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METHODS AND APPARATUS FOR IMPROVING THE QUALITY OF CARDED FIBROUS MATERIALS

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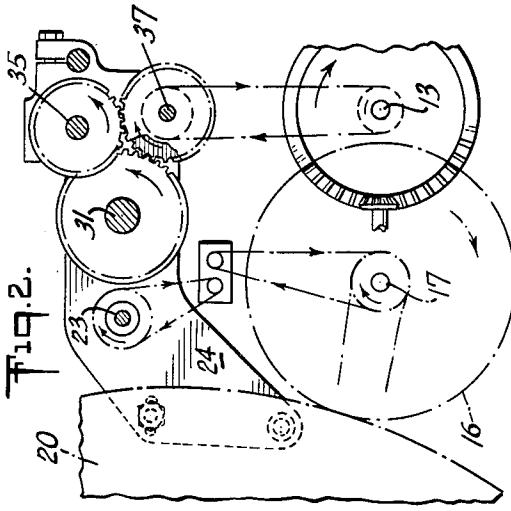


Fig. 2.

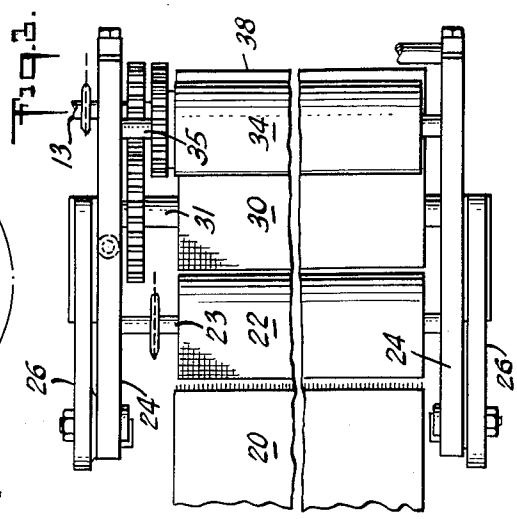


Fig. 3.

