls, some of the elements shown in Fig. 1 being omitted for convenience of illustration.

Referring to the drawings, and particularly to Fig. 1, the reference numeral 1 denotes a supply package of continuous synthetic material, 2 herein referred to as tow, which is fed through a trumpet or concentrator 8 into the nip of a set of feeding rollers shown as including a pair of lower driving rollers 9 and 10 supporting and driving an upper roll 12, which may be covered with soft covering material 11. Incorporated between the feeding rolls is a relatively broad conveyor apron 13 extending from the lower rolls 9 and 10 and driven thereby to a carrier roll 15 and thence rearwardly to a tension roll 14, the apron 13 comprising a continuous conveyor herein shown as driven by the lower back rolls and designed to convey the stock or tow to the breaking rolls 17 and 18 adjacent the end of the conveyor apron.

The breaking rolls are shown as comprising a lower driving roll 17 supporting a driven roll 18 which is provided with a soft covering 19. These breaking rolls grasp the ends of the tow pro-

jecting from the conveyor and by sheer force of speed differential break the tow at some point between the nip of the breaking rolls 17 and 18 and the nip of the feeding rollers and conveyor apron. While the breaking is being accomplished there is a tendency for the broken portions of the tow, designated by the numeral 3, to spread into a flat band, the band becoming wider as the breaking is accomplished. This would be a serious hindrance to the purpose desired and accordingly it is necessary to restrict the movement of this band and to guide it into as small a cross sectional area as possible. This is accomplished as herein shown by passing the stock through a restricting guide member or concentrator 16 which constitutes an important feature of the present invention in combination with the other elements of the system. The guide member is shown in detail in Fig. 2 and comprises a tapering tube, preferably of brass or the like and formed in the general shape of a truncated cone. The top portion of the tube is slotted to permit easy threading. The enlarged entering end of the truncated cone is preferably flared as indicated to reduce possible friction with the fibers. The purpose of condensing the ribbon of fibers into an area of small size is to deliver these fibers to the yarn being twisted (as shown at 5 in Fig. 1) as nearly adjacent one another as is possible so that each fiber will be caught in the twisting operation and twisted into the yarn instead of falling out as fly or clearer waste. After drafting is accomplished and the yarn twisted the finished yarn may be wound upon a conventional ring spindle, as shown at 6 in Fig. 1. The upper rolls 11 and 18 have been described as weighted or tensioned. Any suitable means for applying such tension may be employed. One such means is diagrammatically illustrated with reference to the upper soft covered roll 18 of the pair of breaking rolls 17 and 18. As shown, the weighting or tensioning mechanism is that described and claimed in my co-pending application, Serial No. 646,761, filed February 11, 1946, now Patent No. 2,492,082, Dec. 20, 1949, entitled Weighting and Unweighting Device Pertaining to Drafting Rolls in Spinning Machinery. The mechanism is diagrammatically illustrated as comprising a slidably mounted hooked member 21 engaging the axis of the roll 18 and compressed by a spring 22 held by washer 23 and adapted to be released or applied by a suitably pivoted cam lever 24 hingedly and threadedly mounted at the top of the rod 25, the lower part of which is in the form of a hook detachably engaged in a bracket carried by the spinning frame. Other weighting mechanism may be employed if desired. Similar weighting mechanism may also be applied to the upper roll 11 of the set of feeding rollers.

It should be pointed out that the drafting apron 13 constitutes an important feature of the invention. It serves as a conveyor for the unbroken fibers and at the same time presents a friction surface for the broken fibers. This conveyor apron is to be distinguished from an ordinary drafting control apron, which would require the presence of a self-weighted carrier roll resting upon the top of guide roll 15, which in the present device is driven solely by the apron 13 due to contact friction. It has been found by experiment that in the present system the addition of such a weighted control roll, an important feature of other conveyor belt systems, is harmful inasmuch as it disturbs the movement of the fibers and results in the inclusion of short fibers in the fiber length distribution of the yarn.

The apron 13 in the present device serves the dual purpose of conveying the loose ends of the unbroken filaments until such time as they have actually entered in the bite of the breaking rolls, at which time the apron serves as a retarding force for the broken ends of the filaments, preventing such ends from being disturbed or moved from their relative positions until such time as they can leave the apron itself.

It will thus be understood that the function of the belt or apron is primarily that of a conveyor and supporting element, and accordingly it is not necessary that the belt pass under the nip of the back or feeding rollers, although such arrangement is generally preferred as a matter of convenience and economy in utilizing the already present driving rollers 9 and 10 or the additional function of driving the belt 13. Entirely satisfactory results may be obtained, however, by employing a separate driving roll for the apron such as is illustrated in the arrangement shown in Fig. 3. In this construction it will be seen that the belt functions solely as a conveyor and an additional carrier roll 125 is provided which is placed within the draft zone and the belt or apron 13 passes around the carrier roll 125, thence forwardly over the roll 15, rearwardly to the tension roller 14 and thence back to the carrier roller 125. In this construction the apron or belt 13 is simply a conveyor moving at a speed equal to the speed of the back roller or may be actuated at a higher speed than the speed of the back rollers, such speed referring, not to revolutions, but to linear speeds per minute of the periphery of the back rolls, while the speed of the belt refers to speed of advance of the roller, which may be expressed in inches per minute.

I have found that my improved system possesses many advantages as compared with other systems heretofore in use known to me. Thus, my improved system permits the manufacture of spun yarn of excellent quality directly from tow without intermediate processes. The system also possesses the advantage of relatively few parts. Threading is substantially automatic, there being no complicated tubes to be threaded. It is found that the truncated cone trumpet device 16 is practically self-threading in that the operator has merely to start the end of the unbroken tow into the end of the aperture at the end of the truncated cone, then thrust the end into the bite of the breaking rollers, the result being that the tow is promptly jerked into the desired position down the center of the truncated cone, which is so set that the fiber passes through the truncated cone near the bottom portion which is farthest away from the slot at the top. This particular setting of the truncated cone is desirable in that the accumulation of short fly and broken filament is prevented within the trumpet itself.

The invention has been described in detail for the purpose of illustration but it will be obvious that numerous modifications and variations may be resorted to without departing from the spirit of the invention.

I claim:

1. In a process for making spun yarn directly from broken filaments formed from continuous filaments, comprising passing a tow of continuous filaments from feeding rolls to breaking rolls, breaking the continuous tow into short filaments

intermediate the two sets of rolls; the improvement which comprises initially supporting a portion at least of the broken filaments intermediate the sets of rolls upon a conveyor apron, then progressively concentrating the filaments prior to their entry into the second set of rolls, and conveying the broken filaments directly to the spinning step from the second set of rolls.

2. In a process for making spun yarn directly from broken filaments formed from continuous filaments, comprising passing a tow of continuous filaments from feeding rolls to breaking rolls, breaking the continuous tow into short filaments intermediate the two sets of rolls; the improvement which comprises initially supporting a portion at least of the broken filaments between the two sets of rolls upon a conveyor apron, then progressively concentrating the broken fibers, and after the concentrating step delivering the concentrated fibers to the second set of rolls, and spinning the broken fibers after passing from the second set of rolls.

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