METHOD AND APPARATUS FOR SEPARATING FOREIGN MATERIAL FROM FINE FIBERS

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10 Claims. (Cl. 19-65)

1 This invention relates to the removal or partial removal of foreign material from camel’s hair, vicuña and other animal fibers and from cotton and other vegetable fibers, and it is in the nature of an improvement upon or modification of the inventions disclosed in my co-pending applications Serial No. 468,217, filed November 11, 1942, entitled “Method and Apparatus for Separating Fibers” (now Patent No. 2,420,035); Serial No. 582,585, filed March 15, 1945, entitled “Means for Separating Short Coarse Fibers from Long Fine Fibers” (now Patent No. 2,420,036); Serial No. 410,300, filed September 10, 1941, entitled “Method and Apparatus for Separating Fibers” (now Patent No. 2,420,033), and Serial No. 662,240, filed April 15, 1946, entitled “Method and Apparatus for Parallelizing Textile Fibers” (now Patent No. 2,420,034).

The invention will be explained with particular reference to removing coarse stiff fibers (beard hairs) from camel’s hair although it will be apparent to persons skilled in the art that it is equally applicable to (i) removing coarse stiff fibers (beard hairs or lamp hairs) from camel’s hair, vicuña, wool or other textile fibers comprising fine crimped fibers and relatively coarse stiff fibers and (ii) removing blotches of branding paint, burrs, vegetable defect, straw and other foreign material from wool or other animal fibers and from cotton and other vegetable fibers.

When used in this specification and in the appended claims the term “foreign material” includes kemp hairs, beard hairs, blotches of branding paint, burrs, straw and other vegetable defect as well as sections, fragments, or pieces thereof.

The principal object of this invention is to provide a novel method and a novel apparatus for separating foreign material from a mixture of foreign material and fine fibers.

A further object is to provide such a method and such an apparatus which is economical in operation and in construction.

Further objects will be apparent from a consideration of the following description and of the annexed drawing in which three embodiments of my apparatus are shown for the purpose of illustration.

In the drawings:

Fig. 1a is a diagrammatic view in elevation, illustrating one embodiment of appropriate mechanical apparatus elements adapted to perform one embodiment of the method.

Fig. 1b is a diagrammatic view in elevation, illustrating a continuation of the apparatus of Fig. 1a and embodying elements adapted to perform the method.

Fig. 2 is a diagrammatic view in elevation, illustrating another embodiment of appropriate mechanical apparatus elements adapted to perform the several steps of another embodiment of the method.

Fig. 3 is a diagrammatic view in elevation, illustrating another embodiment of appropriate mechanical apparatus elements adapted to perform another embodiment of the method.

Fig. 4 is a fragmentary plan view showing details of a fiber dividing means which may be utilized in the apparatus and method.

The raw stock to be processed preferably is first taken from the bale in which it was packed in the country of its origin and is dusted and scoured for the purpose of removing as much sand, dust, vegetable defect and natural grease as possible. The steps if scouring and dusting are not necessary but are preferred.

The stock is then fed to a machine which is adapted to open up the fiber and pull apart the matted tips and cots for the dual purpose of releasing additional entrapped impurities and disposing the fiber over the width of the machine in an increasingly thinner web or film as it progresses along the length of the machine from feed to delivery. Such a machine may be a card or a garnett into which may be incorporated the special coarse fiber removing devices and motions that are in part the subject of this invention.

Referring to Fig. 1a, the feed is designated generally by the numeral 10. The feed consists of a hopper 11, a spike apron 12, reciprocating combs 13 and 14, a scale pan 15, a feed apron or conveyor belt 16, feed rolls 17a and 17b, a lickermill 18 and a transfer roll 19.

After scouring and dusting, the raw stock, which consists of intermingled coarse stiff fibers, fine crimped fibers, vegetable defect, anddruk and the like, is fed to the hopper 11 and is carried upwardly by the spike apron 12. The reciprocating comb 13 reduces the thickness of the layer of stock upon the spike apron returning the excess to the hopper 11. The reciprocating comb 14 loosens the stock from the spike apron and causes it to fall into the scale pan 15.

When a predetermined weight of stock has accumulated in the scale pan 15 the scale pan bottom walls 18a and 18b are swung outwardly to the dot dash positions shown in Fig. 1a and the contents of the scale pan is deposited upon the feed
apron 16. The bottom walls 15′-15′ are then closed and the scale pan is thus prepared to receive another predetermined weight of the stock.

