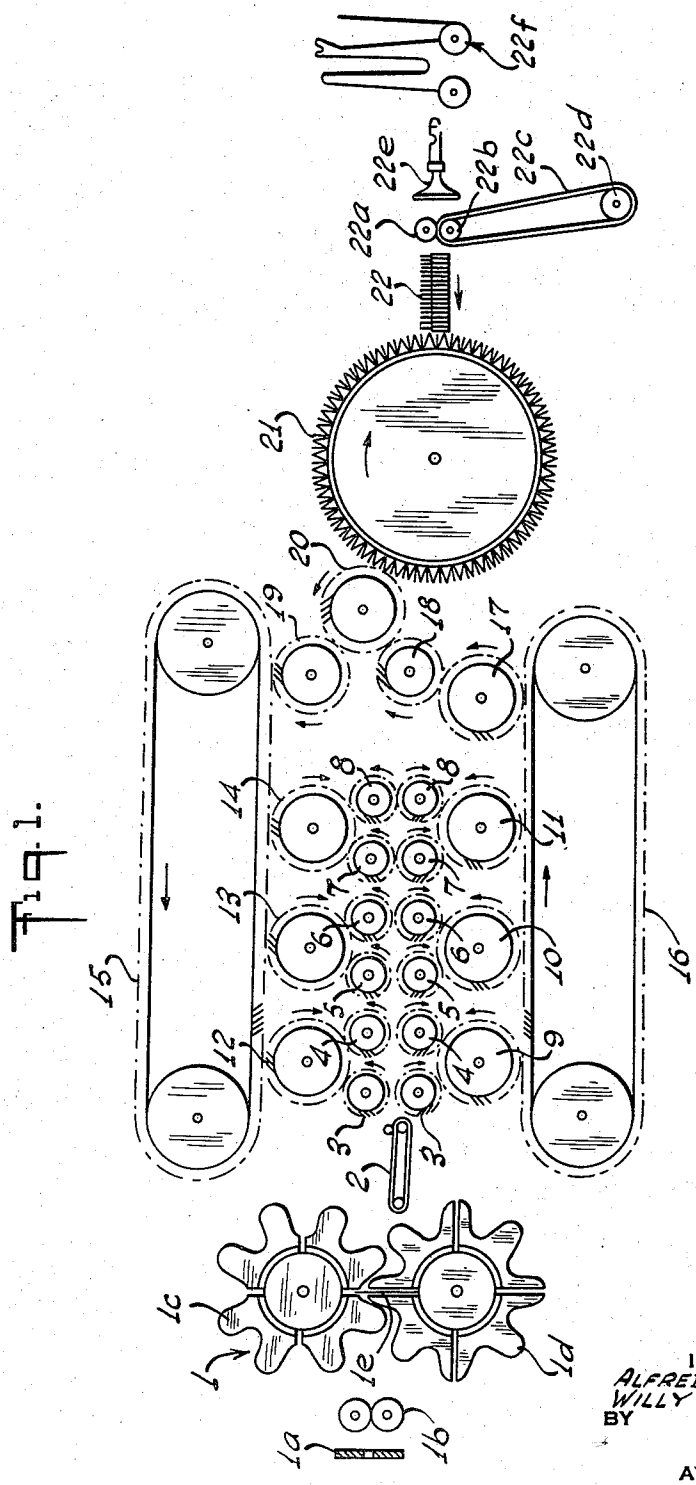
Feb. 16, 1960 A. SCHEIBE ET AL 2,924,853

PROCESS FOR MAKING A DEFORMABLE FIBROUS BAND, TAPE AND LIKE ARTICLE

Filed Oct. 14, 1957 4 Sheets-Sheet 1

Fig. 1.



