United States Patent

[11] **3,570,732**

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[73] Assignee **Maremont Corporation**
Chicago, Ill.
Continuation-in-part of application Ser. No. 620,098, Mar. 2, 1967, now abandoned.

[54] **TEXTILE BALE LAYER SEPARATOR**
15 Claims, 5 Drawing Figs.

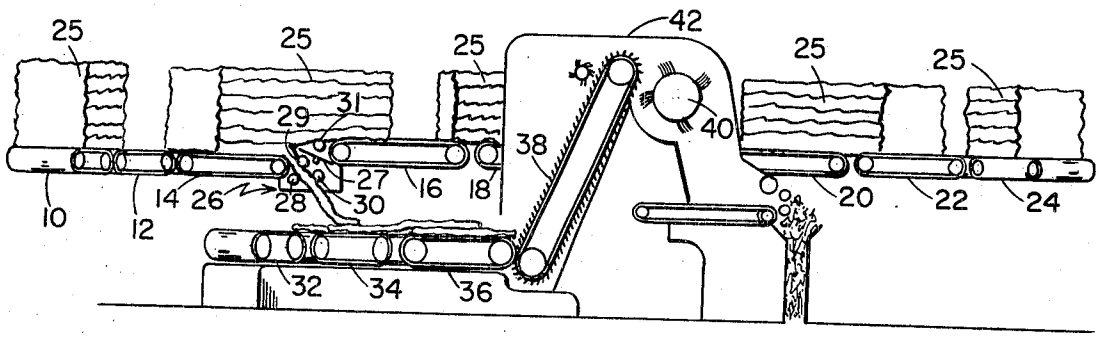
[52] **U.S. Cl.** **225/94,** 83/4, 225/99
[51] **Int. Cl.** **B26f 3/02,** B26d 4/00
[50] **Field of Search** ..... 225/93, 94, 96, 98, 99, 4; 83/4; 156/584; 146/130; 82/(Inquired)

[56] **References Cited**
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Primary Examiner—James M. Meister
Attorney—Joseph H. Heard

ABSTRACT: Apparatus for separating the layers of textile bales, of either rectangular or cylindrical shape, and for feeding the separated layers to an opener, blender, card or other machine for subsequent processing. The apparatus includes separating means, and support means for supporting a bale and the separating means in separating relationship with each other and for providing relative motion between them. The separating means includes a parting tension mechanism for tensioning the fibers at the parting line between the bale and the layer being separated from it and producing the parting line ahead of the separating means, and also includes a blade for the removal of any fibers not successfully acted upon by the parting tension. The apparatus may be constructed so that the bale is stationary and the separating means is moved, or vice versa. A conveyor mechanism is provided for conducting each parted layer intact from the bale and to another machine, for subsequent processing.



