Aug. 18, 1964 KUNIO AOKI 3,144,686

CARDING ENGINE HAVING SUCTION CLEANING MEANS BETWEEN THE LICKER-IN AND THE CARDING CYLINDER

Filed June 26, 1961 4 Sheets-Sheet 1

Fig. 1

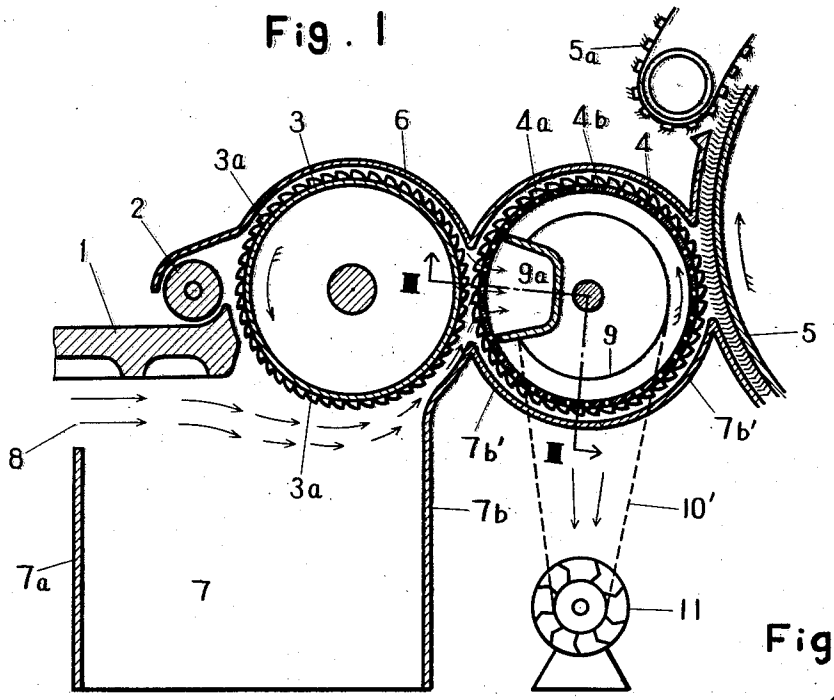


Fig. 1a

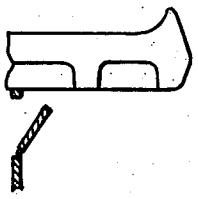
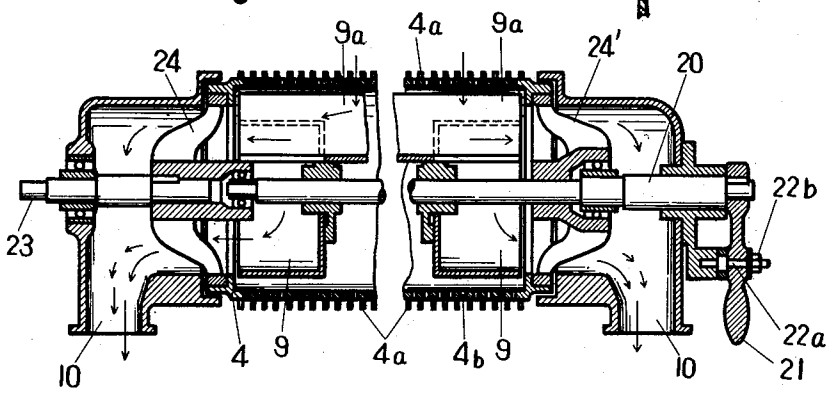


Fig. 2



INVENTOR
KUNIO AOKI

BY
Wenderoth, Lind & Ponack

ATTORNEYS

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Fig. 3

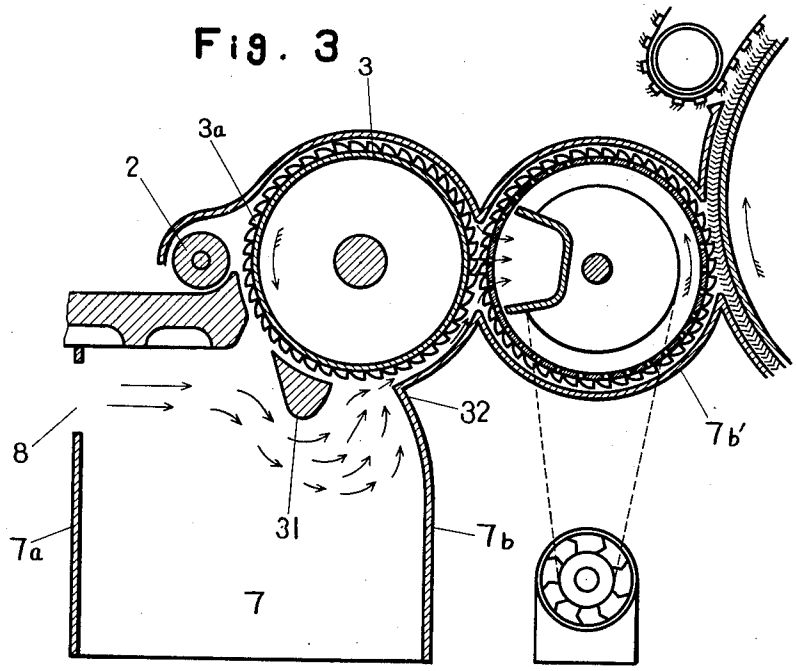
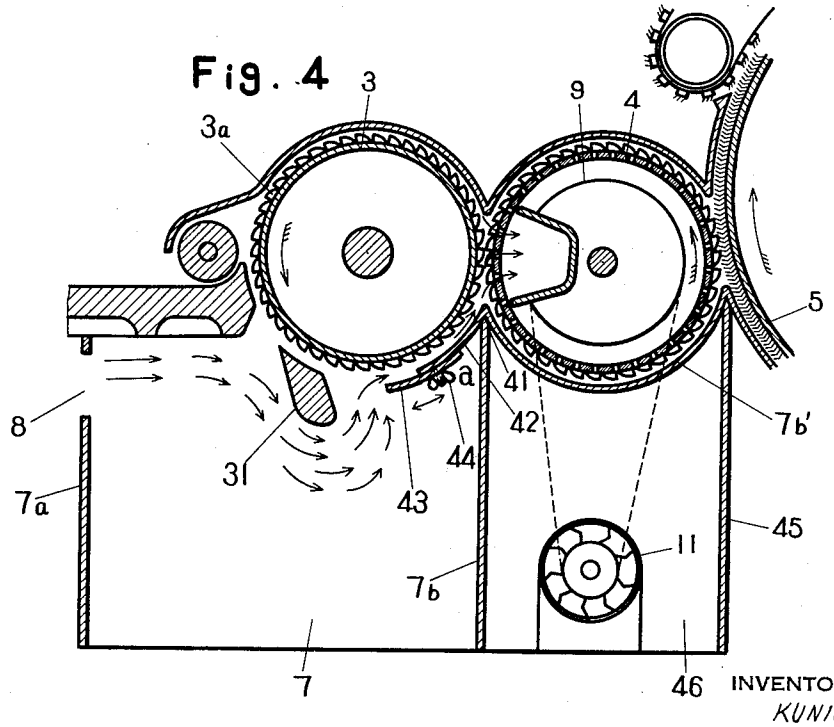