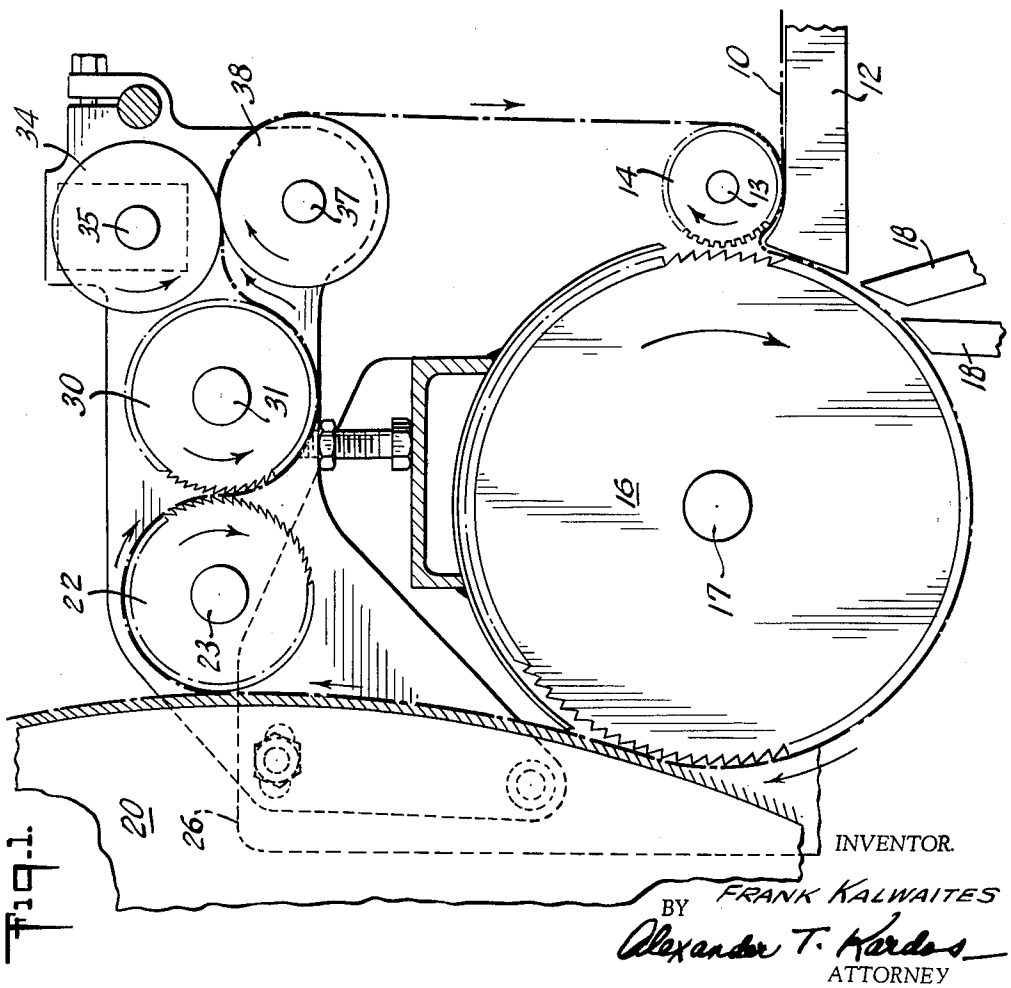


Fig. 1.

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METHODS AND APPARATUS FOR IMPROVING THE QUALITY OF CARDED FIBROUS MATERIALS

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The present invention relates to methods and apparatus for improving the quality of carded fibrous materials and more particularly is concerned with methods and apparatus for improving the quality of carded fibrous webs, slivers, and the like by removing clumps, tufts and knots from the fibrous materials as they are being carded, and refeeding the removed clumps, tufts and knots for additional processing whereby improved carding efficiency is attained and carded fibrous materials having higher quality, greater cleanliness, and improved uniformity are obtained.

In the carding of textile fibers, a sheet of fibrous materials, such as a picker lap, is customarily fed to a carding machine which opens up the fibers of the picker lap, cleans the fibers by removing accompanying foreign matter, and produces therefrom a continuous end called a sliver.

The picker lap which is normally used to feed a carding machine comprises a continuous, considerably-compressed sheet of fibrous clumps, tufts and occasional knots which have been rolled under pressure into a substantially cylindrical package. In many cases, the clumps, tufts and knots are present to such a high degree that the customary opening, cleaning and individualization of the fibers by a conventional card is not sufficient to properly prepare the fibers for subsequent operations.

In some cases, efforts have been made to remove the clumps, tufts and knots from the fibrous materials as they are being carded and to recycle these clumps, tufts and knots for additional processing. For example, in United States Patent 1,368,319 which issued February 15, 1921, there are disclosed methods and apparatus for removing a portion of the fibrous materials as it is being carded and recycling that portion for additional processing by rotatable worker and stripper rolls and by the main cylinder of the carding machine. Such efforts have been successful to some degree but there still remains considerable room for improvement.

It has now been discovered that improved carding efficiency may be attained and improved carded fibrous materials of higher quality, greater cleanliness, and improved uniformity may be obtained by removing certain undesirable portions such as clumps, tufts and knots from the fibrous materials being carded on the main cylinder of the carding machine, reducing the linear speed of the removed portions drastically so that it is as low or even lower than the original linear speed of the picker lap being fed to the carding machine, and then refeeding the removed portions at that very low speed through substantially the complete feed works of the carding machine, and then carding such fibrous portions again.

The following description of the present invention relates primarily to the use of viscose rayon staple fiber and/or cotton fibers. Such is illustrative only and the principles of the present invention may also be applied to other fibers either by themselves or in blends of various proportions with each other. Such other fibers include, for example, other natural fibers notably flax or wool, or synthetic or man-made fibers such as cellulose acetate or other cellulose ester fibers, nylon 6, nylon 6/6, acrylic fibers, polyester fibers, polyolefin fibers, etc.