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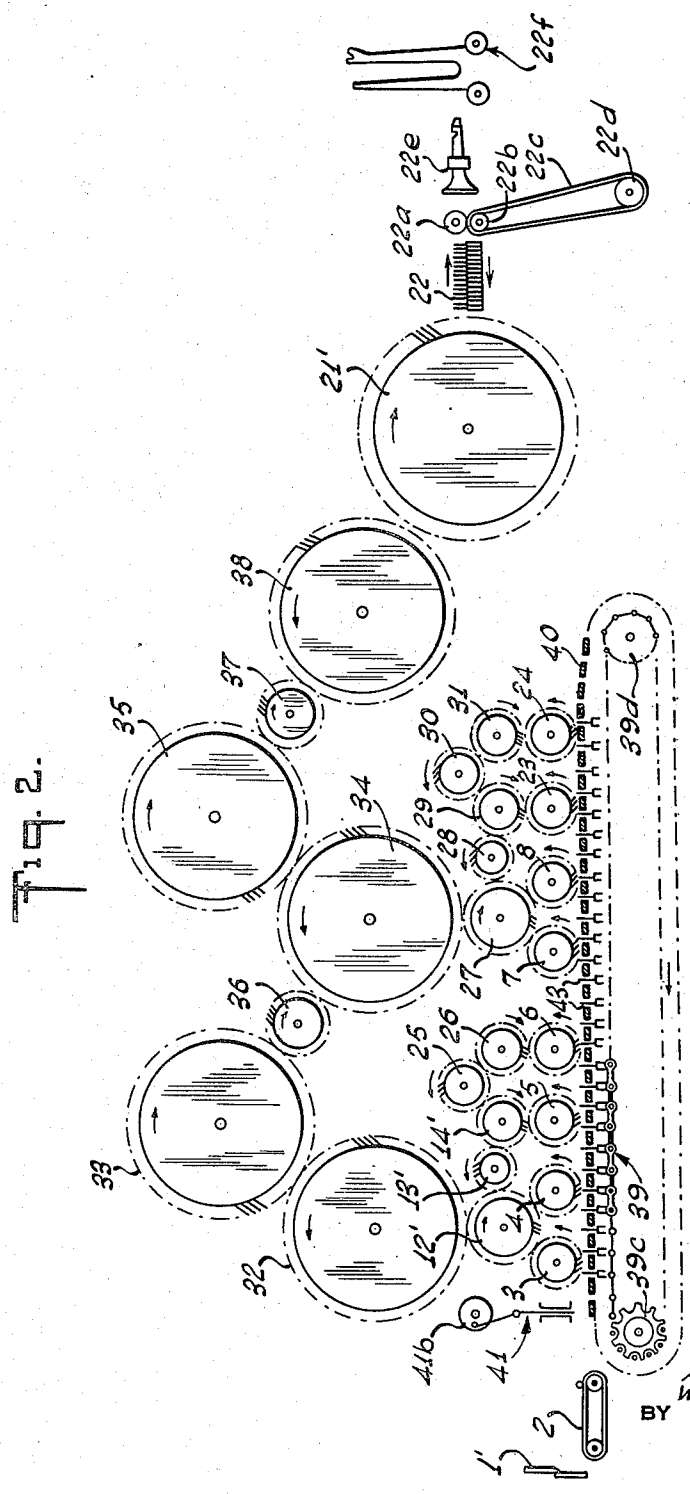
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PROCESS FOR MAKING A DEFORMABLE FIBROUS BAND, TAPE AND LIKE ARTICLE

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Fig. 2.



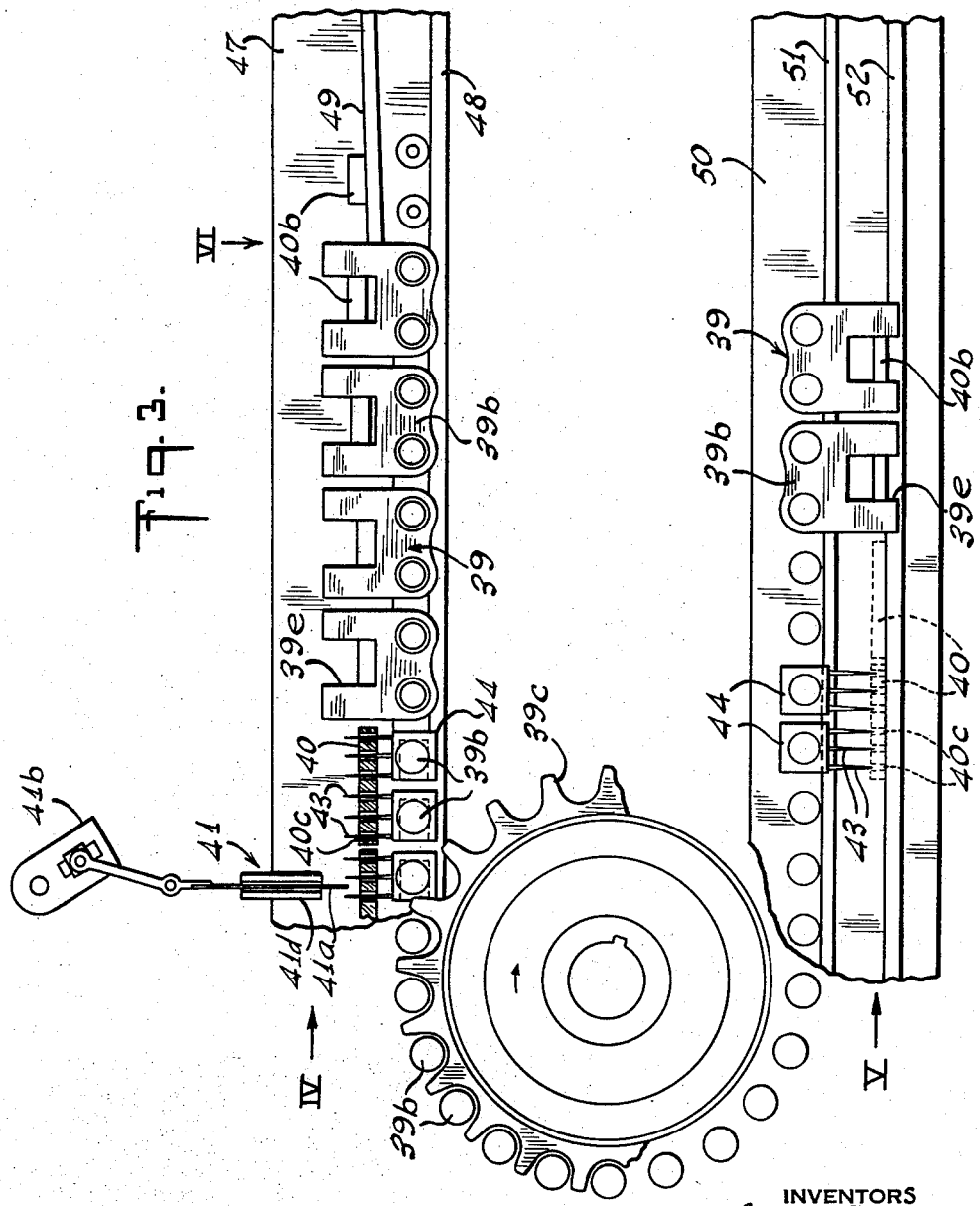
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PROCESS FOR MAKING A DEFORMABLE FIBROUS BAND, TAPE AND LIKE ARTICLE