Fig. 4



INVENTOR
KUNIO AOKI
BY
Henderson Sturdevant & Brooks
ATTORNEYS

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Fig. 5

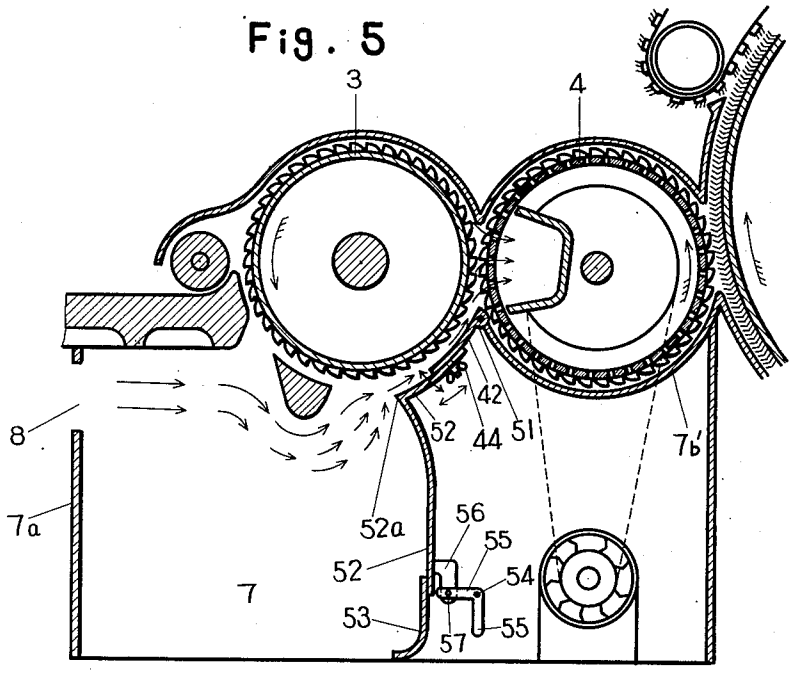
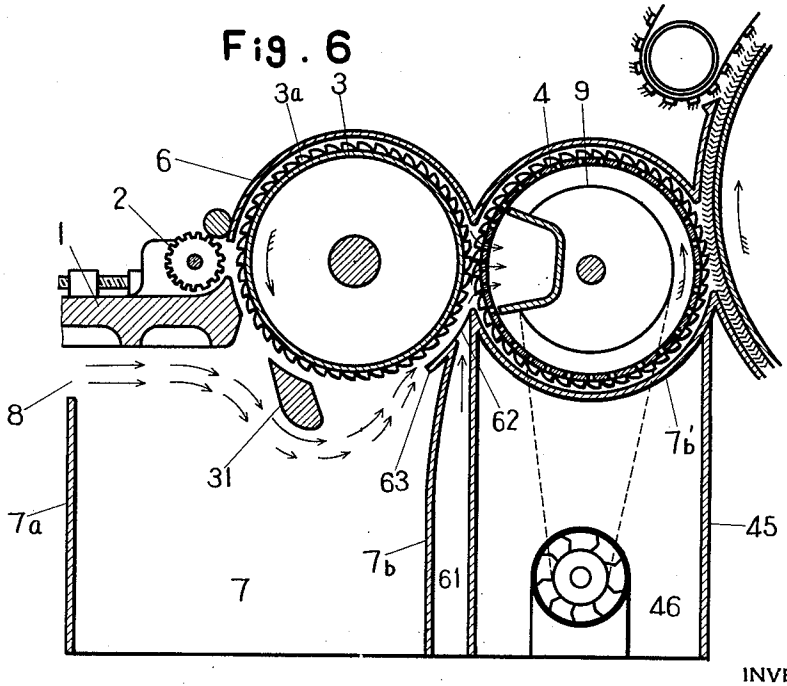


Fig. 6



INVENTOR
KUNIO AOKI

BY
Wenderoth, Lind & Ponack
ATTORNEYS

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CARDING ENGINE HAVING SUCTION CLEANING MEANS BETWEEN THE LICKER-IN AND THE CARDING CYLINDER

