United States Patent [19]

Hoffman et al.

[11] **3,729,777**

[45] **May 1, 1973**

[54] **SYSTEM FOR OPENING CRIMPED MULTIFILAMENT BANDS**

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[73] Assignee: **Wellman, Inc.**, Boston, Mass.

[22] Filed: **May 21, 1971**

[21] Appl. No.: **145,794**

[52] **U.S. Cl.** ..... **19/65 T**

[51] **Int. Cl.** **D01d 11/02**

[58] **Field of Search** ..... 19/65 R, 66 T; 242/149, 152.1, 153; 28/1 R, 1 CS

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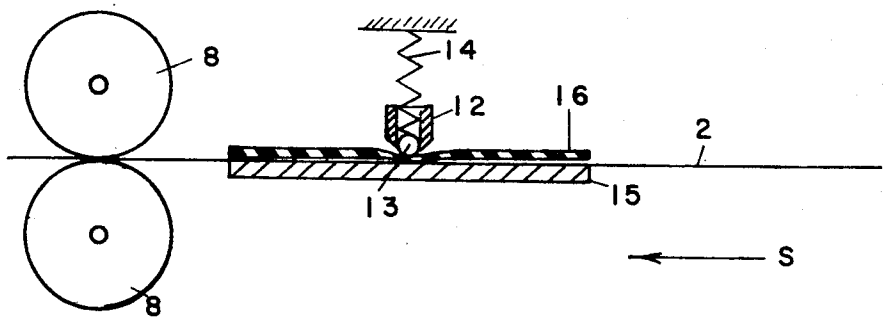
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Primary Examiner—Dorsey Newton
Attorney—Erwin Salzer

[57] **ABSTRACT**

A system for opening an initially compact crimped multifilament tow includes a plurality of units arranged in tandem and performing different functions. One or more of the units are primarily intended to deregister the crimped portions of the tow, or band, by imparting a braking action on the latter at ever changing laterally spaced points. The deregistration unit of the system includes an elastomeric blanket resting on a solid support and compressed at a plurality of laterally spaced points by a plurality of roller bodies (balls or rollers) supported by a common carriage movable transversely to the band to be deregistered. The band is sandwiched between the blanket and support, and drawn by means of tension rolls, through the gap formed between the blanket and the support. The system further includes a band spreading unit for imparting the desired ultimate width to the deregistered band. The spreading action in this unit is effected by supporting the band upon a bed formed by extension springs whose length is progressively increased in the direction of the travel of the band. This, in turn, is achieved by supporting the extension springs by a pair of diverging conveyer belts.