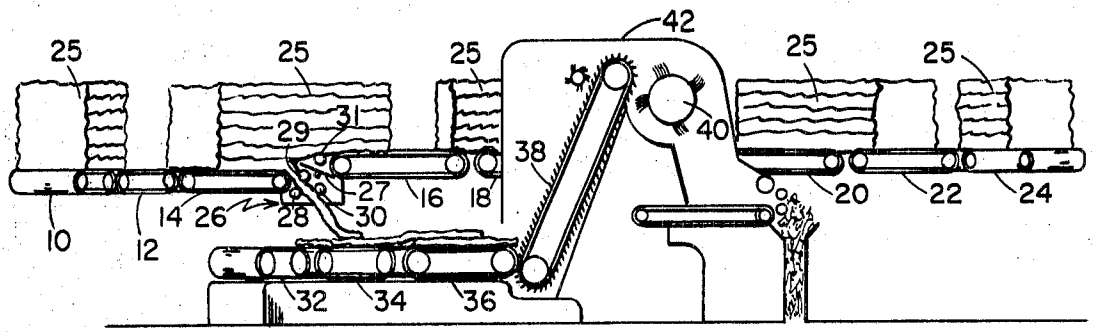


FIG. 1

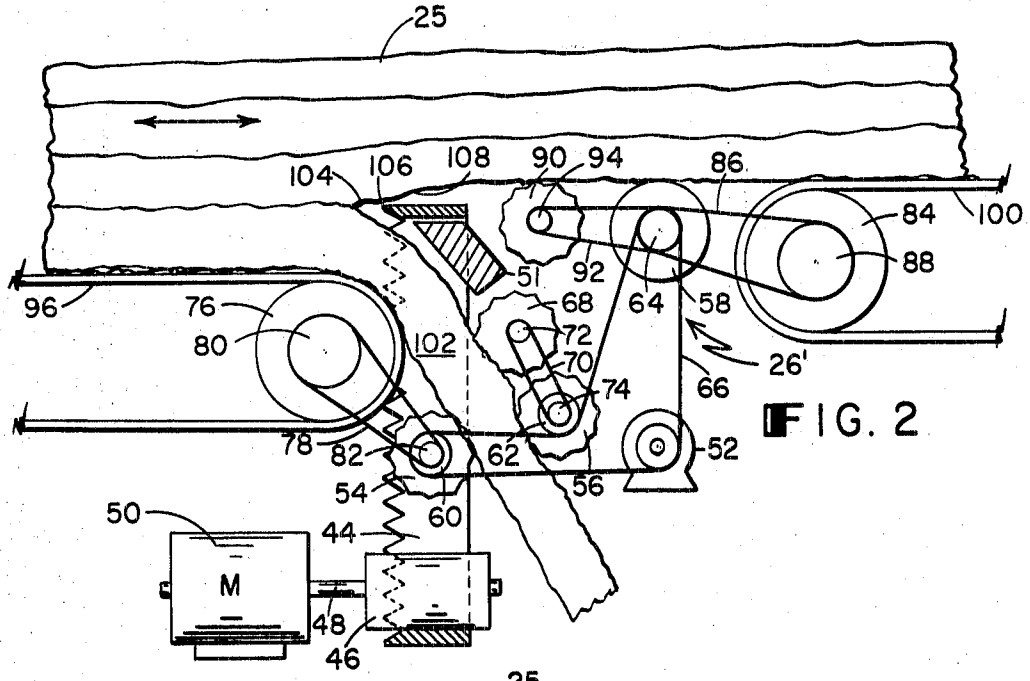


FIG. 2

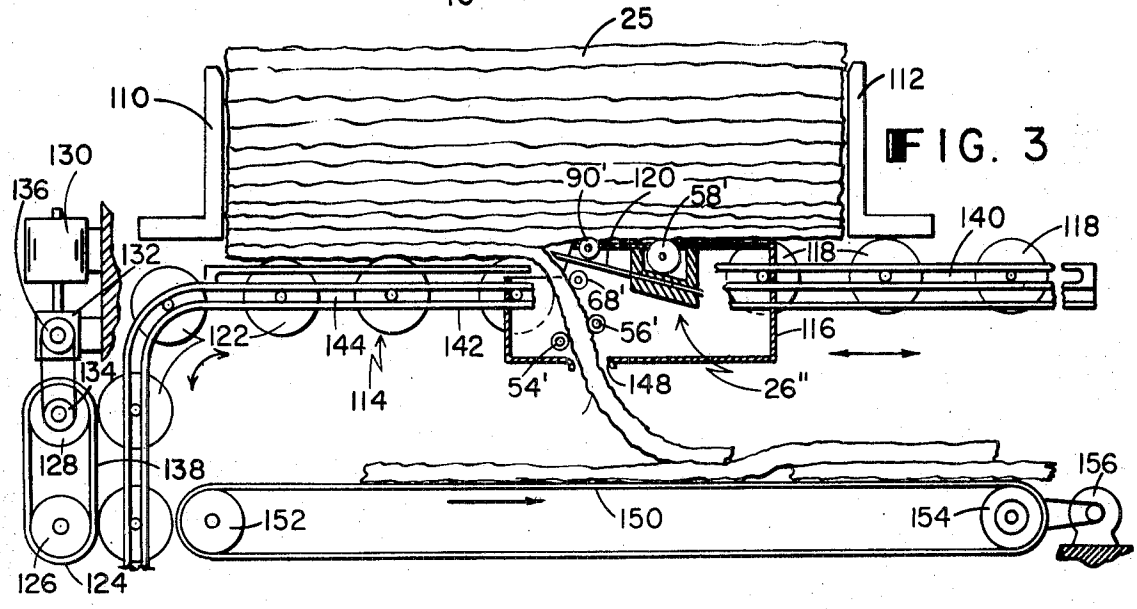


FIG. 3

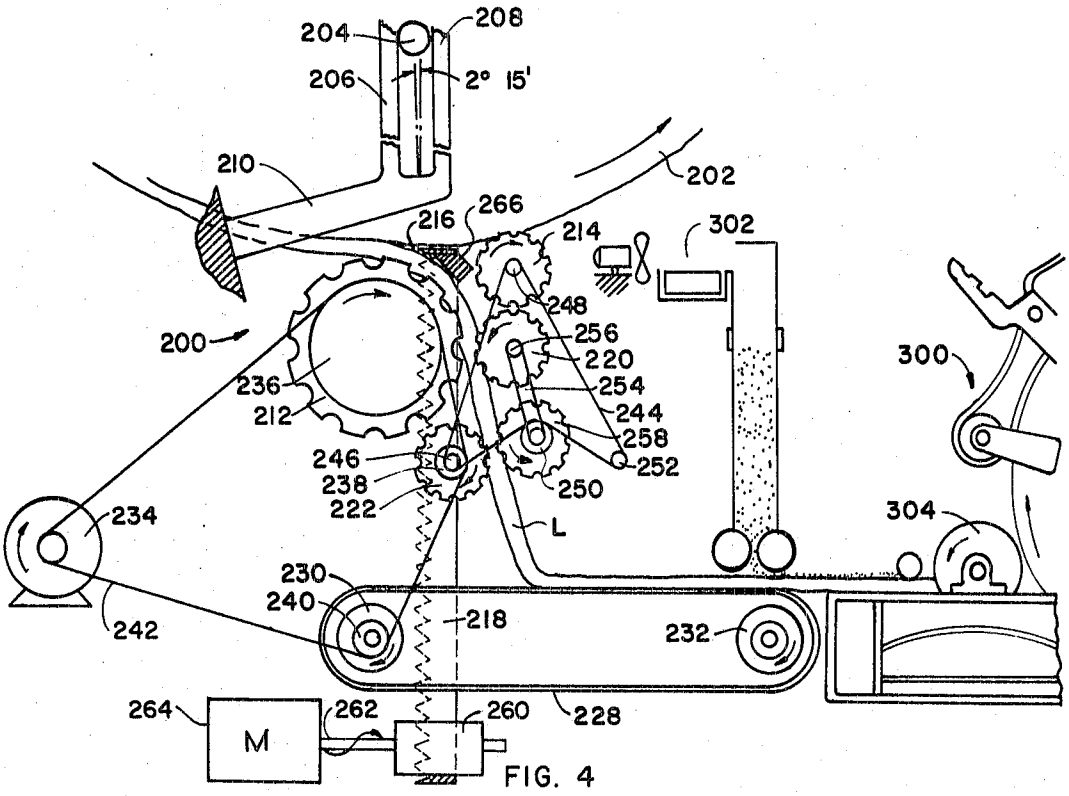

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FIG. 4

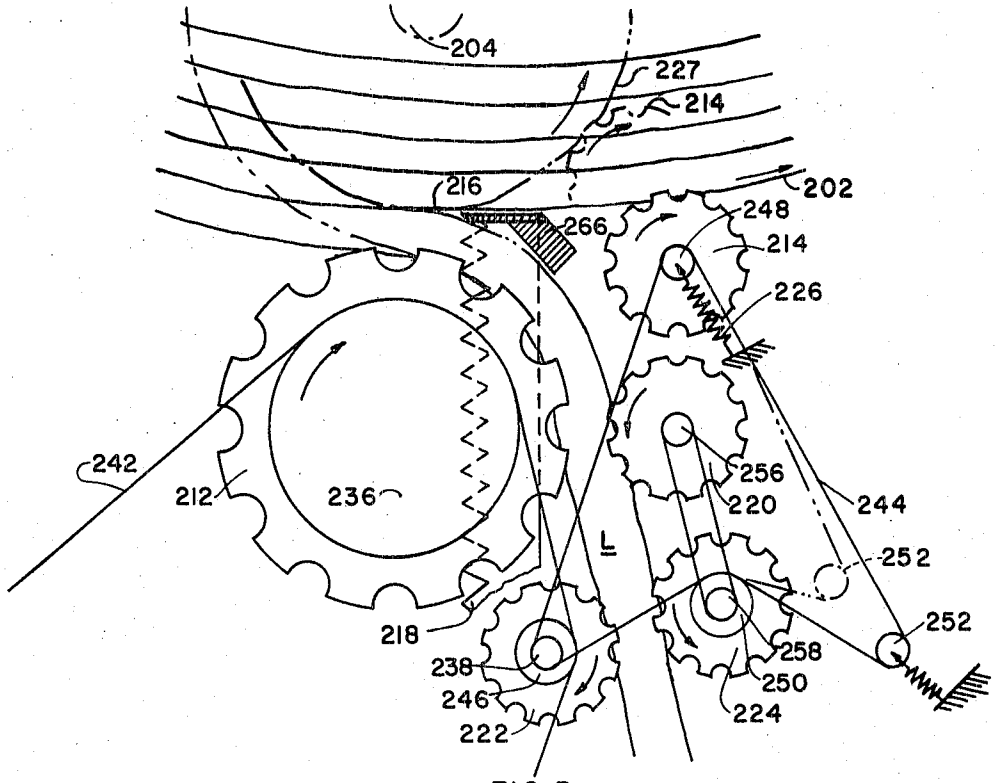

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FIG. 5

TEXTILE BALE LAYER SEPARATOR

This invention is a continuation-in-part of my pending application Ser. No. 620,098 filed Mar. 2, 1967, now abandoned and relates to the separating and subsequent opening of the layers of textile bales.

Opening, blending and cleaning bales of textile fibers is presently a slow and inefficient process. Devices are known which pluck tufts of fiber from a bale in an attempt to perform an opening operation simultaneously with breaking down the bale. Such devices are not as successful as expected for they turn out tufts at a nonuniform rate as a result of the differences in density from bale to bale, from layer to layer and layer boundary to layer within each bale. In addition, the outputs of such devices which pluck from beneath a bale are affected by the lessening weight of the bale as tufts are removed, and that weight is a factor in the size and weight of tufts removed. In some instances, too, destruction of the natural layer formation of the fibers is not required or desirable for successful performances of the following processing operation, in which event plucking of the fibers from the bale occasions at least one unnecessary processing step.