Other aspects of the present invention, as well as variations, advantages and benefits thereof, will become apparent from the following description which is to be construed with reference to the accompanying drawings wherein:

FIGURE 1 is a fragmentary, schematic drawing in side elevation of one embodiment of the apparatus of the present invention, with some parts omitted for purposes of clarity and for more clearly illustrating the inventive concept;

FIGURE 2 is a fragmentary, schematic drawing in side elevation of the apparatus of FIGURE 1, very similar to FIGURE 1, but in smaller scale and illustrating some of the driving and speed relationships of some of the elements of the apparatus involved; and

FIGURE 3 is a fragmentary, schematic drawing in plan of the apparatus of FIGURES 1 and 2, drawn to the same scale as FIGURE 2, and showing additional driving and speed relationships of the elements of the apparatus involved.

Referring to the drawings and with particular reference to FIGURE 1, a sheet of fibrous material, such as a picker lap **10**, is drawn or fed along a stationary feed plate **12** by a deeply fluted, steel feed roll **14** measuring about 2¼ inches in diameter and carried in bearings which rest in brackets at each end of the feed plate **12**. The feed roll **14** rotates very slowly on a shaft **13** at a constant speed, say from about 1 to about 1⅔ revolutions per minute (from about 0.59 to about 0.98 feet per minute), and feeds the picker lap at a definite, constant rate to a licker-in **16** rotating on a shaft **17** at a very much greater speed. The feed roll **14** holds the clumps and tufts of the picker lap in a controlled position to be worked upon by the rapidly rotating licker-in **16**. The licker-in is usually about 9 inches in diameter and rotates with a speed of about 300 to about 600 revolutions per minute (from about 706 to about 1412 feet per minute). The ratio of the linear speed increase of the licker-in to the feed roll is in the range of from about 1000:1 to about 1600:1 but more normally is in the range of from about 1200:1 to about 1400:1.

The major function of the licker-in **16** is to open the clumps and tufts of the picker lap **10** as it is held by the very slowly rotating feed roll **14** and the stationary feed plate **12**. As the very rapidly moving teeth of the wire on the licker-in **16** closely approach within about 0.010 inch to about 0.020 inch of the feed plate **12**, they necessarily pass through the very slowly advancing fibrous picker lap **10** extending outwardly over the feed plate **12**. This is, however, a gradual, progressive action due to the bevel of the feed plate **12** and the curvature of the surface of the licker-in **16**. At first, the teeth of the wire on the licker-in **16** penetrate only the upper surface of the fibrous picker lap **10**. However, as the picker lap **10** is gradually slowly advanced, the teeth of the licker-in **16** reach further and further into the picker lap **10**, finally penetrating it completely. The result of the licker-in action is to open gradually the clumps and tufts which comprise the picker lap **10**. As this opening is accomplished, a portion of the dirt, debris or other extraneous matter carried with the fibers of the picker lap **10** will be reached by the teeth of the licker-in and separated therefrom.

The opened-up fibers are then advanced on the surface of the licker-in **16** past a pair of conventional mote knives **18, 18** where a considerable portion of the dirt, debris and other extraneous matter is removed, prior to the fibers being fed to the main cylinder **20** of the textile card. The main cylinder **20** is conventional and is approximately 50 inches in outside diameter and about 40 to 45 inches in width. It rotates on a shaft (not shown) with a surface linear speed of from about 165 revolutions per minute up

to about 250 revolutions per minute (from about 2160 to about 3270 feet per minute).

The fibers are transferred from the licker-in **16** to the surface of the main cylinder **20** and are carried forwardly thereby in conventional manner. The fibers of the picker lap which are more or less individualized are carried substantially on the points of the fillet or metallic wire thereon. Any clumps, tufts or knots which were not completely opened by the licker-in, however, are carried slightly higher on the surface of the main cylinder **20** than the main body of the more or less individualized fibers. As this fibrous material advances upwardly, it passes immediately adjacent a metering or transfer roll **22** which is rotatably mounted on a shaft **23** in bearings mounted in brackets **24** adjustably fastened to the card frame **26**.

The metering roll **22** is carefully and accurately positioned with a clearance of from about 0.040 inch to about 0.080 inch with respect to the surface of the main cylinder **20**. Its length is approximately the same as that of the main cylinder **20** but its diameter is considerably smaller and is in the range of from about 3 inches to about 5 inches. The surface linear speed of the metering roll **22** is considerably slower than the surface linear speed of the main cylinder **20** and must have a linear speed reduction ratio with respect thereto of at least 1:10. Normally, the linear speed reduction ratio is considerably less than the value and is normally in the range of from about 1:50 and even as low as about 1:100. This, of course, results in a substantial reduction in the surface linear speed of the fibrous materials.

The clearance and the positioning of the metering roll **22** is such that it permits the preponderance or bulk of the individualized fibers to pass freely onwardly on the surface of the main cylinder **20**. The clumps, tufts and occasional knots which are present will protrude, however, to a greater degree and are contacted by and removed from the main cylinder **20** by the slowly moving metering roll **22**.

As the clumps, tufts and occasional knots are individually removed from the main cylinder **20** and deposited on the metering roll **22**, the extreme slowness of the speed of the metering roll **22** is such that the sparely positioned clumps, tufts and knots are condensed or brought together substantially into a self-containing fibrous web or sheet. This fibrous web or sheet is advanced around the periphery of the metering roll **22** and is removed therefrom by a retracting roll **30** which is rotatably mounted on a shaft **31** mounted in bearings in the brackets **24** which are adjustably mounted in the card frame **26**.

The retracting roll **30** is approximately the same diameter and length as the metering roll **22** but rotates with a considerably slower surface speed. The ratio of the surface linear speeds of the retracting roll **30** to the metering roll **22** must be at least as low as about 1:10 but normally may range to as low as about 1:60 or even as low as about 1:100. In this way, the fibrous web or sheet is even further compacted or condensed and becomes more uniform in fiber distribution and web weight.

It is to be noted that the linear speed of the fibrous web is now considerably reduced because of the successive linear speed reductions in the web transfer from the main cylinder **20** to the metering roll **22** and then from the metering roll **22** to the retracting roll **30**. Although the individual ratios of the linear speed reductions in these two fiber transfers extends over relatively wide ranges and may be individually varied over relatively wide ranges as above noted, the sum of the two reductions must be such that the linear speed of the fibrous web, as it is carried on the peripheral surface of the retracting roll **30**, must be about equal to or less than the linear speed of the picker lap **10** as it is advanced between the feed roll **14** and the feed plate **12**.

The slowly moving compacted web is then removed from the retracting roll **30** and passes between a pair of smooth faced nip rolls **34** and **38** rotating on shafts **35** and **37** also mounted in bearings in brackets **24**. The nip rolls **34** and **38** rotate at approximately the same speed and are normally geared together. They are in light pressing contact and operate in positive fashion to draw and remove the fibrous sheet or web from the retracting roll **30**. If desired, or necessary, the nip rolls **34** and **38** may possess a surface linear speed which is slightly greater than the surface linear speed of the retracting roll **30** whereby a slight draft is created between the nip rolls **34**, **38** and the retracting roll **30**. This draft may be a mere tension draft or may possess substantially any value but preferably is in the range of a value greater than 1:1 and up to about 2:1.

The fibrous web, after being passed through the nip of the rolls **34**, **38** is then delivered downwardly in the direction of a succeeding portion of the picker lap **10** as it is being carried on the feed plate **12** in being advanced to the feed roll **14**. The linear speed of the fibrous web as it leaves the nip rolls **34**, **38** is about equal to or slightly less than the speed of the feed roll **14** and consequently a slight draft may be created as the fibrous web is gripped by the feed roll **14** and advanced thereunder together with the succeeding portion of the picker lap **10**. In this way the fibrous web of removed clumps, tufts and knots is slowly advanced under the feed roll **14** and is again processed and opened by the licker-in **16** and the main cylinder **20**.

It is this second processing and opening up by the licker-in **16** which is believed to create the improvement in the carding efficiency whereby the resulting carded fibrous materials having higher quality, greater cleanliness, and improved uniformity are obtained. As noted above, it is the very high speed of the licker-in **16** as compared to the very low feed of the picker lap and the removed clumps, tufts and knots which accomplishes the desired improved cleaning action.

Referring to FIGS. 2 and 3 of the drawings which show the apparatus of FIG. 1 in smaller scale and which illustrate some of the driving and speed relationships of the elements of the apparatus of FIG. 1. In FIG. 2 there is shown the driving relationship between shaft **13** on which the feed roll rotates and shaft **37** on which the smooth-faced nip roll **38** rotates.

Also shown are the driving method for shaft **17** on which the licker-in rotates and shaft **23** on which is rotatably mounted the transfer roll.

In FIG. 3 there is shown the speed relationship between various rolls through a set of gears mounted on the various shafts of the rolls. A cutaway of this gearing arrangement is shown in FIG. 2. On shaft **37** carrying the smooth-faced nip roll there are mounted two gears. The first gear intermeshes with a gear mounted on shaft **35** carrying the other smooth-faced nip roll. The second gear on shaft **37** meshes with the gear on shaft **31** carrying the retracting roll.

The invention will be further illustrated in greater detail by the following specific example. It should be understood, however, that although this example may describe in particular detail some of the more specific features of the invention, it is given primarily for purposes of illustration and the invention in its broader aspects is not to be construed as limited thereto.

Example

A 16-oz., bleached cotton fiber lap is fed over the feed plate of a card to a 2¼ inch diameter feed roll rotating at about 1⅓ r.p.m. This represents a peripheral surface linear speed of about 0.785 foot per minute. The feed roll is conventional and is a deeply-fluted steel roll mounted in bearings in the card frame. To insure sufficient pressure by the feed roll on the bleached cotton fiber lap to reduce "plucking" by the licker-in to a minimum, each end of the feed roll is weighted by conventional means.

The bleached cotton fiber lap passes under the feed roll and is fed to a 9-inch diameter licker-in rotating at

about 450 r.p.m. The peripheral surface linear speed is about 1070 feet per minute. The licker-in is conventional and consists of a cylinder covered with "licker-in" wire. The result of the licker-in action is to open up the bleached cotton fiber lap, remove dirt and other waste therefrom and, in general, comb and clean the fibers.

The fibers are then transferred in accordance with standard practice to a main cylinder having a diameter of 50½ inches and rotating at about 200 r.p.m. The peripheral surface linear speed is about 2650 feet per minute. The fibers on the main cylinder are carried upwardly thereon and clumps, knots or tufts of fibrous material are removed therefrom by a 3½ inch diameter transfer or metering roll rotating at 40 r.p.m. The peripheral surface linear speed is about 36.6 feet per minute.

The metering roll is covered with metallic card clothing and is spaced from the main cylinder by a clearance of 0.060 inch. Such spacing permits the bulk of the individualized fibers to pass but enables the teeth of the transfer roll to catch the clumps, knots and tufts which protrude to a greater extent. The reduction in velocity of the fibers being transferred from the main cylinder to the metering roll is about 72 to 1 and results in the formation of an intermatted mass of clumps, knots and tufts of cotton fibers along with a certain amount of trash, leaf, waste, seed particles, etc.

The intermatted mass is then transferred to a 3½ inch diameter retracting roll rotating at only about 7/16 r.p.m. The retracting roll is also covered with metallic card clothing. Its peripheral surface linear speed is about 0.40 foot per minute which represents a speed reduction of about 91 to 1 as compared to the metering roll. This speed reduction creates considerable retraction and the formation of a relatively very heavy fibrous web on the retracting roll. It is to be observed that the linear speed of the fibrous web at this moment (0.40 foot per minute) is actually less than the linear speed of the feed roll (0.785 foot per minute) which originally feeds the bleached cotton fiber lap to the licker-in.

