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Araki et al.

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[54] **DEVICE FOR STRIPPING FIBER TUFTS IN THE PICKING PROCESS**

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[52] **U.S. Cl.** ..... **19/80 R**

[51] **Int. Cl.** **D01g 7/06**

[58] **Field of Search** ..... 19/80 R, 81, 145.5; 241/101 A

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Primary Examiner—Dorsey Newton

[57] **ABSTRACT**

Device for stripping fiber tufts utilized for plucking fiber tufts from a pressed fiber bale or opening fiber tufts into smaller fiber tufts, in the picking process. In this stripping device, a plurality of stripping members are turnably assembled about a common shaft, and these stripping members are provided with a plurality of pins or saw teeth secured on a working surface thereof. These stripping members are rotated in opposite directions one by one alternately or one group by one group alternately along the common shaft.

6 Claims, 10 Drawing Figures

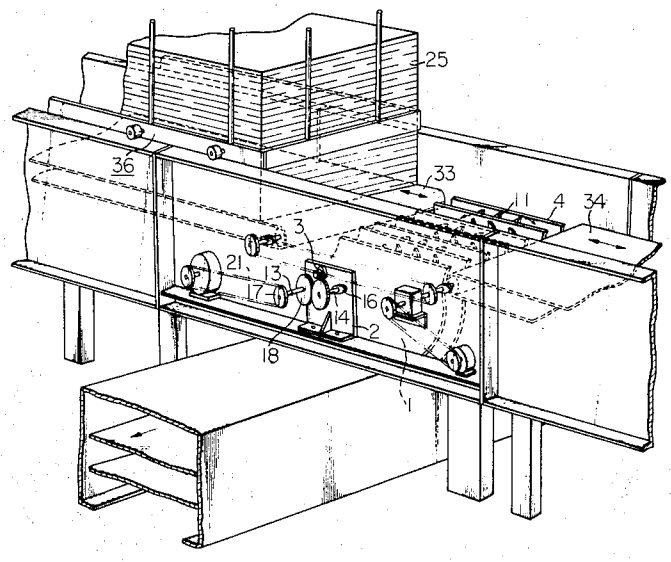


Fig. 1

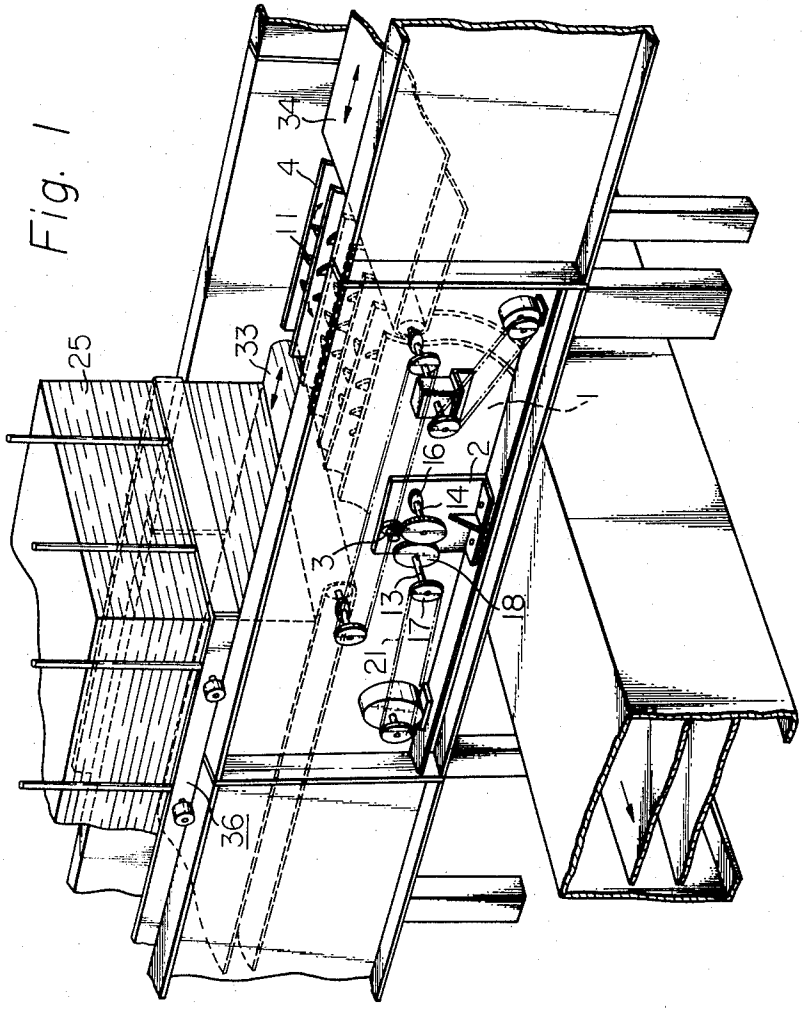
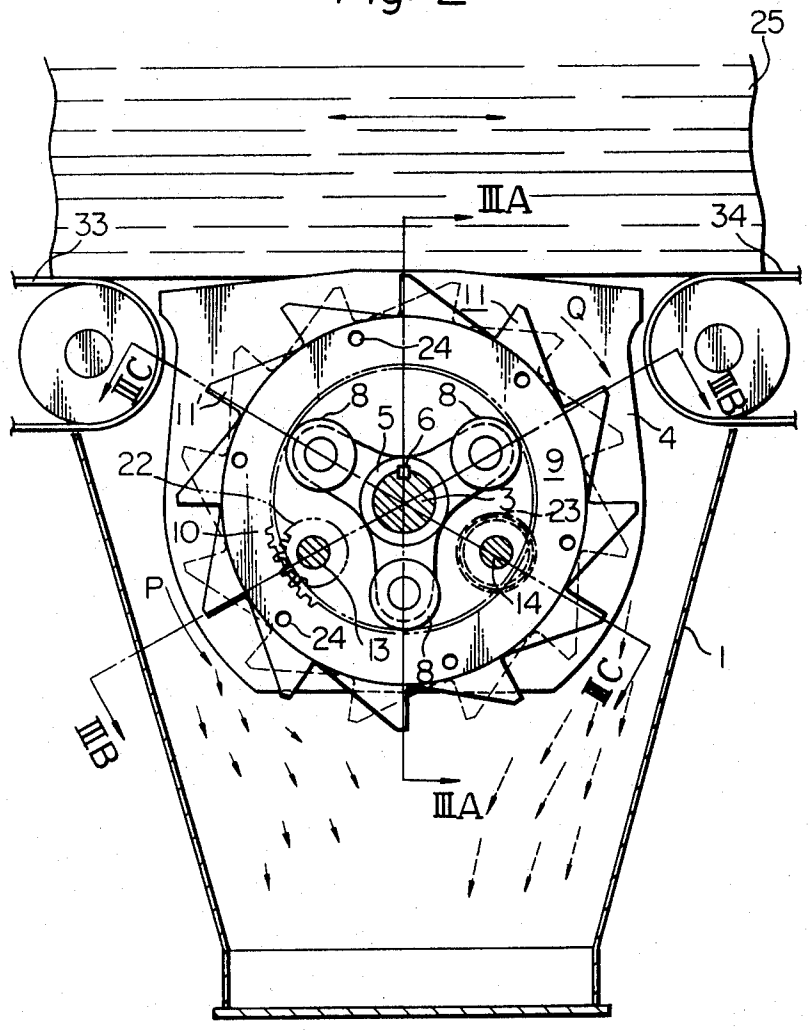