Attempts have been made to capitalize on the layer construction of the bale by using human labor to separate the bales a layer at a time, but this is slow and expensive. Unless carefully done, manual separating and handling of the layers also lessens whatever natural uniformity the layers possessed while in the bale.

It is therefore a primary object of this invention to provide a textile bale layer separator capable of taking the layers from the bale cleanly, with a minimum of long strands and strings of fiber, with little or no actual cutting of the bale or fibers, and following and preserving to a degree the natural boundaries of the layers.

Another object of the invention is to provide such a separator in which the layered fibers are conveyed from the bale in a uniform, controlled manner and may if otherwise suitable be introduced directly into a subsequent processing machine of a kind adapted to operate upon a fibrous layer or layers, such as a card or certain types of openers and blenders. Prior to or simultaneously with such introduction, other fibers in loose or similarly layered form may be combined therewith, if desired for blending or other purposes.

The apparatus of the invention includes separating means and support means for supporting a layered bale of textile fibers and the separating means in separating relationship to each other and for providing relative motion between them, the separating means including a parting tension mechanism for maintaining tension at the parting line between the bale and the layer being separated from it and producing the parting line ahead of the separating means. The parting tension mechanism when in its preferred form includes a first parting roll for maintaining tension on the layer being separated from the bale and a second parting roll for maintaining parting tension on the surface of the bale separated from the layer. The bales may be of the rectangular type comprising generally planar layers unconnected at their ends, or they may be of the cylindrical type comprising continuous convolute layers wound around the bale axis or a small diameter tube or arbor concentric with such axis. The separating means preferably also includes a blade effective a predetermined distance rearwardly of the parting line between the bale and the layer being separated therefrom to remove any fibers which, by reason of extreme length or other unusual factors, continue to bridge the interface between the bale and the layer.

In accordance with various embodiments of the invention, the blade may be of the circular type or of the band type, the separating means may be moved while the bale remains stationary or the bale may be moved in relation to the separating means, and the separated layer may be conducted to another machine by itself or with other layers or fibers added thereto.

Other objects, features and advantages will appear from the following description of preferred embodiments of the invention, taken together with the attached drawings thereof, in which:

FIG. 1 is a diagrammatic view of apparatus according to the invention for separating layers from moving rectangular bales and submitting the layers to an opening machine;

FIG. 2 is an enlarged view of a portion of the apparatus shown in FIG. 1, using a band saw blade;

FIG. 3 is a diagrammatic view of a portion of another embodiment of the invention wherein the apparatus for separating is moved through a stationary bale;

FIG. 4 is a diagrammatic view partially in section, of a portion of yet another embodiment of the invention wherein interconnected convolutely wound layers are continuously separated from a cylindrical bale, and fed onto a continuous conveyor which in turn delivers the same to a fiber processing machine; and

FIG. 5 is an enlarged sectional view similar to FIG. 1 of the apparatus for separating layers from a cylindrical bale as shown in FIG. 4.

There is shown in FIG. 1 a plurality of conveyors **10, 12, 14, 16, 17, 20, 22** and **24** constituting a portion of a circular path of such conveyors used to submit and resubmit bales **25** of cotton, for example, to separator **26** having separating means including a rotating circular saw blade **27** having a smooth cutting edge and lower and upper parting tension rolls **29** and **31**, respectively. Layers parted by separator **26** are deposited by tension rolls **28** and **30** onto blender-conveyors **32, 34** and **36** which receive the layers in overlapping arrangement for transport to inclined spiked apron **38** and then beater **40** in housing **42** of a fiber-opening machine.

Preferably there is more than one separator between the conveyors and there may be more than one set of blender-conveyors supplying either one or more than one opener. The use of more than one separator increases the diversity of bales contributing to a blender-conveyor. The fiber opener may be of any type adapted to work upon either a single fibrous layer or a stack of such layers.

Separator **26'**, FIG. 2, is similar to separator **26** of FIG. 1 except that in lieu of a smooth circular blade, separator **26'** employs a toothed band saw blade **44** driven by pulley **46** on shaft **48** of motor **50** and guided by guide block **51**. A second motor **52** drives tension rolls **54** and **56** and spacer roll **58** directly by means of pulley **60, 62** and **64**, respectively, interconnected with belt **66**. Lower parting tension roll **68** is driven by belt **70** interconnecting pulley **72** on roll **68** and pulley **74** on roll **56**. Conveyor roll **76** is driven by belt **78** interconnecting pulleys **80** and **82** and conveyor roll **84** is driven by belt **86** interconnecting pulleys **64** and **88**. Upper parting tension roll **90** is also driven from pulley **64** by belt **92** engaged with pulley **94**.

Conveyor web **96** driven on conveyor roll **76** carries the bale **25** toward band saw **44** and conveyor web **100** driven by conveyor roll **84** carries it beyond band saw **44**. Upper and lower parting tension rolls **68, 90** separate the layer **102** from bale **25** at parting line **104** ahead of the cutting portion **106** of band saw **44** by maintaining a tension on layer **102** and the lower surface **108** of bale **25**. Adjacent parting line **104**, such tension acts upon and detaches from either bale **25** or layer **102** fibers bridging the interface therebetween. Band saw **44** should be set so that its toothed edge **106** is on a plane with parting line **104** or approximately one layer thickness above conveyor web **96**. Conveyor web **100** may be at the same level as conveyor web **96** but spacing it somewhat higher, at approximately the height of cutting edge **106** or higher, helps create tension at parting line **104**. Spacer roll **58** may be used as an added support between roll **90** and conveyor web **100**. Tension rolls **54** and **56** may be employed to exert added tension on the separating layer **102**. Tension rolls **54** and **56** and parting tension rolls **68** and **90** need not be smooth but may have grooved, roughened or other types of surfaces and configurations such as the polygonal cross section or rolls **54, 56, 68** and **90** in FIG. 2. The travel of conveyor webs **96** and **100** may be reversed by reversing motor **52**, when layer **102** has been completely severed, thereby returning bale **25** to a position ahead of band saw **44**. Reversal techniques are not necessary in continuous feed systems such as shown in FIG. 1, where there is a constant supply of bales to one or more separators.

The toothed blade 44 of separator 26' does not cut the fibers engaged thereby as readily as the smooth blade of separator 26, but rather tends to grasp and move them bodily in the direction of blade travel. This removes the fibers from the interface as satisfactorily as cutting, and has the additional advantage of preserving the original fiber length. Air suction or other means (not shown) may be provided at the point where blade 44 exits from beneath the bale to salvage the dislodged fibers from the blade for future use.

Separator 26'', FIG. 3, is movable, while bale 25 is held stationary between stops 110 and 112 and is supported by conveyor 114. The function and construction of separator 26'' is the same as that of 26' but separator 26'' is housed in compartment 116 suspended from one of rollers 118 behind the static blade 120 and from one of the rolls 122 ahead of the blade. Rolls 122, compartment 116 and rolls 118 are driven as a unit by an assembly, shown in FIG. 3 turned 90° from its actual orientation, including a belt 124 on rollers 126 and 128, roller 128 being driven by motor 130 through reversing mechanism 132 interconnected with roller 128 by means of pulleys 134 and 136 and belt 138. In the actual position of the drive assembly, belt 124 engages end surfaces of the rolls 122 moved thereby. Pivoted spacing links (not shown) interconnect adjacent rolls 122, and are also provided between adjacent rolls 118. Rolls 118 slide in upper groove 140 of frame 142, rolls 122 in lower groove 144. The system of FIG. 3 is designed to return separator 26'' to the end of bale 25 after each layer is separated, but may as well be arranged for a circuitous path of travel and use one or more similar separators to operate on one or more stationary bales.

Parting tension rolls 68' and 90', tension rolls 54' and 56' and spacer roll 58' are similar to their unprimed counterparts in FIG. 2 and the means to drive them is omitted for greater clarity. Cutting edge 120 may be linearly or rotationally driven or may be stationary as it moves with compartment 116.

The separating means in separators 26, 26' and 26'' may include the parting tension rolls 29 and 31, 68 and 90, and 68' and 90', respectively, without a saw, blade, or other type of cutting edge. The parting tension rolls could carry spikes or pins on their surfaces which would securely engage the fibers and pull the layers from the bale without aid of a blade.

As layers are separated from bale 25 they are directed by tension rolls 54', 56' through port 148 in compartment 116 in overlapping fashion to blender-conveyor web 150 driven on rolls 152, 154 by motor 156.

In operation, FIG. 2, bale 25 is carried to and through edge 106 on band saw 44 driven by motor 50 by conveyor webs 96 and 100. As layer 102 passes downwardly over the end of web 96 it encounters lower parting tension roll 68, and surface 108 of bale 25 encounters upper parting tension roll 90. The tension imparted by rolls 68 and 90 along with that provided by tension rolls 54 and 56 create a parting line 104 between layer 102 and surface 108 ahead of edge 106 which causes layer 102 to part from bale 25 generally along the natural layer boundaries of the bale. Blade edge 106 acts only to remove persistent strands and fibers that fail to completely respond to the parting tension. Spacer roll 58 and conveyor web 100 set slightly higher than cutting edge 106 increase the tension on surface 108 thereby aiding in the maintaining of parting line 104. When layer 102 has been completely separated from bale 25, motor 52 may be reversed, returning bale 25 to its starting position ahead of cutting edge 106.

Should the device of FIG. 2 be used in a continuous feed system such as indicated in FIG. 1, no reversal is necessary. In that circumstance layers 102 from many bales may be deposited in overlapping arrangement on a conveyor-blender, which submits a diverse succession of layers to inclined spiked apron 38 resulting in a good random blending of the cotton input. From there the cotton is submitted to beater 40.

Separator 200, FIG. 4, is similar in concept to the separators 26, 26' and 26'' shown in FIGS. 1 through 3, the primary difference being that it is adapted to separate the fibrous layers of a cylindrical bale which have been convolutely would under controlled pressure about the bale's axis and about a small diameter tube or arbor initially or subsequently positioned at such axis. The arbor 204 extends beyond each end of cylindrical bale 202 and is journaled between vertically extending horizontally spaced legs 206 and 208 at each end of stand 210, whereby as the layer is removed from the revolving bale 202 and the bale decreases in diameter, arbor 204 drops lower into the slot between legs 206 and 208, keeping the periphery of bale 202 in position for engagement by the rolls 212, 214 positioned therebeneath. As shown in FIG. 4, the legs 206 and 108 are slightly canted at an angle of approximately 2°15' relative to the vertical, to partially compensate for the change in diameter of the bale and facilitate continued engagement of bale 202 by roll 214 as layer L is removed.