10 Claims, 16 Drawing Figures



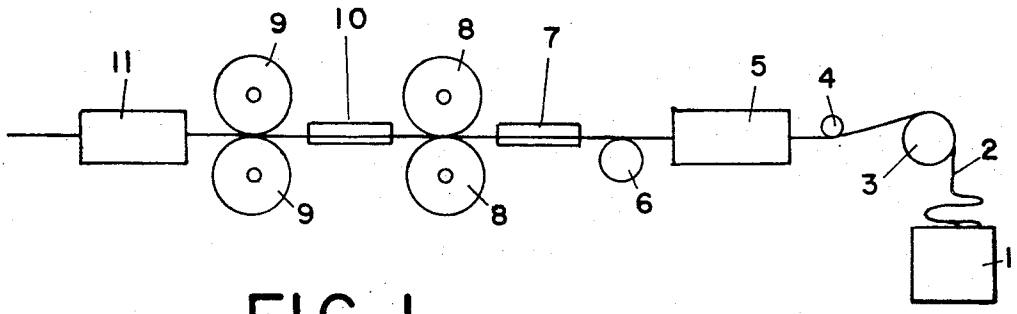


FIG. 1

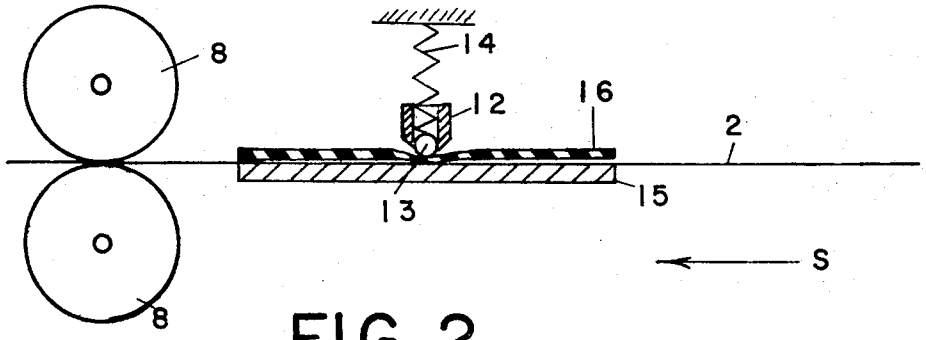


FIG. 2

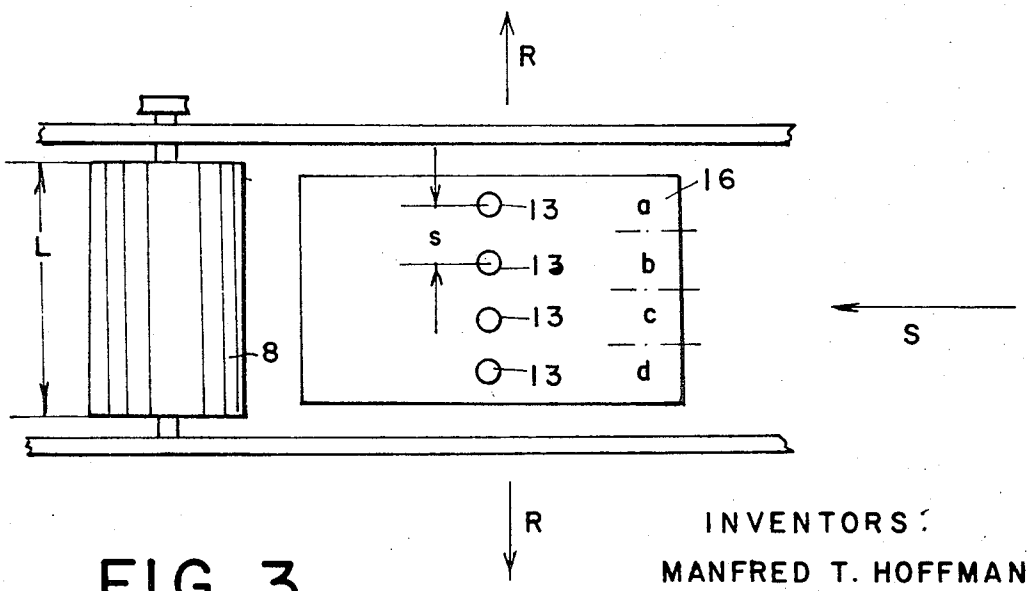


FIG. 3

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FIG. 4

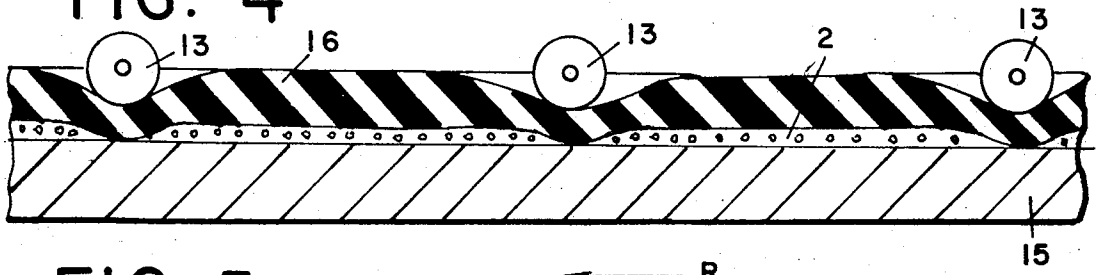


FIG. 5

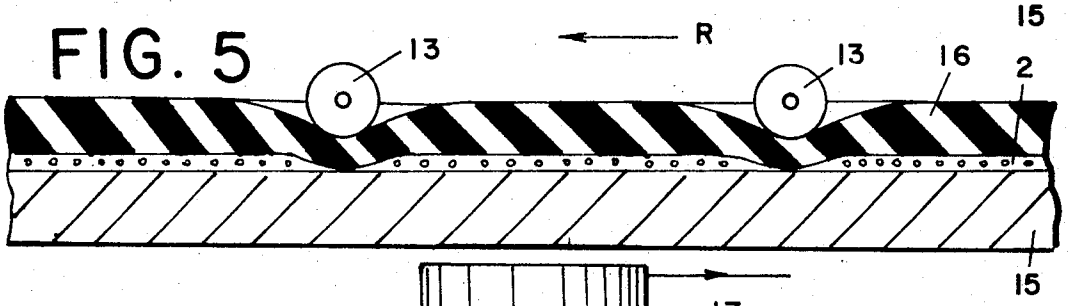


FIG. 6

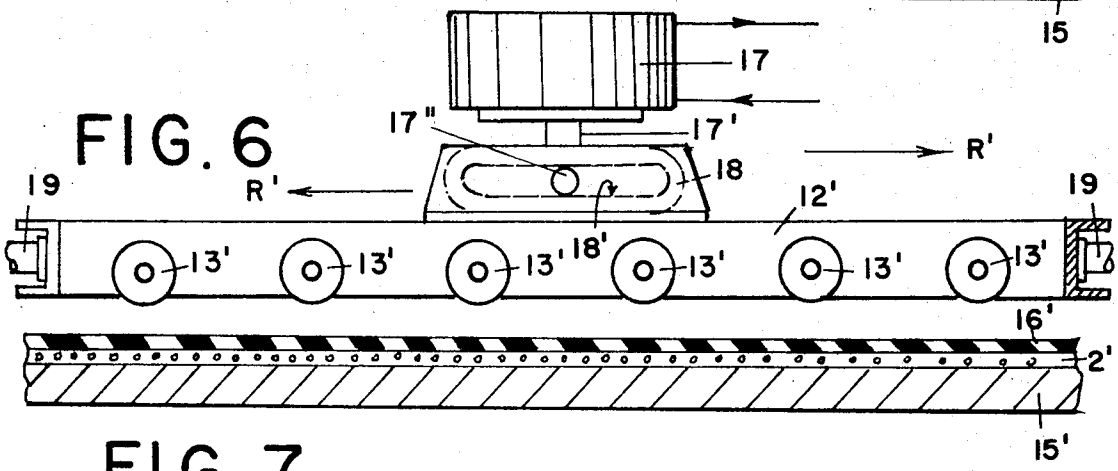
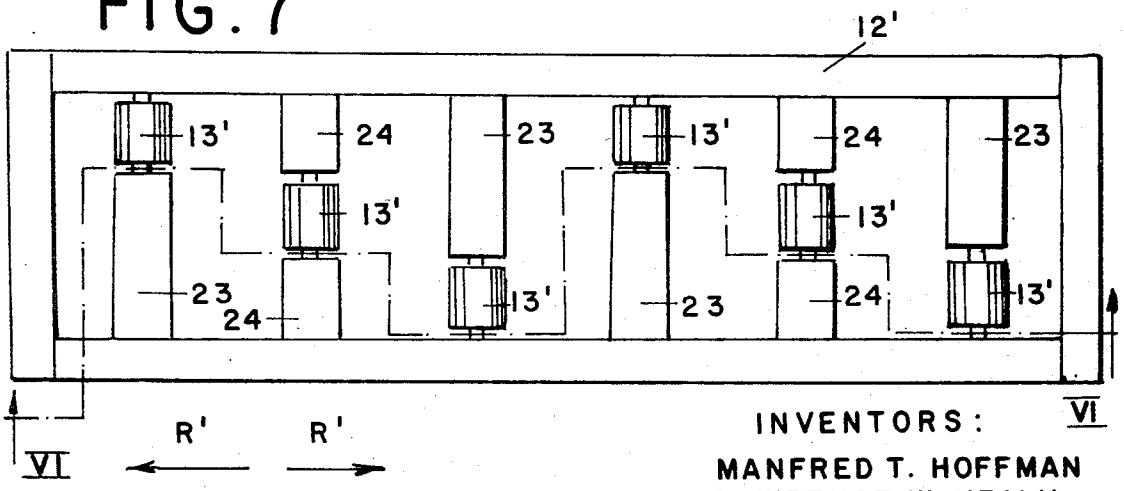