Filed June 26, 1961 4 Sheets-Sheet 4

Fig. 7

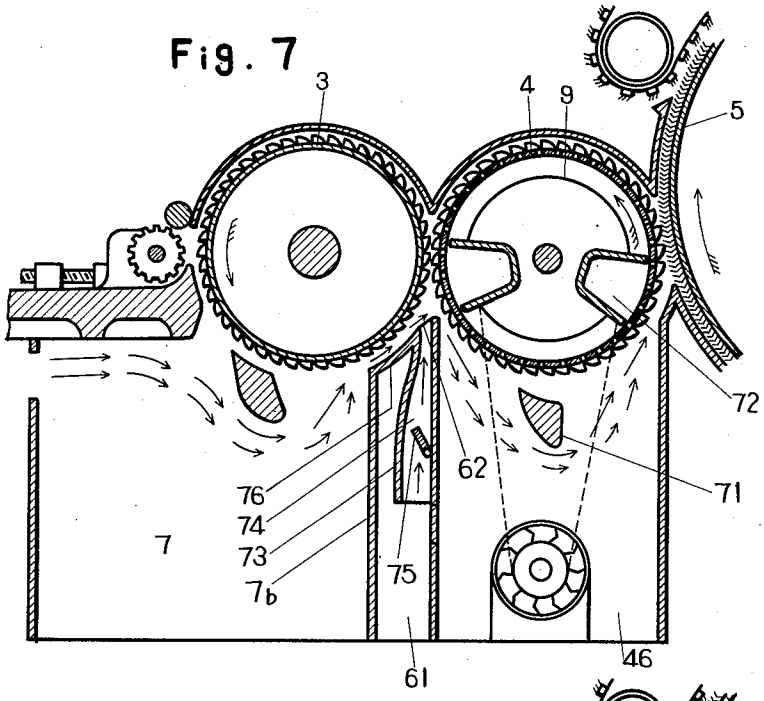
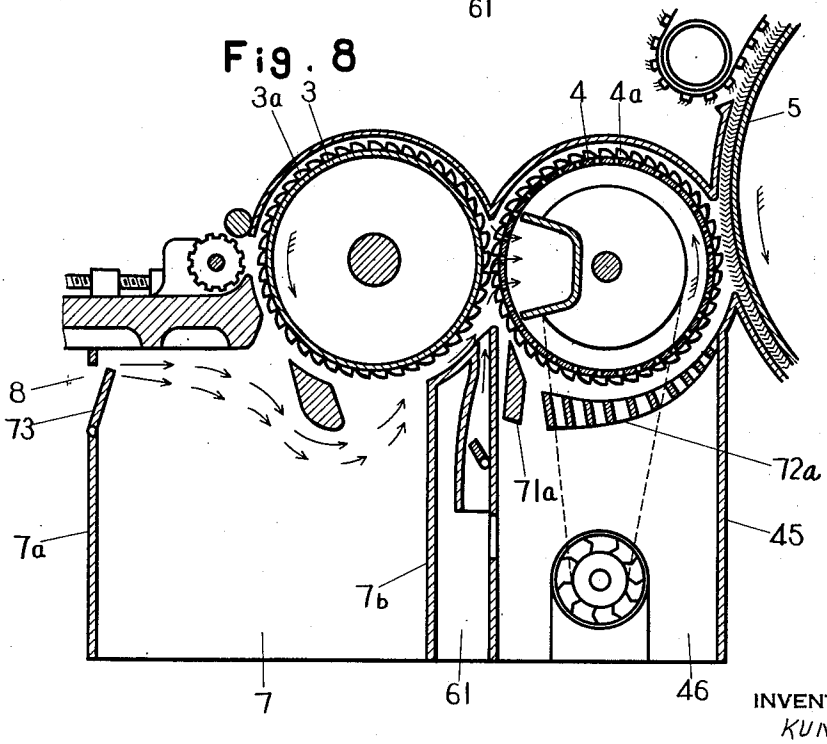


Fig. 8



INVENTOR
KUNIO AOKI

BY
Wenderoth, Lind & Ponack
ATTORNEYS

United States Patent Office

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CARDING ENGINE HAVING SUCTION CLEANING MEANS BETWEEN THE LICKER-IN AND THE CARDING CYLINDER

Kunio Aoki, Osaka, Japan, assignor to Daiwa Boseki Kabushiki Kaisha, Osaka, Japan

Filed June 26, 1961, Ser. No. 119,734
Claims priority, application Japan Dec. 27, 1957
11 Claims. (Cl. 19—105)

This invention relates to improvements in carding engines, this application being a continuation-in-part application of my application Serial No. 779,240, now abandoned.

Heretofore, in the conventional carding engine the fibers fed from the feed roll and taken by the licker-in and had the short fibers and foreign matters contained therein such as dust, pieces of seed, etc. separated by means of the centrifugal force induced by the rotation of the licker-in and gravity; following which the short fibers and foreign matters fell to the bottom of the carding engine and were removed.

In the present invention a licker-in and a cage roller likewise clothed with a saw tooth wire are disposed alongside each other with their peripheral surfaces adjacent to each other, and a carding cylinder is provided with its peripheral surface adjacent that of the cage roller. Inside the cage roller there is provided a suction compartment which opens towards at least a part of the inner peripheral surface of said cage roller. Part of the carding engine below the licker-in is enclosed to define an air chamber, this air chamber having in at least a part thereof an air inlet whereby an air stream is set up which passes along the underside of the licker-in after it is sucked into the air chamber. Further, the top of the licker-in and cage roller is covered with a casing.

Therefore, when the carding engine of the present invention is operated the air that enters by means of the suction action of the suction compartment from the air inlet provided in the front wall of the air chamber sets up an air stream in the air chamber which passes along the bottom surface of the licker-in to be drawn into the suction compartment of the cage roller.

When the material fibers are fed to the licker-in, a greater part (about 80%) of the fibers being caught on the saw tooth wire of the licker-in, are in this state conveyed to and transferred to the cage roller by means of the raking off action of the saw tooth wire of the cage roller and the sucking action of the suction compartment within the cage roller. In the meanwhile, the heavier foreign matters together with some of the fibers separate from the licker-in and on account of the centrifugal force induced by the rotation of the licker-in and of their own weight fall toward the air chamber. However, as already described hereinbefore, there being set up in the apparatus of the present invention a constant air stream below the licker-in, only the relatively heavier dust of the falling foreign matters and fibers can fall all the way through the air stream; whereas the relatively lighter dust, fibers, etc. are sucked by means of the air stream to the surface of the cage roller where the long fibers among them are caught by the saw tooth wire on the peripheral surface of the cage roller where they remain, while only the minute dust and short fibers are sucked through the spaces between the saw tooth wire into the suction compartment and thus

separated. The fibers that are carried and conveyed by the cage roller are then transferred to the carding cylinder.

Consequently, according to the present invention first only the relatively heavier dust contained in the material fibers is separated from the fibers and minute dust and removed by means of the action of the air stream, following which the minute dust and short fibers only are separated from the long fibers by the saw tooth wire mounted on the cage roller and the action of the suction compartment. Thus the dust and minute fibers which account for the lowering of the quality of the fibers are very efficiently removed with no loss of the long fibers. Again, according to the invention, a greater part of the material fibers conveyed by the saw tooth wire of the licker-in is taken off by the saw tooth wire of the cage roller and at the same time the minute dust and short fibers are sucked and separated, the carding is accomplished. Thus, when the fibers in this carded state are transferred to the carding cylinder it becomes possible to enhance to a remarkable extent the carding effects.

The invention is described in detail hereinafter, reference being made to the accompanying drawings, in which:

FIG. 1 is a sectional view of the essential parts of the apparatus of the present invention;

FIG. 1*a* is a fragmentary view of a part of the apparatus of FIG. 1 showing a damper in the air inlet 8;

FIG. 2 is a sectional view taken along line II—II of FIG. 1 and viewed in the direction of the arrow; and

FIGS. 3, 4, 5, 6, 7 and 8 are sectional views similar to FIG. 1 showing still other embodiments of the invention. In the drawings like reference numerals refer to like parts.

Generally, as is well known a carding engine consists chiefly of a feed plate 1, a feed roll 2, a licker-in 3, a carding cylinder 5 provided with revolving flats 5*a* and a doffer (not shown).

However, as shown in FIG. 1 according to the present invention a licker-in 3 clothed with a saw tooth wire 3*a* and a cage roller 4 having numerous perforations 4*b* and clothed with a saw tooth wire 4*a* are disposed alongside each other such that their peripheral surfaces are adjacent to each other, and adjacent to this cage roller there is further provided a carding cylinder positioned so that its peripheral surface is adjacent the peripheral surface of the former. The licker-in 3, the cage roller 4 and a part of the carding cylinder 5 are covered with an upper casing 6. At least a part of the lower part of the licker-in faces an air chamber 7 which has an air inlet 8 provided in its front wall 7*a*. The two side walls of the air chamber 7 are not shown in the drawings, but a back wall 7*b* as shown therein is positioned at a point about below where the licker-in 3 and the cage roller 4 are adjacent to each other, the upper part of this back wall 7*b* being extended upwards so as to form an under casing 7*b'* of the cage roller 4 which covers the lower part of the cage roller 4 as well as a part of the carding cylinder 5. While this under casing 7*b'* has been shown in the drawing as covering the whole of the lower surface of the cage roller 4, it is not necessarily required that it do so, it being possible to provide windows in suitable places or openings in several places, or make it wholly of a wire screen.

Inside the cage roller 4 is secured a suction compartment 9 whose opening 9*a* opens towards the point where the peripheral surface of the cage roller 4 and the pe-

ripheral surface of the licker-in 3 are closest to each other. The air in the suction compartment 9 is exhausted via a duct 10 by means of an exhaust fan 11.

While the suction compartment 9 provided inside the cage roller 4 and its suction mechanism may be of any convenient construction, a description of an example with reference to FIG. 2 will be given below.

In FIG. 2 the two ends of an opening 9*a* which opens towards a part of the interior periphery of the cage roller communicate with tub-like suction compartments 9 the ends of which are open and connect with ducts 10, 10. The ducts 10, 10 at both ends of the cage roller 4 join in forming a duct 10' which is connected to an exhaust fan 11. Consequently, the air which has been sucked into the openings 9*a* of the suction compartment 9 from the numerous perforations 4*b* of the cage roller 4 is exhausted by means of the exhaust fan 11 via suction compartments 9, 9, ducts 10, 10 and duct 10'.

The suction compartment 9 is secured to a stationary shaft 20 which has a handle 21 secured thereto. While not shown in the drawing the handle 21 has an enlarged portion at about its middle part wherein a curved slot is provided. When the shaft 20 is rotated by operating the handle and thereby the opening 9*a* of the suction compartment 9 which is secured to this shaft 20 is set at the desired position, a nut 22*b* fitted to a stud 22*a* which fits in the curved slot of the handle 21 is tightened. By doing this, the opening 9*a* of the suction compartment 9 can be set in the desired position by manipulation of the handle 21.

On the other hand, the cage roller 4 is supported by radial arms 24, 24', the radial arm 24 being secured to a rotating shaft 23 other than the aforementioned shaft 20 and the radial arm 24' being freely rotatably mounted on a stationary shaft 20. By rotating the rotating shaft 23 by means of a suitable power source (not shown) the cage roller 4 is rotated.

When the carding engine illustrated in FIGS. 1 and 2 is operated, with the exhaust fan 11 being activated an air stream flowing in the same direction as the rotation of the licker-in 3 is set up in the air chamber 7 below said licker-in 3 flowing from the air inlet 8 towards the opening 9*a* of the suction compartment 9 to be finally exhausted by the exhaust fan 11. A greater part of the fibers of the material fibers fed from the feed roll 2 is caught by the saw tooth wire 3*a* of the licker-in 3 and conveyed thereon, while the dust, seeds and other foreign matters are, if they are of sufficient heaviness, separated from the fibers by the powerful centrifugal force of the licker-in 3 or by gravity and fall to the bottom of the air chamber 7. On the other hand, foreign matters which are minute and of relatively light weight and short fibers that are not readily caught by the saw tooth wire 3*a* as well as a part of the long fibers float in the air stream that flows along the underside of the licker-in 3 and are conveyed towards the cage roller 4 together with the greater part of the fibers carried by the saw tooth wire 3*a* of the licker-in 3.

