

[54] **APPARATUS FOR MANUFACTURING WEBS FROM FIBER MATERIAL**

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[58] Field of Search.....19/95, 106, 156, 156.3, 156.4

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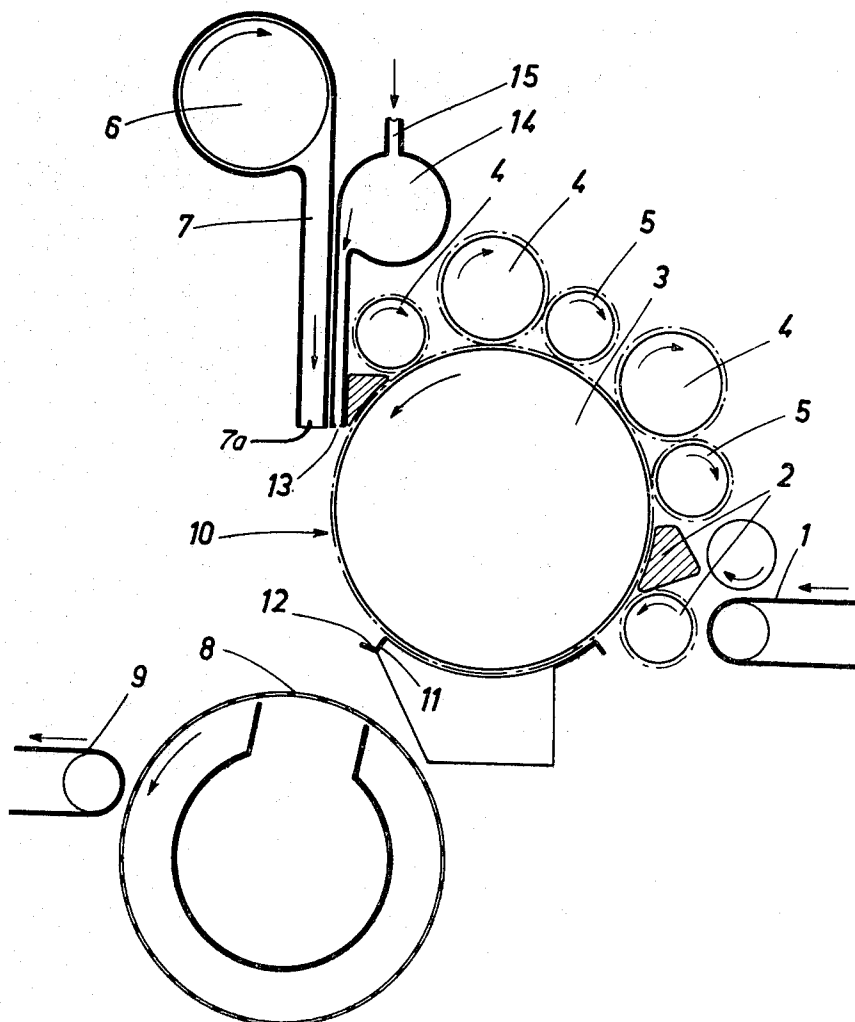