Also, it is to be observed that, due to the very large compaction of the fibrous mat and the crowding of the fibrous materials therein and the closing-up of voids and thin areas, a levelling action is obtained whereby relatively good weight and fiber uniformity is obtained in the retracted fibrous web.

The retracted fibrous web is then drawn from the retracting roll by a pair of cooperating, smooth-faced, 3-inch diameter pressure nip rolls rotating at about ¾ r.p.m. This is equivalent to a peripheral surface linear speed of about 0.59 foot per minute whereby a draft of about 1.5 with respect to the retracting roll is obtained.

The fibrous web then is passed downwardly and is drawn under the slightly more rapidly moving feed roll to join the bleached cotton fiber lap also being fed thereto. The composite layer is then fed to the licker-in, and the clumps, knots and tufts in the re-fed fibrous web are given a second combing action by the rapidly rotating licker-in. In this way, any fibrous clumps, knots or tufts, as well as any trash, leaf, waste, seed particles, etc., which escape the first combing and cleaning action of the licker-in are given a second combing and cleaning thereby. And, in this second combing and cleaning action, the re-fed material is on top of the bleached cotton fiber lap whereby it receives more direct action by the teeth of the licker-in.

This cleaning process is continued and the silver ultimately removed at the other side of the main cylinder is examined and found to be of higher quality, greater cleanliness and improved uniformity than a silver prepared by a conventional card which has not been equipped with the quality-improving apparatus of the present invention.

Although a specific example of the inventive concept has been described, the same should not be construed as limited thereby nor to the specific substances mentioned therein but to include various other compounds of equivalent constitution as set forth in the claims appended hereto. It is understood that any suitable changes, modifications and variations may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. In apparatus for improving the quality of carded fibrous materials which comprises a rotatable feeding surface for advancing fibrous materials, a rotatable cleaning surface for receiving fibrous materials from said rotatable feeding surface to open up the same and individualize the fibers thereof, and a rotatable carding surface for receiving said fibrous materials from said rotatable cleaning surface to card the same, the improvement which comprises:

a rotatable surface immediately adjacent said rotatable carding surface and traveling at a peripheral surface linear speed less than that of said rotatable carding surface for withdrawing a portion of said fibrous materials from said rotatable carding surface;

a second rotatable surface immediately adjacent said first-mentioned rotatable surface and traveling at a peripheral surface linear speed less than that of said first-mentioned rotatable surface for withdrawing said portion of said fibrous materials from said rotatable surface; and

a pair of cooperating rotatable surfaces forming a nip immediately adjacent said second rotatable surface and traveling at a peripheral surface linear speed greater than that of said second rotatable surface to draw said portion of said fibrous materials from said second rotatable surface,

said rotatable feeding surface positioned in proximity to said pair of cooperating, rotatable surfaces to receive said portion of said fibrous materials from said pair of cooperating rotatable surfaces, and said rotatable cleaning surface receiving said portion of said fibrous materials from said rotatable feeding surface for additional cleaning, prior to returning the same to said rotatable carding surface for additional carding.

2. In apparatus for improving the quality of carded materials which comprises a rotatable feeding surface for advancing fibrous materials, a rotatable cleaning surface for receiving fibrous materials from said rotatable feeding surface to open up the same and individualize the fibers thereof, and a rotatable carding surface for receiving said fibrous materials from said rotatable cleaning surface to card the same, the improvement which comprises:

a rotatable surface immediately adjacent said rotatable carding surface and traveling at a peripheral surface liner speed less than that of said rotatable carding surface for withdrawing a portion of said fibrous materials from said rotatable carding surface;

a second rotatable surface immediately adjacent said first-mentioned rotatable surface and traveling at a peripheral surface linear speed less than that of said first-mentioned feeding surface for withdrawing said portion of said fibrous materials from said rotatable surface; and

rotatable drawing means immediately adjacent said second rotatable surface and traveling at a peripheral surface linear speed greater than that of said second rotatable surface to draw said portion of said fibrous materials from said second rotatable surface,

said rotatable feeding surface positioned in proximity to said rotatable drawing means to receive said portion of said fibrous materials from said rotatable drawing means, and said rotatable cleaning surface receiving said portion of said fibrous materials from said rotatable feeding surface for additional cleaning, prior to returning the same to said rotatable carding surface for additional carding.