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Fig. 3.



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PROCESS FOR MAKING A DEFORMABLE FIBROUS BAND, TAPE AND LIKE ARTICLE

Filed Oct. 14, 1957 4 Sheets-Sheet 4

Fig. 4.

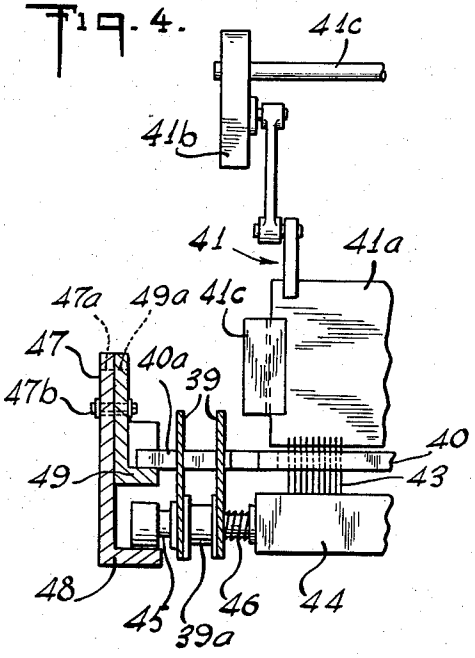


Fig. 5.

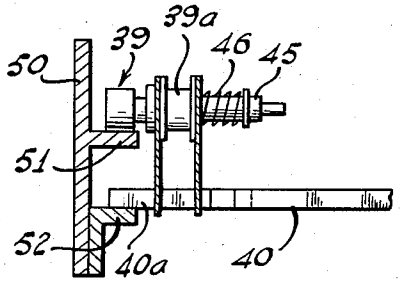
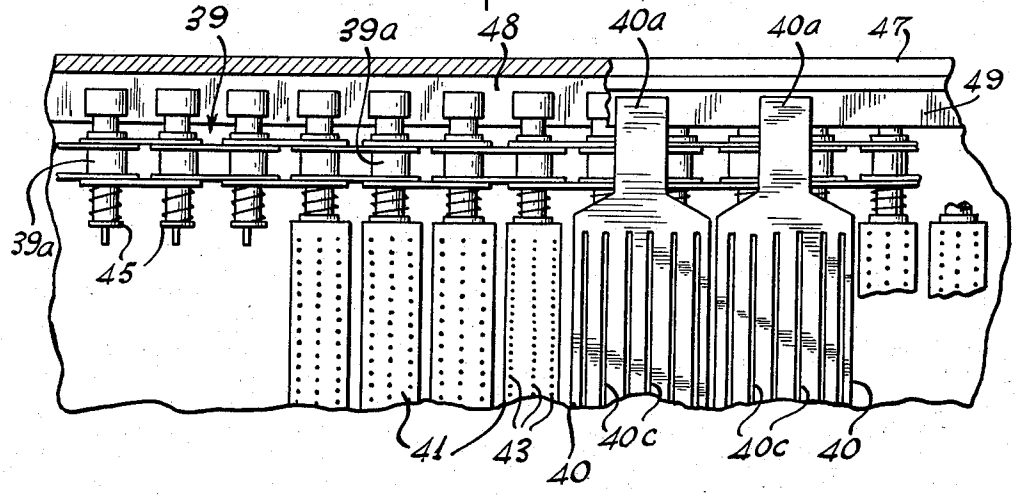


Fig. 6.