FIG. 7



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FIG. 8

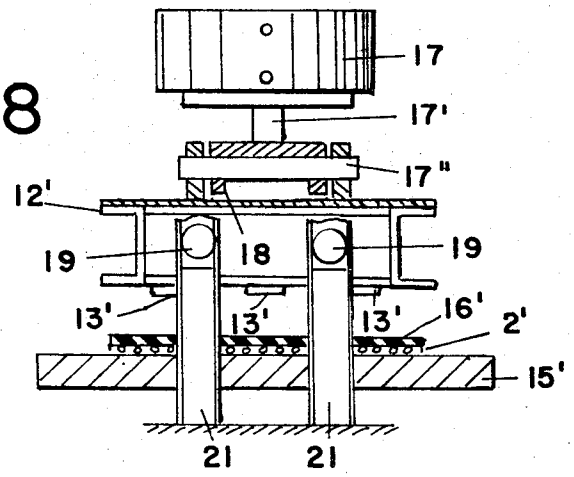


FIG. 9

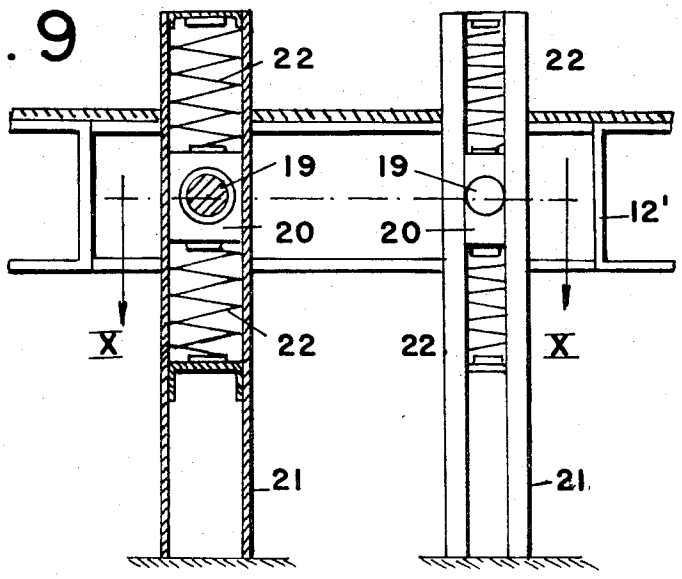
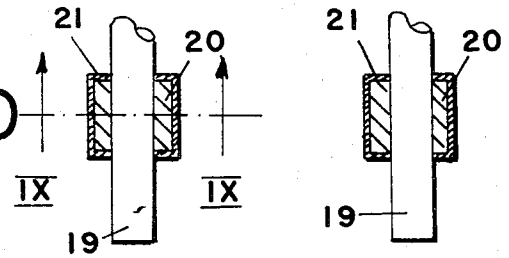