3. In apparatus for improving the quality of carded materials which comprises a rotatable feed roll for advancing fibrous materials, a rotatable licker-in for receiving fibrous materials from said rotatable feed roll to open up the same and individualize the fibers thereof, and a rotatable carding surface for receiving said fibrous materials from said rotatable licker-in to card the same, the improvement which comprises:

a rotatable metering roll immediately adjacent said rotatable carding surface and traveling at a peripheral surface linear speed less than that of said rotatable carding surface for withdrawing a portion of said fibrous materials therefrom;

a rotatable retracting roll immediately adjacent said rotatable metering roll and traveling at a peripheral surface linear speed less than that of said rotatable metering roll for withdrawing said portion of said fibrous materials therefrom; and

a pair of cooperating rotatable nip rolls immediately adjacent said rotatable retracting roll and traveling at a peripheral surface linear speed greater than that of said rotatable retracting roll to draw said portion of said fibrous materials therefrom,

said rotatable feed roll positioned in proximity to said pair of cooperating, rotatable nip rolls to receive said portion of said fibrous materials from said pair of cooperating rotatable nip rolls, and said rotatable licker-in receiving said portion of said fibrous materials from said rotatable feed roll for additional cleaning, prior to returning the same to said rotatable carding surface for additional carding.

4. A method of improving the quality of carded fibrous materials which comprises:

feeding a lap of fibrous materials to a rotatable cleaning surface traveling at a peripheral surface linear speed very much greater than the speed at which the lap is fed to said rotatable cleaning surface,

transferring said fibrous materials to a rotatable carding surface traveling at a peripheral surface linear speed very much greater than that of said rotatable cleaning surface,

transferring a portion of said fibrous materials from said rotatable carding surface to a rotatable doffing surface traveling at a peripheral surface linear speed sufficiently less than that of said rotatable carding surface as to bring about such transfer,

transferring said portion of said fibrous material from said rotatable doffing surface to a rotatable fiber working surface traveling at a peripheral surface linear speed sufficiently less than that of said rotatable doffing surface so as to retract and condense the same and increase the fiber uniformity of said portion of fibrous materials,

returning said retracted and condensed portion of said fibrous materials to said lap of fibrous materials being fed to said rotatable cleaning surface for additional processing thereof.

5. A method of improving the quality of carded fibrous materials which comprises:

feeding a lap of fibrous materials to a rotatable cleaning surface traveling at a peripheral surface linear speed very much greater than the speed at which the lap is fed to said rotatable cleaning surface,

transferring said fibrous materials to a rotatable carding surface traveling at a peripheral surface linear speed very much greater than that of said rotatable cleaning surface,

transferring a portion of said fibrous materials from said rotatable carding surface to a rotatable doffing surface traveling at a peripheral surface linear speed sufficiently less than that of said rotatable carding surface as to bring about such transfer,

transferring said portion of said fibrous material from said rotatable doffing surface to a rotatable fiber working surface traveling at a peripheral surface linear speed sufficiently less than that of said rotatable doffing surface so as to retract and condense the same and increase the fiber uniformity of said portion of fibrous materials,

drawing said retracted and condensed portion of said fibrous materials with a positive draft from said rotatable working surface and

returning said drawn portion of said fibrous materials to said lap of fibrous materials being fed to said rotatable cleaning surface for additional processing thereof.