Thus, at that point where the peripheral surface of the licker-in 3 and that of the cage roller 4 are adjacent to each other, owing to the fact that the licker-in 3 and the cage roller 4 are rotating while their respective saw teeth wires 3*a* and 4*a* come together occlusively with a minute clearance between them, a greater part of the fibers held and conveyed by the saw tooth wire 3*a* of the licker-in 3 is, while being opened and carded by the saw tooth wire 4*a*, by means of the raking off action of cage roller 4 and the suction action of the suction compartment 9 transferred to the cage roller 4. On the other hand, the long fibers among the fibers and foreign matter that are floating in the air stream get caught on the saw tooth wire 4*a* by the suction action of the suction compartment 9, while the minute foreign matters and short fibers floating in the air stream are sucked in-

to the suction compartment and pass through the perforations 4*b* without clogging them and are exhausted.

For regulating the flow of the air stream it is advantageous to provide a damper in the air inlet 8, as shown in FIG. 1*a*. In addition, for stabilizing the air stream set up on the underside of the licker-in 3 it is preferred that the front wall 7*a* of the air chamber 7 be located, if possible, towards the front of the carding engine, for example, in the vicinity under the front end of the feed plate 1.

Since according to the present invention as described hereinabove, the cleaning of the fibers is carried out in two places, i.e., under the licker-in 3 and on the peripheral surface of the cage roller 4, not only is the cleaning efficiency very excellent but also on account of the action of the air stream the loss of long fibers is small. Moreover, with the fibers being opened and combed by the saw tooth wire 4*a* of the cage roller 4, the opening and combing ability of the carding cylinder 5 and the revolving flats 5*a* can be enhanced considerably. Again, according to the invention, because the transfer of the fibers between the licker-in 3 and the cage roller 4 is effected by means of the raking off action of the saw tooth wire 4*a* of the cage roller 4 and the suction action of the suction chamber 9, the transfer is effected even though the rate of rotation of the cage roller is less than that of the licker-in. Thus it is possible to rotate the licker-in 3 at a speed higher than the peripheral speed of the carding cylinder 5 and to accordingly enhance the opening and carding ability and thus increase greatly the productive capacity of the carding engine.

In addition, by opening the suction chamber 9 towards the point where the licker-in 3 and the cage roller 4 are adjacent to each other part of the air in between the licker-in 3 and the upper casing is sucked into the suction compartment 9. In consequence, since the extent to which the fiber lap fed by the feed roll 2 is affected by the air stream that is set up in concomitance with the rotation of the licker-in decreases, the tendency of fibers from the lap to fall even after leaving the tip of the feed table 1 is lessened. Furthermore, in this instance by positioning the tip of the upper casing 6 of the licker-in 3 so that it covers the upper part of the feed roll 2 as shown in FIG. 1, and as a result, making somewhat larger the space covered by the upper casing 6 where the feed roll 2 and the licker-in 3 come adjacent to each other, it becomes possible to reduce the effect of the air stream that occurs in concomitance with the rotation of the licker-in 3.

Moreover, since in the embodiment shown in the aforementioned FIGS. 1 and 2 the underside of the cage roller 4 is enveloped by an under casing 7*b'*, the fibers caught by the saw tooth wire 4*a* are supported by the air stream set up in the space between the under casing 7*b'* and the cage roller 4 in concomitance with the rotation of the latter, and while being held in the saw tooth wire 4*a* of said cage roller 4 are transferred to the carding cylinder 5. Thus, in the carding engine of FIG. 1 the under casing 7*b'* functions not merely as a casing but also serves as a means to control the air stream on the underside of the cage roller 4.

Thus, according to the invention, for conveying a substantial amount of the fibers carried by the saw tooth wire 4*a* of the cage roller 4 to the carding cylinder, it is preferable that means for controlling the air stream be provided so that an air stream is provided on the underside of the cage roller 4 that is sufficient for supporting said fibers.

In addition, according to the invention, for enhancing the cleaning efficiency of the licker-in 3 it is preferred that at a suitable place below the licker-in 3 a mote knife be provided leaving a clearance sufficient for the passage of the fibers carried on the saw tooth wire 3*a* of the licker-in 3 but as close to the licker-in 3 as possible, and further that the carding engine be so designed that the licker-in 3 and the cage roller 4 rotate in the same direction while the

carding cylinder 5 rotates in a direction opposite to that of the cage roller 4. However, inasmuch as the material fibers fed from the feed roll 2 pass the underside of licker-in 3 and are transferred to the cage roller 4, the direction of rotation of each of the rotating members is automatically determined.

Therefore, according to the present invention a preferred embodiment thereof is a carding engine whose construction comprises disposing side by side a licker-in 3 clothed with a saw tooth wire 3*a* and a cage roller 4 clothed with a saw tooth wire 4*a* so that both rotate in the same direction and further that their peripheral surfaces are adjacent to each other, providing a carding cylinder 5 rotating in a direction opposite to that of the cage roller 4 so that the peripheral surface of said carding cylinder 5 comes adjacent to the peripheral surface of said cage roller 4, providing inside said cage roller 4 a suction compartment 9 opening towards a point at which the cage roller 4 and licker-in 3 are adjacent to each other, covering the upper parts of the licker-in 3 and cage roller 4 as well as a part of the carding cylinder 5 with an upper casing 6, leaving a space between each of the rotating members and said upper casing, providing a partitioning wall 7*b* below the vicinity of the point at which the licker-in 3 and cage roller 4 are adjacent to each other, also providing two side walls and a front wall 7*a* to define an air chamber 7 at least below the licker-in 3, providing an air inlet 8 in said front wall 7*a*, and providing an air stream controlling means which will set up along the underside of said cage roller 4 an air stream sufficient to convey to the carding cylinder a substantial amount of the fibers which have been transferred to the peripheral surface of the cage roller 4 from the peripheral surface of the licker-in 3. Hence, in this case the partitioning wall 7*b* constitutes the back wall of the air chamber 7. The partitioning wall 7*b* can be provided below the cage roller slightly closer to the cage roller than the point where the licker-in 3 and the cage roller 4 are closest to each other, or below the closest point, or in a suitable location between the mote knife and the point where the licker-in and the cage roller are closest.

Other suitable embodiments of the invention are described hereinafter with reference to FIGS. 3, 4, 5, 6, 7 and 8 of the accompanying drawings.