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United States Patent Office 2,924,853 Patented Feb. 16, 1960

2,924,853

PROCESS FOR MAKING A DEFORMABLE FIBROUS BAND, TAPE AND LIKE ARTICLE

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Application October 14, 1957, Serial No. 690,023

Claims priority, application Germany October 18, 1956

4 Claims. (Cl. 19—.51)

This invention relates to a process of and apparatus for producing stretchable or otherwise deformable fibrous ribbons, bands, tapes and like articles from staple fiber sections. Under the term "staple fibers" are included rayon, nylon and all other synthetic fibers.

Known processes for effecting such production may be classified into three groups. In one, the staple fiber sections are overlapped on one another and are thereafter stretched out of their original shape. In practice, however, it has been found that the desired offsetting or staggering of the individual fibers relative to one another becomes too regular when this procedure is followed, as a result of which production of a fibrous band suited for only small distortions is rendered impossible. The second group of processes for this purpose is characterized by the use of suitably coated rollers or like means which effect a displacement of the staple fiber sections relative to one another. Such a procedure is also disadvantageous, especially from the standpoint of the physical strength characteristics of the ultimately produced band, since the fibers are subjected to very considerable mechanical stresses. The third group of processes is based on the tearing of the endless filaments or strands of the original spun cable into fibers, and here too the principal disadvantage is an excessive stretching or elongation of the individual fibers.

It is, therefore, an important object of the present invention to provide means enabling the aforesaid disadvantages and drawbacks inherent in known processes of this type to be overcome in a novel and highly efficacious manner.

Another object of the present invention is the provision of means for and a process of transforming a spun synthetic cable into a fiber fleece, which is ultimately to be shaped into the form of a fibrous band, tape or the like, without subjecting the individual fibers to any undue stresses and strains.

Still another object of the present invention is the provision of apparatus by means of which different groups of fibers extracted from the original spun cable are recombined at appropriately spaced time intervals into the form of a fiber fleece of substantially uniform characteristics.

More particularly, according to the present invention, the spun synthetic cable is first cut into staple fiber sections by means of any suitable cutting device. Thereafter, the individual fiber sections are subjected to the action of means which shave or skim one thin layer of fibers after another off each section until the same is substantially completely disintegrated. Finally, the so-formed thin layers with their fibers in an oriented condition are transported along paths of different lengths to a suitable joining or combining device by means of which the fiber fleece is formed. The latter is then passed through means for transforming the fleece into the desired fibrous band, strip, tape or the like.

Advantageously, several successive staple fiber sections may be simultaneously disintegrated by having shaved or skimmed therefrom thin layers of fibers at a plurality of serially arranged locations past some or all of which each fiber section must pass, in which case the narrowness of the passageway along which the fiber sections are moved past the various shaving locations increases gradually and uniformly from the first such location to the last.

The shaved-off layers of fibers are effectively divided into at least two groups, and the various groups are then transported along the aforesaid paths of different length to the joining device, and as a consequence thereof the layers of any one group reach the joining device preferably alternately with the layers of any other group and in a timed sequence determined by the lengths of the parts and the rate of travel therealong, whereby a precise staggering or offsetting of the fibers relative to one another is attained.

According to the present invention, furthermore, apparatus for carrying out the process described above is characterized by a plurality of shaving or skimming cylinders or rollers arranged widthwise along the initial path of travel of the staple fiber sections and opposite at least one of the broad flat surfaces of said staple fiber sections, each of such cylinders being provided with peripheral scraper means or with a like coating, and each cylinder, as viewed in the direction of travel of the fiber sections, being located in closer proximity to the path of travel than the next preceding cylinder. The apparatus is further characterized by transporting means for the shaved-off thin layers, said transporting means being likewise provided with scraper coating or like means, and by a joining or combining cylinder or roller following the transporting means.

In a particular embodiment of the invention, the shaver cylinders are disposed in groups on both sides of the initial path of travel or shaving passageway, i.e., opposite the flat, wide surfaces of the staple fiber sections, each of the groups of cylinders having associated therewith individual transporting means both of which lead to a common joining cylinder.

The foregoing and other objects, characteristics and advantages of the process and apparatus according to the present invention will be more clearly understood from the following detailed description when read in conjunction with the accompanying drawings, in which:

Fig. 1 is a schematic illustration of one embodiment of an apparatus according to the present invention;

Fig. 2 is a schematic illustration of another embodiment of an apparatus according to the invention;

Fig. 3 is a schematic illustration, on an enlarged scale, of a portion of the apparatus shown in Fig. 2;

Fig. 4 is a fragmentary vertical transverse view taken in the direction of the arrow IV in Fig. 3;

Fig. 5 is a fragmentary vertical transverse view taken in the direction of the arrow V in Fig. 3; and

Fig. 6 is a fragmentary horizontal transverse view taken in the direction of the arrow VI in Fig. 3.