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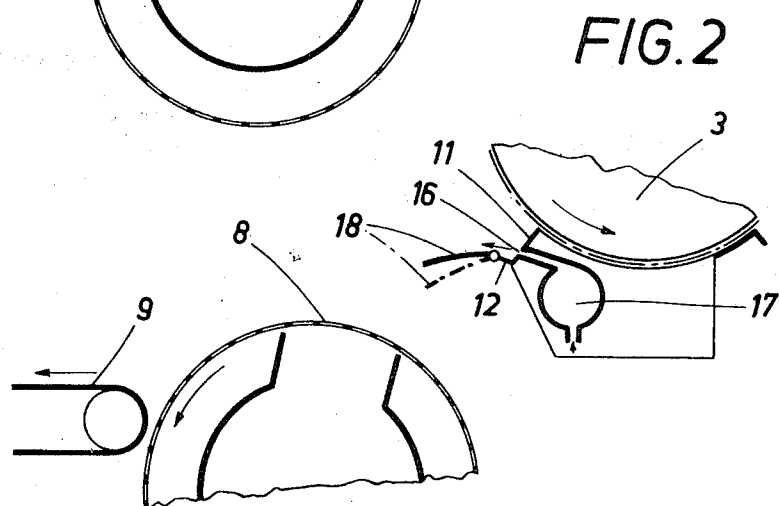
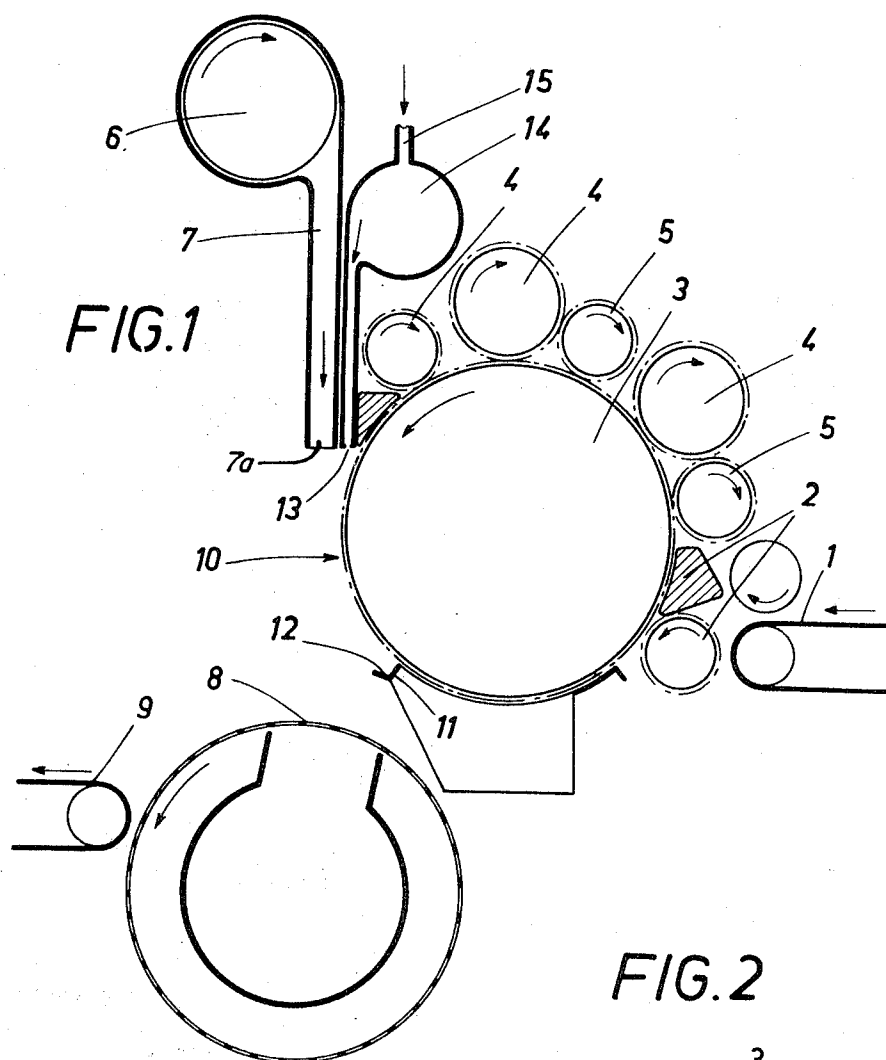
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[57] **ABSTRACT**