FIG. 10



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FIG. 11

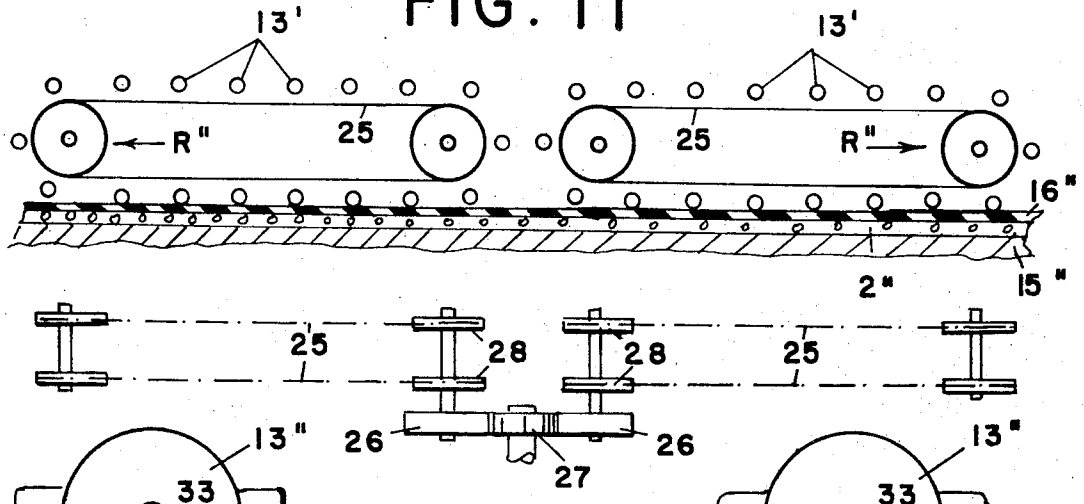


FIG. 12

FIG. 13

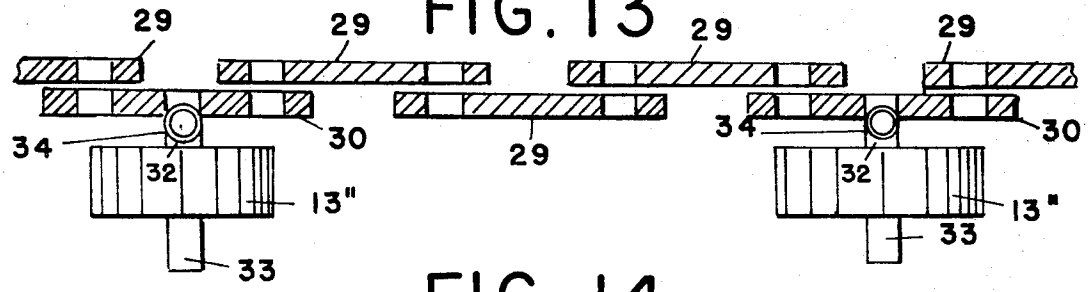


FIG. 14

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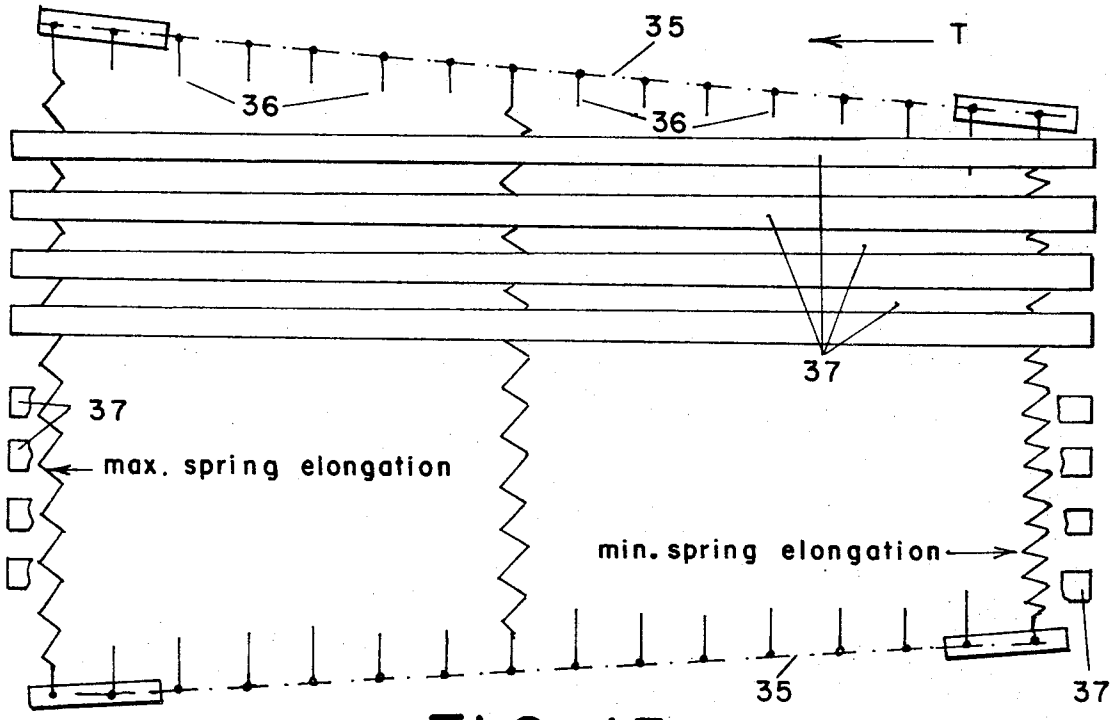


FIG. 15

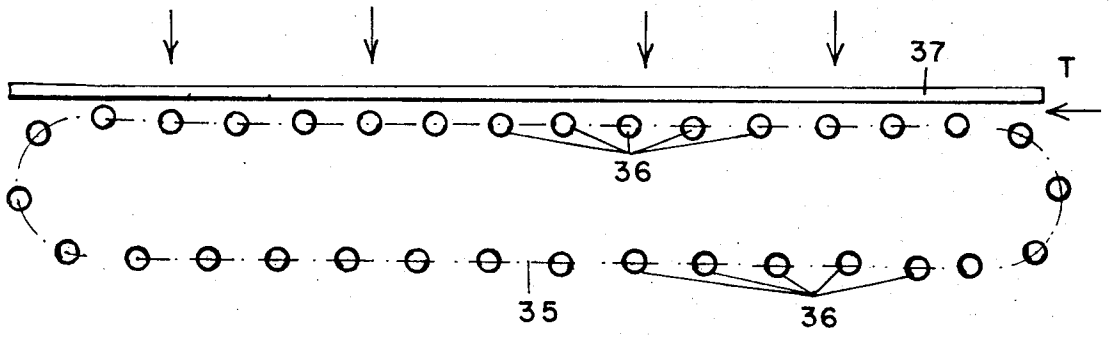


FIG. 16

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SYSTEM FOR OPENING CRIMPED MULTIFILAMENT BANDS

BACKGROUND OF THE INVENTION

There are a number of prior art methods, and prior art systems, for deregistering a crimped tow, or a band, formed by substantially parallel crimped fibers, and for spreading such bands of fibers to progressively increase the width thereof. These methods and systems are subject to certain limitations, and it is the primary object of this invention to provide a novel system for performing the above functions which system is not subject to the limitations of prior art systems of the kind under consideration.

The most widely adopted systems for deregistering and spreading a tow consisting of crimped fibers, or a band of such fibers, include fluted rolls which grip the fibrous bands whose constituent fibers are to be deregistered and to be spread out laterally at discrete, laterally spaced points. Fluted rolls are relatively expensive, and this is one of the reasons why it is desirable to substitute less expensive mechanisms for fluted rolls.