Referring now more particularly to Fig. 1, the spun synthetic cable (not shown) is fed via a slotted plate 1*a* and feed rollers 1*b* to a cutting device 1 consisting, by way of example only, of a pair of meshing fluted rollers 1*c* and 1*d* carrying, in a manner not specifically illustrated and forming no part of the present invention, one or more knives or cutting tools 1*e*. The number of such knives is determined by the length desired for each staple fiber section. Cutting of the spun cable is effected, for example, at a slant or on the bias. It is, of course, possible to employ other types of rotating knives or, if desired, knives moving longitudinally of the path of travel of the spun cable, the sole determining factor being that the knife must exert a pulling force on the synthetic cable so as to cut it while in tensioned condition, as it would be, for example, at the region of con-

tact between the fluted rollers 1*c* and 1*d*. Use of plain scissors or like cutting devices which are stationary (relative to the path of travel) during the cutting operation, in lieu of movable knives, is to be avoided since a stationary cutting device would tend to arrest movement of the cable and thus lead to formation of a compressed area at the location of the cut and extending across the entire width of the cable, the effect of such a compressed area being only to hinder further treatment of the fibers. In contradistinction to this, cutting of the synthetic cable in tensioned condition brings about a curling of the ends of the staple fiber sections and thus an initial separation of the individual fibers from one another.

Positioned behind the cutting means 1 is a short conveyor belt 2 the discharge end of which is disposed adjacent a gap defined between a pair of axially parallel cylinders or rollers 3 journaled for rotation in the directions of the arrows and driven at substantially equal angular speeds. Following the pair of cylinders 3 are further parallel cylinder or roller pairs 4, 5, 6, 7 and 8, the gap between the cylinders 4 being smaller then that between the cylinders 3, the gap between the cylinders 5 being smaller than the gap between the cylinders 4, etc., and the gap between the last cylinders 8 being smallest of all. Thus, the cylinders 3 to 8 define therebetween a gradually narrowing passageway along which the cut staple fiber sections are to travel. It will be noted that all the upper cylinders 3 to 8 rotate independently of each other in one direction (counter-clockwise), while all the lower cylinders 3 to 8 rotate independently of each other in the opposite direction (clockwise), each pair of cylinders having associated therewith driving means (not shown) for rotating the two respective cylinders at a slightly higher angular speed than the preceding pair of cylinders.

The cylinders 3 to 8 are provided with outer peripheral scraper surfaces which may be constituted, by way of example, by a plurality of sawteeth, a roughened steel covering, needles, or by any other like scraper coating or scraper means of the type commonly employed in the worsted, carded wool and cotton industries. As schematically indicated in Fig. 1, all the points or cutting edges of the teeth or elements of the various scraper coatings point in the direction of rotation of the associated cylinders.

From the foregoing it will be understood that the cylinders 3 to 8 are positioned and constructed to shave or skim thin layers of fibers from the staple fiber sections passing between the cylinders. Such a shaving action results from the fact that, depending on the top rake of the teeth or scraper elements each cylinder pair 4 to 8, the spacing or gap between which is slightly smaller than the thickness of the fiber section entering the gap from the preceding cylinder pair, tends to exert a forward feeding and pulling force on the fiber section therebetween, while the preceding cylinder pair, which is rotating at a lesser angular speed than the following one, tends to exert a retarding force on such fiber section. The various cylinders are preferably mounted for adjustment of the gap widths so as to enable the retarding force exerted by each cylinder pair to be varied as desired. Suitable means (not shown expressly) cooperate with the conveyor 2 to exert a retarding force on each fiber section entering the gap between the cylinders 3.

Located below and intermediate the lower sets of shaver cylinders 3—4, 5—6, and 7—8, respectively, are three take-off rollers or cylinders 9, 10 and 11, all of which are also provided with suitable coatings of scraper elements having top rakes as schematically indicated, the take-off cylinders being arranged for rotation in one and the same direction opposed to the direction of rotation of the lower shaver cylinders. Similarly, above and intermediate the upper sets of shaver cylinders 3—4, 5—6 and 7—8, respectively, are arranged three further take-off cylinders 12, 13 and 14 rotating opposite to the upper

shaver cylinders and having scraper coatings the elements of which are angled as shown. An endless conveyor belt 15 having a scraper coating as indicated is mounted above and in operative relation to the upper take-off cylinders 12 to 14, and another endless conveyor belt 16 also provided with a suitably angled scraper coating is mounted below and in operative relationship with the lower take-off cylinders 9 to 11.

Rotatably mounted behind the cylinders 11 and 14, respectively, and in operative relationship with the conveyor belts 16 and 15 are two transfer cylinders 17 and 19 each coated with suitably angled scraper elements, the cylinder 17 cooperating with a similarly constructed transfer cylinder 18 which in turn cooperates with a delivery cylinder 20, while the cylinder 19 cooperates directly with the delivery cylinder 20.

Thus, the take-off cylinders 9 to 14, the conveyor belts 15 and 16, the transfer cylinders 17, 18 and 19, and the delivery cylinder 20 together constitute transporting means which effect transfer of the thin layers of fibers shaved or skimmed off the staple fiber sections away from the shaver cylinders 3 to 8. Moreover, as is readily seen from Fig. 1, the path of travel of the lower ones of these thin fiber layers along the part 9—10—11—16—17—18 of the transporting means to the delivery cylinder 20 is longer than the path of travel of the upper thin fiber layers along the part 12—13—14—16—19 of the transporting means to the same delivery cylinder 20. The purpose of this difference in the lengths of the paths of travel of the upper and lower thin fiber layers will be more fully explained hereinafter.

Situated behind the delivery cylinder 20 is a cylinder 21, hereinafter referred to as a "joining cylinder" or "combining cylinder." The cylinder 21 is provided with an outer covering of bristles or like elements and is positioned for receiving the thin fiber layers from the transporting means 9 to 20. The lengths of the respective paths of travel of the upper and lower thin fiber layers are so predetermined with respect to one another that any upper and lower layers shaved at the same time from a particular one of the staple fiber sections arrive at different times at the delivery cylinder 20. Thus, although these thin layers were in spatial coincidence with one another when shaved off the said staple fiber section, upon reaching the delivery cylinder 20 they are longitudinally displaced relative to one another and are picked up by the cylinder 20 in timed sequence and so transferred to the joining cylinder 21. The arrangement of the transporting means preferably is such that alternately an upper layer and a lower layer are picked up by the delivery cylinder 20, and the various layers received by the cylinder 21 substantially in end to end relationship are joined or combined into the form of a continuous fiber fleece of properly oriented fiber structure and uniform physical characteristics.

A bed of needles 22 movable (as shown by the arrows) along an endless path having upper and lower reaches is positioned behind the joining cylinder 21 in such a manner that the needles being shifted from the lower reach to the upper reach of this path serve to remove from the adjacent part of the joining cylinder 21 that portion of the fiber fleece carried thereby. Thus, the needles 22 function in a manner analogous to the hackles of a hackling machine.

Adjacent the delivery end of the needle bed 22 is disposed a distorting mechanism comprising a pair of cylinders 22*a* and 22*b* over one of which runs a leather belt 22*c* maintained at the proper tension by a roller or cylinder 22*d*. The fiber fleece removed from the joining cylinder 21 by the needles 22 is delivered to and passes between the cylinders 22*a* and 22*b* where it is transformed into a band or tape ready for passage through a rotary funnel 22*e* to a suitable spool winding mechanism 22*f*. Alternatively, the formed tape or band may be deposited in a spinning can.

Referring now to Figs. 2 to 6, in the embodiment of the invention there illustrated the lower shaver cylinders 3 to 8 are replaced by a traveling needle field consisting of a plurality of erect or inclined needles 43 carried by transverse supporting members 44 extending between and supported by the opposite links 39*a* and 39*b* of a double endless sprocket chain 39 disposed below the upper shaver cylinders and moved in the direction of the arrow through the intermediary of sprocket wheel means 39*c* and 39*d*, one of which may be an idler wheel while the other is connected to suitable drive means (not shown). As may be most clearly seen in Figs. 3, 4 and 6, each supporting member 44 carries three rows of needles 43, while each set of links 39*a* and 39*b* supports two of said supporting members. Each of the links 39*a* and 39*b*, moreover, is provided at one side, i.e., the side remote from the transverse supporting members 44, with a parallel-sided recess 39*e*. A plurality of carrier plates 40 are mounted over the needle field 44, each plate 40 having two ends 40*a* and 40*b* of reduced width slidably extending through the recesses 39*e* of the links 39*a* and 39*b*, and each plate further being provided with six longitudinal slots or perforations 40*c* through which the respective rows of needles 43 project. The lengths of the slots 40*c* depend, of course, on the lengths of the needle rows, while the number of slots or other types of perforations and thus the widths of the plates depend on the number and distribution of the needle rows at each chain link. Each link 39*a* carries two axially displaceable pins 45 each biased by means of a spring 46 in the direction of the opposite link 39*b* and constructed at one end to be received in a corresponding recess (not shown) provided in one end of the associated supporting member 44, whereby the latter may be removed from the chain 39 by retraction of the respective pins 45. Positioned adjacent the opposite sides of the upper reach of the chain 39 are two frame members 47 (only one being shown) each including a lower horizontal guide ledge 48 and an upper guide ledge 49 slightly inclined upwardly to the horizontal as seen in the direction of chain movement, the ledges 48 providing a slide path for the outermost ends of the pins supporting the members 44, and the ledges 49 providing a slide path for the ends 40*a* and 40*b* of the carrier plates 40. The upper ledges 49 may be adjusted on the frame members 47 through the intermediary of nut and bolt means 47*b* extending through slots 47*a* and 49*a* (see Fig. 4). Adjacent the opposite sides of the lower reach of the chain 39 are disposed two frame members 50 (only one being shown) each including an upper horizontal guide ledge 51 and a lower guide ledge 52 providing respective slide paths for the pins 45 and the carrier plates 44 during movement of the chain along the lower part of its path, the ledges 52 thus preventing the plates 40 from falling out of the apparatus.