The embodiment shown in FIG. 3 is substantially identical to that shown in the aforementioned FIG. 1, except that a mote knife 31 is provided below the licker-in 3, and further the upper portion of a back wall 7*b* of the air chamber 7 forms a projecting portion 32 projecting into the air chamber 7 at that part adjacent to the licker-in 3, which upper portion of the back wall 7*b* being spaced a suitable distance from the licker-in 3 takes the form of an under casing.

The mote knife 31 is provided as close to the licker-in 3 as possible, leaving, however, a sufficient space for the passage of the fibers carried by the saw tooth wire 3*a* of the licker-in 3.

In this embodiment the air which enters the air inlet 8 first collides with the mote knife 31 and is deflected downward, following which a part of the air stream is again deflected by the projecting portion 32 of the back wall 7*b*. Thus, on account of the fact that the air stream is deflected in two places, the dust that floats in the air stream is separated more satisfactorily and the cleaning efficiency is enhanced. In this case, a damper may also be provided in the air inlet 8 of the front wall 7*a* of the air chamber 7 for the purpose of regulating the air stream.

FIGS. 4 and 5 illustrate respectively other modifications of the present invention. The embodiment shown in FIG. 4 is substantially identical in construction to that shown in the aforementioned FIG. 3, except for the following details. In this embodiment the back wall 7*b* of the air chamber is practically perpendicular, and with the point of the junction of this wall with the under casing 7*b'* as the starting point a plate 42 extends there-from along the licker-in 3 and is properly spaced therefrom. To this plate 42 at its forward end there is adjustably attached so as to be slidable along the plate 42 and adjustable plate 43. In addition, at a point below the point where the cage roller 4 and the carding cylinder are adjacent to each other a partition 45 is provided whereby a chamber 46 is formed below the cage roller 4, in which chamber 46 the exhaust fan 11 is housed.

In FIG. 5 is illustrated an embodiment that is substantially identical to that of FIG. 4 except for the following points. In this embodiment, a plate 42 is hinged to the under casing 7*b'* of the cage roller 4 at its tip, and to the forward end of this plate 42 there is attached a sliding plate 52 having a projecting portion 52*a* thereon, which plate is mounted so as to be slidable by means of the manipulation of a screw 44. To the lower part of the sliding plate 52 is attached an elastic sheet 53 such as, for example, a rubber or synthetic resin sheet, which in conjunction with the sliding plate 52 forms the back wall of the air chamber 7. Furthermore, when a crank 55 pivoted at a point 54 is turned, an arm 56 loosely connected at a point 57 moves up and down whereby the plate 42 and the sliding plate 52 move up and down making possible the adjustment of the gap between them and the licker-in 3. Also, although not shown in the drawings, when the desired angle of spread has been achieved between the plate 42 and the licker-in 3 by turning the crank 55, provision has been made so that said crank 55 may be secured. Further, the projection 52*a* of the sliding plate 52 may be made to protrude and the underside thereof be formed into a curved portion, as shown in FIG. 5, or it need not be made to protrude in such a fashion.

Thus, in the embodiment shown in FIG. 4 the space below the plate 42 and sliding plate 43 constitutes a dead air space, and not only is the cleaning efficiency enhanced because the air stream that flows in from the air inlet 8 is deflected twice, once at the mote knife 31 and again at the projecting portion of the sliding plate 43, as in the case of the embodiment shown in FIG. 3; but also since the position of the projecting portion of the sliding plate 43 can be advanced or retracted, it is possible to control the intensity of the air stream, and the thickness of the air stream layer as well as the angle of deflection of the air stream at the projecting portion of the sliding plate 43, etc. Further, in FIG. 4 the rear partition 45 of the chamber 46 may be provided under the carding cylinder 5. This rear partition 45 is not indispensable.

On the other hand, in the embodiment shown in FIG. 5, since the plate 42 and the sliding plate 52 which constitute the under casing of the licker-in 3 can be freely adjusted as to their opening with respect to the licker-in 3, and at the same time the projecting portion 52*a* of the sliding plate 52 can be adjusted so as to advance or retract its position, and the combined lengths of the plate 42 and the upper part of the sliding plate 52 which constitute the under casing of the licker-in 3 can be freely adjusted.

Consequently, the embodiment shown in FIG 5, as compared with that shown in FIG. 4, affords still greater freedom in the control of such factors as the intensity of the air stream, the thickness of the air stream layer, and also the angle of deflection of the air stream in front of the projecting portion 52*a* of the sliding plate 52.

Therefore, by means of the embodiments shown in FIGS. 4 and 5 it becomes possible to form a most suitable air stream depending on the factors such as the type of material fibers, the kinds of foreign matters contained and as to how they are contained, the peripheral speed of the licker-in, the shape and location of the mote knife, etc.

The embodiment shown in FIG. 6 is identical to that shown in FIG. 3, except for the following points. The back wall 7*b* of the air chamber has been constructed to serve as the wall on one side of a duct chamber 61.

Air is supplied from an entry (not shown) to the duct chamber 61 which is provided with an air outlet 62 opening at about the point where the licker-in 3 and cage roller 4 are adjacent to each other or in a suitable location somewhat further below the licker-in 3. In addition, the tip of the wall 7*b* on one side of the duct chamber 61 is turned under the licker-in 3 to form an under casing 63 covering a part of the underside of the licker-in 3. Further, as in the case of FIG. 4, a chamber 46 is formed under the cage roller 4 by means of a partitioning wall 45 and side walls (not shown).

In the forward portion of this under casing 63 a sliding plate like that shown in FIG. 4 may also be provided. A damper may also be provided in the inlet 8 of the front wall 7*a* of the air chamber 7. Further, the under casing 7*b'* of the cage roller 4 may be made in the form of a grid as shown in FIG. 8 and described hereinafter. In addition, it is possible to provide a damper in the outlet 62 of the duct chamber 61, or by hinging a part of the wall 7*b* of the duct chamber 61—which wall also serves as the back wall of the air chamber 7—it is possible to regulate the size of the opening of said outlet 62.