The action of deregistration systems predicated on fluted rolls depends primarily upon the geometry of the fluted rolls. Since their geometry is fixed and cannot be changed, it is impossible to vary to a significant extent fiber deregistration and fiber spreading systems involving fluted rolls.

Fluted roll deregistration systems sub-divide the bands to be processed into zones where a maximum pressure prevails and into zones where a minimum pressure prevails. There is no gradual change of deregistration pressure between maximum pressure and minimum pressure. In some instances it is, however, desirable to establish pressure gradients, or zones of intermediate pressure, between points where the deregistration pressure is highest and points where virtually no pressure at all is exerted upon the fibrous bands to be processed.

Some experimentation has been done with systems including roller bodies — i.e., either rollers or spheres or balls — moved transversely to the direction of feed, or of advancement, of the fibrous bands to be deregistered and widened. Some of these systems are impractical because of the great length of the stroke and the large velocity of the movement of the roller bodies which they require, and others of these systems are impractical because the roller bodies tend to damage the tow, or band of fibers, and tend to get entangled by fibers drawn out of the tow or band of fibers. These dangers are particularly large if the size of the roller bodies is relatively small.

This invention relates to a deregistration and spreading system involving roller bodies which are moved transversely to the direction of movement or the direction of feed of the bands to be processed and which system is not subject to the above limitations and drawbacks of prior art systems.

SUMMARY OF THE INVENTION

A system embodying this invention includes means for advancing bands of substantially parallel fibers in a direction longitudinally of the bands. It includes further a carriage carrying roller bodies. The carriage extends transversely to the aforementioned direction and supports a plurality of roller bodies having a predetermined spacing transversely to said direction. The carriage is acted on by drive means moving the same transversely to the aforementioned direction. The system further includes means arranged below the roller body carriage defining a narrow passageway for the bands of fibers. The passageway-defining means include a solid band-supporting plate and a flexible band-covering blanket arranged to rest upon the upper surface of the bands of fibers and to exert a relatively slight pressure on said upper surface. The band covering blanket is engaged under pressure by the aforementioned plurality of roller bodies and subjected to relatively high pressures at a plurality of spaced continuously changing points thereof as said roller body carriage moves under the action of said drive means.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic representation of a system embodying this invention and including two deregistration stations;

FIG. 2 is a diagrammatic side elevation of one of the two deregistration stations of FIG. 1;

FIG. 3 is a diagrammatic top plan view of the structure of FIG. 2;

FIG. 4 is a cross-section of the deregistration means of FIGS. 2 and 3 drawn on a much larger scale than FIGS. 2 and 3;

FIG. 5 shows a cross-section the same structure as FIG. 4 following a predetermined displacement of the roller body carriage;

FIG. 6 is a section along VI—VI of FIG. 7 and shows another deregistration device embodying the present invention;

FIG. 7 is a top-plan view of the roller body carriage of the structure of FIG. 6;

FIG. 8 is a side elevation of the structure of FIG. 6;

FIG. 9 shows a detail of FIG. 8 on a larger scale, the right portion of FIG. 9 being a front view and the left portion of FIG. 9 being a section along IX—IX of FIG. 10;

FIG. 10 is a section along X—X of FIG. 9;

FIG. 11 is a diagrammatic side elevation of an embodiment of the invention involving a pair of revolving endless conveyers;

FIG. 12 is a diagrammatic top-plan view of the structure of FIG. 11;

FIG. 13 is a side elevation of several links of a chain conveyer which may be used in connection with the structure of FIGS. 11 and 12;

FIG. 14 is a section along XIV—XIV of FIG. 13;

FIG. 15 is a diagrammatic top plan view of a band spreading unit forming part of the system according to this invention; and

FIG. 16 is a diagrammatic side elevation of the structure of FIG. 15.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to FIG. 1 of the drawings, numeral 1 has been applied to indicate a bale from which tow band 2 is drawn. Tow band 2 is supported by horizontal guide rods 3 and 4, and then enters banding jet 5. There tow band 2 is subjected to the action of streams of air which flatten the band 2 and increase its width. The band 2 leaving banding jet 5 is supported by a roll 6 before entering the first deregistering device 7. Band 2 is

drawn through deregistering device 7 by a pair of power driven smooth surfaced rolls 8. The smooth surfaced rolls 9 draw band 2 through a second deregistering device or deregistering station 10 which is substantially of the same nature as deregistering device or deregistering station 7, to be described below in detail. The last stage of the system is formed by a second banding jet 11, or other band spreading device.

It will be understood that the rolls 8 are means for advancing bands 2 of substantially parallel fibers in a direction longitudinally of said bands.

In FIG. 2 reference numeral 12 has been applied to indicate a carriage carrying roller bodies 13. The term roller bodies as used in this context is a generic term encompassing balls or spheres similar to those used in roller bearings, and also encompassing rollers similar to those used in roller bearings. In FIG. 3 the carriage 12 has been deleted. This figure shows merely the roller bodies or steel balls 13 per se which are actually supported by a carriage 12. The former are spring loaded as indicated at 14 in FIG. 2. The arrows R in FIG. 3 indicate diagrammatically drive means, e.g., a crank mechanism not shown, for moving carriage 12 transversely to the direction in which the band 2 is moved by rolls 8 and in which the constituent fibers thereof are mainly oriented. This direction has been indicated in FIG. 3 by the arrow S. Passageway defining means below carriage 12 define a narrow passageway for bands 2. These means include the solid band-supporting plate 15 which is preferably of stainless steel. A flexible band-covering blanket 16 is arranged to rest upon the upper surface of fibrous bands 2 which are drawn by rolls 8 through the gap or passageway formed between parts 15 and 16. The band-covering blanket 16 is preferably formed by a sheet of an elastomer, e.g., vulcanized rubber. Blanket 16 exerts a relatively slight pressure on the upper surface of band 2, substantially equal to the weight of blanket 16. Blanket 16 is held in position by appropriate means (not shown), e.g., by fasteners securing some of its points to plate 15. Blanket 16 is engaged under pressure by spring-loaded roller bodies 13, and subjected to relatively high pressures at a plurality of laterally spaced points thereof which change continuously as roller bodies 13 are oscillated by carriage 12 in the direction of arrows R.