A carding drum has a peripheral surface which has a substantially vertically extending release portion. The drum is operable to rotate in a predetermined sense whereby said release portion is moved downwardly. Inlet means supply fiber material to said peripheral surface outside said release portion. Workers and stripples cooperate with said peripheral surface between said inlet means and said release portion in the direction of movement of said peripheral surface during rotation of said drum. A web-forming conveyor succeeds said drum and has a web-forming surface formed with suction openings. An air nozzle is connected to a blower to receive compressed air therefrom and extends throughout the length of said drum and has an outlet orifice arranged to discharge said air in a substantially downwardly directed stream, which flows tangentially past said release portion to impinge on said suction surface. During rotation of the drum, fibers are released from said release portion and entrained by said airstream in a substantially vertical direction to said suction surface through an open space. A baffle defines a lower limit of said release portion and extends approximately radially relative to said drum and close to said peripheral surface thereof.

7 Claims, 2 Drawing Figures





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APPARATUS FOR MANUFACTURING WEBS FROM FIBER MATERIAL

This invention relates to an apparatus for manufacturing webs from fiber material, which apparatus comprises a material inlet, a carding drum rotating at high speed, a plurality of rolls, which are set with teeth and disposed at the periphery of the carding drum and cooperate with it and are smaller than the carding drum, a suction roll or the like which succeeds the carding drum, and an air nozzle, which is supplied by a blower and extends along the length of the drum to eject an airstream which flows in the sense of rotation of the drum approximately tangentially thereto and serves to transport the fibers which have been detached from the carding drum so that said fibers move toward the suction roll or the like.

In the manufacture of webs of fiber material it is known to supply the material to a carding drum which is set with pins or the like and rotates at high speed and serves to disintegrate the material into individual fibers. From the carding drum, the material is ejected in most cases by centrifugal force onto a succeeding conveyor belt or against a suction roll, by which the web being formed is delivered to a conveyor. It is also known to provide an air nozzle, which is disposed closely behind the material inlet and extends in the direction of rotation of the carding drum approximately tangentially thereto and facilitates the detaching of the fibers from the clothing on the carding drum. It has been found, however, that the use of a carding drum does not result in a perfect uniformity of the web which has thus been made because a drum which is combed only adjacent to the material inlet does not result in a fine disintegration of the material.

It is also known to make fiber webs with the aid of cards which consist of a material inlet, a carding drum, workers and strippers cooperating with said carding drum, and a doffer, e.g., in the form of a roll. In this process, the card is supplied in most cases by a preformed web, which is disintegrated by the card or re-formed by the card into a uniformized fine web and delivered to the doffer roll, detached from the latter by means of so-called fly combs, and delivered onto a conveyor. Owing to the multiplicity of the workers and strippers cooperating with the carding drum and having also a tooth clothing, a very fine and complete disintegration of the material results. The carding drum rotates at a relatively low peripheral velocity so that there is also a uniformized but still coherent, thin web, which remains on the carding drum and must be detached by the doffer drum, which in that case has a peripheral velocity which is smaller than that of the carding drum so that the web is reliably removed from the carding drum and the fibers are condensed on the doffer roll. These relatively low peripheral velocities reduce the possible throughput of the material. Besides, the doffer drum and the succeeding fly combs or the like increase the structural expenditure and there is the inevitable and often serious disadvantage that the fibers in the fine web are substantially parallel to each other and to the longitudinal direction of the web so that the fine web has quite different tensile strengths in the longitudinal and transverse directions.

Another known apparatus has a carding drum having workers and strippers, and the carding drum rotates at such a high speed that the fibers can fly off under centrifugal force to a succeeding suction roll. The space traversed by the fibers in flight between the carding drum and the suction roll is enclosed by a housing. There is an air nozzle at the lower limit of the range in which the fibers fly off the carding drum and the air jet produced by said nozzle is approximately tangential to the periphery of the drum and opposite to the sense of rotation of the drum. The high-speed rotation of the carding drum results in a cylindrical body of air, which rotates with the carding drum and obstructs the flying of the fibers off the drum in spite of the high-speed rotation of the drum. For this reason, the airstream in a direction which is opposite to the sense of rotation of the drum serves to oppose the rotating air cylinder and ensure that the fibers fly off the clothing of the carding drum. This effect will not be accomplished because the teeth

