June 17, 1958 A. BOER 2,838,804

FIBER OPENING MACHINE

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Fig. 1

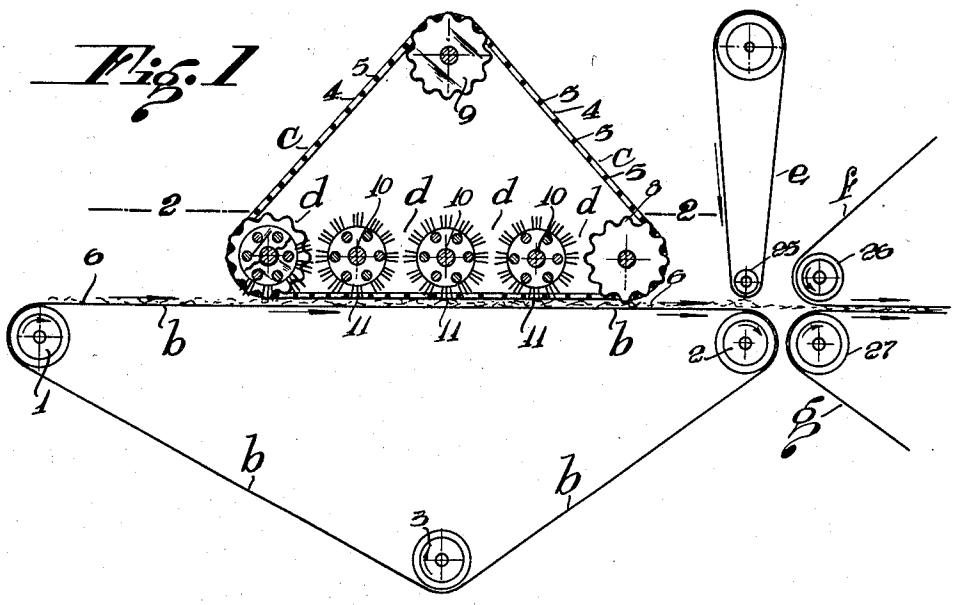
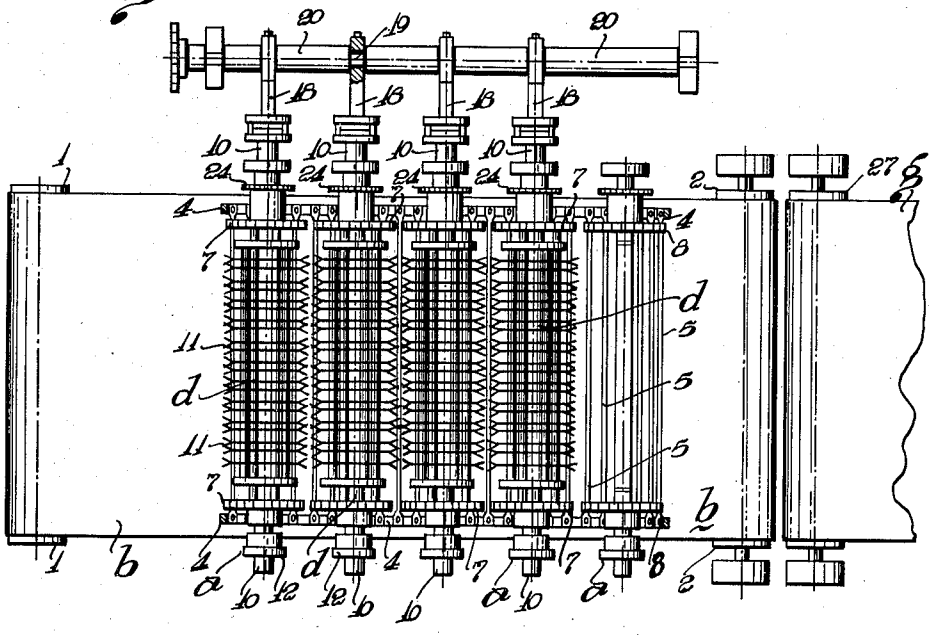


Fig. 2



INVENTOR.
Arpad Boer
BY Albert B. Jacobs
Attorney

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Fig. 3

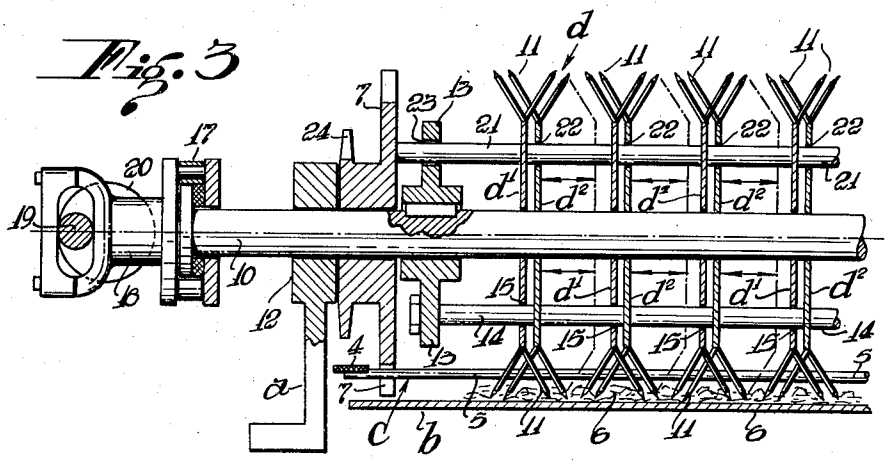


Fig. 4

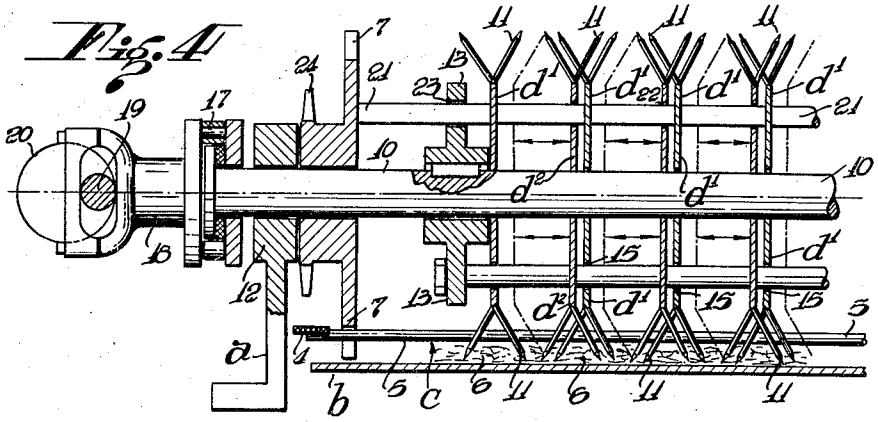
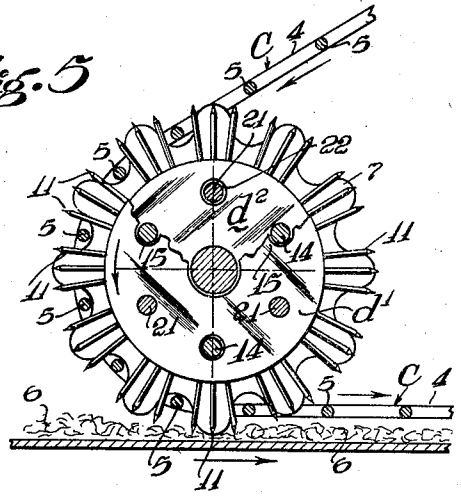


Fig. 5



INVENTOR.
Arpad Boer
BY
Albert B. Jacobs
Attorney

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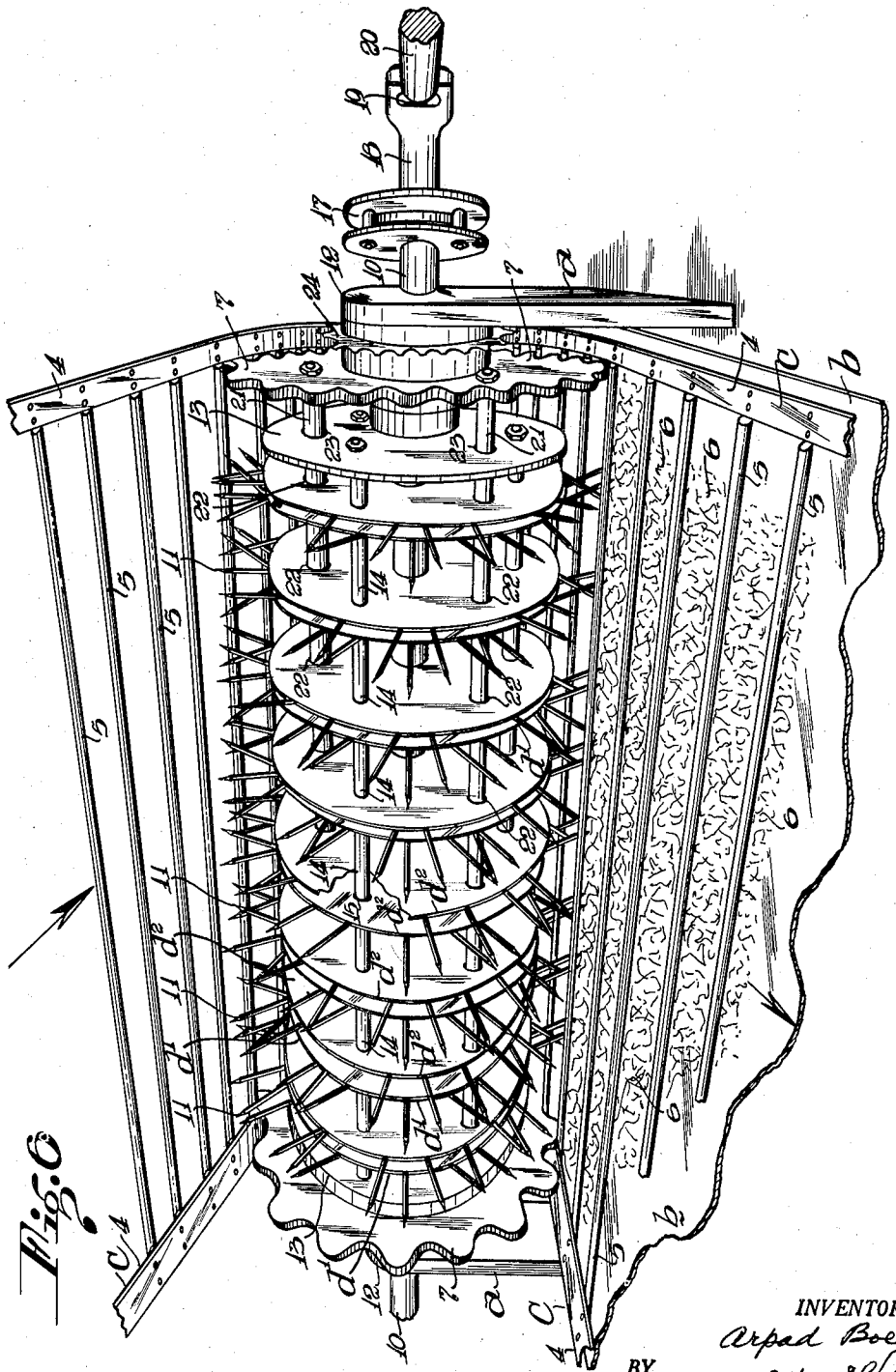


Fig. 6

INVENTOR.
Arpad Boer
BY Albert L. Jacobs
Attorney

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2,838,804

FIBER OPENING MACHINE

Arpad Boer, Buenos Aires, Argentina, assignor to Bancroft-Brillotex International S. A., Montevideo, Uruguay, a corporation of Uruguay

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6 Claims. (Cl. 19—65)

The present invention relates to a fiber opening machine and more particularly to a new mechanism operating on an opposed double-acting principle which solves one of the most serious and important problems in the wool and cotton industry and other related industries processing fibers.

In general, the machine comprises sets of disks provided with opposed barbs which by relative movement seize the fibers on both sides and with successive effects, so that in a short process the fibers are opened up completely, even when they are in entangled balls.

For this purpose, the machine comprises rollers formed of multiple barbed disks extending in different directions so that they constitute an opposed phase with respect to other similar disks inserted between the spaces left by them. Since one of these phases undergoes an alternating lateral reciprocal movement, there is produced between both phases the multiple effect of separation of the fibers at various points of the material which is being treated without the occurrence of disturbances or adverse effects and without retention of the fibers between the barbs of the operative disks since, between these barbs, there operate rods without interrupting the action in any given sector of the disk roller in order to cause the fibrous material to follow along a tangential plane where there may be other separating disk rollers operating under similar conditions. Because the rods are transverse, they form an endless belt which in cooperation with another endless belt contributes to the conduction of the wool or fibers treated.

The present invention has as an object the provision of fiber opening and cleaning mechanism which, although based on sets of barbs, does not damage the fibers, inasmuch as the relative movement of the parts is moderate but of great efficiency.

Another object is to replace manual operation and processing by a device somewhat simulating manual operation and wherein the fibrous material is seized by two opposite parts and opened to separate the filaments in a lateral direction.

Another object of the invention is to provide a relatively simple mechanization which effects rapid and positive processing to disentangle and to separate laterally the wool or cotton fibers or other animal, vegetable, mineral or synthetic filaments.

Another object is to provide a fiber opening system which works ahead of or after any other machine for the treatment of fibrous material with the advantage that it is not only able to separate the fibers but also to effect a cleaning by letting fall the thistles, burls and other foreign bodies or extraneous material that may be present.

A preferred embodiment of the invention is illustrated by way of example in the accompanying drawings wherein:

Fig. 1 is a side view of the machine as it appears in operation;

Fig. 2 is a plan view of the machine taken on line 2—2 of Fig. 1;

Fig. 3 is a front view of one of the operative rollers of the machine showing the sets of barbed disks and their relationship to the belt of cross-rods with which they function ;

Fig. 4 is a view similar to Fig. 3 but with the parts in positions resulting from the displacement due to relative reciprocal lateral movement thereof;

Fig. 5 is a side view of a barbed disk;

Fig. 6 is a perspective view of a barbed roller seen from the inner part of the belt of transverse rods.

Referring to the drawings, *a* is the bedframe for the bearings and supports for the shafts of the entire mechanism. For the conveyance of the fibers to be treated, the machine comprises an endless belt *b* mounted around rollers **1**, **2** and **3** with the active operative length of which the endless belt *c* formed by the pair of cords **4** and cross-rods **5** cooperates. The treated fibers **6** are conveyed by the belt *b* and are conducted below the active operative length of the rod belt *c* which is in superposed relationship to endless belt *b*.

The rod belt *c* is mounted on spaced pairs of toothed wheels **7**, **8**, and **9**, the first pair of which is on the same shaft **10** as the first fiber opening roller *d*, the other opening rollers *d* being the same and, with the first roller *d*, forming the series shown in Figs. 1 and 2.

Each roller *d* comprises a plurality of disks d^1 and a plurality of disks d^2, which form two opposed phases which, by lateral relative reciprocal movement in the manner hereinafter explained, give rise to the mechanical action in question.

Each disk d^1 or d^2 is provided with a multiplicity of barbs **11** which extend obliquely outwardly at an angle so that in either direction the barbs of each disk d^1 are able to mesh with the barbs of the next adjacent disk d^2, but without friction between the barbs of one disk with respect to the other, as they are perfectly guided. The barbs **11**, as is clearly shown in Fig. 3, are arranged to leave regular spaces for the treads of the cross rods **5**, so that, when these rods position the fibers **6** conveyed by the belt *b*, the barbs **11** which project from among the rods **5** of belt *c* can act on the fibers without their being raised or retained between the barbs. Thus, as the wool or fibers **6** pass between the endless belt *b* and the rod belt *c*, the barbs **11** of the various separating rollers *d* rise between said rods **5** to seize and laterally open the filamentous material as is shown in Figs. 2 and 4.

The shaft **10** of each fiber opening roller *d* acts as means of rotation in the bearings **12** of the bedframe *a*, and is provided with the end chucks **13** and the disks d^2, which are laterally displaceable, so that these disks d^2 have relative movement with respect to the disks d^1 which are maintained in permanent position in the plane of traction.

For this purpose, the displaceable disks d^2 are joined together by bars **14** which pass through perforations **15** of the disks d^1 and, in turn, the bars **14** are joined to end chucks **13** which have central socket openings in which is intimately connected the shaft **10** which passes and slides through the central openings **16** of toothed wheels **7**. The shaft **10**, by means of the yoke **17**, is articulated rotatably with the connecting rod **18** which, through eccentric **19**, is responsive to the rotation of the arbor **20**. During this rotation, the eccentric **19** produces in the connecting rod **18**, shaft **10**, chucks **13**, bars **14**, and disks d^2 an alternating reciprocal lateral movement from the position shown in solid lines in Fig. 3 to that shown in solid lines in Fig. 4, and vice versa.

For their part, the disks d^1 are joined together by means of the bars **21** which pass through the openings **22** of the disks d^2 and openings **23** of the chucks **13**, and, as can be seen in Figs. 3 and 4, these bars **21** are con-

nected to the tooth wheels 7, forming with them and the disks d^1 an assembly which is rotatable jointly with the assembly formed by the disk d^2, except that the disks d^1 undergo no lateral displacement.

The two assemblies formed by the disks d^1 and d^2 constitute a unit rotatable with its general shaft 10 in the bearings 12 of the bedframe *a*, so that this rotatable unit constitutes and acts as a roller *d*, as shown in Figs. 1, 2, and 6.

Each of the tooth wheels 7 has a pinion 24 around which pinions passes a chain or other transmission member to be driven by a motor. In this way each roller *d*, formed by the disks d^1 and D^2 jointly, rotates on its shaft 10 and, since this shaft has coupled to it a connecting rod 18 which is responsive to the eccentric 19, when the roller *d* rotates, the assembly of disks d^2 connected to the shaft 10 is displaced alternately, as is clear from Figs. 3 and 4. The relative movement between the disks d^2 and the disks d^1 is thereby obtained.

The movement of rotation of the opening rollers *d* is produced in combination with the circulation of the rod belt *c*, because the rods 5 of this belt are adapted to act on the teeth of wheel 7, and, in turn, these rods 5, being cross pieces, are inserted between the spaces left by the barbs 11 of the disks d^1 and d^2. Due to this arrangement, the rod belt *c* and the base belt *b* circulate in the lower part of the opening rollers *d*, in a plane tangential to the disks d^1 and d^2. Since the barbs 11 are longer than the section of the rods 5, these barbs project below the rods to a sufficient extent for the wool or fiber 6 passing between belts *c* and *b* to be reached by said barbs. Inasmuch as the barbs have a relative lateral displacement under the action of the eccentric 19 of each roller *d*, the fibers are not only conducted longitudinally in accordance with the movement of the belt, but they are also seized and plucked laterally by the barbs 11 in either direction. After being subjected to the action of the first roller *d*, the fibers come in front of the second roller *d* in a modified condition, the relative lateral displacement above referred to opening the fibers laterally with respect to each other as they pass from one roller to the next under the conveying action imparted by the two belts *c* and *d* which operate at the same speed.

Since the cross rods 5, which form the belt *c*, define the operative plane where the barbs 11 pass through the spaces left by the rods, the alternating action of the bars in opposite directions occurs very readily, and the fibers cannot get tied up in the barbs 11, as the rods 5 prevent this, at the end of which the entire fibrous material which passes below the rollers *d* has been treated by the barbs without losing the plane of conduction given by the operative length of the belt *c*.

Beyond the opening rollers *d*, which is an essential part of the fiber treating machine, belt *b* with its rollers 2 cooperates with another endless belt *e* which, with its roller 25, cooperates with the roller 2 to grip the fibers already opened by the opening rollers *d*. The rollers 2 and 25 with their respective belts deliver the fibers to the rollers 26 and 27, which are operated at a greater speed and drive belts *f* and *g*, respectively, so that the fiber portions are pulled, leaving them parallel to each other in the direction of traction.

From the foregoing, it will be understood that rotation of the triangularly arranged rollers 1, 2, and 3 effects circulation of belt *b* in the direction of the arrows of Fig. 1, and that the rotative movement of the rollers *d* and their toothed wheels 7 is effected by circulation of the belt *c* with its cross-rods 5 in the direction of the arrows of that same figure. At the same time as the rollers *d* rotate, presenting their barbs 11 between the rods 5 of belt *c*, the assembly formed by the disks d^2, chucks 13 and shaft 10 undergoes a lateral alternating reciprocal displacement in response to the eccentric 19 of the arbor 20, providing relaive movement between said assembly containing the disks d^2 and the assembly of the disks d^1.

Consequently, the barbs of the movable disks d^2 and the barbs of the non-displaceable disks d^1 form two opposite phases which, due to the alternating movement, operate bilaterally, since, as shown in Figs. 3 and 4, the barbs 11 of the disks d^2, on shifting to the left for example, approach the right face of the disks d^1, while, when they shift to the right, they approach the left face of these disks d^1, and, since the barbs 11 extend obliquely to both sides, the barbs of both disks d^2 and d^1 on approaching either side overlap without touching each other in each alternating reciprocal movement.

As the fibers 6 are conducted over belt *b*, they enter the operative zone where the opening rollers *d*, while rotating together with the circulation of the belt *c*, present their barbs 11 between the rods 5, and with the alternating lateral displacement of the assembly corresponding to the disks d^2, the bars 11 rising between the rods 5 produce separation of the fibers, in a manner analogous to manual operation, but with greater uniformity, efficiency, and rapidity, since, on passing from one roller *d* to the next, the action of lateral separation of the fibers is progressive. At the end of the processing, upon leaving the last roller *d*, the filamentous material is completely open with consequent elimination of foreign bodies, for, as the fibers are being separated laterally, these foreign bodies, which may be thistles, seeds, dust, or burls in general, lose support and fall wherever they find an empty space, for example, during the transfer from rollers 2 and 25 to rollers 26 and 27. As pointed out above, this transfer from the rollers 2, 25 to the rollers 26, 27 produces longitudinal plucking due to the greater speed of belts *f* and *g* with respect to the speed of belts *b* and *e*, this greater speed being expressed by longer arrows adjacent belts *f* and *g* as compared to the arrows of belts *b* and *e*.

It will be further understood that the fibers 6 do not leave the plane defined by the operative plane of belt *c*, as the rods 5 prevent said fibers from being raised by the barbs 1 in the rotation of the opening rollers *d*.

The foregoing is intended as illustrative and not as limitative since, within the terms of the appended claims, various modifications may be made without departing from the invention.

I claim:

1. A fiber opening machine comprising an endless cross-rod belt made up of longitudinal cords and spaced cross-rods, a series of opening rollers associated with said endless belt each opening roller of which series has a plurality of peripherally barbed disks forming a first assembly and a plurality of peripherally barbed disks laterally displaceable with respect to the first barbed disks and constituting a second assembly, means for linking the first and second barbed disc assemblies together to form a unit for rotation, a shaft on which each opening roller and its barbed disk assemblies are mounted, one of said assemblies being secured to said shaft, means for rotating each such shaft and means for imparting a lateral displacement motion to the second assembly of barked disks relative to the first assembly of barbed disks, the spatial and operative arrangement being such that the barbs of the disks pass between the cross-rods of the endless belt whereby during operation of the machine the barbs rise between the rods and cross a plane defining a passage channel for fibers to be processed.

2. A fiber opening machine comprising an endless cross-rod belt made up of longitudinal cords and spaced cross-rods, a series of opening rollers associated with said endless belt each opening roller of which series has a plurality of peripherally barbed disks forming a first assembly and a plurality of peripherally barbed disks laterally displaceable with respect to the first barbed disks and constituting a second assembly, means for linking the first and second barbed disk assemblies together to form a unit for rotation, a shaft on which each opening roller and its barbed disk assemblies are mounted, one of said as-

semblies being secured to said shaft, means for rotating each such shaft and means for imparting a lateral displacement motion to the second assembly of barbed disks relative to the first assembly of barbed disks, the spatial and operative arrangement being such that the barbs of the disks pass between the cross-rods of the endless belt whereby during operation of the machine the barbs rise between the rods and cross a plane defining a passage channel for fibers to be processed, an endless belt adapted to act as a fiber conveyor and having a portion in parallelism with a portion of the cross-rod endless belt to form a fiber processing passage therebetween, the said barbs extending through the spaces between the cross-rods of the said cross-rod endless belt to act upon the fibers.

3. A fiber opening machine comprising an endless cross-rod belt made up of longitudinal cords and spaced cross-rods, a series of opening rollers associated with said endless belt each opening roller of which series has a plurality of peripherally barbed disks forming a first assembly and a plurality of peripherally barbed disks laterally displaceable with respect to the first barbed disks and constituting a second assembly, means for linking the first and second barbed disk assemblies together to form a unit for rotation, a shaft on which each opening roller and its barbed disk assemblies are mounted, one of said assemblies being secured to said shaft, means for rotating each such shaft and means for imparting a lateral displacement motion to the second assembly of barbed disks relative to the first assembly of barbed disks, the spatial and operative arrangement being such that the barbs of the disks pass between the cross-rods of the endless belt whereby during operation of the machine the barbs rise between the rods and cross a plane defining a passage channel for fibers to be processed, each of the said barbed disks having a circular central portion with openings therethrough and barbs mounted around the periphery and extending obliquely outwardly therefrom.

4. A fiber opening machine comprising an endless cross-rod belt made up of longitudinal cords and spaced cross-rods, a series of opening rollers associated with said endless belt each opening roller of which series has a plurality of peripherally barbed disks forming a first assembly and a plurality of peripherally barbed disks laterally displaceable with respect to the first barbed disks and constituting a second assembly, means for linking the first and second barbed disk asemblies together to form a unit for rotation, a shaft on which each opening roller and its barbed disk assemblies are mounted, one of said assemblies being secured to said shaft, means for rotating each such shaft and means for imparting a lateral displacement motion to the second assembly of barbed disks relative to the first assembly of barbed disks, the spatial and operative arrangement being such that the barbs of the disks pass between the cross-rods of the endless belt whereby during operation of the machine the barbs rise between the rods and cross a plane defining a passage channel for fibers to be processed, each of the said barbed disks having a circular central portion with openings therethrough and barbs mounted around the periphery and extending obliquely outwardly therefrom, and the said means for imparting lateral displacement motion including bars extending through openings in said disks, a chuck at each end of the asemblies in which said shaft is secured, a toothed wheel beyond each chuck for engagement with a cross-rod endless belt and a driven eccentric device for effecting reciprocal longitudinal movement of said shaft and of those disks secured thereto.

5. A fiber opening machine comprising a series of opening rollers each of which includes a plurality of barbed disks arranged as two disk assemblies and one of which is laterally displaceable with respect to the other, an endless belt composed of longitudinal cords provided with rods at intervals forming spaces through which the barbs of said disks are adapted to project successively, an endless belt having a portion serving as a fiber conveyor and extending adjacent the first endless belt where the barbs project therethrough, means for circulating said belts at the same speed, means for rotating said barbed disk assemblies so that the barbs thereof successively act upon fibers between said belts, means for effecting lateral displacement of one assembly of barbed disks with relation to the other assembly of barbed disks thereby acting on said fibers to open them, means for transferring the thus treated fibers to a receiving means and means for imparting a sudden increase in speed to the fibers being transferred to complete their processing.

6. A fiber opening machine in accordance with claim 5 in which the barbed disks have their barbs mounted peripherally and extending angularly outwardly in two directions in V-shaped formation, the barbs of one assembly being always out of contact with the barbs of the other assembly but together forming fingers which act to open the fibers.

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