Fig. 2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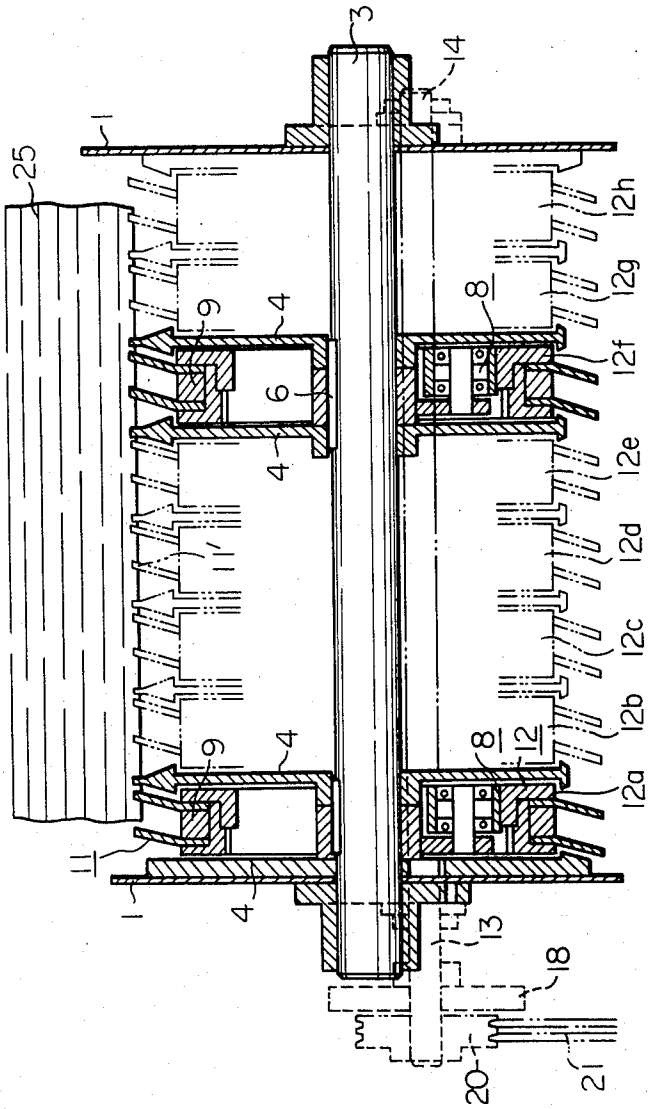