FIG. 4 shows the fibrous band 2 sandwiched between plate 15 and elastomeric blanket 16. The roller bodies, or rollers, 13 compress blanket 16 at the points where they are initially positioned. Rollers 13 are moved by their supporting carriage (not shown in FIGS. 4 and 5) from right to left, as seen in FIGS. 4 and 5. As rollers 13 move in the direction of arrow R from the position shown in FIG. 4 to the position shown in FIG. 5, pressure waves are established in blanket 16 which travel in the direction of arrow R. There is a pressure peak at the points where rollers 13 compress blanket 16, and the pressure declines as rollers 13 leave the particular point in their travel from right to left. The constituent fibers of band 2 are selectively gripped, and substantially immobilized, at the varying points where the compression of blanket 16 by rollers 13 is largest, and the width of the gap between plate 15 and blanket 16 reduced to a minimum which is virtually zero. This selective gripping action results in deregistration of the crimps in band 2. The deregistration is continuous rather than limited to specific zones as in systems where deregistration is effected by grooved or fluted rolls.

Referring again to FIGS. 2 and 3, the letter L has been applied to indicate the length of the power driven rolls 8. The nip of rolls 8 is arranged immediately adjacent the exit end of the passageway for band 2 formed by plate 15 and blanket 16. The letter *s* has been applied to indicate the spacing between the centers of roller bodies 13. It is apparent from FIG. 3 that the spacing *s* is substantially less than the length L of rolls 8, or the width of the band to be deregistered, which width is slightly less than the length of rolls 8. As a result, the amplitudes of the roller bodies 13 required to deregister band 2 need to be but a fraction of the total width of band 2. This tends to greatly simplify the drive means for moving carriage 12 and roller bodies 13 in the direction of the arrows R. It further tends to allow to move band 2 by rolls 8 at relatively high velocities in the direction of the arrow 5 while moving parts 12,13 at relatively moderate velocities in the directions of the arrows R. As indicated in FIG. 3, the entire width of blanket 16 and of band 2 covered by blanket 16 may be subdivided into several zones *a,b,c,d* which have the same width. The amplitudes of roller bodies 13, i.e., their farthest spacings or travel from the center positions thereof shown in FIG. 3 is one half of the spacing *s*, or one half of the width of any of the four zones *a,b,c,d*.

Referring now to FIGS. 6–10, the carriage 12′ is supported by a hydraulic lifting device 17 allowing to selectively lift and lower carriage 12′, as desired. FIG. 6 shows carriage 12′ in the raised position thereof, its rollers 13′ being raised above the levels of elastomeric blanket 16′, fibrous band 2′ and solid support 15′. In the lowered position of carriage 12′ rollers 13′ engage under pressure the upper surface of elastomeric blanket 16′ and compress the latter at discrete laterally spaced points. The operation of the structure calls for a freedom to oscillate in the direction of the arrows R′. To this end the lift rod 17′ of the hydraulic lifting device 17 supports a pair of vertical plates 18 of which each is provided with an oblong slot 18′. Pin 17″ supported on the upper surface of carriage 12′ projects through the oblong slots 18′ in plates 18. Carriage 12′ is provided with shafts 19 which extend in the direction of the arrows R′. Shafts 19 are supported in bearings 20 vertically guided by uprights 21. Bearings 20 are arranged between a pair of compression springs 22 tending to maintain carriage 12′ in such a floating position that roller bodies 13′ are out of engagement with elastomeric blanket 16′ (FIGS. 6 and 8.). Engagement under pressure between rollers 13′ and elastomeric blanket 16′ is effected by lowering carriage 12′ by means of hydraulic lifting device 17. The pressure between parts 13′ and 16′ can readily be adjusted to the exact pressure level required for any particular application of the system. Shafts 19 are free to follow the up and down movements of carriage 12′ and transmit these movements to bearings 20, capable of following these movements since they are suspended between helical compression springs 22. When carriage 12′ is oscillated, or reciprocated, in the direction of arrows R′ of FIG. 6 by appropriate drive means (not shown), shafts 19 move back and forth inside of stationary bearings 20 and pin 17″ moves back and forth inside of the slots 18′ of slotted plates 18.

For reasons of clarity the spacing between rollers 13' and elastomeric blanket 2' has been greatly exaggerated in FIG. 6. The maximum spacing between these parts in the raised position of carriage 12' and rollers 13' need to be but very small, or but a small fraction of an inch.

Referring now more particularly to FIG. 7, it will be apparent that each of the rollers 13' is rotatably supported by brackets 23 and 24, respectively, brackets 24 being shorter than brackets 23. It is apparent from FIG. 7 that rollers 13' are arranged in staggered relation, and displaced in the direction of the feed or movement of the band 2' whose crimped fibers are intended to be deregistered. The staggered arrangement of rollers 13' as shown in FIG. 7 is conducive to a more complete deregistration of crimps since it increases the randomness at which points of the bands to be deregistered are gripped differentially. For most applications the randomness at which points of the band to be deregistered are gripped differentially is ample in the arrangement of FIGS. 1 and 2 , which is particularly desirable because of its great simplicity.