The initial part of the apparatus according to this embodiment of the invention is otherwise substantially the same as that of Fig. 1, including a cutting device 1' which, though depicted only diagrammatically, may be substantially identical with the device 1, a conveyor belt 2, and shaver cylinders 3 to 8 arranged above the needle-carrying chain 39. As may be seen from Fig. 2, however, the cylinders 3 to 6 constitute one group of four shaver cylinders, while a second group of shaver cylinders is constituted by the cylinders 7 and 8 in conjunction with additional cylinders 23 and 24. Journaled above the shaver cylinders 3 to 6 are take-off cylinders 12', 13', 14', 25 and 26, while take-off cylinders 27, 28, 29, 30 and 31 are journaled above the shaver cylinders 7, 8, 23 and 24. All of these cylinders are, of course, coated with suitable scraper means as set forth with respect to the various cylinders in the embodiment of Fig. 1. Further, in advance of the first shaver cylinder 3 is disposed a tamping device 41 including a tamper plate or foot 41*a* extending substantially across the entire space between the chain links 39*a* and 39*b* and driven by a pair of cranks 41*b* (only one of which is shown) interconnected by a drive rod 41*c* for vertical reciprocal movement under the influence of a pair of guides 41*d* (only one being shown) slidably accommodating the opposite sides of the plate 41*a*.

Rotatably arranged above the take-off cylinders 12' and 27, respectively, are tambours or carding cylinders 32 and 34, while above these are journaled doffing cylinders 33 and 35, respectively. A further carding cylinder or tambour 38 is disposed rearwardly of the cylinder 34 in cooperating relationship with a final doffing cylinder 21' which is followed by a traveling needle field 22 and band-forming means 22*a* to 22*f* in the same manner as disclosed with respect to Fig. 1. Transfer cylinders 36 and 37 are located in operative relationship between the cylinders 33—34 and 35—38, respectively. The cylinders 35 and 38 thus assume the position of the delivery roller 20, while the cylinder 21' assumes the position of the joining cylinder 21.

In operation, the cut staple fiber sections coming from the cutting device 1 via the conveyor belt 2 are sequentially tamped or pressed onto the needle field 43 at the upper surfaces of the carrier plates 40 by the tamper device 41 so as to move with the chain 39. As the chain moves in the direction of the arrow shown in Fig. 2, under the action of the drive means connected, for example, to sprocket wheel 39*c*, the ends 40*a* and 40*b* of the carrier plates ride along the guide ledges 49 and, due to the upward inclination of the latter, the carrier plates are brought gradually closer and closer to the shaver cylinders 3 to 8, 23 and 24 to thereby gradually narrow the passageway defined between these cylinders and the carrier plate surfaces. The spacing between the shaver cylinders and the carrier plates is, as in the case of the upper and lower shaver cylinders of Fig. 1, so adjusted and determined as a function of the initial thickness of the staple fiber sections that the carrier plates 40 press the sections against the scraper means of the cylinders 3 to 8, 23 and 24 and enable the latter to remove one thin layer of fibers after another from the various staple fiber sections until at the cylinder 24 the sections are practically completely disintegrated. Moreover, the shaver cylinders are so spaced from each other within each group in conjunction with an appropriate spacing of the cylinders 6 and 7, i.e., one section length or integral multiple thereof apart, that all the shaver cylinders remove a fiber layer from the particular section located therebelow at one and the same time.

The frequency with which the staple fiber sections follow one another on the carrier plates 40 is determined by the speed of movement of the chain 39 which in turn determines the shaving period, i.e., the period of time required for each fiber section to pass beneath any one shaver cylinder. This frequency or shaving period is so predetermined that the individual fiber layers removed from the first group of shaver cylinders 3 to 6 are transported by the take-off cylinders 12' to 26 to the first tambour or carding cylinder 32 so as to be deposited on the latter in longitudinally spaced relationship, and that the individual fiber layers removed from the second group of shaver cylinders 7 to 24 are transported by the take-off cylinders 27 to 31 to the second tambour or carding cylinder 34 so as to be deposited on the latter in longitudinally spaced relationship. The doffing cylinder 33 receives the first set of thin fiber layers from the cylinder 32 in the same relationship and deposits them on the transfer cylinder 36 which is so constructed as to deposit the fiber layers taken from the cylinder 33 sequentially and individually into the spaces remaining between the second set of fiber layers on the carding cylinder 34. Thus, the continuous fiber fleece is initially formed on the cylinder 34 by alternating fiber layers from the first and second sets thereof, the density of the fleece being determined by the rate at which the fiber layers on the cylinder 34 follow one another and by the rate at which

the fiber layers from the cylinder 33 are transferred onto the cylinder 34. These rates will, of course, depend on the respective lengths of the two paths of travel defined, respectively, by the part 12'—13'—14'—25—26—32—33—36 of the transporting means from the first group of shaver cylinders and by the part 27—28—29—30—31 of the transporting means from the second group of shaver cylinders.

From the cylinder 34 the joined fiber layers are transferred by the doffing cylinder 35 and the transfer cylinder 37 to the carding cylinder or tambour 38, and from the latter to the joining cylinder 21. The fleece is then removed from the cylinder 21 by the traveling needle bed 22 with the individual fiber layers in overlapping and longitudinally staggered relationship as described hereinabove with respect to Fig. 1 and transformed into a wound band or tape by the means 22 to 22*f*. The cylinders 32, 34 and 38 are coated with scraper means or the like which may be in the form of needles so arranged that the fibers lie on these cylinders when being transported thereby, while the cylinders 33, 35 and 21' are coated with needles or like scraper means so arranged that the fibers stand thereon when being transported thereby.

By way of résumé, therefore, it will be seen that the process according to the present invention basically is characterized by the steps of cutting a flat, spun synthetic cable into a plurality of staple fiber sections, shaving successively from each of said sections a plurality of thin layers of fibers until each section is substantially completely disintegrated, continuously transporting said layers in at least two groups, and one after another within each group, over travel paths of different lengths to a common location, and uniting or joining the layers of the various groups substantially in end to end relation and with the fibers in oriented condition so as to form a continuous fiber fleece.

Concurrently, the apparatus according to the invention is characterized by the provision of shaver means serially arranged adjacent a path of movement for the staple fiber sections in such a manner that each shaver means is located in slightly greater proximity to the path of movement than the next preceding shaver means. All of the shaver means are provided with scraper means to shave thin layers of fibers from the staple fiber sections contacting the said scraper means while being moved along said path, and transporting means are provided to transfer the thin layers of fibers in at least two groups over respective travel paths of different lengths from the shaver means to suitable joining means arranged at the common terminus or intersection of said travel paths for forming the desired fiber fleece.

While we have described preferred embodiments of our invention, it is to be understood that this disclosure is for the purpose of illustration only, and that various omissions and changes in shape, proportion and arrangement of the parts, as well as the substitution of equivalent elements for the arrangements shown and described may be made without departing from the scope of the invention as set forth in the appended claims.

We claim:

1. In the process of making a deformable fibrous band, tape and like article; the steps of cutting a flat, spun synthetic cable into a plurality of staple fiber sections, shaving successively from each of said sections at at least one of the flat wide surfaces thereof a plurality of thin layers of fibers until each section is substantially disintegrated, continuously transporting said layers in at least two groups, and one after another within each group, over paths of different lengths to a common location, and uniting said layers of said groups

at said common location with said fibers in uniformly oriented condition to form a fiber fleece.

2. In the process of making a deformable fibrous band, tape and like article; the steps of cutting a flat, spun synthetic cable into a plurality of staple fiber sections, passing said sections successively along a passageway narrowing gradually in the direction of movement of said sections, shaving successively from at least one of the flat wide surfaces of each of said sections as the same move along said passageway a plurality of thin layers of fibers until each section is substantially disintegrated, continuously transporting said shaved-off layers in at least two groups, and one after another within each group, over paths of different lengths to a common location, and uniting said layers of said groups in alternating sequence at said common location with said fibers disposed in oriented condition to form a fiber fleece.

3. In the process of making a deformable fibrous band, tape and like article; the steps of cutting a flat, spun synthetic cable while under longitudinal tension into a plurality of staple fiber sections of predetermined length, passing said sections successively along a passageway of gradually increasing narrowness as viewed in the direction of movement of said sections, shaving successively from the opposite, flat and wide surfaces of each of said sections at a plurality of shaving locations arranged serially along and on opposite sides of said passageway respective groups of thin layers of fibers until each section is substantially disintegrated, continuously transporting the layers of one of said groups in timed sequence over a first path of predetermined length to a joining location, simultaneously transporting the layers of the other group in timed sequence over a second path of different length than said first path to said joining location, and uniting said layers of said two groups in alternating sequence with said fibers disposed in oriented condition to form a fiber fleece.

4. In the process of making a deformable fibrous band, tape and like article; the steps of cutting a flat, spun synthetic cable while under longitudinal tension into a plurality of staple fiber sections of predetermined length, gripping each of said sections and one after another at one of the flat, wide surfaces thereof, moving said sections sequentially and while so gripped past two groups of serially arranged shaving locations and along a path the spacing of which from said shaving locations decreases gradually from one shaving location to the next, shaving successively at the respective shaving locations and from the opposite flat, wide surface of each of said sections a plurality of thin layers of fibers until each section is substantially disintegrated, continuously transporting said layers shaved from said sections at the first of said groups of shaving locations in longitudinally spaced condition over a path of predetermined length to a joining location continuously transporting said layers shaved from said sections at the second of said groups of shaving locations in longitudinally spaced condition over another path of different length to said joining location, and uniting said layers shaved from said sections at both said groups of shaving locations in alternating sequence with said fibers disposed in oriented condition to form a fiber fleece.

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