6. A method of improving the quality of carded fibrous materials which comprises:

feeding a lap of fibrous materials to a rotatable cleaning surface traveling at a peripheral surface linear speed very much greater than the speed at which the lap is fed to said rotatable cleaning surface,

transferring said fibrous materials to a rotatable carding surface traveling at a peripheral surface linear speed very much greater than that of said rotatable cleaning surface,

transferring a portion of said fibrous materials from said rotatable carding surface to a rotatable doffing surface traveling at a peripheral surface linear speed sufficiently less than one-tenth that of said rotatable carding surface as to bring about such transfer,

transferring said portion of said fibrous material from said rotatable doffing surface to a rotatable fiber working surface traveling at a peripheral surface linear speed sufficiently less than one-tenth that of said rotatable doffing surface so as to retract and condense the same and increase the fiber uniformity of said portion of fibrous materials, and

returning said retracted and condensed portion of said fibrous materials to said lap of fibrous materials being fed to said rotatable cleaning surface for additional processing thereof.

7. A method of improving the quality of carded fibrous materials which comprises:

feeding a lap of fibrous materials to a rotatable cleaning surface traveling at a peripheral surface linear speed very much greater than the speed at which the lap is fed to said rotatable cleaning surface,

transferring said fibrous materials to a rotatable carding surface traveling at a peripheral surface linear speed very much greater than that of said rotatable cleaning surface,

transferring a portion of said fibrous materials from said rotatable carding surface to a rotatable doffing surface traveling at a peripheral surface linear speed sufficiently less than one-tenth that of said rotatable carding surface as to bring about such transfer,

transferring said portion of said fibrous material from said rotatable doffing surface to a rotatable fiber working surface traveling at a peripheral surface linear speed sufficiently less than one-tenth that of said rotatable doffing surface so as to retract and condense the same and increase the fiber uniformity of said portion of fibrous materials,

drawing said retracted and condensed portion of said fibrous materials with a positive draft from said rotatable working surface and

returning said drawn portion of said fibrous materials to said lap of fibrous materials being fed to said rotatable cleaning surface for additional processing thereof.

8. An apparatus for improving the quality of carded materials which comprises a rotatable feed roll for advancing fibrous materials, a rotatable licker-in for receiving fibrous materials from said rotatable feed roll to open up the same and individualize the fibers thereof and a rotatable carding surface for receiving said fibrous materials from said rotatable licker-in to card the same the improvement which comprises:

doffing means located immediately adjacent said rotatable carding surface for withdrawing a portion of said fibrous materials from said carding surface,

condensing means located immediately adjacent said doffing means for receiving said portion of said fibrous material from said doffing means and condensing the same to form a web of said fibrous material,

a second doffing means located immediately adjacent said condensing means to remove said fibrous material from said condensing means in the form of a web,

said rotatable feed roll positioned in proximity to receive said web of said fibrous materials from said second doffing means and

said rotatable licker-in receiving the web of said fibrous materials from said rotatable feed roll for additional cleaning prior to returning the same to said rotatable carding surface for additional carding.

9. An apparatus for improving the quality of carded materials which comprises a rotatable feed roll for advancing fibrous materials, a rotatable licker-in for receiving fibrous materials from said rotatable feed roll to open up the same and individualize the fibers thereof and a rotatable carding surface for receiving said fibrous materials from said rotatable licker-in to card the same the improvement which comprises:

doffing means located immediately adjacent said rotatable carding surface for withdrawing a portion of said fibrous materials from said carding surface,

condensing means located immediately adjacent said

doffing means for receiving said portion of said fibrous material from said doffing means and condensing the same to form a web of said fibrous material,

doffing means located immediately adjacent said condensing means and rotating at a surface linear speed greater than the surface linear speed of said condensing means to remove said fibrous material from said condensing means in the form of a web and simultaneously draft said web,

said rotatable feed roll positioned in proximity to receive said drafted web of said fibrous materials from said last mentioned doffing means and

said rotatable licker-in receiving the web of said fibrous materials from said rotatable feed roll for additional cleaning prior to returning the same to said rotatable carding surface for additional carding.

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