When deregistering a crimped tow, or band, its width is increased concomitently with its deregistration. In some instances it is necessary or desirable to provide means for increasing the degree of spreading, or widening, of a band concomitant with the deregistration of its crimped fibers. Structures having such performance characteristics are shown diagrammatically in FIGS. 11 and 12 and essential details thereof are shown on a larger scale in FIGS. 13 and 14.

In FIGS. 11 and 12 reference character 25 has been applied to indicate a pair of endless belt-type or chain-type conveyers each forming a carriage for supporting a plurality of roller bodies 13''. Conveyors 25 are arranged above solid support plate 15'' and above the elastomeric blanket 16'' which sandwich the band 2'' of crimped fibers intended to be deregistered and spread out, or laterally widened. Support 15'' and blanket 16'' define a passageway therebetween which is at right angles to the plane of FIG. 11. Fibrous band 2'' is drawn through this passageway by transport rolls similar to the smooth transport rolls 8 of FIGS. 2 and 3. A number of roller bodies 13 engages the elastomeric blanket 16'' under pressure, and thus causes selective gripping of fibers, or imparting a selectively deregistering braking action upon fibers, at a plurality of laterally spaced, ever changing points. Conveyers 25 revolve in opposite directions indicated by arrows R''. This has a tendency to significantly increase the width of fibrous band 2''.

As shown in FIG. 12 each conveyer belt is driven by one of a pair of spur gears 26 which are both engaged by a pinion 27. This causes rotation of sprocket gears 28 for chain conveyers 25 in opposite directions.

Conveyers 25 may be formed by link chains. This has been shown in FIGS. 13 and 14. The link chain of FIG. 12 includes normal chain links 29, and roller-body-supporting chain links 30. Each chain link 30 is provided with a slot 31. A portion of the metal removed from chain links 30 in forming slots 31 is bent 90° out of the planes of chain links 30, and forms small platforms 32 projecting at right angles from chain links 30. Pins 33 supporting roller bodies 13'' are slidably arranged inside of slots 31. A helical compression spring 34 is interposed between each platform 32 and each roller-supporting pin 33, as diagrammatically shown in FIG. 12.

In the interest of greater simplicity and clarity the pins for connecting chain links 29 and 30 have been deleted in FIGS. 13 and 14. For the same reasons FIG. 14 shows but one of a pair of chains formed by links 29,30 for supporting roller bodies 13''.

The deregistration devices 7 and 10 of FIG. 1 are both constructed in accordance with the principles explained in connection with FIGS. 2–14. Since the crimped tow or band 2 of FIG. 1 is wider after having passed upstream deregistration device 7, the downstream deregistration device must be adapted to receive a wider band 2. In the downstream deregistration device 10 the number of roller bodies ought to be larger than in the upstream deregistration device. Preferably the number of roller bodies is larger per unit of width in the downstream deregistration device 10 than in the upstream deregistration device 7. The length L of tension rolls 9 is larger than the length L of tension rolls 8.

The width of band 2 upon leaving transport or tension rolls 9 is, or may be, less than its required final width. The final width is imparted to band 2 by air streams in the downstream banding jet 11.

In some instances it may be desirable to impart the final width to band 2 by means other than air jets. FIGS. 15 and 16 refer to a mechanical band spreader which may take the place of downstream banding jet 11.

The structure of FIGS. 15 and 16 includes a pair of endless conveyors 35 which diverge in the direction S of the travel of a band intended to be spread out to its ultimate width. Conveyors 35 are caused to revolve by drive means (not shown) as indicated by arrow T in FIG. 16. Conveyors 35 are interconnected by helical springs the ends of which are attached to conveyors 35. Springs 36 are progressively extended as they travel from right to left, as seen in FIGS. 15 and 16, or from the intake end to the outlet end of the band spreader The upper surface of the band spreader of FIGS. 15 and 16 is covered by a plurality of spaced control ribbons 37 pressing the band to be spread slightly against the revolving and progressively widening bed formed by springs 36. Since the proportions of FIGS. 15 and 16 are very different from those of any actual structure, some numerical data will be given below to supplement the information given in connection with FIGS. 15 and 16.

In a band spreader according to FIGS. 15 and 16 which was used commercially for opening or spreading tow, helical coils were used having a length of 42 inches in non-stretched condition and 14 turns per inch. The spacing of the conveyors 35 at the relatively narrow upstream end of the spreading device was 52½ inches. When stretched to approximately that length the springs 36 had about 9½ turns per inch. The length of the helical springs 36 increased when travelling in the direction of arrow T. The maximum travel was 54 inches and resulted in an increase of the length of springs 36 of about 18 percent. It is this controlled and readily controllable increase in the length of springs 36 which results in any desired spreading of a fibrous band to its desired ultimate width.

Only one of the power driven rolls 8,9, i.e., the lower roll, need to be driven positively. The upper roll may be operated by its frictional engagement with the lower roll. Some of the fibers between the first deregistration device 7 and rolls 8 are under tension, and some of the fibers between the second deregistration device 10 and rolls 9 are likewise under tension. The other sections of the fibrous band 2 are preferably substantially slack. Since the length of the band 2 is increased by the partial deregistration of its fibers between deregistration device 7 and rolls 8, rolls 9 must be rotated at a higher peripheral velocity than rolls 8 to take account of that lengthening of band 2. The lengthening, or stretching, of band 2 occurs concomitant with the deregistration of its crimps which is, in effect, an increase of the distance between the crests of contiguous crimps.

The size of the discrete areas at which a localized braking or gripping action is exerted upon the constituent fibers of band 2 depends primarily upon the size of roller bodies 13 and the thickness and the elastic properties of flexible blanket 16. The smaller the diameter of roller bodies 13, and the smaller the thickness of blanket 16, the smaller the size of the discrete areas of fibrous band 2 which are subjected to a relatively large, localized, braking or gripping action.