of the carding drum are like saw teeth, which are forwardly inclined in the sense of rotation of the drum, so that the airstream from the nozzle urges the fibers back into the spaces between the teeth. Besides, the impact of the airstream from the nozzle on the cylindrical body of air rotating in the opposite direction results in eddies of air, which are unfavorable for a uniform flying-off. The housing which encloses the space traversed by the fibers in flight is also unfavorable because the air draft which is due to the suction action of the suction roller is also retarded on the walls of the housing with generation of turbulence. This phenomenon promotes also an irregularity of the web which is formed.

Still another known carding arrangement consists of a plurality of carding drums which are arranged one behind the other and in which the last carding drum is provided with an air nozzle which extends over the length of the drum and which has an airstream extending approximately tangentially to the drum and in the sense of rotation of the drum. The air nozzle is continued by a sliding surface, which is arranged like a doffer and extends directly to the suction roll, which is slightly spaced from the carding drum and on a somewhat higher level than the latter. Hence, the fibers do not actually fly from the last carding drum to the suction roll but more or less slide under the pushing action of the airstream so that the desired layer of entangled fibers cannot be obtained but the fibers are maintained in their uniform orientation imparted to them by the carding operation. Besides, the airstream produced by the relatively slow rotation of the drum is not sufficient to detach all fibers from the carding set, particularly when finer or lighter fibers are concerned.

It is an object of the invention to eliminate all these disadvantages and to provide a relatively simple apparatus, which has a high throughput capacity and enables the manufacture of a completely uniform web, which has the desired layer of entangled fibers, regardless whether relatively coarse and heavy fibers or fine and lightweight fibers are being processed.

In an apparatus of the kind described first hereinbefore, the invention accomplishes the stated object essentially in that the air nozzle is directed downwardly, the range in which the fibers fly from the carding drum is limited by a baffle, which is approximately radial and extends closely to the drum, the space traversed by the fibers in flight between the carding drum and suction roll or the like is free of a housing, and the fibers impinge on the suction roll or the like approximately in a vertical direction. The carding drum rotates at such a high speed that the fibers can fly off under the action of centrifugal force. The air which rotates with the carding drum and the air from the air nozzle are radially deflected from the drum by the baffle so that all fibers still adhering to the clothing on the carding drum are caused to fly off, particularly because the movement imparted to the air by the baffle is in the direction of the teeth of the carding drum so that the fibers are withdrawn from the teeth and not forced back into the spaces between the teeth. In an operation performed without the air nozzle, fibers would also fly off under the action of centrifugal force and of the air which has been deflected by the baffle but there would then be a risk, particularly with lightweight fibers, that the individual fibers combine in flocks as they fly toward the suction roll or the like and form an irregular web. This flocking is due to the fact that the individual fibers fly off at different velocities because they differ in mass and weight and then catch up during flight and agglomerate. The airstream acts to prevent these phenomena so that a uniform flight results and a uniform web is formed. Because the space traversed by the fibers in flight between the carding drum and the suction roll or the like is free of a housing, the turbulence otherwise occurring on the housing walls will be avoided. This contributes to a still more uniform flight and the formation of a still more uniform web. As the individual fibers impinge in an approximately vertical direction on the suction roll or the like, the fibers fall from above onto the top portion of the suction roll so that thicker webs can be obtained with a lower suction force. Besides, this arrangement prevents the formation of a flaky or shingled web on the suction roll or the like.

In a development of the invention, the baffle is provided with a longitudinal flange, which includes an obtuse angle with the baffle so that the baffle and the longitudinal flange together form a member which is approximately scooplike in cross section and which improves the deviation of air from the periphery of the carding drum to the suction roll.

