Feb. 22, 1966 F. REITERER 3,235,911

APPARATUS FOR DETACHING THE WEB OF FIBERS FROM A CARDING MACHINE

Filed March 13, 1963 3 Sheets-Sheet 1

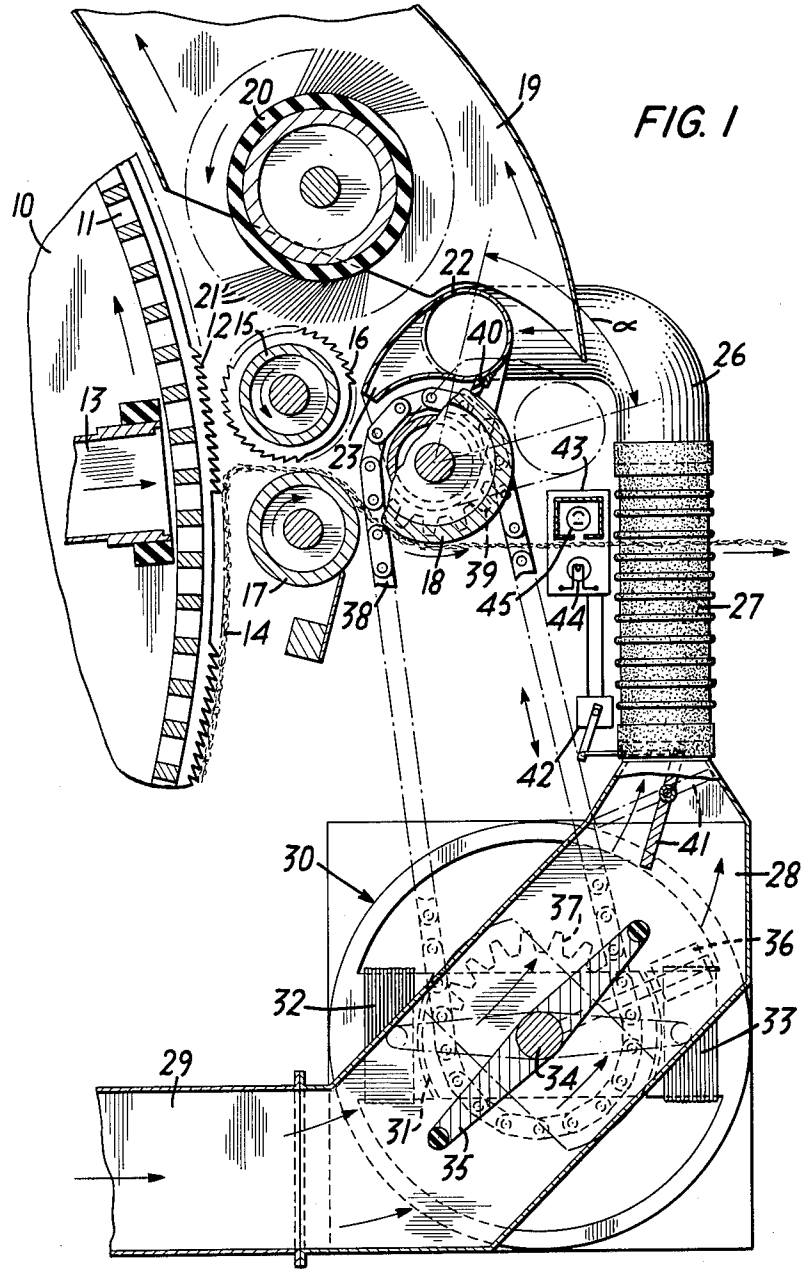

FIG. 1