Fig. 3A

Fig. 3B

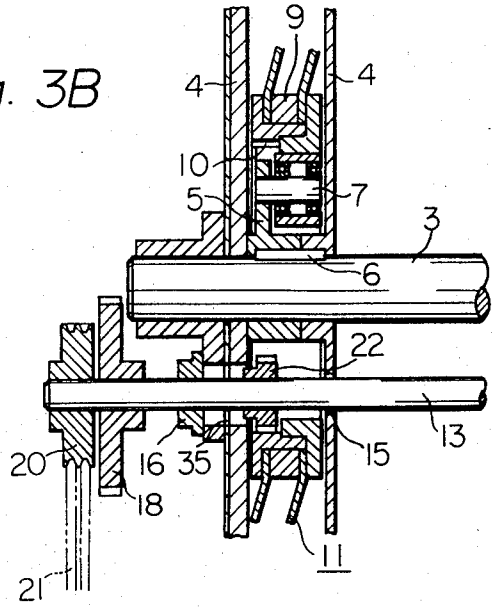

Fig. 3C

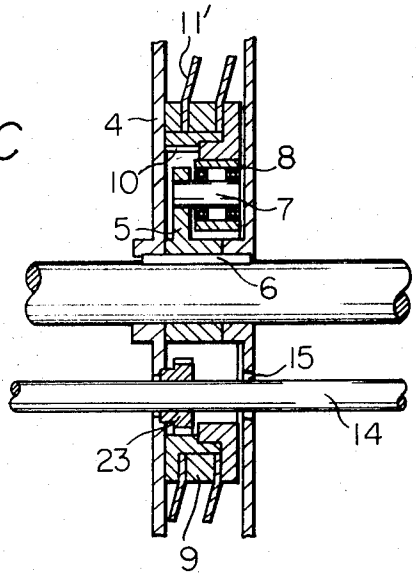

Fig. 4

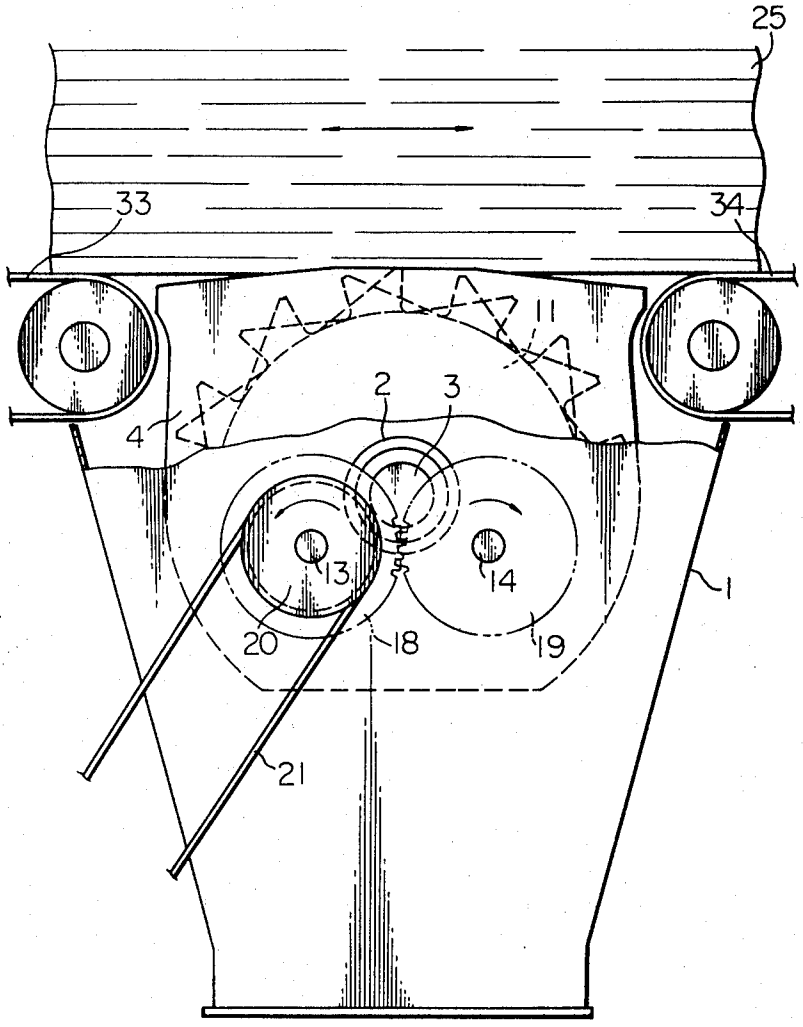

Fig. 5

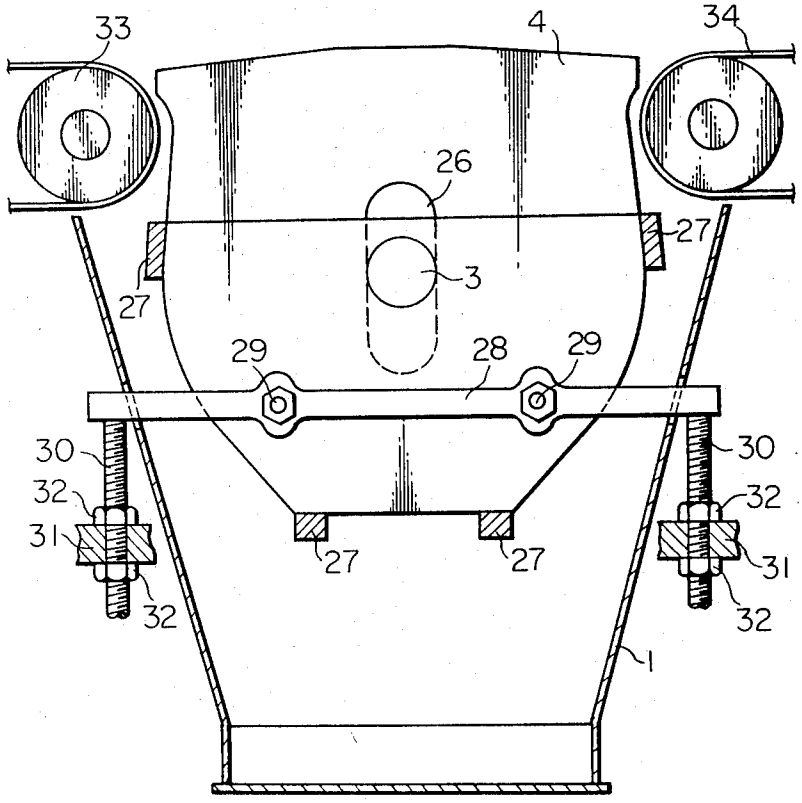

Fig. 6

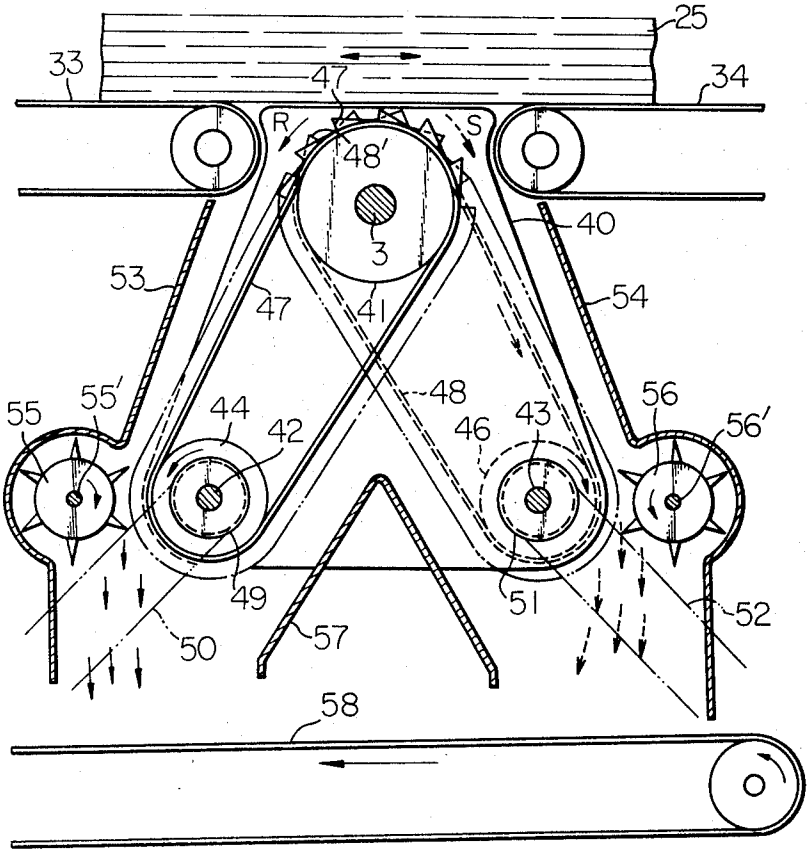
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Fig. 7

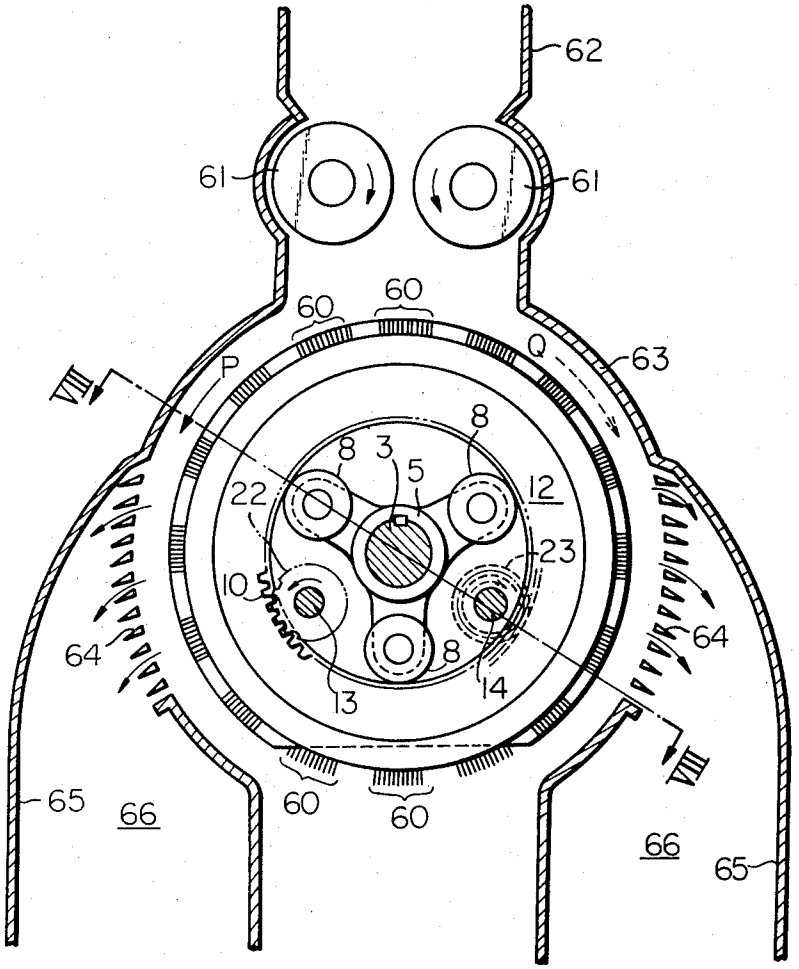
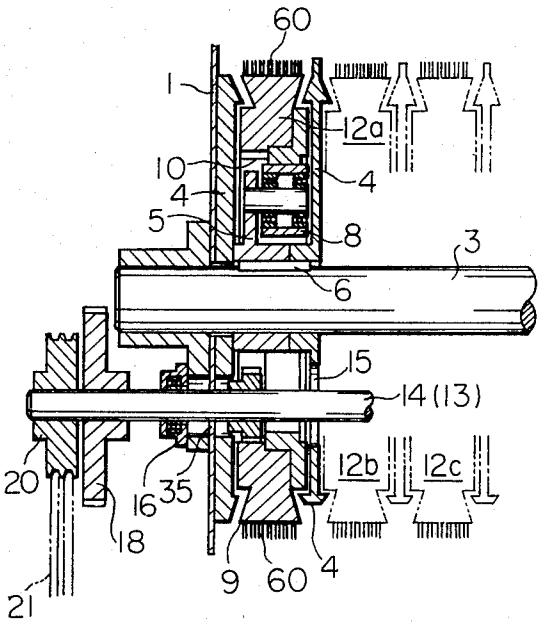


Fig. 8



DEVICE FOR STRIPPING FIBER TUFTS IN THE PICKING PROCESS

SUMMARY OF THE INVENTION

The present invention relates to a device for stripping fiber tufts in the picking process, more particularly relates to a stripping device capable of being utilized as an apparatus for plucking fiber tufts from pressed fiber bale or an apparatus for opening and cleaning fiber tufts in the picking process.

In the conventional machines utilized in the picking process, for example, so called bale plucking machine or opening and cleaning machines, a plucking roller or opening roller is utilized for plucking fiber tufts from a fiber bale or for opening larger fiber tufts into smaller fiber tufts respectively. These rollers principally comprise a rotatable shaft or drum and a plurality of teeth members secured to the peripheral surface thereof so that these teeth members rotate together with the shaft or drum in one rotational direction. We have observed the following drawbacks in the above-mentioned plucking roller or opening and cleaning roller. In case of the bale plucking apparatus wherein a plucking roller is disposed below a plurality of supporting bars which support a pressed fiber bale, because of the unevenness of fiber density of the pressed fiber bales, particularly cotton bales wherein the fiber density varies remarkably, the plucking action by the plucking roller can be effectively applied to portions where the fiber density is comparatively low. However, it is difficult to apply the effective plucking action to portions where the fiber density is comparatively high, because the teeth of the plucking roller tend to slip upon the under surface of these portions. Even if the teeth of the plucking roller effectively work on these portions, only comparatively larger blocks of fibers can be separated from the fiber bale. As a result of this, uniform plucking of the fiber bale is disturbed, in other words, the thickness of the fiber bale on the supporting bars becomes increasingly less uniform as the bale plucking operation proceeds. Due to the above-mentioned irregular change in the thickness of the fiber bale, it becomes difficult to dispose the next fresh fiber bale on the fiber bale just before completion of the plucking operation thereof so as to carry out the plucking operation continuously. Consequently, a machine operator is required to rearrange the fiber bale by troublesome manual operation so as to attain the desirable uniform plucking operation. Further, in the above-mentioned bale plucking apparatus, it is impossible to prevent clogging the spaces formed between the supporting bars with large blocks of fibers. The above-mentioned clogging sometimes causes breaking of the teeth of the plucking roller.

In the case of the above-mentioned opening and cleaning machines, a so called striker roller or pin roller has been applied, wherein a plurality of beating bars or pins are secured to a rotatable shaft or drum, which is rotated in one direction. In these machines fiber tufts are gripped by a gripping means such as a pair of gripping rollers and the gripped fiber tufts are opened by the beating bars or pins so as to separate smaller fiber tufts from the gripped fiber tufts. However, it has been observed that the gripped fiber tufts tend to hang from the gripping means. In this condition, the beating bars or pins usually work on only one side of the hanging material while the other side of the hanging material does not receive effective action by the beating bars or pins. And it has often been observed that, because of this one sided effective action of the beating bars or pins, the length of the hanging material increases, and finally a comparatively large block of fiber tufts is separated from the gripped fiber tufts.

The principle object of the present invention is to eliminate the above-mentioned drawbacks observed in the conventional bale plucking apparatus or opening and cleaning device in the picking process.

For the sake of easy understanding of the present invention, the plucking or opening action by means of the above-mentioned plucking roller or opening and cleaning roller is hereinafter referred to as "stripping action" and the means for carrying out this stripping action is hereinafter referred to as a "stripping roller."

In the stripping roller according to the present invention, a plurality of stripping members are coaxially and rotatably mounted on a shaft in such a way that some number of stripping members are capable of turning toward one rotating direction while remaining number of stripping members are capable of turning toward the opposite rotating direction. The arrangement of the above-mentioned opposite turning stripping members may be chosen in one by one alternate arrangements or one group by one group alternate arrangement. Each stripping member comprises a plurality of stripping knives or bars secured to a circular circumferential surface of a base body rotatably mounted on the shaft. A stripping member comprising a plurality of stripping pins rigidly mounted on a circumferential surface of a disc may be utilized wherein the disc is rotatably mounted on the shaft. In this case, fine stripping action can satisfactorily be carried out.

The detailed composition, characteristic function of the stripping roller according to the present invention are hereinafter illustrated with reference to the accompanying drawings.

BRIEF ILLUSTRATION OF THE DRAWINGS

FIG. 1 is a perspective view of a cotton bale plucker utilizing a stripping device according to the present invention,

FIG. 2 is a schematic front view of a stripping device, in which a side frame portion thereof shown in FIG. 1 is omitted,

FIGS. 3A, 3B and 3C are schematic cross sectional views taken along line IIIA—IIIA, line IIIB—IIIB and line IIIC—IIIC in FIG. 2,

FIG. 4 is a schematic side view of the driving mechanism of the stripping device shown in FIG. 1,

FIG. 5 is a schematic front view of modified separation plates utilized for the stripping device according to the present invention,

FIG. 6 is a schematic front view, partly in section, of another embodiment of the stripping device utilized for cotton bale plucker, according to the present invention,

FIG. 7 is a front view, partly in section of an opening and cleaning apparatus utilizing the stripping device according to the present invention,

FIG. 8 is a cross-sectional view of the stripping device taken along a line VIII—VIII in FIG. 7.

