March 3, 1970 J. R. BROWNELL 3,497,920

APPARATUS AND METHOD FOR DE-REGISTERING TOW

Filed Oct. 25, 1967 3 Sheets-Sheet 1

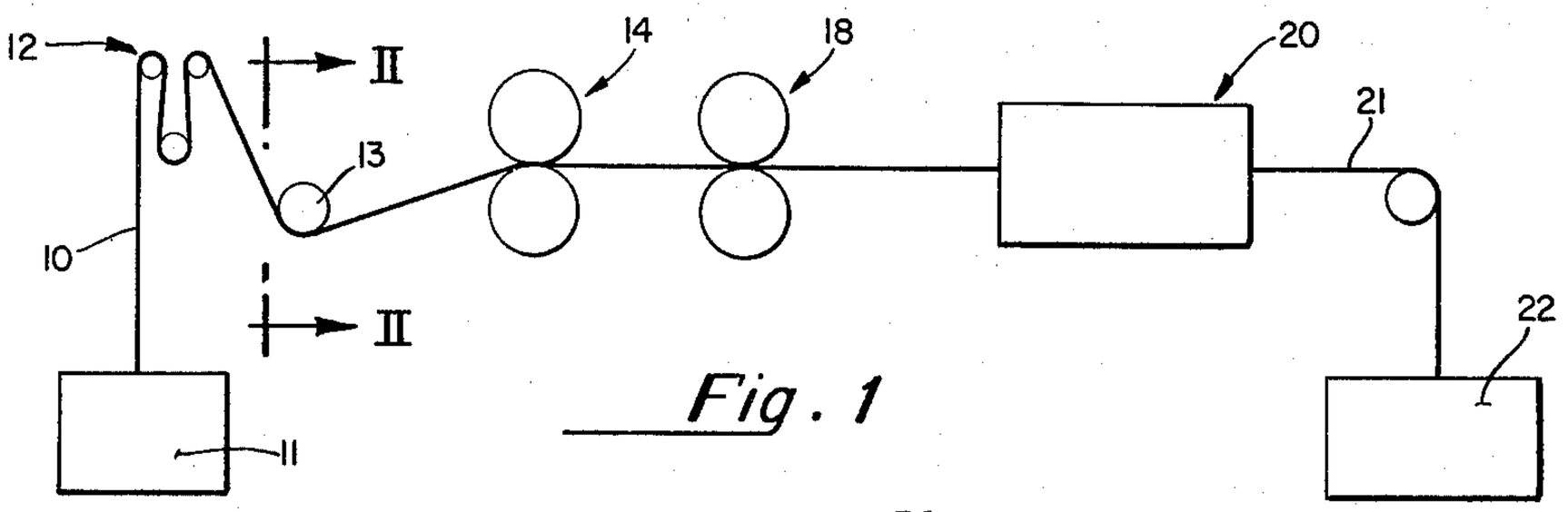

Fig. 1

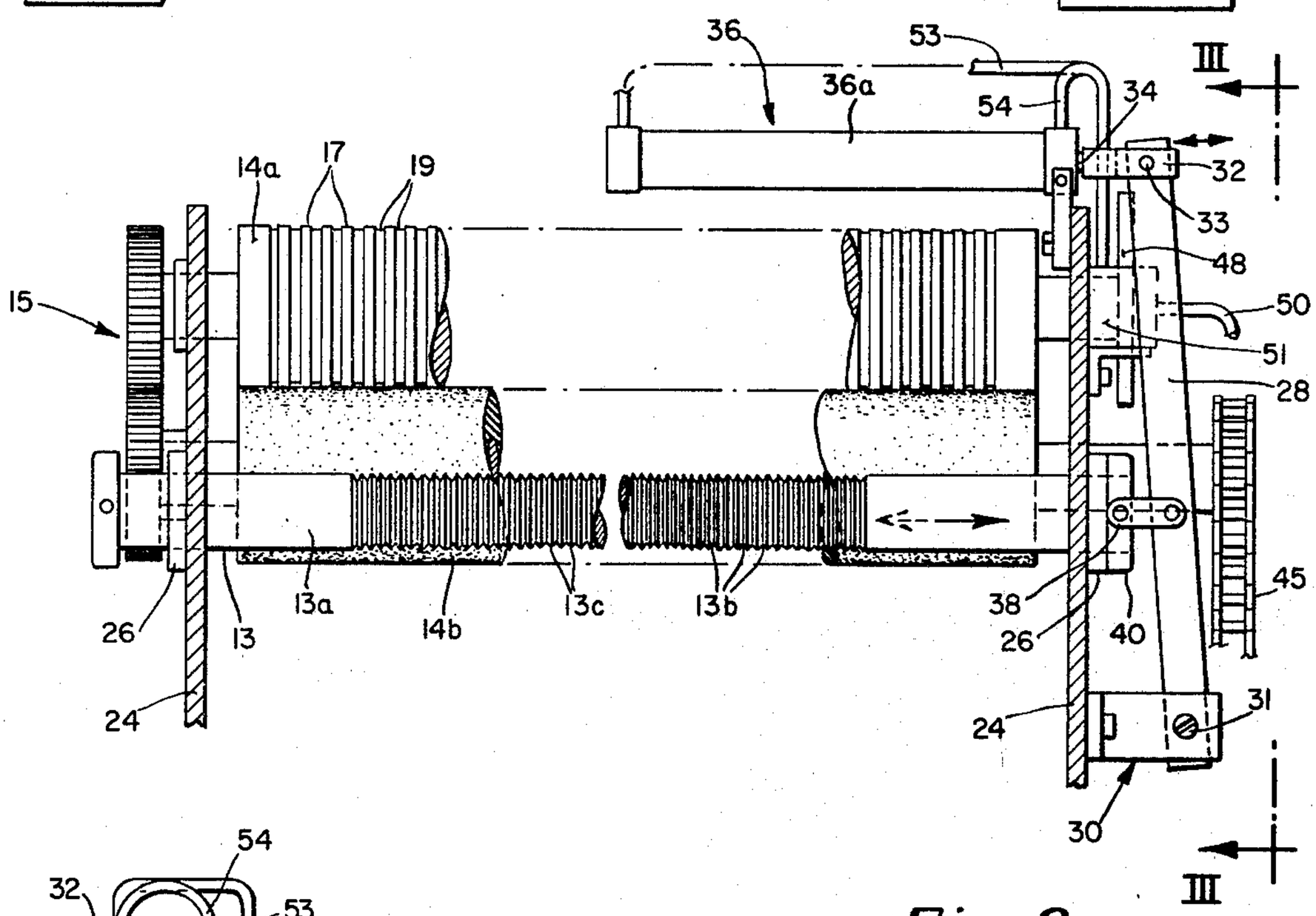

Fig. 2

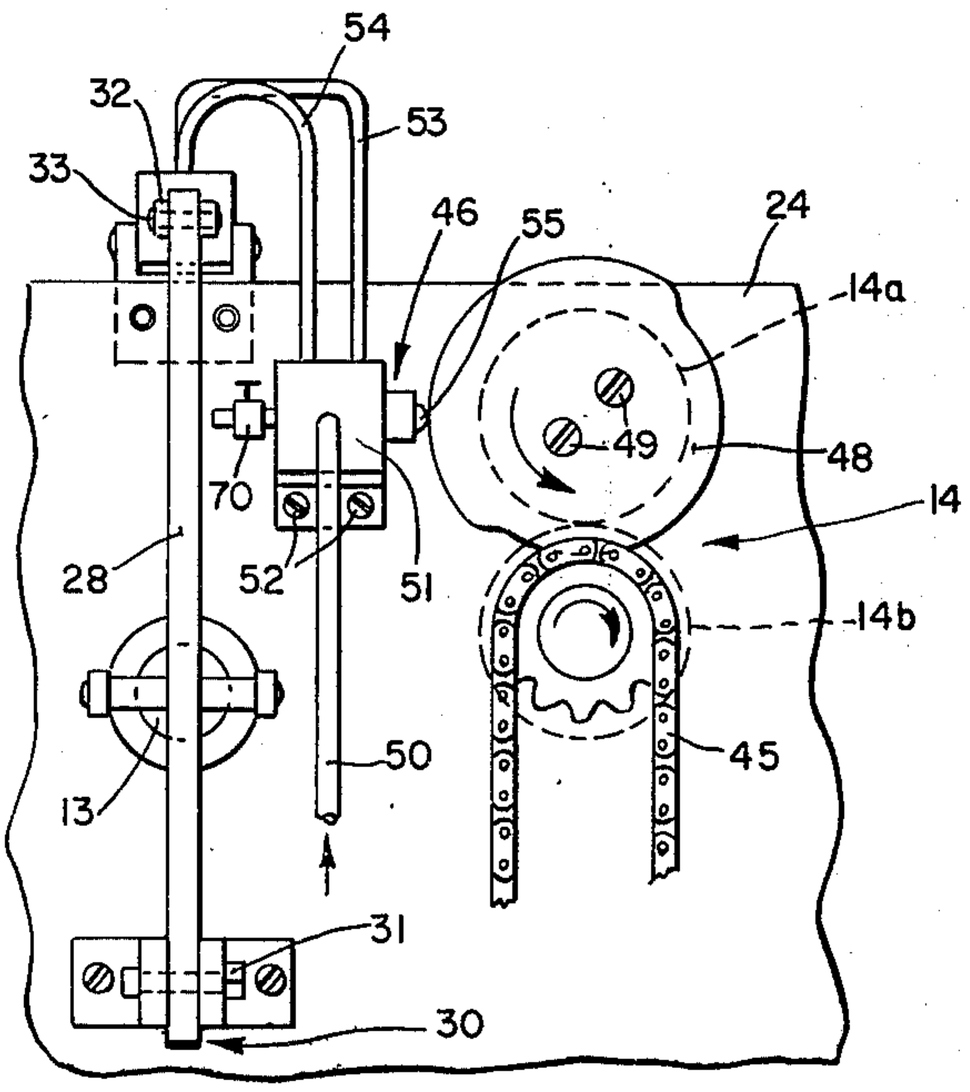

Fig. 3

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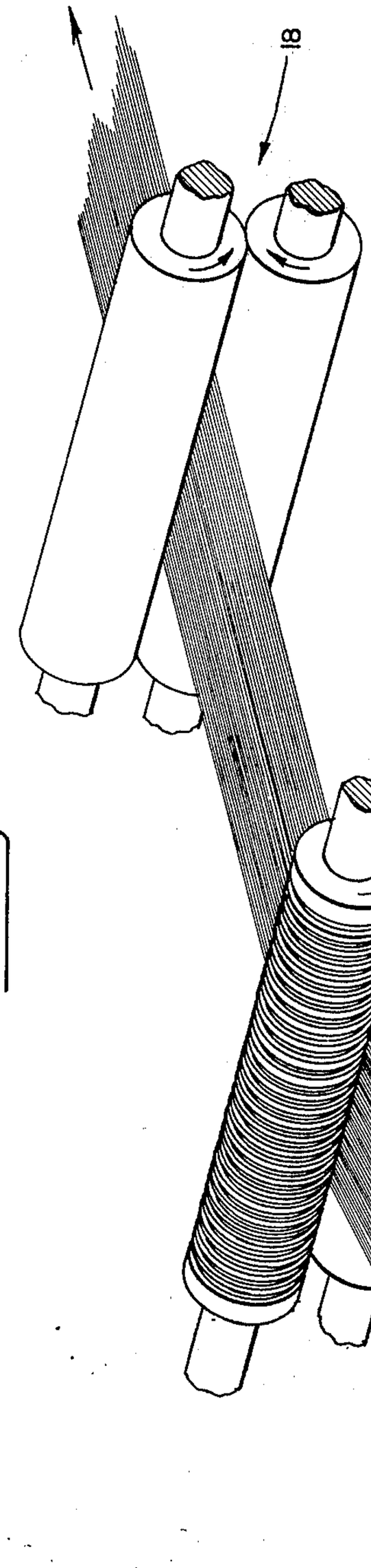

Fig. 4

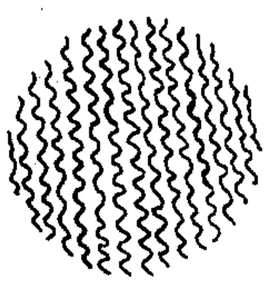

Fig. 6

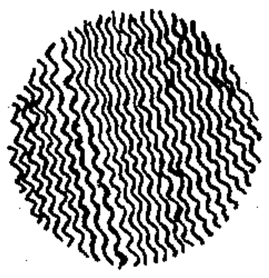

Fig. 5

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APPARATUS AND METHOD FOR DE-REGISTERING TOW

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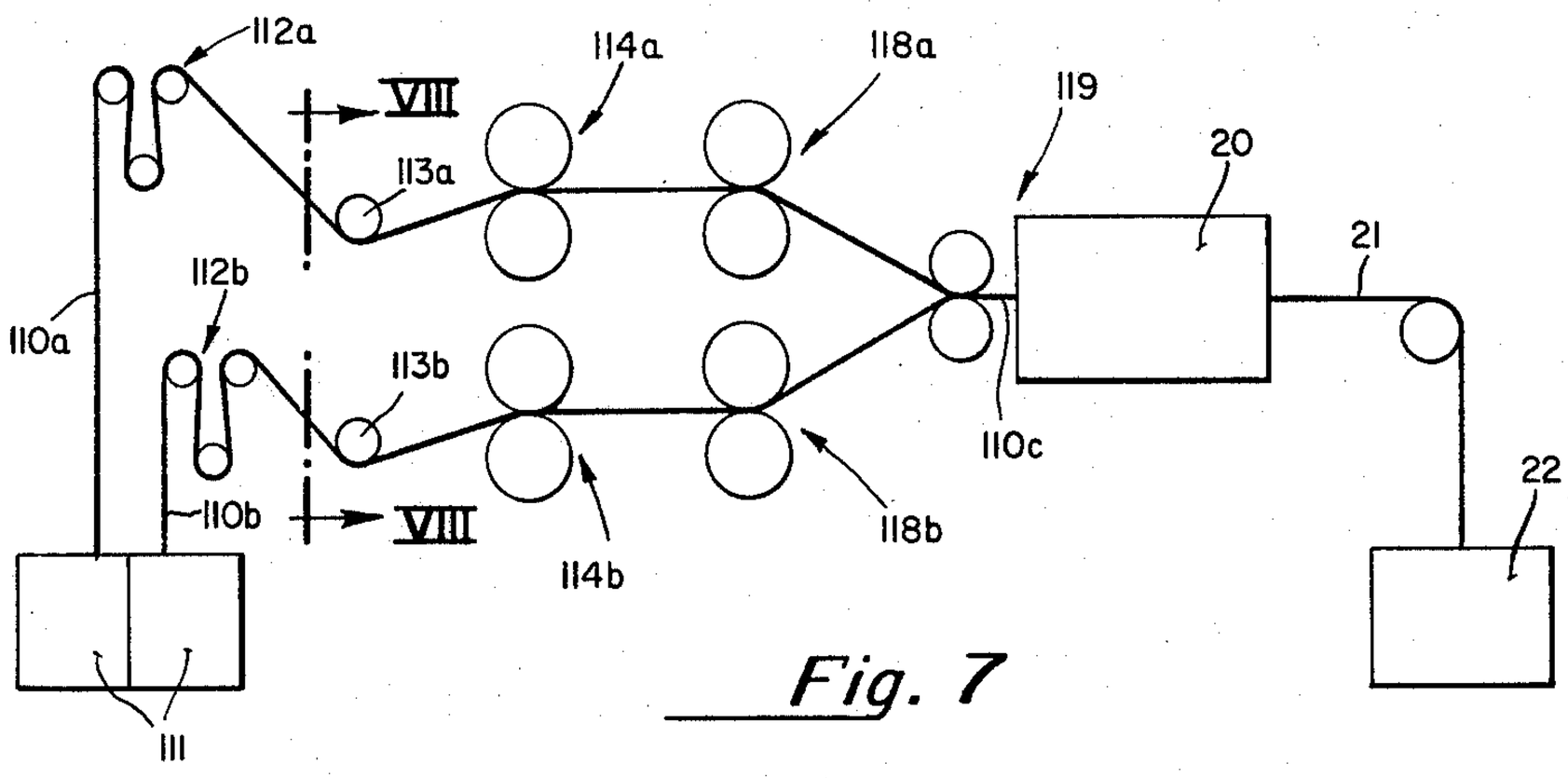

Fig. 7

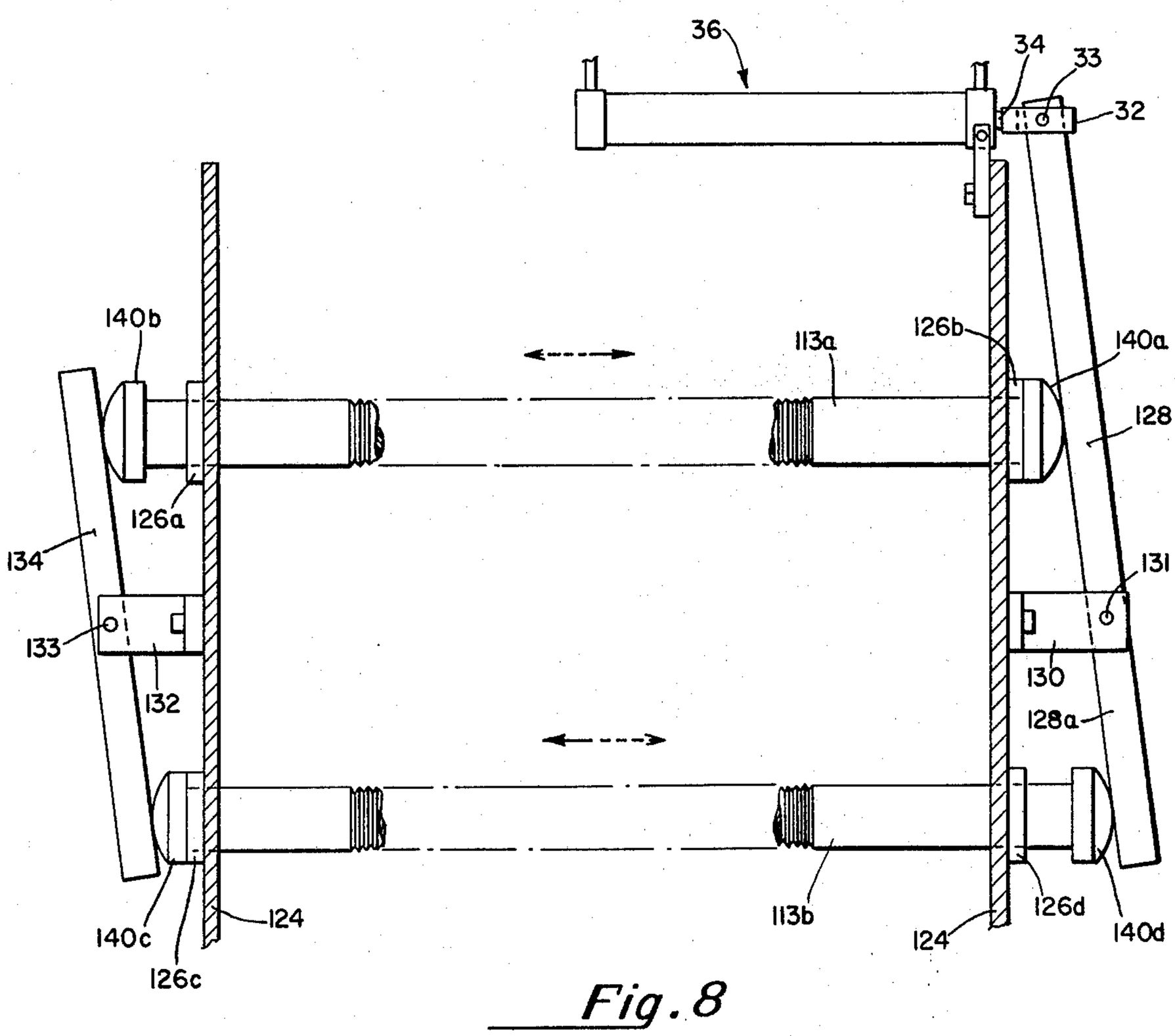

Fig. 8

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APPARATUS AND METHOD FOR DE-REGISTERING TOW

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Filed Oct. 25, 1967, Ser. No. 677,910
Int. Cl. D01b 3/04; D02g 3/00
U.S. Cl. 19—65 9 Claims

ABSTRACT OF THE DISCLOSURE

A tow of crimped textile material is passed through a machine to de-register the crimp, that is, to move the adjacent filaments in the tow with respect to one another so that the crimps in the filaments are out of phase or non-aligned with one another. The machine includes a pair of draw rollers which are elastically surfaced and have interroll pressure to supply the force necessary to draw the tow sheet through the machine. Spaced ahead of these rollers, is a second pair of elastically surfaced tension rollers with interroll pressure, at least one of which has a circumferentially profiled surface. The tow passes between this roller and its mating elastically surfaced roller and then through the draw rollers, thereby displacing some of the filaments relative to other filaments in the tow. Spaced ahead of this second pair of tension rollers, is a roller which has a series of sharp circumferential grooves and ridges thereon, and the tow, which is under tension, is separated into separate bundles with various tensions a, it passes over this roller. A mechanism actuates this roller to reciprocate it transversely to the direction of advancement of the tow. These reciprocations are adjustable as to length of stroke, frequency, and dwell at the end of each stroke.

BACKGROUND OF THE INVENTION

The present invention relates to a novel apparatus and process for opening a filamentary tow; this invention being directed particularly to tow made of continuous filament synthetic textile material which has been crimped.

In the prior art, various apparatus and processes have been developed to open or de-register the tow prior to conducting further operations on the tow, such as chemically treating it or cutting it into short lengths for further processing. Such apparatus, for instance, as shown in U.S. Patent 3,156,016, issued Nov. 10, 1964, includes a pair of rollers which are elastically surfaced through which the tow is drawn in a belt-like mass. Spaced along the tow upstream of these rollers, is a second pair of rollers through which the tow passes. These rollers impart a retarding force on portions of the tow at spaced intervals transversely of the path of the tow. These rollers generally consist of a smooth surface roller and a mating roller having a plurality of grooves and ridges thereon which serve to grip the tow at spaced intervals across the width of the tow. When the tow emerges from the first set of rollers, it is partially de-registered, that is, the crimps in adjacent filaments in the tow are no longer aligned with one another so as to mate perfectly, but rather are disoriented or out of phase with one another so that they do not fit snugly together.

There are numerous reasons for wanting to de-register the tow. One such reason is to eliminate the incidence of shiners. Shiners are areas in the tow wherein the crimps of adjacent filaments are more or less perfectly mated or registered. When partially de-registered tow is chemically treated or cut into staple lengths, and/or formed into sliver or top, the shiners tend to remain joined and, therefore, there is a lack of uniformity in the finished product.

Known apparatus and methods for de-registering tow have not been completely successful in eliminating shiners.

SUMMARY OF THE INVENTION

The present invention covers an apparatus and method for de-registering a filamentary tow sheet which includes passing the tow over a traversing roller which reciprocates the tow transversely of its direction of travel, prior to passing it through drawing and tensioning rollers.

Accordingly, a principal object of this invention is to provide a new and improved method and apparatus for de-registering tow by reciprocating the tow sheet transversely as it advances to the tow tensioning rollers.

Another object is to provide an apparatus to substantially reduce or eliminate the incidence of shiners in the tow.

Another object is to provide a new method of reducing or substantially eliminating the incidence of shiners in tow.

These and other objects of the invention will become apparent from the following disclosure with reference to the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of a tow opening apparatus in accordance with one embodiment of my invention;

FIG. 2 is a section taken as indicated by the lines and arrows II—II in FIG. 1;

FIG. 3 is a view taken as indicated by the lines and arrows III—III in FIG. 2;

FIG. 4 is a perspective view of a portion of the apparatus shown in FIG. 1;

FIG. 5 is a face view of tow prior to de-registration of the crimp in the filaments of the tow;

FIG. 6 is a face view of tow subsequent to de-registration of the crimp;

FIG. 7 is a schematic view of a tow opening apparatus in accordance with an alternate embodiment of my invention; and

FIG. 8 is a section taken as indicated by the lines and arrows VIII—VIII in FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Although specific forms of the invention have been selected for illustration in the drawings, and the following description is drawn in specific terms for the purpose of describing these forms of the invention, this description is not intended to limit the scope of the invention which is defined in the appended claims.

FIG. 1 shows schematically an apparatus for de-registering filamentary tow in accordance with a preferred embodiment of my invention. The tow sheet **10** is withdrawn from a container **11** and is passed over one or more guide and tension bars designated **12**, to maintain the proper tension in the tow and to guide it to the traversing guide **13**. The tow passes around, and is engaged with a portion of the circumferential surface of the traversing guide, **13**, as it advances longitudinally into a station comprising a set of rollers (designates **14**). These rollers **14** grip the tow at transversely spaced intervals, and pull the tow from the container **11** through the apparatus. The tow emerges from rollers **14** in a partially de-registered condition due to filaments having different tensions while being pulled over the sharp circumferential ridges and grooves of the traverse guide **13** and being gripped at spaced intervals as it is pulled by the tensioning rollers **14**. The de-registered tow then is passed between a pair of drive rollers **18** which impart an additional positive drive thereto and draw it through the apparatus. The tow emerges from the drive rollers **18** in a de-registered condition and is ready for further processing, as for example,

being chemically treated and/or cut to form top or sliver in the apparatus designated generally **20**, which may be of any type well-known in the art. The processed tow then is passed to further appropriate processing devices **22** by transport means **21**.

Referring to FIG. 2, the details of the traversing guide **13** are shown. The traversing guide **13** preferably comprises a substantially cylindrical roller **13***a* having a plurality of V-shaped annular grooves **13***b* therein; said grooves forming a plurality of sharply pointed annular ridges **13***c*. The roller **13***a* is supported in a frame **24** which may be an integral part of the overall apparatus as desired. It is not necessary that the roller be free to rotate in the frame **24**, however, it is necessary that means be provided for sliding the roller in the frame, so that it may be reciprocated, as indicated by the arrows in FIG. 2. To this end, bearing means **26** are provided which are affixed to the frame **24** and retain the roller **13***a* for sliding engagement therewith.

The mechanism for reciprocating the traversing guide **13** is shown in detail in FIGS. 2 and 3. It comprises a lever arm **28** which is pivotally connected at its lower end to the frame **24** by the clevis arrangement **30**. A yoke **32** embraces the lever arm at the upper end, and the arm is pivotally connected to the yoke **32** by means of pin **33** which passes through a clearance hole in the lever arm **28**. The yoke is fixedly connected to the piston rod **34** (FIG. 2). The piston rod is connected to the piston of a pneumatic double-acting piston and cylinder arrangement designated **36**, which may be of any conventional type. Movement of the piston rod **34** pivots the lever arm **28** through a relatively small angle about the clevis pin **31**. A link **38** is pin connected to one end of the traversing guide **13** and to the lever arm **28**, so that the pivoting of the lever arm **28** slides the guide **13** in its bearings **26**. Link **38** has a hole at either end, through each of which a pin passes with ample clearance, thereby permitting a loose pivotal connection with the lever arm and with the hub **40** which is fixedly connected to the roller **13***a*.

In FIG. 2, the tow sheet **10** has been omitted for the sake of clarity. The rollers **14***a* and **14***b* are driven by any suitable means, such as the chain and sprocket drive **45** which is fixedly attached to the lower roller **14***b* to rotate said roller in the direction of the arrow (FIG. 3). Roller **14***b* is connected by means of gears **15** (FIG. 2) to upper roller **14***a* to drive said roller in the direction of the arrow shown in FIG. 3. Roller **14***b* may be smooth surfaced and preferably is covered with a resilient material, such as hard rubber. The upper roller **14***a* preferably is circumferentially profiled as shown in FIG. 2. Its profile consists of a number of uniformly spaced annular ridges **17** having annular grooves **19** therebetween. The circumferential or annular ridges **17** are disposed perpendicular to the axis of the cylindrical roller **14***a*. The surfaces of the rollers are in contact when there is no tow sheet in the apparatus, so that the rollers **14** grip the tow sheet when it is fed between them and impart a positive pull on the tow sheet. Thus the sheet is under tension as it is pulled across the traversing roller **13** and is partially de-registered thereafter.

Referring to FIG. 3, an air input conduit **50** from an air supply (not shown) is attached to a valve **51** fixed to the frame **24** of the apparatus in any conventional manner, as by bolts **52**. Leading from the valve **51** are two air lines **53** and **54** which are attached, respectively, to opposite ends of the cylinder **36***a*. Pneumatic force is applied to either end of the pneumatic cylinder **36** through either of the conduits **53** or **54**, to move the piston. The valve **51** is controlled by a plunger **55** actuated by a cam **48** mounted on upper roller **14***a* by means of screws **49**, as shown in FIG. 3.

With the cam in the position shown in FIGS. 2 and 3, the plunger **55** follows the larger diameter of the cam and controls the air flow through the valve **51**, so that air under pressure flows through the air line **54** only and into the cylinder **36***a*, thereby forcing the piston therein toward the left (as viewed in FIG. 2). The air in the line **53**, being exhausted from the cylinder, passes through the valve **51** and out the exhaust valve **70** to the atmosphere. The piston rod **34** is thus pulled to the left, as is the yoke **32**, thereby pivoting the lever arm **28** in a counterclockwise direction about the pin **31**. This drives the link **38** to the left, thereby sliding the roller **13***a* to the left.

As the cam **48** continues to rotate, the plunger **55** will follow the cam surface and eventually will be riding along the smaller diameter surface of the cam. As the plunger moves from the larger diameter to the smaller diameter surface, it changes position in the valve **51** and permits air to flow through line **53** to the cylinder **36***a*, rather than line **54**. Air under presure will then enter the cylinder **36***a* only through line **53** thereby forcing the piston therein to the right (as viewed in FIG. 2), and exhausing the air from line **54** through the rake **51** and out the valve **70**. In so doing the piston pushes the rod **34** and yoke **32** to the right, thereby pivoting the lever arm **28** in a clockwise direction about pin **31** and pulling link **38** and roller **13***a* to the right.

The cam **48** in this embodiment preferably is designed to synchronize the reciprocations of the traversing guide **13** with the rotation of one of the rollers **14** so that the guide **13** is shifted from left to right or right to left every 180 degrees of rotation of the roller **14***a*. Other cams could be used within the scope of this invention. The reciprocations of the traversing guide **13** can be controlled, not only by the cam **48**, but also by the air pressure and exhaust valve **70**. All of these provide means for controlling the speed of the traverse stroke, the speed of reversal or length of time at the end of the traverse stroke, and the length of the traverse stroke. Thus, by changing the air pressure in line **50** and/or the back pressure by adjusting exhaust valve **70** and/or changing the cam **48**, the reciprocations can be manipulated.

Referring to FIGS. 4, 5, and 6, I shall now describe the effects of this apparatus. The tow sheet **10** engages the traversing guide **13** and is divided into a plurality of multi-filament bundles. As the traversing guide **13** is reciprocated, the tow sheet **10** is likewise reciprocated transversely of the direction of advancement of the tow sheet through the apparatus. The V-shaped grooves **13***b*, however, do not completely retain each of the aforesaid multifilament bundles. Some of the filaments from each bundle ride up and over the crests **13***c* and into the adjacent grooves **13***b* as the traversing guide reciprocates. This also occurs during the dwell at the extremities of the stroke, since the tow continues to move across the traversing roller **13**. Thus, the integrity of the multifilament bundles is constantly changing as they are fed into the nip of the tensioning rollers **14**. In this regard, it is preferred to use a quick stroke in reciprocating the roller **13**.

This plurality of separate bundles of filaments is then acted upon by the rollers **14**. These rollers grip the advancing tow sheet in separate, ever changing groups of filaments. Thus, the griping of the tow in the rollers **14** is never uniform or uniformly repetitive across the tow sheet, but changes constantly, so that the tension in the filaments of the tow sheet is ever varying, the tow being partially de-registered as it enters the tensioning rollers **14**.

FIG. 5 shows schematically the top face of the tow sheet before it is fed into the traversing guide **13**. In FIG. 6, the same face of the tow sheet is shown schematically downstream of the rollers **18**. As shown, the crimps are substantially de-registered.

In the alternate embodiment of FIG. 7, more than one container **111** of tow is processed simultaneously. The tow is withdrawn from the containers over suitable guide and tension bars **112***a* and **112***b* in two separate sheets **110***a* and **110***b*. Tow sheet **110***a* is fed to traversing guide **113***a* and tow sheet **110***b* is fed to traversing

guide **113***b*. From the traversing guides, the separate sheets pass through separate sets of tensioning rollers **114***a* and **114***b*, respectively, and thence to drive rollers **118***a* and **118***b*, respectively. Thereafter, the sheets are drawn together at the nip of a pair of rolers **119**, and are then further processed as a single sheet of tow **110***c* in a similar fashion to that shown and described with reference to tow **10** in FIG. 1 (similar numbers designating similar parts).

To accomplish dual oscillation of the tow sheets, I have provided a mechanism which is more clearly shown in FIG. 8. A mounting bracket **130** is affixed by any suitable means to the frame **124**. Lever arm **128** is pivotally attached to the mounting bracket **130** as by means of pin **131**. The upper end of the lever arm **128** is pivotally connected to yoke **32** by means of pin **33**; the yoke being connected to the piston and cylinder arrangement **36** as previously described with reference to FIG. 2. The lever arm has a lower extension **128***a*. Traversing guide **113***a* reciprocates in bearings **126***a* and **126***b* in the frame **124**. At opposite ends of the traversing guide **113***a* are hubs **140***a* and **140***b*, each of which has a substantially rounded outwardly extending surface. Traversing guide **113***b* similarly reciprocates in bearings **126***c* and **126***d*, and has similar hubs **140***c* and **140***d* at either end. A mounting bracket **132** is affixed to the frame **124** by any suitable means. Pivotally connected to the mounting bracket **132**, as by pin **133**, is lever arm **134**. The mounting brackets **130** and **132** position their respective lever arms **128** and **134**, so that the arms are continually in contact with the respective adjacent hubs **140***a* and **140***b* and **140***c* and **140***d* of the traversing guides **113***a* and **113***b*.

The cam and pneumatic piston and cylinder arrangement shown in FIGS. 2 and 3 is used in this embodiment also. As the cam **48**, FIG. 3, rotates it actuates the valve **51** by means of the plunger **55** and thus the piston rod **34** is caused to reciprocate. When the piston rod **34** moves to the left (as viewed in FIG. 8) drawing with it the yoke **32** and causing the lever arm **128** to pivot counterclockwise about pin **131**, the lever arm **128** by impinging on the adjacent hub **140***a* forces the traversing guide **113***a* to the left. The hub **140***b* of the traversing guide **113***a* which is adjacent to the lever **134** forces the lever arm **134** to be pivoted about the pin **133** in a counterclockwise direction, and the end of the lever **134** which is adjacent to the hub **140***c* of the traversing guide **113***b* is in turn moved in a counterclockwise direction about the pin **133**, so that it forces the traversing guide **113***b* to the right to the position shown in FIG. 8. Movement of the piston rod in the opposite direction causes the lever arms **128** and **134** to move in a clockwise direction about the pins **131** and **133** respectively, so that the traversing guide **113***b* is moved to the left and the traversing guide **113***a* is moved to the right.

It will be understood that various changes in the details, materials and arrangement of parts which have been herein described and illustrated in order to explain the nature of this invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the following claims.

It will further be understood that the "Abstract of the Disclosure" set forth above is intended to provide a non-legal technical statement of the contents of the disclosure in compliance with the Rules of Practice of the United States Patent Office, and is not intended to limit the scope of the invention described and claimed herein.

What is claimed is:

1. In apparatus for de-registering tow:

(a) means for advancing a multifilament tow sheet longitudinally;

(b) means disposed in advance of said tow advancing means for frictionally gripping the tow sheet at spaced intervals transversely thereof; and

(c) means immediately in advance of said second mentioned means for reciprocating the tow sheet transversely as it advances to the second mentioned means, consisting of a single profiled surface for engaging the tow sheet as it advances and means coacting therewith to reciprocate the profiled surface transversely of the direction of advance of the tow sheet.

2. The invention of claim **1** wherein means are disposed in advance of said profiled surface for tensioning the tow sheet as it passes over said profiled surface.

3. The invention of claim **1** wherein said profiled surface comprises a substantially cylindrical body having a plurality of V-shaped circumferential grooves therein.

4. The invention of claim **3** wherein the means to reciprocate the cylindrical body comprises a fluid pressure operated piston, a lever connected to said piston at one point and pivoted about a second point, linkage means connecting said cylindrical body with said lever whereby when said piston pivots said lever about said second point, said body is moved transversely within said apparatus.

5. An apparatus as in claim **3** wherein control means are provided for synchronizing the transverse reciprocation of said cylindrical body with the rotation of said frictional gripping means.

6. An apparatus as in claim **5** wherein said frictional gripping means comprises a profiled roller and a smooth surface roller in engagement therewith and said control means comprises a cam fixedly connected to one of said rollers in said frictional gripping means, a fluid pressure control valve connected to said piston to control said piston, follower means connected to said valve and engaging said cam surface to follow said cam surface and control said valve.

7. A process of de-registering tow comprising:

(a) longitudinally advancing a multifilament tow sheet;

(b) subjecting said tow sheet to a gripping action at a plurality of spaced areas transversely of the direction of the advancement of the tow sheet so as to retard advancement at those areas;

(c) separating the advancing tow sheet into a plurality of multifilament bundles immediately in advance to the spaced gripping of said tow sheet; and

(d) reciprocating the entire tow sheet in its separated state by moving the entire sheet in one transverse direction and then another.

8. In a process as in claim **7**, the additional step of tensioning the tow sheet through the separating step so that it is separated and reciprocated in a tensioned state.

9. In a process as in claim **7** the additional step of changing the integrity of the multifilament bundles while reciprocating said tow sheet.

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U.S. Cl. X.R.

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