In this carding engine illustrated in FIG. 6, by feeding an auxiliary supply of air from the duct chamber 61, the air stream flowing along the underside of the licker-in 3 as well as the suction action of the suction compartment 9 provided inside the cage roller 4 is controlled.

As to the embodiment shown in FIG. 7, this is identical to that shown in FIG. 6, except for the following differences. An under casing 7*b'* is not provided at the underside of the cage roller 4, but instead a mote knife 71 is provided below the cage roller 4 within the chamber 46. A second opening 72 for the suction compartment 9 is provided slightly lower than at the point where the cage roller 4 and carding cylinder 5 are adjacent to each other. Further, the back wall 7*b* of the air chamber 7 also serves as one of the side walls of the duct chamber 61, the duct chamber 61 being further partitioned with a partition 73 so as to form an air passage 74. In this air passage 74 is fitted a damper 75 in a suitable location whereby the amount of the auxiliary supply of air that flows is regulated. Also, an upper part 76 of the duct chamber 61 constitutes the under casing of the licker-in 3. Although not shown in the drawing, an entry for air to flow in into duct chamber 61 is provided in a suitable location of the duct chamber 61.

In this embodiment shown in FIG. 7, by having a chamber 46 below the cage roller 4 and having a second opening 72 which opens slightly below the point where the cage roller 4 and carding cylinder 5 are adjacent to each other, an air stream controlling means replacing the under casing 7*b'* of FIG. 1 has been provided; and by having a mote knife 71 below the cage roller 4, the structure is such that cleaning operations are also performed here.

The embodiment illustrated in FIG. 8 is also identical to that shown in FIG. 6 except for the following differences. In this embodiment a mote knife 71 is provided below the cage roller 4 at a point where the cage roller is adjacent to the licker-in 3. Spaced from the mote knife 71*a* is a grid 72 covering the underside of the cage roller 4, and extending from the carding cylinder 5 to the mote knife 71*a*. In addition, a damper 73 is provided in the opening 8 in the front wall 7*a* of the air chamber 7. However, there is no provision for a second opening in the cage roller in this embodiment.

By having a chamber 46 below the cage roller 4 and a grid 72*a* at the underside of the cage roller 4 at a part thereof that is adjacent to the carding cylinder 5, an air stream controlling means corresponding to the under casing 7*b'* shown in FIG. 1 is provided, whereby a substantial amount of the fibers carried by the saw tooth wire 4*a* of the cage roller 4 is transferred to the carding cylinder 5 without dropping to the bottom of the chamber 46.

Thus by means of the carding engine of the present invention of which suitable embodiments have been described with reference to FIGS. 3 to 8 of the accompanying drawings the following advantages are achieved:

(1) The greater part of the fibers fed from the feed roll is opened and combed by the licker-in, then conveyed while being held on the saw tooth wire, following which it is subjected to further vigorous opening and combing action by means of the saw tooth wire of the cage roller, whereby the cleaning is accomplished.

(2) Although these opened and combed fibers are held on the saw tooth wire of the cage roller, retaining intact their orderly alinement, since they do not adhere to the suction surface, they can be easily transferred to the carding cylinder. Therefore, since the suction perforations are not clogged, a much greater increase in the carding effect of the carding cylinder can be realized and results in the obtaining of even slivers.

(3) By providing a cage roller between the licker-in and the carding cylinder and having wound a saw tooth wire on this cage roller and further by providing a suction compartment inside the cage roller which opens toward the point where the licker-in and said cage roller are adjacent to each other, the fibers held on the peripheral surface of the licker-in are very promptly and completely transferred to the peripheral surface of the cage roller. Therefore, the licker-in can be operated at a much higher surface speed than that of the carding cylinder, thus resulting in a notable increase in the capacity of the carding engine.

(4) (A) Since the upper casing covers the licker-in and a specified clearance is provided between it and the licker-in, and since moreover the suction compartment opens toward the point where the licker-in and the cage roller are adjacent to each other, high pressure does not develop in the space between the licker-in and the upper casing. Therefore, the greater part of the fiber lap fed from the feed roll, upon leaving the tip of the feed table, does not drop downward but advances along the peripheral surface of the licker-in thereby achieving the effect as described in paragraph (1), above.

(B) Furthermore, as a result of the foregoing, as it is possible to make the flow of the air stream on the underside of the licker-in gentle, so that even comparatively minute foreign matters such as dust can be removed in the air chamber. In addition, the capacity of the exhaust fan need not be so large.

Although several specific embodiments of the invention have been described herein, these being described merely for illustrative purposes, the invention should not be limited thereby. While many modifications other than those given herein are possible, as will be apparent to those persons skilled in the art, it is to be understood that it is intended to cover all such modifications so long as they do not depart from the scope of the invention as defined in the appended claims.

Having thus described the invention, what is claimed is:

1. A carding engine, comprising a carding cylinder, a licker-in spaced from said carding cylinder, a suction cylinder between said licker-in and said carding cylinder and having its periphery closely adjacent said carding cylinder and said licker-in, said suction cylinder comprising a cage roller having a plurality of apertures in the cylindrical wall thereof, a plurality of saw teeth on the outer cylindrical surface thereof, a vacuum box fixedly mounted within said cage roller, said vacuum box having at least one opening therein, said opening extending in the peripheral direction of said cage roller at least along a portion of said suction cylinder, an exhaust fan connected to said vacuum box, an upper cas-

ing over at least the upper portions of said licker-in and said suction cylinder, and a plurality of substantially vertical walls at least below said licker-in and enclosing a still air space in communication at least with said licker-in, one of said walls having an opening therein into said still air space.

2. A carding engine as claimed in claim 1 in which the opening in the said one wall is in a wall which lies on the opposite side of said licker-in from said suction roller.