The fact that the roller bodies 13 and the blanket 16 may readily be replaced by roller bodies of different size and by a different blanket imparts a high degree of flexibility to the present system. Hence this system lends itself to opening of tows or bands of fibers whose physical and chemical properties differ widely and of fibers having widely differing deniers.

It is not possible to substitute rigid perforated plates for flexible blanket 16 and to allow roller bodies 13 to engage directly the constituent fibers of band 2. This tends to result in damage to the tows or bands intended to be deregistered and in entanglement of fibers and parts of the fiber processing machinery.

We claim as our invention:

1. A system for opening and deregistering bands formed by substantially parallel crimped fibers including

a. means for advancing bands of substantially parallel crimped fibers in a direction longitudinally of said bands;

b. a carriage carrying roller bodies, said carriage extending transversely to said direction and supporting a plurality of roller bodies having a predetermined spacing transversely to said direction;

c. drive means for moving said roller body carriage transversely to said direction; and

d. means arranged below said roller body carriage defining a narrow passageway for said bands, said passageway defining means including a solid band-supporting plate and a flexible band-covering blanket arranged to rest upon the upper surface of said bands and to exert a relatively slight pressure on said upper surface, said band-covering blanket being engaged under pressure by said plurality of roller bodies and subjected to relatively high pressures at a plurality of spaced continuously changing points thereof as said roller body carriage moves under the action of said drive means relative to said bands.

2. A system as specified in claim 1 wherein

a. said means for advancing said bands is a pair of power driven tension rolls having a predetermined length and arranged with the nip thereof immediately adjacent the exit end of said passageway-defining means;

b. said predetermined spacing of said plurality of roller bodies is substantially less than said predetermined length of said pair of tension rolls; and wherein

c. said drive means for moving said roller body carriage transversely to said direction in a drive adapted to oscillate said roller body carrying carriage at amplitudes of the order of one half said predetermined spacing of said plurality of roller bodies.

3. A system as specified in claim 2 wherein said flexible blanket is formed of an elastomer and wherein said roller body carriage is supported by a lifting device and has a freedom of motion relative to said lifting device.

4. A system as specified in claim 3 wherein said roller body carriage is provided with horizontal shaft means projecting therefrom, and slidable in bearings adjustable in vertical direction.

5. A system as specified in claim 1 wherein said roller body carriage is formed by a pair of endless conveyers moving in opposite directions relative to said blanket.

6. A system for opening and deregistering bands formed by substantially parallel crimped fibers including

a. means for advancing bands of fibers in a direction longitudinally of said bands;

b. means defining a narrow passageway for said bands, said passageway-defining means including a solid band-supporting plate and an elastomeric band-covering blanket superimposed upon said plate and arranged to engage and to rest upon the upper surface of said bands and to exert a relatively slight pressure on an area of said bands coextensive with said blanket; and

c. means for establishing in said blanket a plurality of aligned, serially related zones of relatively high pressure traveling in said blanket transversely to said direction, said high pressure zone establishing means including a plurality of roller bodies jointly movable relative to said blanket, having a predetermined spacing and engaging under pressure the outer surface of said blanket.

7. A system as specified in claim 6 wherein

a. said means for advancing said bands is a pair of tension rolls having a predetermined length and arranged at the exit end of said passageway-defining means;

b. said predetermined spacing of said plurality of roller bodies is substantially less than said predetermined length of said pair of tension rolls; and wherein

c. said plurality of movable roller bodies has oscillatory drive means oscillating at amplitudes of about one half said predetermined spacing of said plurality of roller bodies.

8. A system as specified in claim 7 wherein a band-spreading device is arranged adjacent said pair of tension rolls at the side thereof opposite said plate and said blanket, said band-spreading device including

a. a pair of revolving diverging endless conveyers;

b. a plurality of helical springs each affixed with one of the ends thereof to one of said pair of conveyers and progressively stressed and elongated from the narrowly spaced end of said pair of conveyers to the widely spaced end thereof; and

c. means for keeping a band of fibers resting on said plurality of helical springs in engagement with said plurality of helical springs to move jointly with said pair of conveyers and with said plurality of helical springs and thereby to increase in width as said plurality of helical springs is progressively elongated.

9. A system for opening and deregistering bands formed by substantially parallel crimped fibers including

a. a first deregistration device and a second deregistration device arranged in tandem with said first deregistration device;

b. said first deregistration device and said second deregistration device each including means for advancing bands of substantially parallel crimped fibers in a direction longitudinally of said bands; a carriage carrying roller bodies, said carriage extending transversely to said direction and supporting a plurality of roller bodies having a predetermined spacing transversely to said direction; drive means for moving said carriage transversely to said direction, and means arranged below said carriage defining a narrow passageway for said bands, said passageway defining means including a solid band-supporting plate and a flexible band-covering blanket arranged to rest upon the upper surface of said bands, and to exert a relatively slight pressure upon said upper surface, said band-covering blanket being engaged under pressure by said plurality of roller bodies and subjected to relatively high pressures at a plurality of spaced continuously changing points thereof as said carriage moves under the action of said drive means relative to said bands; and

c. said carriage of said second deregistration device having a larger number of more narrowly spaced roller bodies than said carriage of said first deregistration device.

10. A system as specified in claim **9** including a band-spreading device arranged in tandem with said second deregistration device, said band-spreading device including

a. a pair of revolving diverging endless conveyers;

b. a plurality of helical springs each affixed with one of the ends thereof to one of said pair of conveyers and progressively stressed and elongated from the narrowly spaced end of said pair of conveyers to the widely spaced end thereof; and

c. means for keeping a band of fibers resting on said plurality of helical springs in engagement with said plurality of movable springs to move jointly with said pair of conveyers and with said plurality of helical springs and thereby to increase in width as said plurality of helical springs are progressively elongated.

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