DETAILED ILLUSTRATION OF THE INVENTION

Detailed mechanism of a cotton bale plucker adopted with a stripping device according to the present invention is shown in FIGS. **1, 2, 3A, 3B, 3C** and **4.** In this bale plucker, a shaft **3** is rigidly supported by a pair of brackets **2** mounted on a pair of side frames **1** of the bale plucker. A plurality of separation plates **4** are secured to the shaft **3** in such a way that the intervening spaces between two adjacent separation plates **4** are identical. A three armed bracket **5** is also rigidly mounted on the shaft **3** at each intervening space between two adjacent separation plates **4.** As shown in FIGS. **2, 3A,3B** and **3C,** these separation plates **4** and three armed brackets **5** are secured to the shaft **3** by means of a key **6.** The three armed bracket **5** is provided with three arms extended radially from the central axis thereof with an intervening angle of 120° between adjacent two arms. At each terminal position of each arm which is a symmetrical position with respect to the central axis of the three armed bracket **5,** a horizontal shaft **7** is secured to the arm of the bracket **5.** A guide roller **8** is rotatably mounted on each horizontal shaft **7.** A ring shaped member **9** is slidably supported by three rollers **8,** in each intervening space between two adjacent separation plates **4.** That is, each ring shaped member **9** is slidably engaged with said three rollers **8** at the inside cylindrical surface of the ring shaped member **9.** An internal gear **10** is formed on the inside cylindrical surface of the ring shaped member **9** at an outside area beside the contacting surface thereof with three roller **8.** A pair of saw tooth plate **11** provided with a plurality of saw teeth **11'** are coaxially secured to the ring shaped member **9** with a predetermined intervening space therebetween, by a plurality of pins **24.** Each saw tooth plate **11** is provided with a plurality of teeth projected outward from the rotational axis of the ring shaped member **9.** The assembly of each ring shaped member **9** with the saw teeth plate **11** is hereinafter referred to as a stripping member **12.**

A pair of horizontal rotatable shafts **13, 14** pass through apertures **15** of each separation plate **4,** apertures **35** of the side frames **1** and the inside space of the ring shaped member **9,** and these horizontal shafts **13, 14** are rotatably supported by small brackets **16** secured to the brackets **2.** A pulley **17** and a plain gear **18** are rigidly mounted on the shaft **13** at an end portion thereof, while another plain gear **19** is rigidly mounted on the shaft **14** at a particular position where the gear **18** meshes with the gear **19.** Consequently, the shafts **13** and **14** can be driven simultaneously in opposite directions to each other when the pulley **20** is driven by a V belt **21.** A plurality of pinion gears **22, 23** are rigidly mounted on the shafts **13** and **14** respectively. These gears are arranged so as to engage with the internal gear **10** of the respective ring shaped member **9.** Consequently, any ring shaped member **9** wherein the internal gear **10** thereof meshes with the pinion gear **22,** simultaneously rotated in the opposite directions to that of any ring shaped member **9** wherein the internal gear **10** thereof meshes with the pinion gear **23.** Therefore, the working directions of the saw teeth of the stripping member **12** depend upon whether the internal gear **10** meshes with the pinion gear **22** or the pinion gear **23.** In this embodiment, internal gears **10** of the ring shaped members **9** arranged along the shaft **3** alternately mesh with the pinion gears **22** and **23.** Consequently, working directions of the saw teeth of the stripping member **12** are alternately changed with respect to the lateral direction of the bale plucking machine along the shaft **3.**

As the separation plates **4** are arranged with a fixed intervening space between two adjacent plates **4,** the top edges of these plates **4** work to support a supplied cotton bale **25.** In this cotton bale plucking machine, it is so designed that the outer profile of the saw teeth of the stripping member **12** project beyond a horizontal curved plane defined by the top edges of these plates **4.**

The working effect of the stripping member mainly depends upon the rotating speed thereof and the relative position of the outer profile of the saw teeth of the stripping member **12** to the horizontal curved plane defined by the top edges of these plates **4.**

Consequently, it is required to choose the above-mentioned positional relationship between the outer profile of the stripping member **12** and the horizontal curved plane defined by the top edges of the separation plates **4** so as to attain the optimum effective plucking action. For the sake of easy adjustment of the above-mentioned positional relationship, it is preferable to use a displaceable set of separation plates **4** wherein each separation plate **4** is provided with a perpendicular slot **26** instead of a circular aperture for engaging with the shaft **3** so as to allow displacement in the perpendicular direction. To support these separation plates **4,** these plates **4** are rigidly secured by horizontal rods **27** extending along the shaft **3** in parallel condition. The separation plates **4** arranged at both sides of the device are secured to horizontal bars **28** extending laterally toward the outsides of the side frames **1** by means of fastening bolts **29.** At both end portions of each horizontal bar **28,** vertical rods **30** are rigidly secured as shown in FIG. **5.** The bottom portion of each vertical rod **30** is provided with a screw thread for fastening to a bracket **31** rigidly secured to the machine frame **1.**

The position of each vertical rod **30** is fixed to the bracket **31** by a pair of fastening nuts **32.** Consequently, the above-mentioned relative position of the separation plates **4** to the stripping member **12** can be easily adjusted by changing the fixed position of the vertical rods **30** to the brackets **31.**

As shown in the drawings, a pair of conveyer belts **33, 34** are disposed in such a condition that the upper portion of these belts **33, 34** are positioned at substantially the same position of the horizontal curved plane defined by the top edges of the separation plates **4.** The conveyer belts **33** and **34** are provided with reciprocal driving motion wherein a stroke of this reciprocal motion is chosen so as to displace the supplied cotton bale reciprocally above the working position of the stripping roller comprised of the stripping members **12.**

According to the present invention, a device **36** for supplying fresh cotton bale is mounted above the conveyer belt **33.** A fresh cotton bale is supplied to the stripping device when a processing cotton bale, which becomes thin, is displaced to a position below the device **36.** As the subject matter of the present invention is not directed to the cotton bale plucking machine, the detailed illustration of the supplying device **36** is omitted. As each stripping member **12** is separated by the separation plates **4** on both sides, even if two adjacent

stripping members **12** rotate in opposite directions, air currents created about each stripping member **12** do not interfere with the air current created about the adjacent stripping member **12.** Consequently, the fiber tufts separated from the cotton bale **25** are smoothly delivered to a bottom portion of the device where a conveyer belt (not shown) is disposed so as to carry the cotton tufts to a successive machine.

According to the stripping device of the above-mentioned embodiment, as the stripping saw teeth **11'** of stripping member **12** work in opposite directions alternately, for example, if the saw teeth **11'** of the stripping members **12***a*, **12***c*, **12***e*, **12***g* . . . work in a clockwise direction about the shaft **3**, the saw teeth **11'** of the stripping members **12***b*, **12***d*, **12***f* and **12***h* . . . work in a counterclockwise direction. Consequently even if a certain portion of the cotton bale is very hard to pluck, the slippage of the teeth **11'** of the stripping member **12** can be satisfactorily prevented and uniform plucking action can be applied to the cotton bale **25.**

In the above-mentioned embodiment, the stripping members **12** are rotated in either one of two rotating directions about the shaft **3** alternately. However, it is also effective to rotate a pluralities of adjacent stripping members **12** as a group so that the driving mechanism of the stripping members **12** becomes simpler.

For the sake of avoiding prolixity in the following description, the illustration about the same machine elements as the above-mentioned first embodiment is abbreviated and the same reference numerals as the first embodiment are used for indicating these elements.

In the embodiment of the stripping device shown in FIG. **6,** a horizontal shaft **3** is stationarily mounted on a pair of brackets secured to machine frame (not shown) at a particular position between the two conveyer belts **33, 34.** A plurality of separation plates **40** are rigidly mounted on the shaft **3** with an equal intervening space between two adjacent separation plates **40.** A drum **41** is rotatably mounted on the shaft **3** at each intervening position between two adjacent separation plates **40.**

A pair of horizontal shafts **42** and **43** pass through corresponding apertures formed at symmetrical bottom positions of each separation plate **40** in parallel condition with the shaft **3** and rotatably supported by bearings (not shown) secured to machine frames (now shown) in rigid condition. A plurality of drums **44** are turnably mounted on the shaft **42** in such a way that each drum **44** is disposed in each intervening space between two adjacent separation plates **40.** A plurality of drums **46** are turnably mounted on the shaft **43** in the same manner as the drums **44** on the shaft **42.** An endless belt **47** provided with a plurality of saw teeth **47'** planted thereon is belted on each pair of drum **41** and **44,** while another endless belt **48** provided with a plurality of saw teeth **48'** is belted on each pair of drum **41** and **46.** A pulley **49** is rigidly mounted on an outside end portion of the shaft **42** and the pulley **49** is positively driven by a driving mechanism (not shown) by way of an endless belt **50.** A pulley **51** is rigidly mounted on an outside end portion of the shaft **43** and the pulley **51** is positively driven by a driving mechanism (not shown) by way of an endless belt **52.** As shown in the drawing of FIG. **6,** the pulley **49** is driven counterclockwise while the pulley **51** is driven clockwise. Consequently, each endless belt **47** is turned counterclockwise about the shaft **3,** while each endless belt **48** is turned clockwise about the shaft **3.**

The point of each saw tooth of the endless belts **47, 48** is pointed toward their respective belts turning directions. In this embodiment, the relative disposition of the outside profile of the saw teeth of the endless belts **47, 48** at the top portions thereof to the horizontal plane defined by the top edges of the separation plates **40** is chosen in a way similar to the first embodiment. In this embodiment of the stripping device, fiber tufts taken from the fiber bale **25** are thrown to both sides of the endless belts **47** and **48.** Therefore, both sides of the endless belts **47** and **48** are covered with inclined cover plates **53, 54.** At the bottom terminal of the endless belts **47** and **48,** a pair of cleaning rollers **55, 56** are rigidly mounted on the respective shafts **55', 56'** so as to strip fiber tufts from these endless belts **47, 48** respectively. These rollers **55, 56** are rotated toward opposite directions to these endless belts **47, 48.** An intermediate separation plate **57** is disposed between the lower terminals of the endless belts **47** and **48,** and the above-mentioned covers **53, 54** are extended downward so as to cover the cleaning rollers **55, 56** and then further downward to a position in the proximity of and above a conveyer belt **58** which carries opened fiber tufts to the succeeding machine. In this embodiment, each endless belt **47** is driven to counterclockwise about the shaft **3,** which direction is opposite to the turning direction of the adjacent endless belts **48.** Consequently, very effective bale plucking action similar to that of the first embodiment can be attained.

In the above-mentioned embodiment shown in FIG. **6,** plural sets of stripping belts are utilized and the supplied fiber bales **25** are reciprocally displaced above the stripping device by means of a pair of endless belts **33, 34** as already explained in the case of the first embodiment. However, it can be applicable that, plural sets of stripping endless belts **47, 48** are mounted on a carrier (not shown) which is capable of reciprocally moving along the space formed between two adjacent separation plates **40,** under a supplied fiber bale which is stationarily positioned at a predetermined location.

As it is briefly explained in the section of the summary of the invention, the stripping device according to the present invention can be satisfactorily applied for the opening and cleaning apparatus in the picking process. An embodiment of the stripping device for this purpose is shown in FIGS. **7** and **8.** The stripping device utilized for opening and cleaning cotton tufts has a very similar construction to the stripping device shown in FIGS. **1 – 4.** That is, the stripping roller applied to this device has almost the same construction as that utilized for the bale plucker of the first embodiment, except the saw teeth.

As shown in FIGS. **7** and **8,** a plurality of thick pins **60** are planted as plural groups on the circumferential surface of the ring shaped member **9** so as to form a stripping member **12.** However, it may be allowed to secure these pins **60** so as to uniformly cover the circumferential surface of the ring shaped member **9.** A pair of feed rollers **61** are rotatably supported above the stripping member **12** by respective bearings (not shown) secured to the machine frame at an intervening position between a reserve box **62** and a main cover **63** of the stripping device. A plurality of horizontal grid bars **64** are adjustably mounted on the main cover **63**

at apertures formed on both sides thereof as shown in FIG. 7. A pair of outside covers **55** are formed at outside and away from these grid bars **64** so that a pair of sealed spaces **66** are formed outside the delivery portion of the stripping roller.

When the driving mechanism of the machine is started, the pulley **20** is driven by way of a V-shaped belt **21**, and the driving shaft **13** is rotated counterclockwise (P direction in FIG. 7). Consequently, the stripping members **12***a*, **12***c*, . . . are rotated in the P direction by way of the pinion **22** mounted on the shaft **13**. The plain gear **18** secured to the driving shaft **13** meshes with the plain gear (not shown) secured to the driving shaft **14** so that the shaft **14** is rotated clockwise in FIG. **7**. Consequently, the stripping members **12***b*, **12***d* . . . are rotated in the Q direction by way of the pinion **23** mounted on the shaft **14**. According to the above-mentioned rotation of these stripping members **12***a*, **12***b*, **12***c*, **12***d* . . . , wherein two adjacent stripping members are rotated in opposite directions to each other, the fiber tufts delivered from the nip of the feed rollers **61** receives stripping action from both sides by the stripping members as mentioned above, and very uniform opening action can be carried out. It is important to realize that, according to the stripping action by the pins from both sides of the fiber tufts being delivered from the nip of the feed rollers **61**, the increasing of the length of the hanging fiber tufts from the nip of the feed rollers **61** can be completely prevented. Further, as the stripping action in opposite directions is made by two adjacent stripping members, the relative stripping speed of the stripping members can be understood as double the stripping speed of the conventional device wherein the stripping action is only imparted from one direction to the fiber tufts being delivered from the nip of the feed rollers. Consequently, the stripping speed of each stripping member can be very much lowered so that the fiber damage imparted by the stripping operation is remarkably reduced. When the fiber tufts delivered from the feed rollers **61** are separated into smaller fiber tufts, the impurities contained in the fiber tufts are extracted through the spaces formed between two adjacent grid bars **64** and these impurities are thrown into the spaces **66** formed between the cover **63** and the outside cover **65.**

In the above-mentioned embodiment, thick pins **60** are planted on the circumferential surface of the ring shaped member **9,** however, saw teeth material and the like may be utilized instead of the pins **60.**

What is claimed is:

1. Device for stripping fiber tufts from a mass of fibers in the picking process, comprising an assembly of plural stripping members turnably assembled about a common shaft, a plurality of separation plates each disposed between two adjacent stripping members, a first means for turning half of said stripping members in a clockwise direction about said common shaft, a second means for turning the other half of said stripping members in a counterclockwise direction about said common shaft, each of said stripping members provided with a plurality of saw teeth or pins secured on the working surface thereof, means for supplying said fiber mass to a working position of said assembly of said stripping members, said supplying means disposed in proximity to and above said assembly, means for delivering stripping fibers to a succeeding machine and said delivery means disposed below said stripping members, whereby each combination of said stripping members turning opposite directions to each other impart stripping actions in opposite directions to said mass of fibers at said working position thereof.

2. Device for stripping fiber tufts from a mass of fiber according to claim **1,** wherein said assembly of stripping members comprises plural pairs of stripping members arranged along said common shaft, said stripping members of each pair are turned in opposite directions to each other about said common shaft.

3. A stripping device according to claim **1,** wherein said assembly of stripping members is utilized as a plucking roller of a bale plucking machine, top edges of said separation plates define the position of the under surface of a fiber bale.

4. A stripping device according to claim **3,** wherein half of said stripping members are endless belts turnably mounted on respective drums rotatably mounted on said common shaft, another half of said stripping members are endless belts turnably mounted on said respective drums so as to turn in the opposite direction to said first mentioned half of said stripping members, said endless belts are provided with a plurality of saw teeth or pins planted on the working surface of said endless belts.

5. A stripping device according to claim **1** wherein said supply means is disposed above said stripping members, a reserve box for supplying fiber to said supply means, the reserve box being positioned above said supply means, said assembly of stripping members comprising an opening roller for opening and cleaning fiber tufts supplied through said stripping members from said supply means.

6. A stripping device according to claim **1** wherein said common shaft is stationarily supported by a machine frame in horizontal condition, said common shaft being provided with a plurality of guide members secured thereto at respective positions between two adjacent stripping members, each of said stripping members comprising a ring-shaped member having a smooth cylindrical inside surface and having an internal gear cut into a portion of said smooth cylindrical inside surface, a smooth portion of said cylindrical inside surface engaging said guide members, said first and second turning means comprising first and second horizontal shafts extending through a space formed within said assembly of said ring-shaped members in parallel condition with said common shaft, a first group of small pinions secured to said horizontal shaft and a second group of small pinions secured to said second horizontal shaft, said horizontal shafts being driven in opposite directions, the internal gears formed on half of said ring-shaped members being driven by said first group of small pinions and the internal gears formed on the other half of said ring-shaped members being driven by said second group of small pinions.

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