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APPARATUS FOR DETACHING THE WEB OF FIBERS FROM A CARDING MACHINE

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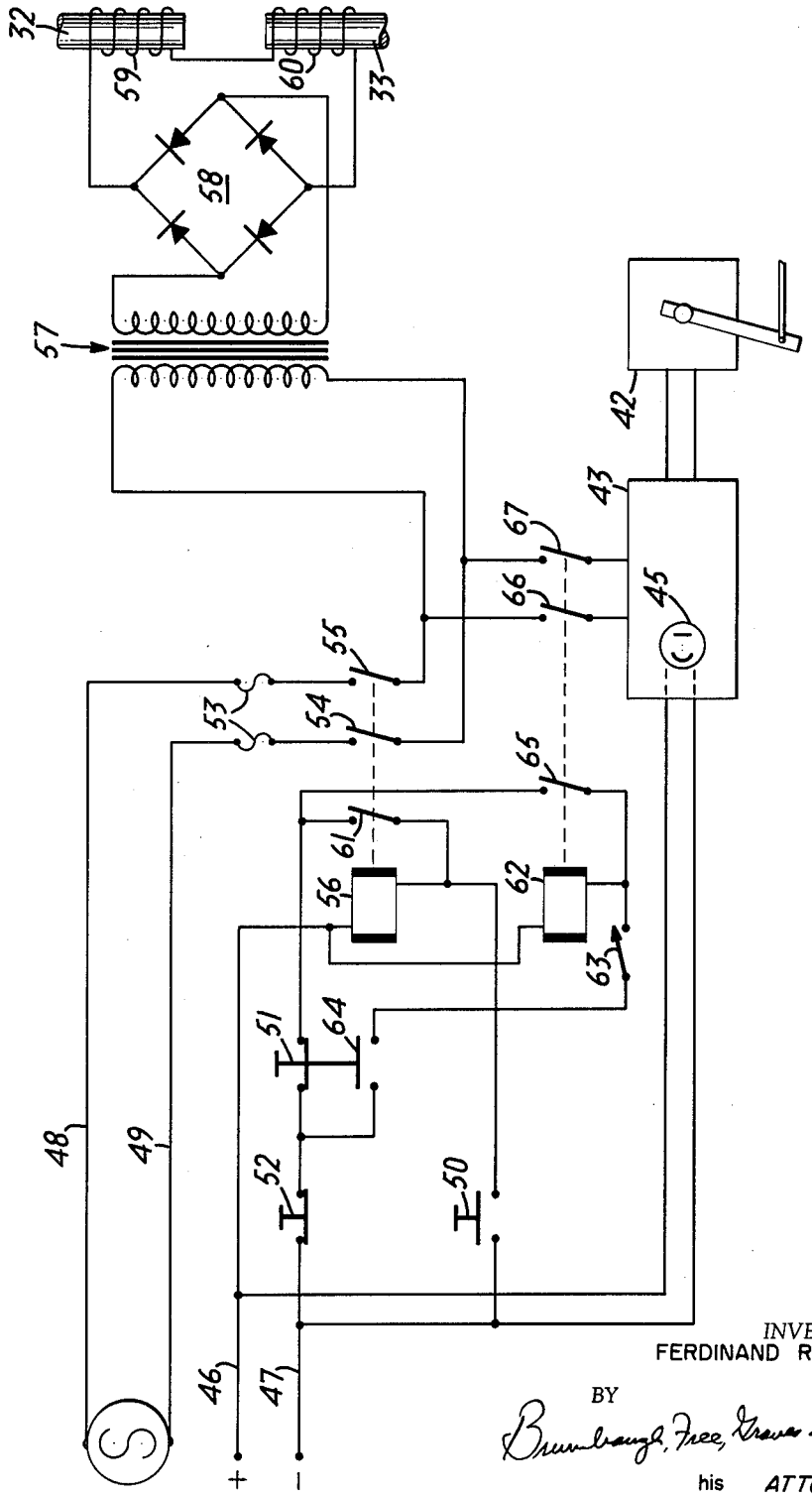

FIG. 2

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APPARATUS FOR DETACHING THE WEB OF FIBERS FROM A CARDING MACHINE

Filed March 13, 1963 3 Sheets-Sheet 3

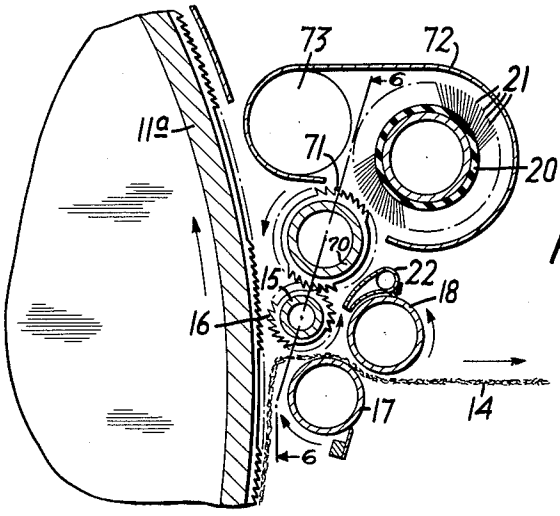


FIG. 5

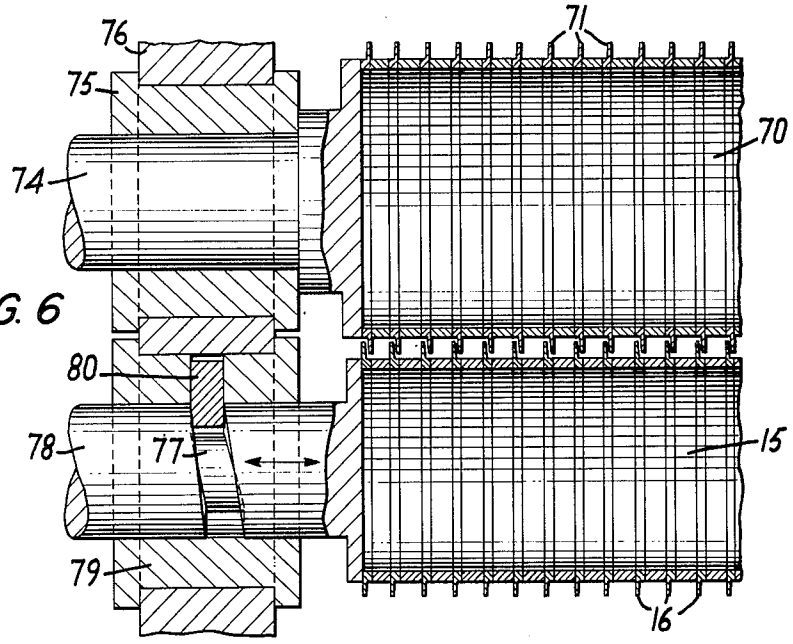
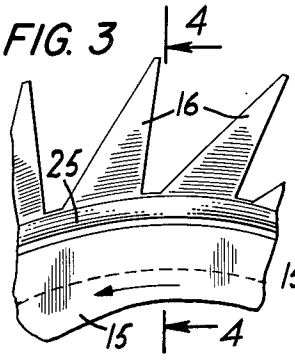


FIG. 6

FIG. 3



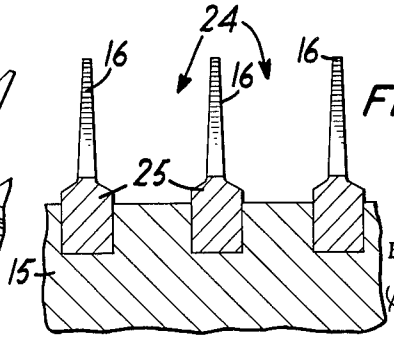


FIG. 4

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United States Patent Office 3,235,911 Patented Feb. 22, 1966

3,235,911

APPARATUS FOR DETACHING THE WEB OF FIBERS FROM A CARDING MACHINE

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Filed Mar. 13, 1963, Ser. No. 264,821
Claims priority, application France, May 28, 1962, 898,977, 899,041; Aug. 7, 1962, 906,289
11 Claims. (Cl. 19—106)

This application is a continuation-in-part of my copending application Serial No. 141,132, filed September 27, 1961, for "Pneumatic Web Removal in Carding Machines," now Patent No. 3,145,428.

This invention relates to devices for removing a web of fibers from a carding machine and, more particularly, to a new and improved web detaching arrangement for carding machines and the like which is especially adapted to assure complete removal of the fibers from the carding machine at high speed and without damage to the fiber web.

In order to avoid the disadvantages of conventional web detaching arrangements, such as vibrating combs which tend to disrupt the alignment of the fibers in a web and which limit the speed of operation of the machine, my above-mentioned copending application describes a detaching arrangement utilizing a plurality of detaching rollers arranged to withdraw the fiber web from the doffer of a carding machine. The arrangement described in that application includes a device for directing a blast of air along the surface of the doffer in the direction opposite to the rotation thereof to assist in detaching the web, along with a hollow perforated roller through which air passes and one or more conveying rollers to direct the web away from the doffer. While that arrangement represents a considerable improvement over the vibrating comb type detachers, nonetheless, it leaves room for further refinement.

Accordingly, it is an object of the present invention to provide a new and improved arrangement for removing a web of fibers from a carding machine.

Another object of the invention is to provide a web detaching arrangement capable of detaching a web of fibers at high speed without disrupting the alignment of the fibers in the web.

These and other objects of the invention are attained by providing, in a carding machine having a cylinder covered with a toothed clothing, a first detaching roller rotating in the same direction as the cylinder and having a plurality of teeth which move closely adjacent to the cylinder clothing to remove the web of fibers therefrom, a second detaching roller rotating in the opposite direction and disposed adjacent to the first roller to receive the web therefrom, along with a nozzle for directing air adjacent to the teeth of the first detaching roller in a direction opposite to the direction of motion thereof and toward the surface of the second detaching roller to direct the web of fibers against the surface of the second roller. A third roller may also be provided to hold the web against the surface of the second roller.

Preferably, the teeth on the primary detaching roller are slanted in the direction opposite to their direction of motion to facilitate removal of the web therefrom by the current of air. In addition, to improve the efficiency of the web removal by the air current, the teeth on the first roller are preferably spaced from each other in the lateral direction, thereby allowing the air to disengage fibers which are held at the base of the teeth. Moreover, in one embodiment, these teeth are arranged in adjacent circles about the first roller and a further roller is provided with similarly mounted teeth which

move in the spaces between the teeth of the first roller so as to clean that roller. If desired, either the first roller or the cleaning roller in this embodiment may also be oscillated in the axial direction to assure complete cleaning of the channels between the teeth.

As a further feature, the velocity of the air current may be regulated in accordance with the density of the fiber web so that higher air velocities, which are more effective in detaching heavy webs, will not be applied to lighter and more fragile webs. Also, if desired, the air supply and the location of the outlet nozzle for the current of air may be controlled so that when operation of the machine is initiated, a strong current of air is supplied but, after the starting period has been completed, the air may be shut off and the air outlet nozzle retracted.

Further objects and advantages of the invention will be apparent from a reading of the following description in conjunction with the accompanying drawings, in which:

FIG. 1 is a view in cross section of a representative embodiment of the invention;

FIG. 2 is an electrical circuit diagram showing a portion of the control system for the machine of FIG. 1;

FIG. 3 is an enlarged fragmentary view illustrating the teeth on the primary detaching roller in the machine of FIG. 1;

FIG. 4 is a view in longitudinal section taken along the line 4—4 of FIG. 3 and looking in the direction of the arrows;

FIG. 5 is a cross-sectional view of a further embodiment of the invention wherein a cleaning roller is provided for the primary detaching roller; and

FIG. 6 is an enlarged view in longitudinal section taken along the line 6—6 of FIG. 5.

In the embodiment of the invention shown in FIGS. 1–4, the detaching arrangement is mounted adjacent to the periphery of a doffer cylinder **10** having a perforated peripheral wall **11** upon which a toothed clothing **12** is mounted, along with an internal air duct **13** arranged to direct air through the wall **11** toward the detaching arrangement to assist in removing a web of fibers **14** from the clothing **12**. It will be understood, however, that the detaching arrangement of the present invention can also be used with conventional doffers having an imperforate peripheral wall and no internal air duct, as in the embodiment shown in FIG. 5.

The detaching arrangement illustrated in FIG. 1 comprises a primary detaching roller **15** rotating in the same direction as the doffer **11** and having a plurality of teeth **16** mounted on its periphery, the teeth being located close enough to the clothing **12** of the doffer to draw the web of fibers **14** away from the clothing, either by direct contact of the teeth with the web or by motion of the current of air carried by the teeth **16** as the roller **15** rotates. A second, web guiding, roller **17** is mounted adjacent to the roller **15** and rotates in the opposite direction so as to receive the web **14** on its outer surface, which is preferably smooth, and a third, web guiding, roller **18** rotating in the same direction as the first roller **15** and the doffer is located close to the second roller and beyond the roller **15** so as to hold the web of fibers **14** against the surface of the second roller over a substantial portion of its area. Preferably, the separation between the rollers **15**, **17** and **18** is great enough so that the web is not compressed as it passes between them and, if desired, the spacing of the roller **18** from the roller **15** may be made adjustable so as to vary the area of contact of the web **14** with the surface of the roller **17**.

Disposed above the three detaching and web guiding rollers is a suction hood **19** into which dust and short

fibers released by detachment of the web are drawn and, in order to facilitate dust removal, a dust collecting cylinder **20** of the type described in my copending application for "Dust Removing System for Carding Machines," Serial No. 179,118, filed March 12, 1962, is mounted at the opening of the hood. As described in that application, the cylinder **20** is covered with a plurality of fine needles **21** which catch the dust and carry it into the hood where it is removed by centrifugal force and by the current of air flowing into the hood.

In order to make certain that the web **14** does not adhere to the teeth **16** of the primary detaching roller **15**, a blowing nozzle **22** having an air outlet opening **23** extending parallel to the axis of the rollers **15**, **17** and **18** is mounted adjacent to the roller **15** so as to direct a current of air tangent to its surface and toward the surface of the second web guiding roller **17**. To facilitate passage of the air current between the teeth **16** and thereby improve the effectiveness of the air current in removing the web **14** from the teeth, the teeth are spaced in the lateral direction, as shown in FIG. 4, rather than being closely adjacent as in the usual toothed clothing, thereby providing channels **24** for the air between adjacent rows of teeth. To accomplish this, the teeth **16** may be formed on a strip **25** which is wound spirally around the roller **15** with adjacent turns in spaced relation or separate circular portions of the strip **25** may be mounted in spaced relation on the roller. In either case, the spacing between adjacent rows of teeth should be at least as great as the height of the teeth above the strip and, in a particular case, a spacing of two millimeters between adjacent rows of teeth was found to be satisfactory.

In addition, as shown in FIG. 3, the teeth **16** are preferably sloped in the direction opposite to the direction of motion of the roller **15** to make it easier for the fibers of the web to slip off the teeth under the influence of the current of air from the nozzle **22**.

Air is supplied to the nozzle **22** through a conduit **26** provided with a flexible section **27** and connected through a damper housing **28** to an air pressure duct **29**. As will be apparent from the description of the control circuit of FIG. 2, which follows, the air supply may be controlled in either of two ways. First, in certain cases, it is desirable to provide a strong current of air upon initiating operation of the carding machine in order to make certain that the detached web of fibers passes between the rollers **17** and **18** but to terminate the flow of air and remove the nozzle from its position between the rollers **15** and **18** after the machine has been started. This mode of operation is accomplished by an electromagnet **30** at one side of the damper housing **28** having a pivotally mounted armature **31** movable between two pole pieces **32** and **33**. A shaft **34** attached to this armature carries a damper **35** and an eccentric weight **36** arranged so that the damper **35** is in the open position, shown in solid lines in FIG. 1, when the armature **31** is aligned with the pole pieces **32** and **33** by energization of the electromagnet. When the electromagnet is deenergized, the weight **36** moves the damper and the armature to the positions shown in dashed outline so that the passageway through the damper housing is closed.

In addition, the shaft **34** carries a gear **37** which is linked by a chain **38** to a similar gear **39** mounted at one end of the roller **18** so as to be movable with respect to the roller. Affixed to the gear **39** is a support plate **40** on which one end of the nozzle **22** is mounted, the other end (not visible in the drawings) being similarly supported for pivotal motion about the axis of the roller **18**. With the damper **35** in the open position shown in solid lines in FIG. 1 permitting air to pass to the nozzle, the gear **39** is turned so that the nozzle is in the position shown in solid lines in FIG. 1 directing the air tangent to the roller **15**. When the damper **35** is turned to the closed position, shutting off the air supply, the chain **38** rotates the gear **39** so as to move the nozzle to the retracted position shown in dashed outline in FIG. 1. As a result of this retraction, the nozzle will not interfere with the flow of air into the hood **19** during normal operation of the machine.

In other instances, it is desirable to maintain the flow of air from the nozzle **22** past the roller **15** at reduced velocity during normal operation of the machine, the velocity being dependent upon the density or thickness of the fiber web. To this end, another damper **41** is mounted in the housing **28** and the position of this damper is regulated by a conventional control device **42**, in accordance with a control signal received from a web density detecting unit **43**. The typical density detecting unit shown in FIG. 1, by way of example, consists of a light source **44** and a photoelectric cell **45** disposed on opposite sides of the web **14** and arranged to provide an electric control signal to the device **42**, directing it to move to the damper **41** toward the closed position in response to decreasing web density or thickness and toward the open position in response to increasing web density.

A typical electrical control circuit for the air control system is shown in FIG. 2 wherein a low voltage direct current source is connected to two conductors **46** and **47** and a source of alternating current at line voltage is connected to two conductors **48** and **49**. In order to initiate the operation of the machine, a push button switch **50** is provided in the usual manner and two further push button switches **51** and **52**, which are normally closed, discontinue the starting operation and direct the normal working operation and the stopping of the machine, respectively, as in conventional machines. The alternating current lines **48** and **49** are joined through two fuses **53** and two normally open contacts **54** and **55** of a relay **56** to a transformer **57** which in turn supplies power through a rectifier bridge **58** to two electromagnet windings **59** and **60** which are wound around the two pole pieces **32** and **33**, shown in FIG. 1. The energizing circuit for the relay **56** is connected from the conductor **46** through the starting switch **50** to the conductor **47**, while a holding circuit leads through a normally open contact **61** and the normally closed switches **51** and **52** to the line **47**.

Furthermore, the actuating coil of a second relay **62** is connected to the conductor **46** and through an on-off switch **63** and a normally open push button switch **64** linked to the switch **51** and then through the normally closed switch **52** to the line **47**. To provide a holding circuit for this relay, a normally open contact **65** leads through the normally closed switches **51** and **52** to the line **47**. Finally, two further normally open contacts **66** and **67** connect the density detecting unit **43** to the power lines **48** and **49** through the contacts **54** and **55**, the unit **43** also being connected to the lines **46** and **47** to supply direct current voltage to the photocell **45**.

In operation, if the air current from the nozzle **22** is not required after the machine has been started, the switch **63** is kept in the open position. Momentary depression of the push button switch **50** energizes the relay **56**, closing the contacts **54** and **55** to supply energy to the electromagnet **30** so as to open the damper **35** and move the nozzle **22** to operating position. At the same time, of course, the carding machine drive motor and blower are started and, as the web of fibers **14** reaches the roller **15**, it is deflected toward the roller **17** and the strong current of air from the nozzle **22** detaches the fibers of the web from the teeth **16** and urges the web against the roller **17** so that it passes between the rollers **17** and **18**. During this operation, the damper **41** is held in the open position since the relay **62** is unenergized and no control power is supplied to the detecting unit **43** and the control unit **42**. When the machine has been started and the web is being withdrawn from the detaching arrangement by the usual sliver forming apparatus (not shown), the button **51** is depressed. This deenergizes the relay and terminates the operation

of the electromagnet so that the weight **36** rotates the shaft **34** to close the damper **35** and pivot the nozzle **22** the retracted position shown in dotted lines.

If continuous application of a controlled air current is desired, the switch **63** is closed before operation is initiated or before the button **51** is depressed. This switch has no effect on the starting of the machine since the switch **64** is normally opened but, when the switch **51** is depressed, this closes the switch **64** energizing the relay **62** and, at the same time, maintaining the relay **56** energized through the switch **64** and the contacts **65** and **61** and, when the button **51** is released, the holding circuit is maintained through that switch. Closing of the contacts **66** and **67** supplies power to the control unit **42** through the detecting device **43** so that the position of the damper is controlled in accordance with the illumination of the photocell **45**, increasing the air current for dense or thick webs and decreasing it for light webs. Upon depression of the stop button **52**, both relays are released, closing the damper **35** and retracting the nozzle **22** in the manner described above.

A modification of the detaching arrangement of the present invention is shown in FIGS. 5 and 6. In this embodiment, the detaching and web guiding rollers **15**, **17** and **18** are the same as described above with reference to FIG. 1 and the doffer is substantially the same except that the outer wall **11***a* thereof is imperforate. Moreover, the air nozzle **22** of this embodiment need not be retractable because it does not interfere with the flow of air, the collecting hood being arranged in a different manner from that of FIG. 1. In this arrangement, the teeth **16** on the roller **15** are mounted in a series of axially spaced circles around the periphery of the roller, as indicated in FIG. 6, and another roller **70** having similarly arranged rings of teeth **71** is mounted closely adjacent to the roller **15** so that the teeth **71** pass between the rings of teeth **16** and very close to the surface of the roller **15**. The roller **71** is rotated in the same direction as the roller **15** but the teeth **71** thereon are slanted forwardly in the direction of rotation so as to be most effective in cleaning the channels between the circles of teeth **16** on the roller **15**, and the rotary speed of the cleaning roller **70** is preferably about 10 to 20 percent greater than that of the detaching roller **15**.

A suction hood **72**, connected to a suction duct **73** and having a dust collecting cylinder **20** of the type described in connection with the FIG. 1 embodiment, is mounted so that the opening of the hood and the periphery of the dust collecting cylinder closely are adjacent to the cleaning roller **70** on the opposite side thereof from the roller **15**. Consequently, the dust and short fibers cleaned from the roller **15** by the roller **70** are drawn from the surface of that roller into the hood.

Furthermore, in order to clean the channels between the rings of teeth **16** more completely, one of the rollers **15** and **70** may be oscillated with respect to the other. In the embodiment shown in FIG. 6, this is accomplished by mounting the shaft **74** for the roller **70** in fixed axial position in a bearing **75** provided in a support plate **76** and forming a groove **77** around the shaft **78** for the roller **15** at an angle to a plane perpendicular to that shaft. To oscillate the shaft **78**, the bearing **79** for this shaft, which is fixed in the plate **76**, carries a pin **80** which projects into the groove **77**. Consequently, during each rotation of the shaft, the roller **15** will be displaced slightly in the axial direction and then restored to its original position, permitting the teeth **71** to sweep the entire width of the channels beween the teeth **16**. With this arrangement, the lateral spacing between the rings of teeth on both rollers may be increased somewhat and, in one case, a five millimeter spacing was found to be satisfactory.

Although the invention has been described herein with reference to specific embodiments, many modifications and variations therein will readily occur to those skilled in the art. Accordingly, all such variations and modifications are included within the intended scope of the invention as described by the following claims.

I claim:

1. Apparatus for detaching a web of fibers from the clothing of a cylinder in a fiber processing machine comprising a primary detaching roller rotating in the same direction as the cylinder and having a plurality of teeth on its outer surface movable adjacent to the clothing to detach a web of fibers therefrom, a second web guiding roller rotating in the opposite direction and having a surface adjacent to the primary roller so as to receive the web of fibers from the primary roller, nozzle means arranged to direct a current of air tangent to the surface of the primary detaching roller in a direction opposite to the direction of rotation thereof and toward the surface of the second web guiding roller, and means for detecting the density of the web of fibers and air current control means responsive to the detecting means for controlling the strength of the current of air from the nozzle means in accordance with the web density.

2. Apparatus according to claim **1** wherein the detecting means comprises light source means and photoelectric means disposed on opposite sides of the web of fibers.

3. Apparatus for detaching a web of fibers from the clothing of a cylinder in a fiber processing machine comprising a primary detaching roller rotating in the same direction as the cylinder and having a plurality of teeth on its outer surface movable adjacent to the clothing to detach a web of fibers therefrom, a second web guiding roller rotating in the opposite direction and having a surface adjacent to the primary roller so as to receive the web of fibers from the primary roller, nozzle means arranged to direct a current of air tangent to the surface of the primary detaching roller in a direction opposite to the direction of rotation thereof and toward the surface of the second web guiding roller, and means for retracting the nozzle means away from the primary detaching roller, means for shutting off the current of air through the nozzle means, and connecting means providing simultaneous operation of the retracting means and the means for shutting off the air current.

4. Apparatus for detaching a web of fibers from the clothing of a cylinder in a fiber processing machine comprising a primary detaching roller rotating in the same direction as the cylinder and having a plurality of teeth on its outer surface movable adjacent to the clothing to detach a web of fibers therefrom, a second web guiding roller rotating in the opposite direction and having a surface adjacent to the primary roller so as to receive the web of fibers from the primary roller, nozzle means arranged to direct a current of air tangent to the surface of the primary detaching roller in a direction opposite to the direction of rotation thereof and toward the surface of the second web guiding roller, and control means for controlling the supply of air to the nozzle means responsive to starting of the fiber processing machine to supply maximum air current to the nozzle means and to termination of the starting operation to reduce the air current to the nozzle means.

5. Apparatus according to claim **4** wherein the control means includes means for regulating the current of air according to the density of the web after termination of the starting operation.

6. Apparatus according to claim **4** wherein the control means includes means for shutting off the current of air and retracting the nozzle means after termination of the starting operation.

7. Apparatus for detaching a web of fibers from the clothing of a cylinder in a fiber processing machine comprising a primary detaching roller rotating in the same direction as the cylinder and having a plurality of teeth on its outer surface movable adjacent to the clothing to

detach a web of fibers therefrom, a second detaching roller rotating in the opposite direction and having a surface adjacent to the primary roller so as to receive the web of fibers from the primary roller, and means for directing the web of fibers away from the teeth of the primary roller and toward the surface of the second roller, wherein the teeth on the primary detaching roller are disposed in rows which are spaced in the axial direction of the roller so as to provide channels between adjacent rows of teeth, and wherein the spacing between adjacent rows of teeth is at least as great as the height of the teeth.

8. Apparatus for detaching a web of fibers from the clothing of a cylinder in a fiber processing machine comprising a primary detaching roller rotating in the same direction as the cylinder and having a plurality of teeth on its outer surface movable adjacent to the clothing to detach a web of fibers therefrom, a second detaching roller rotating in the opposite direction and having a surface adjacent to the primary roller so as to receive the web of fibers from the primary roller, and means for directing the web of fibers away from the teeth of the primary roller and toward the surface of the second roller, wherein the teeth on the primary detaching roller are disposed in rows which are spaced in the axial direction of the roller so as to provide channels between adjacent rows of teeth, and wherein the rows of teeth are circularly disposed about the primary roller and including a cleaning roller rotating adjacent to the primary roller

and having similarly spaced circular rows of teeth arranged to pass adjacent to the surface of the primary roller between the rows of teeth thereon.

9. Apparatus according to claim **8** including means for providing relative oscillation between the primary detaching roller and the cleaning roller in the axial direction with a displacement less than the spacing between the rows of teeth.

10. Apparatus according to claim **8** including dust collecting hood means having an opening disposed adjacent to the cleaning roller to collect dust therefrom.

11. Apparatus according to claim **8** wherein the cleaning roller rotates in the same direction as the primary detaching roller and the teeth on the cleaning roller are slanted forwardly in the direction of rotation thereof.

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