The stock is advanced by the apron 16 to the feed roll 17′. The feed roll 17′ removes the stock from the scale pan and carries it to the bite of the rolls 17′-17′. The stock is then advanced to the surface of the lickerin 18 which is a cylinder provided with the card clothing. The action of the teeth of the lickerin clothing pulling the stock from the teeth of the rolls 17′-17′ is the initial opening action of the apparatus. The lickerin 18 is rotated at a greater surface speed than the surface speed of the feed apron 16 and of the feed rolls 17′-17′. The ratio may be for example 4 to 1, the surface speeds of the feed apron and the feed rolls being substantially the same.

The partially opened stock is carried forward by the lickerin and is removed from the lickerin by the transfer roll 19 which is a cylinder provided with card clothing and which is rotated at a greater surface speed than the lickerin 18; the ratio may be of the order of 2 to 1. The thickness of the layer of stock L is reduced by the action of the transfer roll 19 and if it is passed or advanced forwardly to the surface of the breaker cylinder 20. This cylinder 20 is provided with card clothing and is continuously rotated in a clockwise direction looking at Fig. 1. Three sets of workers and strippers 21′-21′, 22′-22′, and 23′-23′ are mounted above the breaker cylinder 20. These workers and strippers are cylinders provided with card clothing of gradually increasing fineness and, as is customary, they are mounted progressively closer to the surface of the breaker cylinder 20. As the layer of stock L is advanced forwardly by the breaker cylinder, the stock is further opened up and the thickness of the layer of stock L is reduced by the action of the workers and strippers so that, prior to its removal from the surface of the breaker cylinder by the doffer 26, the stock has been opened up and disposed in a relatively thin, even web or film F throughout the width of the face of the breaker cylinder 20, the fine and coarse fibers being intermingled in this web or film and crossing and recrossing each other.

The doffer cylinder 26 is provided with card clothing the teeth of which point in the direction indicated and it is rotated in a counter-clockwise direction at a smaller surface speed than that of the cylinder 20; the ratio being of the order of 1 to 10.

24 is a rotary brush provided at its surface with bristles which are relatively stiff and may be about one inch in length. This brush is rotated in the same direction as the direction of rotation of the doffer 20 and at a surface speed which is substantially greater than the surface speed of the doffer 20. I have found that the presented surface speed of the brush 24 is from four to ten times greater than the surface speed of the doffer 20 and within the range of from about 400 to 1200 feet per minute. The brush 24 is as long as the doffer 20 so that it advances the entire width of the film or web F and, as illustrated, the tips of its bristles act on the back of the teeth of the card clothing of the doffer.

The doffer cylinder 25 is provided with card clothing and is rotated at a slower surface speed than that of the brush 24; the ratio may be of the order of 1 to 10. It removes the film or web F from the surface of the brush 24 and advances it to the stripper cylinder 26. The stripper cylinder 26 is provided with card clothing and it strips the film or web from the surface of the roll 23 and advances it to the brush 27. The stripper cylinder 26 may be rotated at a faster surface speed than that of the doffer cylinder 25; the ratio may be of the order of 2 to 1.

The rotary brush 27 is similar in construction to the brush 24 and it removes the film or web from the surface of the stripper cylinder 26 and advances it to the surface of the apparatus 28. The brush 27 like the brush 24 preferably is rotated at a surface speed which is from four to ten times greater than that of the stripper 26, and within the range of from about 400 to 1300 feet per minute. The tips of its bristles act upon the back of the teeth of the clothing of the cylinder 26.

The tips of the bristles of the brushes 24 and 27 engage the crimped fine fibers while they are on the surface of the cylinders 20 and 26 respectively, and since the brushes 24 and 27 are moving respectively at substantially greater surface speeds than the surface speeds of the cylinders 20 and 26 respectively, they straighten the fine fibers, remove them from the retentive clothing of the cylinders and advance them at a traveling speed to the surface of the apparatus 28. The coarse stiff fibers and danduff, vegetable defect and other foreign material to be thrown downward and free from the film or web F substantially at the region of removal of the film or web from the surface of the cylinders 20 and 26.

In each of these brush and cylinder motions many of the coarse fibers and much of the other foreign material is removed without the loss of an appreciable amount of fine fibers. The amount of foreign material removed at each region of transfer from cylinder to brush is believed to be a direct function of the percent of the foreign material present in the aggregate and that percent varies widely in different batches of raw stock. By transferring the stock from the brush 27 to a cylinder similar to the cylinder 20 or 26, subjecting it to the action of workers and strippers similar to 21′-21′ etc. and then passing it through additional brush and cylinder motions similar to 20′, 24, 25, 26 and 27, additional foreign material may be removed if necessary. The number of such brush and cylinder motions necessary to produce a product which is acceptable for commercial use depends upon the fineness from coarse fibers and from other foreign material required for the proposed commercial use and upon the percent of foreign material present in the batch of stock which is being run.

For example to produce an end product which is substantially free from coarse fibers from some raw stocks consistently with space economy, it may be desirable to subject the web or film to a number of brushing actions. Such a process and apparatus for use therein is disclosed in my copending application Serial No. 706,487 filed October 29, 1946, entitled "Method and Apparatus for Separating Fibers." Instead it may be desirable to subject the film or web after partial removal of the coarse fibers to a coarse fiber dividing and separating method such as disclosed in my said copending application Serial No. 810,300 (now Patent No. 2,420,033). On the other hand, if the sales price or the proposed use of the product does not preclude the presence of cut
fine fibers or the loss of a small percentage of fine fibers the remaining fibers may be subjected to the cutting and separating operations hereinafter described.

The cylinder 28 is provided with card clothing and is rotated in a clockwise direction at a greater surface speed than that of the brush 21; the ratio may be of the order of 2 to 1. Three sets of workers and strippers 28 to 28, 30 to 30 and 32 to 32 are mounted above the cylinder 28. The workers 28, 30 and 32 are driven at a slower surface speed than that of the cylinder 28; the ratio may be of the order of 1 to 15. The strippers 28, 30 and 32 are driven at a faster surface speed than the workers; the ratio may be of the order of 5 to 1. The action of the cylinder 28 and the workers and strippers is to straighten out the crimped fine fibers and to rearrange them (together with any remaining coarse fibers) in the form of a relatively thin web or film; they are disarranged from the form of a thin web or film by the action of the brush 27 throwing the fibers into the teeth of the cylinder 28.

The doffer cylinder 32 removes the film or web F from the surface of the cylinder 28 and the reciprocating doffer comb 33 removes the film from the surface of the doffer cylinder 34. If the foreign material has been removed sufficiently for the desired use the film or web may be collected at this point. If it is to be subjected to another series of brush and cylinder motions it may be transferred from the cylinder 28 to another series of cylinders and brushes similar to 20, 24, 25, 26 and 27. If it is to be subjected to a selective cutting or dividing action it may be deposited by the doffer comb 33 upon the surface of the conveyor belt 34 and conveyed to the selective cutting or dividing apparatus described and shown in my said copending applications Serial Nos. 410,300, 564,211, 582,852 and 652,240 (now Patents Nos. 2,420,033 to 2,420,036 inclusive).

As illustrated in Figs. 1 a and Ib the film or web F is deposited by the doffer comb 33 upon the smooth surface of the conveyor belt 34 which is suitably supported by and driven by the rolls 35, 36, and 37. The web or film F is carried by the upper run of the conveyor 34 to the fiber cutting apparatus 38. This cutting apparatus may be of substantially the same type as that more fully described and illustrated in my copending application Serial No. 410,300 (now Patent No. 2,420,033) except that it is designed to cut completely through both the fine and the coarse fibers engaged by the cutting elements and the cutting elements are spaced a greater distance apart.

The dividing apparatus 38 comprises a rigid roll 39 having a smooth, hard surface which cooperates with the roll 40. The roll 40 is mounted in suitable bearings capable of micrometer adjustment, so as to vary the distance between the peripheries of the rolls 39 and 40, and the surface of the roll 40 is provided with cutting or dividing elements, for example a plurality of steel wires; 40 wrapped helically about the surface of the roll 40 and attached to pins 40 or other suitable means. The wires may be of circular cross section, of diameter between 0.01 inch and preferably they are spaced apart a distance of from three quarters of an inch to three inches, the spacing preferably being determined by the average length of a retracted fine crimped fiber. Camel's hair down or fine fiber has an average extended length of about 3½ inches and an average retracted length of about 1½ inches so that for cutting camel's hair the cutting wires preferably would be spaced a distance of more than 1½ inches apart; two inches has been found to be satisfactory. This length of coarse camel's hair fibers or hairs varies from 1½ to 5 inches and they are normally straight and when a dry card or garnett web or film of intermingled coarse and fine camel's hair fibers is passed between the rotary rolls 39 and 40 with the cutting elements spaced two inches apart, the average cut lengths of the coarse fibers is in the neighborhood of two inches and the average length of the fine fibers is greater due to the fact that they are in generally crinkled or retracted condition when passed between the rolls in dry condition. The cutting elements need not be wires, they may be flutes integral with the roll 40, or any other suitable means.

The rolls 39 and 40 are driven in opposite directions and the smooth roll 41 is driven in a counterclockwise direction as shown in Fig. 1. The rolls 39, 40 and 41 are driven at substantially the same surface speed and at substantially the same surface speed as, or at a slightly greater surface speed than, that of the conveyor 34.

Another acceptable cutting apparatus and method comprises condensing the web or film F from the doffer 33 into a sliver by any suitable apparatus well known to the art and feeding the sliver to a suitable cutting apparatus provided with spaced cutting elements adapted to cut completely through the fibers at stated intervals. Such a cutting device may also consist of a reciprocating single blade knife. The stiff fibers in the sliver are generally straight and extend generally longitudinally thereof, the fine crimped fibers are generally retracted to a fraction of their extended length and the bulk of the fine fibers emerge from the cutter of greater average length than the coarse fibers providing the distance between each successive cutting operation is greater than the average retracted length of the fine fibers.

Regardless of the cutting method employed, the mixture of cut coarse hairs, other foreign material and cut fine fibers is passed in the form of a thin web or film to the series of cylinders and brushes 50, 54, 52, 56, and 58 which correspond respectively to the cylinders 20, 24, 25, 26, 27 and 28 of Fig. 1 a. The fast moving brushes 51 and 54 acting upon the backs of the teeth of the card clothing of the slower moving cylinders 56 and 53 engage the fine fibers, straighten them, remove them from the card clothing and advance them at a greatly accelerated speed and this action causes the cut sections of coarse stiff fibers and fragments of other foreign material to be thrown downwardly and free from the film or web.

The brush 55 serves to remove the foreign material and fine fibers from the roll 39 and to transfer them to the card clothing of the cylinder 56. The workers and strippers 57 to 57, 58 to 58 and 59 to 59 and the cylinder 56 rearrange the fibers to the form of a thin film or web F and the cylinder advances it to the doffer 50.

Similarly the cylinder and the workers and strippers 60 to 60, 61 to 61 and 62 to 62 rearrange the fibers received from the brush 54 to the form of a thin film or web.

Additional brush and cylinder motions may be added after the cylinder 60 is desired.
The doffer cylinder 10 removes the film or web from the cylinder 60 and the doffer comb 71 removes it from the cylinder 70 and deposits it in the container 72.

The apparatus of Fig. 2 is a modification of the brush and cylinder motion shown in Figs. 1a and 1b. The cylinder 80 is provided with card clothing and advances the thin film or web F of intermingled coarse and fine fibers which may be completely untwist, the coarse fibers of which may be cut (as in my copending application Serial No. 410,300, now Patent No. 2,420,033) or the coarse and fine fibers of which may be cut as described above or the burrs or other foreign material of which may be crushed or divided or disintegrated into fragments (as in my copending application Serial No. 662,240). The brush 81 is rotated at substantially greater surface speed than that of the cylinder 80 (preferably within the ratios and the surface speed range described above for the brush 24) and it functions with the cylinder 80 to remove coarse fibers and other foreign material at the region of transfer of the film or web F. It will be noted however that the cylinder 80 is rotated in a clockwise direction whereas the cylinder 20a (Fig. 1a) is rotated in a counterclockwise direction. In each case the brushes 81 and 24 act upon the back of the teeth of the card clothing and the degree of coarse hair and other foreign material removal is substantially the same.

The second brush 82 is provided with slightly stiffer bristles than the first brush 81 and it is rotated in the same direction as and at a greater surface speed than that of the brush 81. The succeeding brushes 83 and 84, each is provided with slightly stiffer bristles than the respectively preceding brush and is rotated in the same direction at a greater surface speed than that of the respectively preceding brush. The surface speed of the last brush 84 preferably does not exceed 1200 feet per minute and is 400 feet per minute or more. The tips of the bristles of one brush acting upon the tips of the bristles of the slower moving preceding brush straightens the fine fibers, removes them from the bristles of the preceding brush and advances them at an accelerated speed, causing many of the coarse stiff fibers and other foreign material to be thrown downwardly and free from the film or web F. I have found that with a rotating brush acting against a rotating brush a very satisfactory separation results if the surface speed of the faster moving brush is as small as 15% greater than that of the preceding brush.

The cylinder 85 removes the fibers from the brush 84 and advances them to the next operation which may be working and stripping.

While I have illustrated four brushes in Fig. 2 this embodiment of the invention may embody two or more brushes acting against each other and one or more transfer cylinders provided with card clothing may be inserted between each group of coating brushes to slow down the speed of the web or film between the groups of brushes.

The apparatus of Fig. 3 is another modification of the brush and cylinder motion of Figs. 1a and 1b in which cylinders 90 and 91 provided with card clothing are substituted for the brushes 24 and 27 respectively. The cylinder 94 corresponds to the cylinder 20a except that it is rotated in the opposite direction but the points of the teeth of the clothing on the cylinder 90 act against the back of the teeth of the clothing of the cylinder 94. The cylinders 92 and 93 correspond to the cylinders 25 and 26 respectively and the cylinder 95 corresponds to the cylinder 28. The cylinders 94, 90, 92, 93, 91 and 95 may be rotated at surface speeds which correspond respectively to the surface speeds given above for the brushes and cylinders 20a, 24, 25, 26, 27 and 28.

The points of the teeth of the card clothing on the cylinder 90 act against the back of the teeth of the card clothing of the cylinder 94 and the cylinder 90 preferably is rotated at a surface speed which is from four to ten times greater than that of the cylinder 94 and within the range of from about 400 to 1200 feet per minute. Many of the coarse fibers and much of the other foreign material is thrown downwardly and free from the film or web F substantially at the region of its removal from the cylinder 91. The cylinder 94 cooperates in the same manner with the cylinder 90 and the cylinder 95 removes the fibers from the cylinder 90. The action of the points of the teeth of the clothing of the cylinders 90 and 91 is substantially the same as the tips of the bristles of the brush 27 of Fig. 1a.

While in the embodiments illustrated in the drawings I have illustrated each of the faster moving separating brushes or cylinders (such as 24, 82 and 80) rotated to move or advance the film or web F downwardly at the region of removal of the film or web from the preceding members so that the foreign material falls by gravity to the floor, these separating members may be rotated to move the film or web upwardly at this region and the upwardly directed coarse fibers, dandruff and other foreign material separated from the film or web may be carried away by pneumatic means.

It will be apparent from the foregoing that the method and apparatus of this invention is economical in operation and in construction. While I have shown and described two desirable methods and two desirable embodiments of the apparatus embodying my invention, it is to be understood that this disclosure is for the purpose of illustration only and that equivalent forms of the apparatus may be used. The substitution of equivalent method steps may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. The method of separating foreign material from fine fibers comprising the steps of forming the intermingled fine fibers and foreign material into a web of the character of a web produced by a carding machine, advancing the web at a predetermined speed upon a retentive surface, such as upon the surface of a rotating cylinder provided with card clothing, with one side of the web exposed, concomitantly straightening the fine fibers, removing the web from said retentive surface and advancing it at a surface speed of from four to ten times greater than the surface speed of said retentive surface and within the range of from about 400 to 1200 feet per minute whereby much of the foreign material is thrown free from the fine fibers substantially at the region of removal of the web from said surface, and conducting said freed foreign material to a locality remote from the fine fibers thereby to permanently separate it therefrom.

2. The method of separating foreign material from fine fibers comprising the steps of forming the intermingled fine fibers and foreign material into a web of the character of a web produced by a carding machine, advancing the web at a pre-
determined speed upon the surface of a cylinder provided with card clothing and rotating in the direction in which the teeth of the card clothing are inclined, concomitantly straightening the fine fibers, removing the web from said retentive surface and advancing it at a surface speed from four to ten times greater than the surface speed of said surface and within the range of from about 400 to 1200 feet per minute whereby much of the foreign material is thrown free from the fine fibers substantially at the region of removal of the web from said surface, and conducting said freed foreign material to a locality remote from the fine fibers thereby to permanently separate it therefrom.

3. The method of separating foreign material from fine fibers comprising the steps of forming the intermingled fine fibers and foreign material into a web of the character of a web produced by a carding machine, advancing the web at a predetermined speed upon a retentive surface, such as upon the surface of a rotating cylinder provided with card clothing, with one side of the web exposed, concomitantly straightening the fine fibers, removing the web from said retentive surface and advancing it at a greatly accelerated speed by subjecting the web to the action of the bristles of a rotating brush, whereby much of the foreign material is thrown free from the fine fibers substantially at the region of removal of the web from said surface, and conducting said freed foreign material to a locality remote from the fine fibers thereby to permanently separate it therefrom.

4. The method of separating foreign material from fine fibers comprising the steps of forming the intermingled fine fibers and foreign material into a web of the character of a web produced by a carding machine, advancing the web at a predetermined speed upon a retentive surface, such as upon the surface of a rotating cylinder provided with card clothing, with one side of the web exposed, concomitantly straightening the fine fibers, removing the web from said retentive surface and advancing it at a surface speed of from four to ten times greater than the surface speed of said retentive surface and within the range of from about 400 to 1200 feet per minute by subjecting the web to the action of the bristles of a rotating brush whereby much of the foreign material is thrown free from the fine fibers substantially at the region of removal of the web from said surface, and conducting said freed foreign material to a locality remote from the fine fibers thereby to permanently separate it therefrom.

5. The method of separating foreign material from fine fibers comprising the steps of forming the intermingled fine fibers and foreign material into a web of the character of a web produced by a carding machine, advancing the web at a predetermined speed upon the surface of a cylinder provided with card clothing concomitantly straightening the fine fibers, removing the web from the teeth of said card clothing and advancing it at a surface speed of from four to ten times greater than the surface speed of said retentive surface and within the range of from about 400 to 1200 feet per minute by subjecting the web to the action of the bristles of a rotating brush acting on the back of the teeth of said card clothing whereby much of the foreign material is thrown free from the fine fibers substantially at the region of removal of the web from said teeth and conducting said freed foreign material to a locality remote from the fine fibers thereby to permanently separate it therefrom.

6. The method of separating foreign material from fine fibers comprising the steps of forming the intermingled fine fibers and foreign material into a web of the character of a web produced by a carding machine, advancing the web at a predetermined speed upon the surface of a cylinder provided with card clothing concomitantly straightening the fine fibers, removing the web from the teeth of said card clothing and advancing it at a surface speed of from four to ten times greater than the surface speed of said retentive surface and within the range of from about 400 to 1200 feet per minute by subjecting the web to the action of the bristles of a rotating brush acting on the back of the teeth of said card clothing whereby much of the foreign material is thrown free from the fine fibers substantially at the region of removal of the web from said teeth and conducting said freed foreign material to a locality remote from the fine fibers thereby to permanently separate it therefrom.

7. The method of separating foreign material from fine fibers comprising the steps of forming the intermingled fine fibers and foreign material into a web of the character of a web produced by a carding machine, advancing the web at a predetermined speed upon the surface of a cylinder provided with card clothing concomitantly straightening the fine fibers, removing the web from the teeth of said card clothing and advancing it at a surface speed of from four to ten times greater than the surface speed of said retentive surface and within the range of from about 400 to 1200 feet per minute by subjecting the web to the action of the bristles of a rotating brush acting on the back of the teeth of said card clothing whereby much of the foreign material is thrown free from the fine fibers substantially at the region of removal of the web from said teeth and conducting said freed foreign material to a locality remote from the fine fibers thereby to permanently separate it therefrom.

8. Apparatus for separating foreign material from fine fibers comprising a first retentive member having a plurality of projections inclined substantially in the same direction to form a retentive surface, means to move said first retentive member at a predetermined surface speed, means to form the fine fibers and foreign material into a web of the character of a web produced by a carding machine, means to continuously advance the web to the surface of said first retentive member, a rotary member having a retentive peripheral surface formed by a plurality of projections, said rotary member being mounted with its retentive projections so positioned relative to said projections of said first retentive member as to engage said web when it is located upon said first retentive member along a line which is substantially parallel to the axis of said rotary member and means to rotate said rotary member at a surface speed of from four to ten times greater than the surface speed of said first retentive member and within the range of from about 400 to 1200 feet per minute and in a direction so that the projections on the peripheral surface of the rotary member act upon the backs of the projections of said first retentive member, whereby upon rotation of the rotary member its retentive surface concomitantly straightens the fine fibers, removing the web from the surface of the first retentive member and advances it at a speed of from about 400 to 1200 feet per minute and much of the foreign material is thrown free from the fine fibers.
fibers substantially at the region of removal of the web from said first retentive member.

9. Apparatus for separating foreign material from fine fibers comprising a first cylinder provided with card clothing, means to rotate said cylinder at a predetermined surface speed, means to form the fine fibers and foreign material into a web of the character of a web produced by a carding machine, means to continuously advance the web to the card clothing of said cylinder and with the ends of its bristles so positioned relative to the ends of the teeth of said card clothing as to engage said web when it is placed upon said card clothing and means to rotate said rotary brush about its longitudinal axis at a speed of from four to ten times greater than the surface speed of said cylinder and within the range of from about 400 to 1200 feet per minute and in a direction so that the bristles of the brush act upon the back of the teeth of the card clothing on said cylinder, whereby upon rotation of the rotary brush its bristles concomitantly straighten the fine fibers, remove the web from the surface of the cylinder and advance it at a speed of from about 400 to 1200 feet per minute and much of the foreign material is thrown free from the fine fibers substantially at the region of removal of the web from the cylinder.

10. Apparatus for separating foreign material from fine fibers comprising a first cylinder provided with card clothing, means to rotate said cylinder at a predetermined surface speed, means to form the fine fibers and foreign material into a web of the character of a web produced by a carding machine, means to continuously advance the web to the card clothing of said cylinder, a second cylinder provided with card clothing, said second cylinder being mounted with its card clothing so positioned relative to the teeth of the card clothing of said first cylinder as to engage said web when it is placed upon said first cylinder along a line which is substantially parallel to the longitudinal axis of said first cylinder and means to rotate said second cylinder about its longitudinal axis at a speed of from four to ten times greater than the surface speed of said first cylinder and within the range of from about 400 to 1200 feet per minute and in a direction so that the points of the teeth of the card clothing of the second cylinder act upon the back of the teeth of the card clothing on said first cylinder, whereby upon rotation of the second cylinder its card clothing concomitantly straightens the fine fibers, removes the web from the surface of the first cylinder, and advances it at a speed of from about 400 to 1200 feet per minute and much of the foreign material is thrown free from the fine fibers substantially at the region of removal of the web from the first cylinder.

ROBERT A. FAIRBAIRN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>532</td>
<td>Parkhurst ------</td>
<td>Feb. 23, 1858</td>
</tr>
<tr>
<td>250,896</td>
<td>Dempster et al.</td>
<td>Dec. 13, 1881</td>
</tr>
<tr>
<td>1,375,986</td>
<td>Vardell -----</td>
<td>Apr. 26, 1921</td>
</tr>
<tr>
<td>1,394,775</td>
<td>Levering ------</td>
<td>Oct. 25, 1921</td>
</tr>
<tr>
<td>2,115,609</td>
<td>Allen et al.</td>
<td>Apr. 26, 1938</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>420</td>
<td>Great Britain</td>
<td>of 1874</td>
</tr>
<tr>
<td>1,709</td>
<td>Great Britain</td>
<td>of 1879</td>
</tr>
<tr>
<td>7,695</td>
<td>Great Britain</td>
<td>of 1892</td>
</tr>
<tr>
<td>27,010</td>
<td>Great Britain</td>
<td>of 1897</td>
</tr>
<tr>
<td>433,941</td>
<td>Great Britain</td>
<td>Aug. 22, 1935</td>
</tr>
</tbody>
</table>
Certificate of Correction

Patent No. 2,513,297

July 4, 1950

ROBERT A. FAIRBAIRN

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 2, line 21, for the words "steps if" read steps of; column 5, line 42, for the serial number "564,211" read 465,217; column 6, line 75, for "is desired" read if desired; column 12, line 17, for "as a" read at a;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of October, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.