March 4, 1941. A. F. BURKARDT 2,233,753

SCUTCHING MACHINE

Filed Aug. 10, 1938 3 Sheets-Sheet 1

Fig. 1.

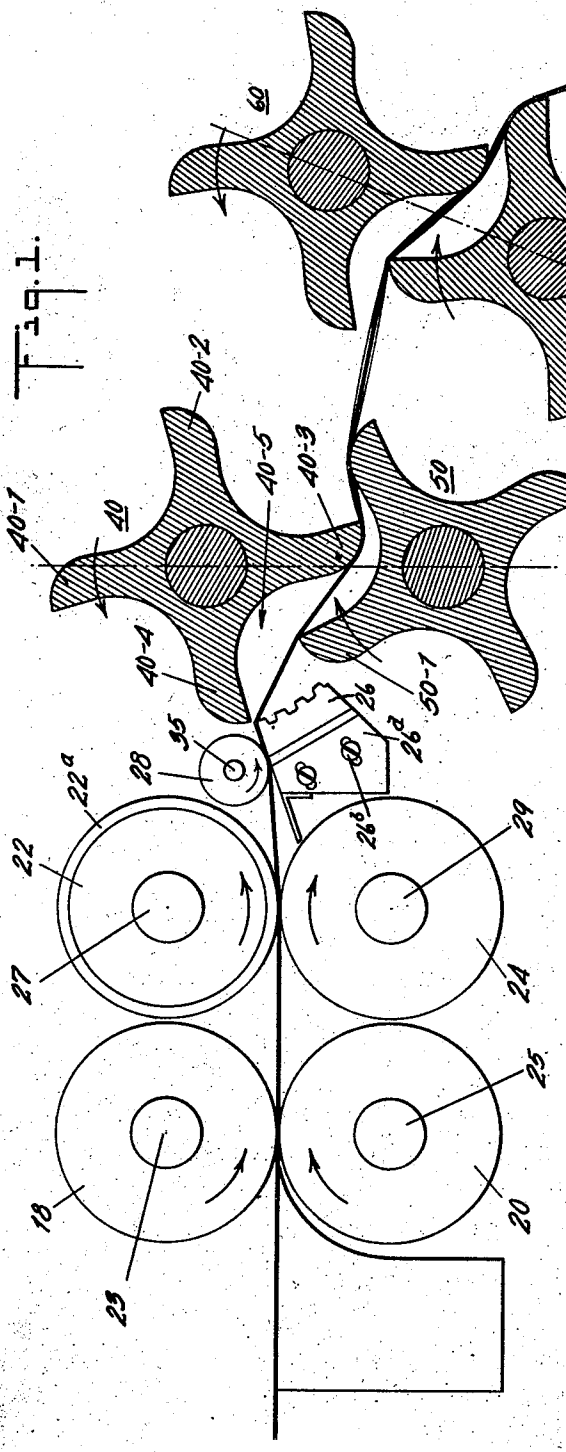
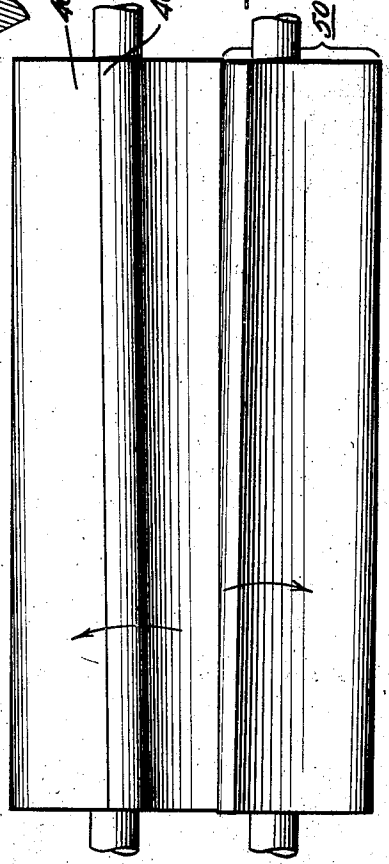


Fig. 2.



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Fig. 4.

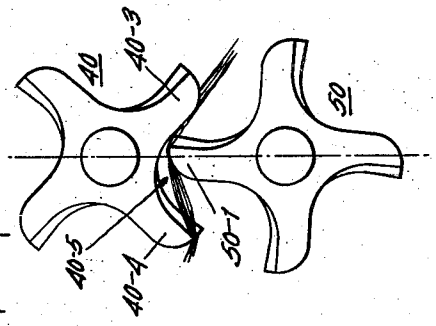


Fig. 5.

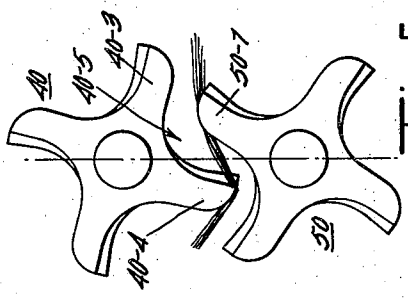
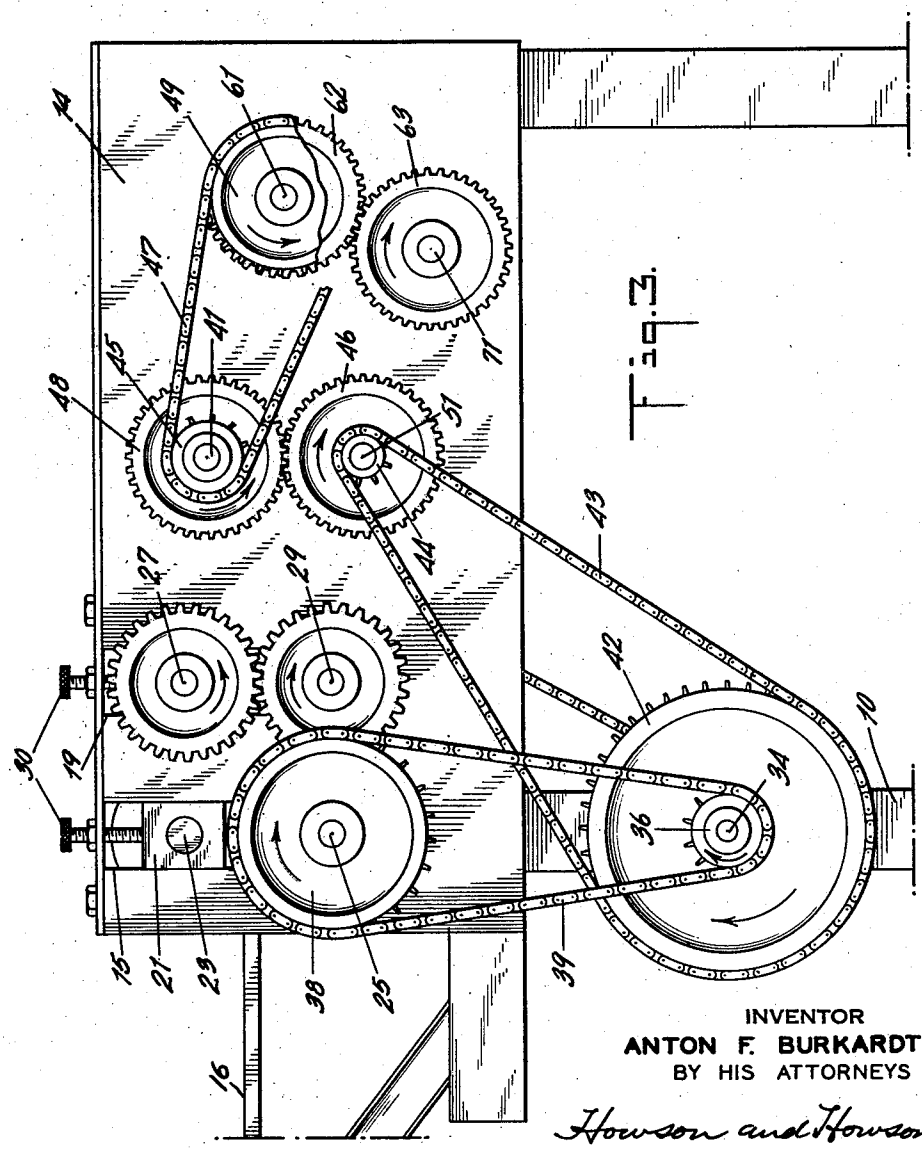


Fig. 7.



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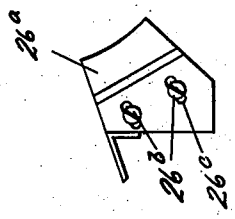


Fig. 7.

Fig. 6.

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UNITED STATES PATENT OFFICE

2,233,753

SCUTCHING MACHINE

Anton F. Burkardt, New York, N. Y.

Application August 10, 1938, Serial No. 224,164

3 Claims. (Cl. 19—33)

This invention relates to machines for removing the fibres from the stems or stalks of fibrous plant materials, such as flax, hemp, ramie and the like. More particularly the invention relates to machines employing cooperating scutching rotors and to an improved combination of feed rolls, breaker bar and scutching rotors of novel form, which cooperate for the purpose of removing the woody inner parts of fibrous plant material.

It is an object of my invention to provide an improved machine for treating stems or stalks of fibrous plant materials for the purpose of separating out the fibres and cleaning them of shives, which machine will produce cleaner fibres and less tow than prior machines.

Another object of my invention is to provide an improved form of scutching rotor for use in the above type of machine and to provide an improved cooperation between the scutching rotor and the breaker bar and between adjacent scutching rotors.

Other objects and advantages of my invention will become apparent as it is described in connection with the accompanying drawings.

In the drawings:

Fig. 1 is a schematic view showing in longitudinal vertical section the feed rolls, breaker bar and scutching rotors of my invention;

Fig. 2 is an end elevation view of the first set of scutching rotors;

Fig. 3 is a side elevation view of the invention;

Figs. 4 and 5 are diagrammatic end elevation views of the scutching rotors in different relative positions;

Fig. 6 is a side elevation view of the invention showing the side opposite to Fig. 3; and

Fig. 7 is a detail view of another form of breaker bar.

Referring to the drawings, the scutching machine may be mounted upon any suitable framework 10. For the purpose of illustration I have shown the framework as including parallel side plates 12 and 14 which support the moving parts of the machine. Since any suitable supporting frame may be employed detailed description thereof need not be given.

Considering the machine generally it will be noted that at one end there is provided a delivery platform 16 which is supported upon the framework of the machine and over which the fibrous stalks or materials are fed to steel food rolls 18 and 20. These rolls are for the purpose of insuring the delivery of a single layer of stalks, which layer shall be of substantially even thickness throughout. The rolls may be adjusted to crush such stalks as may be necessary to insure such even thickness. The rolls 18 and 20 deliver the stalks to a second pair of feed rollers 22 and 24, of which roller 22 may be rubber covered to more firmly grip the stalks. From the feed rollers 22 and 24 the stalks are fed over a breaker bar 26 and beneath a small feed and holding roller 28 to a pair of scutching rotors 40 and 50. After partial cleaning by these scutching rotors the fibrous material is delivered between a second set of scutching rotors 60 and 70. The treatment by rotors 60 and 70 completes the action on the fibres and they may be removed from the machine by hand or by any suitable mechanical device.

Referring more particularly to the constructional and functional details, the mounting of the feed rollers 18, 20, 22 and 24 may be accomplished by providing in the side plates 12 and 14, or their equivalent, vertical slots 13, 15, 17 and 19, in which are received similar bearing blocks 21 for the ends of the shafts 23 and 25 and 27 and 29 upon which the feed rolls 18, 20, 22 and 24 are mounted, respectively. In order to adjust the position of the upper rolls 18 and 22 with relation to the lower rolls 20 and 24, there may be provided adjustment bolts 30 which are screw-threaded through a plate or member on the machine frame and extending across the ends of the slots 13, 15, 17 and 19. The lower ends of the bolts are attached to the bearing blocks of the upper rollers by a loose rotatable connection so that upon rotation of the adjustment bolts 30 the upper bearing blocks 21 will be raised or lowered and therefore the position of the upper rolls with relation to the lower rolls may be varied.

For driving the feed rollers a power shaft 34 may be journaled in the support 10 of the machine and receive power from any suitable source. Fixed upon one end of and rotating with the power shaft 34 is a small sprocket wheel 36 (Fig. 3). Fixed upon an end of the shaft 25 of roller 20 is a large sprocket wheel 38. Connecting the sprocket wheels 36 and 38 is a chain 39 by which the power of the power shaft is delivered to the feed roller 20 at reduced speed.

On the opposite ends of the shafts 23 and 25 from the chain and sprocket wheels there are provided similar intermeshing spur gears 31 and 33, (see Fig. 6). These gears are keyed to the shafts 23 and 25 so as to rotate therewith and with the rollers 18 and 20. In this manner the rollers 18 and 20 are driven at the same speed

in opposite directions so as to feed the fibrous material between them.

As may be seen in Figs. 6 and 3, the second pair of feed rollers 22 and 24 are driven by sprocket and chain mechanism and by spur gears like those just described for driving the first pair of feed rolls 18 and 20.

In order to hold the stalks firmly as close as possible to the edge of the breaker bar 26 as they are fed thereover, a small diameter roller 28 mounted on shaft 35 is provided between the edge of the breaker bar and the feed roll 22. This small roll may have its shaft journaled in the side plates 12 and 14, or equivalent, of the frame. If desired the periphery of the roll 28 may be scored or fluted. As may be seen by reference to Fig. 6 the shaft 35 carrying the roll 28, may be driven from the shaft 27 of the feed roll 22 by means of a sprocket and chain mechanism consisting of a large sprocket wheel 37 fixedly mounted upon and rotating with the shaft 27, a small sprocket wheel 39 is fixed upon the shaft 35 and rotating therewith, and a chain 38 passing around the two sprocket wheels. In this manner the small feed roll 28 is driven at the same peripheral speed and in the same direction as the upper feed rolls 18 and 22.

As may be seen by reference to Fig. 1 the first pair of scutching rotors 40 and 50 are situated one above the other preferably in vertical alignment, while the second pair, 60 and 70, are situated one above the other but with the axis of the lower rotor 70 slightly in advance of the axis of the upper rotor 60. Each of the scutching rotors is supported from the side plates 12 and 14, or equivalent. For this purpose bearing plates, such for example as 12^a, may be bolted to the side plates by bolts 12^b and the plates 12^a may be provided with bearings 12^c in which the shafts upon which the rotors are mounted may rotate.

For driving the first pair of rotors 40 and 50 a large sprocket wheel 42 (see Fig. 3) is mounted upon the power shaft 34 and is connected by a chain 43 with a small sprocket wheel 44 mounted upon the shaft 51 of the lower rotor 50. Also mounted upon the shaft 51, but between the sprocket wheel 44 and the side plates 14, is a spur gear 46 which meshes with a similar spur gear 48 which is mounted upon and turns with the shaft 41 of the upper rotor 40. Mounted upon the end of shaft 41 is a sprocket wheel 45 which is connected by a chain 47 with another larger sprocket wheel 49 which is mounted on and turns with the shaft 61 of the upper rotor 60 of the second set of rotors. In order that both rotors of the second set shall be driven at the same speed, similar intermeshing spur gears 62 and 63 are mounted upon the shafts 61 and 71 of the rotors 60 and 70. Thus it may be seen that the sprocket and chain drive 42, 43, 44, together with the spur gears 46 and 48, causes the rotation of the first set of scutching rotors 40 and 50, and by their rotation, and through the sprocket and chain drive 45, 47, 49 and spur gears 62 and 63, the second set of scutching rotors 60 and 70 is rotated.

Referring now to the details of the scutching rotors it will be noted that each is provided with four blades, such as 40—1, 40—2, 40—3 and 40—4. On any given roller these scutching blades are identical. It should be understood, however, that the invention is not limited to rotors having only four blades. A greater or lesser number of blades may be employed. I have found, however, that a rotor with four blades will produce very satisfactory results and that fibres subjected to the operation and treatment by such rotors will be exceptionally well cleaned, as much as 90% or better of the shives or woody portions of the stalks being removed, without producing an appreciable amount of tow.