3 A carding engine, comprising a carding cylinder, a licker-in spaced from said carding cylinder, a suction cylinder between said licker-in and said carding cylinder and having its periphery closely adjacent said carding cylinder and said licker-in, said suction cylinder comprising a cage roller having a plurality of apertures in the cylindrical wall thereof, a plurality of saw teeth on the outer cylindrical surface thereof, a vacuum box fixedly mounted within said cage roller, said vacuum box having at least one opening therein, said opening extending in the peripheral direction of said cage roller at least along a portion of said suction cylinder, an exhaust fan connected to said vacuum box, an upper casing over at least the upper portions of said licker-in and said suction cylinder, and a plurality of substantially vertical walls at least below said licker-in and enclosing a still air space in communication at least with said licker-in, one of said walls having an opening therein into said still air space, and a damper over the opening in said one of said walls.

4. A carding engine, comprising a carding cylinder, a licker-in spaced from said carding cylinder, a suction cylinder between said licker-in and said carding cylinder and having its periphery closely adjacent said carding cylinder and said licker-in, said suction cylinder comprising a cage roller having a plurality of apertures in the cylindrical wall thereof, a plurality of saw teeth on the outer cylindrical surface thereof, a vacuum box fixedly mounted within said cage roller, said vacuum box having at least one opening therein, said opening extending in the peripheral direction of said cage roller at least along a portion of said suction cylinder, an exhaust fan connected to said vacuum box, an upper casing over at least the upper portions of said licker-in and said suction cylinder, and a plurality of substantially vertical walls at least below said licker-in and enclosing a still air space in communication at least with said licker-in, one of said walls having an opening therein into said still air space, and a mote knife in said still air space beneath said licker-in and extending to a point closely adjacent to said licker-in.

5. A carding engine, comprising a carding cylinder, a licker-in spaced from said carding cylinder, a suction cylinder between said licker-in and said carding cylinder and having its periphery closely adjacent said carding cylinder and said licker-in, said suction cylinder comprising a cage roller having a plurality of apertures in the cylindrical wall thereof, a plurality of saw teeth on the outer cylindrical surface thereof, a vacuum box fixedly mounted within said cage roller, said vacuum box having at least one opening therein, said opening extending in the peripheral direction of said cage roller at least along a portion of said suction cylinder, an exhaust fan connected to said vacuum box, an upper casing over at least the upper portions of said licker-in and said suction cylinder, a plurality of substantially vertical walls enclosing a still air space below said licker-in and in communication at least with said licker-in, one of said walls being a front wall below said licker-in with an opening therein into said still air space, another of said walls being a back wall defining the back of said still air space, said back wall having an air duct along the side thereof remote from said still air space, said air duct opening into a space between the licker-in and the suction cylinder just below the point at which said suction cylinder and said licker-in are most adjacent, and a mote knife in said still air space beneath said licker-in and extending to a point closely adjacent to said licker-in.

6. A carding engine as claimed in claim 1 and a lower casing below and closely adjacent to said suction cylinder and said opening in said vacuum box extends in the peripheral direction only along the portion of said suction cylinder which is closely adjacent to said licker-in, said carding engine further comprising a feed roller on the opposite side of said licker-in from said suction cylinder, said upper casing extending over the upper part of said feed roller, and said still air space is below said licker-in and said still air space is in communication only with said licker-in, said opening in said wall of said still air space and the opening through which said still air space and said licker-in are in communication being unobstructed.

7. A carding engine as claimed in claim 4 in which one of said walls enclosing the still air space is a back wall extending from a point adjacent the point at which said suction cylinder and said licker-in are most closely adjacent and along the under part of said licker-in a part of the way toward said mote knife and then downwardly away from said licker-in, a lower casing beneath said suction cylinder, said back wall having a first part hinged to said lower casing at point at which said suction cylinder and said licker-in are most closely adjacent, a second part adjustably connected to said first part and extending along the under part of said licker-in and then downwardly to a point spaced from the bottom of said still air space, and a flexible sheet adjustably mounted on the end of said second part and extending to the bottom of said still air space, whereby the back wall can be raised and lowered relative to the bottom of the still air space and can also be moved forwardly and rearwardly when the parts of said back wall are moved relative to each other.

8. A carding engine as claimed in claim 4 in which one of said walls enclosing the still air space is a back wall extending downwardly from adjacent the point at which the suction cylinder and said licker-in are most closely adjacent each other, and said back wall has on the upper end thereof a cover plate extending from said point along a portion of the lower part of said licker-in toward said mote knife and being spaced from said licker-in, and an adjustable cover member on the end of said cover portion.

9. A carding engine as claimed in claim 4 in which said walls also are below said suction cylinder and enclose a still air space beneath said suction cylinder which is in communication with said suction cylinder, a further mote knife in said still air space beneath said suction cylinder extending to a point closely adjacent to said suction cylinder, and said vacuum box having a further opening therein, said one opening extending in the peripheral direction along the portion of said suction cylinder which is adjacent said licker-in and said further opening extending along the peripheral portion of said suction cylinder adjacent said carding cylinder.

10. A carding engine as claimed in claim 4 in which said walls also are below said suction cylinder and enclose a still air space beneath said suction cylinder which is in communication with said suction cylinder, one of said walls having a grid extending therefrom beneath a portion of said suction cylinder, and a further mote knife in said still air space beneath said suction cylinder extending to a point closely adjacent to said suction cylinder, said opening in said vacuum box extending in the peripheral direction only along the portion of said suction cylinder which is closely adjacent to said licker-in.

11. A carding engine, comprising a carding cylinder, a licker-in spaced from said carding cylinder, a suction cylinder between said licker-in and said carding cylinder and having its periphery closely adjacent said carding cylinder and said licker-in, said suction cylinder comprising a cage roller having a plurality of apertures in the cylin-

drical wall thereof, a plurality of saw teeth on the outer cylindrical surface thereof, a vacuum box fixedly mounted within said cage roller, said vacuum box having at least one opening therein, said opening extending in the peripheral direction of said cage roller at least along a portion of said suction cylinder, an exhaust fan connected to said vacuum box, an upper casing over at least the upper portions of said licker-in and said suction cylinder, and a plurality of substantially vertical walls at least below said licker-in and enclosing a still air space in communication at least with said licker-in, one of said walls having an opening therein into said still air space, and a mote knife

in said still air space beneath said licker-in and extending to a point closely adjacent to said licker-in, and a damper over the opening in said one wall.

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