Rolls 212, 214 rotate bale 202 in indicated direction and the latter roll exerts parting tension thereon. Lower parting tension roll 220 acts upon the layer L being separated from the bale, and cooperates with roll 214 in creating the parting line 216 extending the length of the bale at the interface between layer L and the inwardly adjacent layer still upon the bale. The interfaces between the convolute layers of bale 202 define a spiral path terminating at the arbor 204. Rotation of the bale produces relative movement along this path of parting line 216 and of band saw blade 218. As is the case in the apparatus shown in FIGS. 1 through 3, band blade 218 or another device such as the circular saw 27 shown in FIG. 1 or the stationary cutting blade 120 shown in FIG. 3 is positioned in the opening formed behind the parting line 216 so as to sever or otherwise free persistent strands and fibers that fail to completely respond to the parting tension.

As shown in FIG. 4, upper parting tension roll 214 is resiliently urged into engagement with the receding periphery of cylindrical bale 202 by spring means 226 which may be brought to bear on the shaft of roll 214 in any conventional manner as the layer is removed. For example, as the bale is reduced to the diameter indicated by the phantom line 227 in FIG. 5, the upper parting tension roll 214 is moved as by spring 226 to the dotted line position shown in FIG. 5. The lower parting tension roll 220 is assisted by roll 212 in outwardly feeding the layer L, as it separated, downwardly from the cylindrical bale 202. Additional conveying rolls 222 and 224 may be provided if desired beneath parting rolls 212 and 220 to further aid in delivering the separated layer L from the bale.

Layer L, which in this instance is continuous, may be deposited on a continuous conveyor 228 which is driven around conveyor rolls 230, 232 and delivered to the next stage of processing. A motor 234 directly drives rolls 212, 222, and 230 by means of pulleys 236, 238 and 240, respectively, interconnected by belt 242. A second pulley 246 on roll 222 is interconnected through belt 244 with a spring loaded tensioning pulley 252 and with pulleys 248 and 250 to provide indirect drive of roll 224 and upper parting tension roll 214. Roll 224 includes a second pulley 258 and drives lower parting tension roll 220 by means of belt 254 interconnecting pulleys 256 and 258. It is to be recognized that the specific pulley arrangement described is only one example of a workable arrangement for driving the rolls of the apparatus, and the invention is not limited to any specific arrangement.

Band saw blade 218 performs the same function as band saw 102 shown in FIG. 2 and should have its toothed edge similarly positioned relative to parting line 216, or at a position spaced approximately the thickness of one layer of the bale above the upper periphery of roll 212. Blade 218 is driven by pulley 260 mounted on shaft 262 of motor 264 and is guided into its proper position by guide block 266 at its upper flight.

As further shown by FIG. 4, the separator 200, if desired, may be used in combination with a carding machine 300 or other machine for processing the fiber of the layer L delivered from the separator. The layers of a cylindrical bale are more adaptable for immediate delivery to a carding machine, without passing through an intermediate opener or picker, because such are both continuous and less dense in nature

than the layers from a rectangular bale. The separator 200 removes layer L from the cylindrical bale 202 so uniformly that it may be fed directly into the feed roll and lickerin 304 of a carding machine 300 adjacent the delivery end of conveyor 228. Additional fiber from a reserve hopper 302 may be blended therewith, if desired, prior to the delivery of layer L to the lickerin 304. Moreover, it might further be possible to combine or blend the separated layers from several separators, prior to delivery to a card, or to otherwise utilize the cylindrical bale separator with other fiber processing machines.

It is to be recognized that although the embodiment shown in FIGS. 4 and 5 and described above discloses a bale supported upon and rotatably driven by rolls 212 and 214, it would be within the scope of the present invention for the bale to be otherwise supported or rotated, or for the bale 202 to remain stationary and the separating means moved around it, similar to the method utilized on the rectangular bale as shown in FIG. 3.

It should be appreciated from the disclosure that various types of static or dynamic blades may be used, with either the moving bale stationary separator structure or the stationary bale-moving separator structure, that both bale and separator may be moved relative to one another, that the moving bale or moving separator may be carried suspended from a conveyor, with the separator or bale, respectively, moving or stationary, positioned beneath it.

Other embodiments will occur to those skilled in the art and are within the following claims.

I claim:

1. Apparatus for separating the layers of textile bales comprising:
- separating means;
- support means for supporting a bale and said separating means in separating relationship with each other and for providing relative motion between them;
- said separating means including a parting tension mechanism for maintaining tension at the parting line between the bale and the layer being separated and producing said parting line ahead of said separating means;
- said parting tension mechanism including a first parting roll for maintaining parting tension on the layer separated from the bale;
- a second parting roll for maintaining parting tension on the surface of the bale separated from the layer; and
- said separating means including blade means disposed adjacent and rearwardly of the parting line between the bale and the layer being separated therefrom.

2. The apparatus of claim 1 in which said separating means is supported below the bale by said support means.

3. The apparatus of claim 1 in which said blade means comprises a rotating circular blade.

4. The apparatus of claim 1 in which said blade means comprises a blade mounted for movement generally parallel to said parting line.

5. The apparatus of claim 1 in which said support means includes a reversing mechanism for returning the bale to a position ahead of said separating means in preparation for successive separating operations.

6. The apparatus of claim 1 in which there are a plurality of separating means and support means and a conveyor mechanism arranged to receive separated layers from said plurality of separating means in overlapping relationship for providing a blend of layers.

7. The apparatus of claim 1 in which said separating means is stationary and said bale is movable relative to it by said support means.

8. Apparatus for separating an outer layer of textile fibers from a layered bale of said fibers, comprising:
- separating means for parting said layer from said bale along a line extending across the interface therebetween;
- means relatively moving said separating means and said bale for advancing said parting line transversely of its length through said bale;
- said separating means including parting tension mechanism tensioning fibers bridging said interface adjacent said parting line and thereby detaching said fibers from said layer or from said bale to separate said layer and said bale; and
- blade means disposed a substantially constant predetermined distance rearwardly of said parting line for removal of any remaining fibers there extending between said bale and said layer.

9. The apparatus of claim 8 in which said blade means comprises a movable toothed blade adapted to remove the fibers without substantial cutting thereof.

10. Apparatus for separating the layers of a generally cylindrical bale of textile fibers disposed in convolute fibrous layers about the bale axis, comprising:
- separating means for parting each successive outer convolute layer from its inwardly adjacent layer along a parting line extending lengthwise of the bale;
- means for mounting said separating means and said bale in separating relationship and then providing for relative movement therebetween in a direction advancing said parting line inwardly along a spiraling path collectively defined by the interfaces between adjacent convolute layers of said bale;
- said separating means including a parting tension mechanism engageable with and exerting opposing forces upon each successive outer convolute layer being parted and upon the inwardly adjacent layer upon the bale for tensioning fibers bridging the interface therebetween adjacent said parting line and for thereby detaching the majority of said fibers from at least one of said layers to separate said outer layer from said inward layer, and blade means disposed a predetermined distance rearwardly of the parting line for removal of any remaining fibers there bridging the interface between said layers; and
- means for directing each outer fibrous layer parted from said bale away from said separating means and away from said bale.

11. The apparatus of claim 10 in which said separating means supports said bale in part and is positioned beneath said bale.

12. The apparatus of claim 10 in which said blade means includes a toothed blade mounted for movement generally parallel to the said parting line, and means for imparting said movement to said blade.

13. The apparatus according to claim 12 wherein said parting tension mechanism comprises a roll engaging the outer convolute layer then being thereby parted and exerting a force thereon in a direction away from the bale, and a second roll engaging the periphery of the bale rearwardly of said parting line and exerting a force thereon directed generally toward the bale axis.

14. The apparatus according to claim 13 wherein said second roll is resiliently urged into continuous engagement with the periphery of the bale rearwardly of said parting line.

15. The apparatus according to claim 10 wherein said parting tension mechanism is stationary in relation to the bale axis, and said cylindrical bale revolves about its said axis.