Referring particularly to Fig. 1, it will be noted that each of the blades of the rotor has a substantially plane face lying in a substantially radial plane, on the advance or forward side of the scutching edge. The following or back sides or faces of the blades are convexly curved and meet the advance faces in a plane substantially tangential to the cylinder of revolution of the scutching edges of the blades. The portions of the rotor between the adjacent blades, such as 40—4, 40—3, is hollowed out in order to provide room for movement of the blades of the adjacent roller 50. For example, the blade 50—1 will move into the space between the blades 40—3 and 40—4 as the rotors 40 and 50 rotate. Thus the rotors intermesh but the blades are so formed and proportioned, and the spaces between them are so formed and proportioned, and the rotors are so positioned that the blades of one rotor never touch the adjacent cooperating rotor. Preferably the rotors and their blades will be so proportioned that during the movement of the blade of one rotor into the space between the blades of an adjacent rotor, the clearance at the closest approach of the blade to the surface of the adjacent roller, will be slightly greater than the thickness of the fibrous material being processed so that the action of the cooperating rotors will be a combined beating and scutching action, which breaks up the woody portion of the stalk and scrapes and beats the fibre to remove the shives. By observing the different relative positions of the blades of the two sets of rotors in Fig. 1 and of the set of rotors in the detail views of Figures 4 and 5 the action of the cooperation of the rotors may be understood.

The cooperative action between the scutching rotors of both the first and second sets is substantially the same, but as may be seen in Fig. 1 the upper rotor 40 of the first set performs an additional function in that its blades cooperate with the breaker bar 26 as the fibrous material is fed over the edge of this bar. Thus the fibrous material, or stalks, are struck and bent so as to break up the woody center portion of the stalks.

Referring to Fig. 1 it will be noted that there is shown a breaker bar having a plurality of horizontal ribs which are spaced about the arc of a circle slightly larger than the circle of rotation of the scutching rotors. However, I have found equally satisfactory the type of breaker bar shown in Fig. 7 in which the face is arcuate and the center of the arc is the center or axis of rotation of the scutching rotor 40. Preferably the breaker bar 26 and also the breaker bar 26^a of Fig. 7 will be adjustable with relation to the axis of rotation of the scutching rotor 40. Thus screws 26^b may be provided to secure the breaker bar in its different positions of adjustment. These screws may pass through slots 26^c in the side plates 26^d fixed to the frame of the machine in any suitable manner and may take into screwed-threaded bores in the sides of the breaker bar.

In order to overcome a tendency of the fibres to follow and wind around the rotor 40 in its rapid rotation, I have found the axis of rotation of this rotor should be substantially equal in

height, or higher than the horizontal plane in which the upper edge of the breaker bar lies. Tendency of the fibres to follow or wrap around the rotor 50 may be overcome by placing the rotor 70 as close as possible to the rotor 50 without interfering with the rotation of either. Since their rotations are not synchronized nor do their blades cooperate the least distance between centers of these rotors 50 and 70 will be the sum of the radii of the two rotors.

I prefer to rotate this first set of scutching rotors 40 and 50 very rapidly. The exact speed of rotation will, of course, be determined by the diameter of the rotors and the linear rate of feed of the stalks by the feed rollers. Since the character of the material treated varies according to age, size and condition, it is not possible to state any definite limits of speed of rotation or rate of feed. These factors must be determined with consideration for the raw material to be treated. It is desirable, however, to so regulate the speed of the rotors and the rate of feed of the fibres to the rotors so that the shives will be in the neighborhood of ⅛th of an inch but larger or smaller shives may be produced effectively in some cases. The fibrous materials may be satisfactorily cleaned for some purposes when such larger or smaller size shives result from the treatment. The size of the shives, however, is not the determining factor of the invention but rather the degree of cleaning shall determine the rates of speed of the rotors and of the feed and their relation to one another.

It is desirable to rotate the first set of scutching rotors 40 and 50 at a higher speed than the second set 60 and 70. A satisfactory ratio of speed of first set to second set is about 4 to 3. Both sets of rotors will, however, run at a peripheral speed considerably higher than the linear rate of feed of the fibrous material, so that there will be no tendency for the fibres to bunch up between the two sets of rotors. Since a large portion of the shives are removed by the first set of scutching rotors, the fibre is relatively clean by the time that it reaches the second set of scutching rotors and this second set complets the scutching or cleaning of the fibre by breaking out and removing the remainder of the woody portion of the fibre or shives so that when the fibre is delivered by the second set of the scutching rotors it is clean.

In order to produce a lateral rubbing of the fibres, it is desirable to give the blades of the scutching rotors a spiral twist (see Figs. 2, 4 and 5). This twist may be in the neighborhood of ⅝ths of an inch for each 2 feet of length of the rotor. Although this amount of twist has been found particularly satisfactory it is obvious that the amount or twist may be varied to suit the particular requirements of any type of fibrous material which it may be desired to treat.

The spiral twist of the blades would normally tend to push the fibres over toward one side of the machine. In order to avoid this, the spiral twist of the rotor 40 may be in the opposite direction from the spiral twist of the rotor 50. Likewise in the second set the rotor 60 will have its blades spirally twisted in the opposite direction as the rotor blades of the rotor 70, but the blades of the rotor 60 may be in the same direction to those of the rotor 50 of the first set. In addition to avoiding the tendency to move the fibres continuously to the side, the reversing of the direction of the spiral twist of the blades accomplishes another desirable result in that it produces a shaking action of the fibre to and fro lengthwise of the rotor. This shaking action is very valuable in shaking out the loose shives from the fibrous material when the fiber is held in suspension between the sets of scutching rotors after the shives have been broken away from the fibres but yet cling thereto.

Operation

As the fibres are fed between the feed rollers 18 and 20 the stems are spread out so that only a single layer of stems will be fed to the scutching rotors, and if the rollers are adjusted and sufficient pressure is exerted the stalks may be crushed and split in a longitudinal direction. Then in passing to the rolls 22 and 24 and 28 the feed roller 22 firmly grips the stalks and the small roll 28 holds the stalks close to the breaking edge as they are fed over the breaker bar 26. Thereupon the blades of the rapidly rotating scutching rotor 40 strike the stalks with great rapidity and the woody portion is broken up into small parts. This action is assisted by the cooperative action of the blades of the scutching rotor 40 and the apron of the breaker bar 26. The face of the apron of the breaker bar 26 "backs up" the stalks and prevents them from moving too far out of the sphere of action of the blades of the scutching rotor. The scutching blades of the scutching rotor 40 scrape off the shives and woody portion from the fibers. As the feed of the fibre continues the stalks are subjected to the cooperative beating and scutching action of the first set of two scutching rotors 40 and 50, being treated on top and bottom thereby.

As the peripheral speed of the scutching rotors 40 and 50 is greater than the rate of feed of the fibers, there will be a pulling action on the fibers by the blades of the scutching rotors. The scutching rotors are of small diameter and the blades of the rotors, therefore, interengage on a relatively acute angle. The result is, as shown in Figure 1 for example, that the fibers are stretched from the top of one blade to the top of the other of the rotor 50, that portion between the blades being, therefore, held relatively taut. It will be noted that the portion of the fibers just referred to is being engaged by the cooperating blade 40—3 of the rotor 40, with the result that a pronounced scutching and combing action on the taut fibers is produced. Because of the relatively small diameter of the scutching rotors 40 and 50, the various blades of one rotor extend deeply into the space between the adjacent blades on the other rotor. Also, the path of movement of the blades, as the blade 40—3, of the rotor 40 with respect to the shape of the rotor 50 between the blades over which the fibers are being held taut, results in producing a physical condition analogous to that produced between the blades of the scutching rotor 40 and the apron of the breaker bar 26. The blades of the rotors, as the blade 40—3 of the rotor 40, enter deeply into the space between adjacent blades of the rotor 50 and with considerable speed.

As the rotors rotate in the direction of the arrow shown in Figure 1, the next length or bight to be operated on will come into engagement with the tops of the blades 40—3 and 40—4 of the rotor 40, and will be subjected to a scutching and combing action by the cooperating blade 50—1 of the rotor 50. The greater part of the woody portion and shives are cleaned out of the fibrous material by the scutching rotors 40 and

50. The now relatively clean fibers as they move from between the scutching rotors 40 and 50 are passed between a second pair of scutching rotors 60 and 70 which, as above described, rotate at a peripheral speed greater than the speed of travel of the fibers themselves, but at a less peripheral speed than the peripheral speed of the scutching rotors 40 and 50.

The presence of the second set of scutching rotors 60 and 70 and the relation of the peripheral speed thereof to the peripheral speed of the scutching rotors 40 and 50 is extremely important. In the absence of the second pair of scutching rotors 60 and 70, and with a relatively high peripheral speed of the rotors 40 and 50, the decorticated or partially decorticated fiber will wind up on the rotors 40 and/or 50, and necessitate a frequent shutting down of the machine to clean the rotors. The presence of the second pair of rotors 60 and 70 obviates this objection as the fibers are fed therethrough and thus find an outlet which prevents the same from winding up on the rotors 40 and 50. Rotating at a less peripheral speed than the rotors 40 and 50, and this speed of rotation being relatively low, there is less tendency for the decorticated fibers to wind up on the rotors 60 and 70.

The action of the scutching rotors 60 and 70 is similar to the scutching action of the rotors 40 and 50, so that as the fibrous material issues from between the scutching rotors 60 and 70 it is practically completely decorticated.

Much of the woody portion and shives are cleaned out of the fibrous material by the scutching rotors 40 and 50 and as the fibre continues on in between the more slowly revolving rotors 60 and 70, they act upon the fibre in the same manner as the rotors 40 and 50 did and complete the cleaning. For some uses the fibre issuing from the machine needs no further processing, but for others, such as for use in cloth, it may be necessary to subject the fibre to a subsequent combing action or to a chemical action, or to both, which subsequent actions form no part of this invention.

Many modifications within the scope of my invention will occur to those skilled in the art. Therefore I do not limit the invention to the size, form and shape of materials, or other details of the specific embodiment described.

I claim:

1. In a scutching machine, means to feed stalks of fibre bearing plants lengthwise into the machine, a plurality of scutching rotors revolving in pairs about spaced fixed axes, said rotors each having a plurality of blades and being recessed between adjacent blades, means to rotate the rotors of each pair at the same angular speed and in such manner that the blades of one rotor will cooperate with the recessed portions of the other rotor of said pair during rotation to scutch fibrous material between said rotors, the blades of the rotors of each pair being twisted spirally with the twist of the blades of one rotor being in the opposite direction to the twist of the blades of the other rotor of the pair, whereby a shaking of the fibre is accomplished.

2. In a scutching machine, means to feed stalks of fibre bearing plants lengthwise into the machine, a plurality of scutching rotors revolving in pairs about spaced fixed axes, said rotors each having a plurality of blades and being recessed between adjacent blades, means to rotate the rotors of each pair at the same angular speed and in such manner that the blades of one rotor will cooperate with the recessed portions of the other rotor of said pair during rotation to scutch fibrous material between said rotors, the blades of the rotors of one pair being twisted spirally with the twist of the blades of one rotor being opposite to the twist of the blades of the other rotor of that pair, the blades of a second pair being twisted spirally in opposite directions with the spiral twist of the blades of the top rotor of the second pair being in the same direction as the twist of the bottom rotor of the first pair whereby a shaking of the fibres is accomplished.

3. In a scutching machine, means to feed stalks of fibre bearing plants lengthwise into the machine, a plurality of scutching rotors revolving in pairs about spaced fixed axes, said rotors each having a plurality of blades and being recessed between adjacent blades, means to rotate the rotors of each pair at the same angular speed and in such manner that the blades of one rotor will cooperate with the recessed portions of the other rotor of said pair during rotation to scutch fibrous material between said rotors, each blade having a scutching edge from which the advance face recedes in a substantially radial plane, the following face of said blade being curved and intersecting said advance face at said scutching edge substantially tangentially, the blades of the rotors of each pair being twisted spirally, with the twist of the blades of one rotor being in the opposite direction to the twist of the blades of the other rotor of the pair, whereby a shaking of the fibre is accomplished.

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