In the processing of very fine fibers which are, e.g., 6-1.0 denier, difficulties may arise because these fine fibers cannot be detached from the teeth of the drum by centrifugal action along. The airstream which is supplied by the blower and discharged by the nozzle is not sufficient for this purpose because with an economically desirable blower the velocity of the airstream is less than the peripheral velocity of the carding drum. Reliable centrifugal removal of even the finest fibers from the carding drum is accomplished by discharging compressed air from a multiplicity of five orifices disposed in a row which extends between the nozzle orifice of the air nozzle and the periphery of the carding drum and is slightly spaced from said periphery. These compressed air discharge orifices ensure that those fibers which are not detached from the teeth of the carding drum by centrifugal force are driven off the teeth and enter the airstream discharged by the nozzle and carrying said fibers to the suction roll or the like. Compressed air is discharged at such a low rate that it is effective only closely behind the orifices and does not disturb the uniformity of the airstream from the nozzle. The compressed air which is effective only within the short distance is entirely sufficient to drive off the fibers which have remained caught on the drum teeth, particularly because the compressed air flows in the direction of the backs of the teeth to the tips of the latter so that it acts in the proper sense and a very small force is sufficient to detach the fibers from the teeth.

In the processing of relatively coarse and heavy fibers, the carrying airstream causes the fibers to impinge on the suction roll or the like in a relatively narrow range. The narrower this impact range, the smaller is the improvement in the uniformity of the web which is being formed. In the processing of relatively light fibers there is a risk that the fibers impinge on the baffle and on the latter combine in flocks, which may also introduce an irregularity into the subsequently formed web. These difficulties are also eliminated if the baffle is provided with a multiplicity of closely spaced, fine orifices, through which compressed air supplied independently of the blower is discharged transversely to the airstream discharged by the nozzle. Hence, fibers which are very light in weight are deflected from the baffle and can no longer agglomerate in flocks. Besides, the airstream which is discharged by the nozzle and serves to carry the fibers is expanded so that the fibers impinge on the suction roll in a relatively wide zone. The rate at which compressed air is discharged is so low that unfavorable disturbances in the overall airstream are avoided.

The compressed air discharge orifices disposed adjacent to the air nozzle and those disposed on the baffle may each be used individually or they may be used jointly, depending on the nature of the fiber material being processed. In any case, the respective sets of orifices are preferably each in communication with a common source of compressed air, so that separate supply conduits leading to the compressed air discharge orifices are eliminated and there is a uniform supply of air to all orifices.

A flap may be disposed at the outside edge of the baffle and extends toward the suction roll or the like and performs an up and down oscillating motion. This flap will effect by strictly mechanical action a corresponding distribution of the fibers which approach the suction roll or the like in flight and consequently a desirable promotion of the scattering.

The subject matter of the invention is strictly diagrammatically shown by way of example in the accompanying drawing, on which

FIG. 1 is a vertical sectional view showing an apparatus for manufacturing webs of fiber material and

FIG. 2 is a similar view showing a modified part of this apparatus.

The apparatus comprises a conveyor belt 1 for supplying a preformed web at a controlled rate, a material inlet 2, a carding drum 3, which is provided with a dense sawtooth clothing and rotates at high speed, and a plurality of workers and strippers 4, 5, which are also set with teeth. The last worker 4 is succeeded by a downwardly directed air nozzle 7 having a wide slot and extending throughout the length of the carding drum 3. This nozzle is supplied by a cross stream blower 6 and which discharges an airstream that flows from orifice 7a tangentially to the periphery of the carding drum and in the direction of rotation thereof. The carding drum 3 is succeeded by a suction roll 8, which is impinged upon by the flying fibers which have been detached from the carding drum. The suction roll delivers the resulting web on a conveyor belt 9. The range 10 in which the fibers fly from the carding drum 3 is limited at its lower end by a baffle 11, which is approximately radial to the drum and provided with a longitudinal flange 12, which includes an obtuse angle with the baffle. The suction roll 8 is disposed so that the fibers impinge on the suction roll in an approximately vertical direction so that the fibers impinge from above on the top portion of the suction roll. The space traversed by the fibers in flight between the carding drum 3 and the suction roll 8 is intentionally free of any enclosure or housing.

A row of fine orifices 13 is disposed between the outlet orifice 7a of the air nozzle 7 and the periphery of the carding drum 3. These orifices are approximately parallel to the airstream discharged by the nozzle and discharge compressed air, which is supplied independently of the blower 6. The orifices 13 are in communication with compressed air receiver 14, which receives compressed air through a conduit 15.

In the modification shown in FIG. 2, the baffle 11 is formed with a multiplicity of closely spaced, fine orifices 16, through which compressed air supplied from a receiver 17 is discharged transversely to the airstream discharged by the nozzle 7. A flap 18 which extends towards the suction roll 8 of the baffle is mounted on the longitudinal flange 12 and performs an up and down oscillating motion to promote the scattering of the fibers which approach the suction roll 8 in flight.

What is claimed is:

1. Apparatus for manufacturing webs from fiber material, which apparatus comprises

1. a carding drum having a peripheral surface with a substantially vertically extending fiber release portion and operable to rotate in a direction to move said release portion downwardly,
2. inlet means for supplying said fiber material to said peripheral surface outside said release portion,
3. worker and stripper rolls disposed at, and adapted to cooperate with, said peripheral surface between said inlet means and said release portion in the direction of movement of said peripheral surface during rotation of said drum,
4. a web-forming conveyor succeeding said drum and having a web-forming surface having suction openings,
5. a blower operable to deliver compressed air,
6. an approximately vertically downwardly extending air nozzle connected to said blower to receive compressed air therefrom and having an outlet orifice extending throughout the length of said drum and arranged to discharge said compressed air in a substantially vertically downwardly directed stream, flowing tangentially past said vertical fiber release portion and impinging substantially vertically on said suction surface,
7. the speed of rotation of said drum being sufficient to release fibers from said release portion into said airstream and said fibers being entrained by said airstream and carried thereby in a substantially vertical direction to said suction surface through an unenclosed space, and
8. an outwardly projecting baffle defining a lower limit of said release portion and extending approximately radially relative to said drum and close to said peripheral surface thereof.

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2. Apparatus as set forth in claim 1, further comprising a compressed air discharge means defining a multiplicity of fine orifices extending substantially parallel to said airstream and arranged in a row extending between said nozzle outlet orifice and said peripheral surface, the fine orifices being slightly spaced from the peripheral surface, and a compressed air supply conduit connected to the fine orifices for supplying compressed air thereto independently of the blower.
3. Apparatus as set forth in claim 2, further comprising a common compressed air receiver in communication with all of said fine orifices, the conduit being connected to the common receiver.
4. Apparatus as set forth in claim 3, wherein the compressed air supply means comprises a common compressed air receiver in communication with all of said fine orifices.
5. Apparatus as set forth in claim 4, in which said baffle has

- a longitudinal flange, enclosing an obtuse angle with said baffle.
6. Apparatus as set forth in claim 5, in which said baffle is formed with a multiplicity of closely spaced, fine orifices which are directed transversely to said airstream, and means other than said blower are provided which are operable to supply compressed air to said orifices independently of the operation of said blower.
7. Apparatus as set forth in claim 6, in which said baffle has an outer edge facing said web forming surface and a flap is hinged to said baffle near said outer edge and extends generally toward said web-forming surface, and is arranged to perform an up and down oscillating motion.
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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,641,628 Dated February 15, 1972

Inventor(s) Ernst Fehrer

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Page 1, item (30), add the following:--

July 25, 1969 Austria A 7183/69
Sep. 30, 1969 Austria A 9217/69

Signed and sealed this 27th day of June 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents