Nov. 25, 1941. D. E. PATTERSON 2,263,591

SCUTCHING MACHINE

Filed June 9, 1939 6 Sheets-Sheet 1

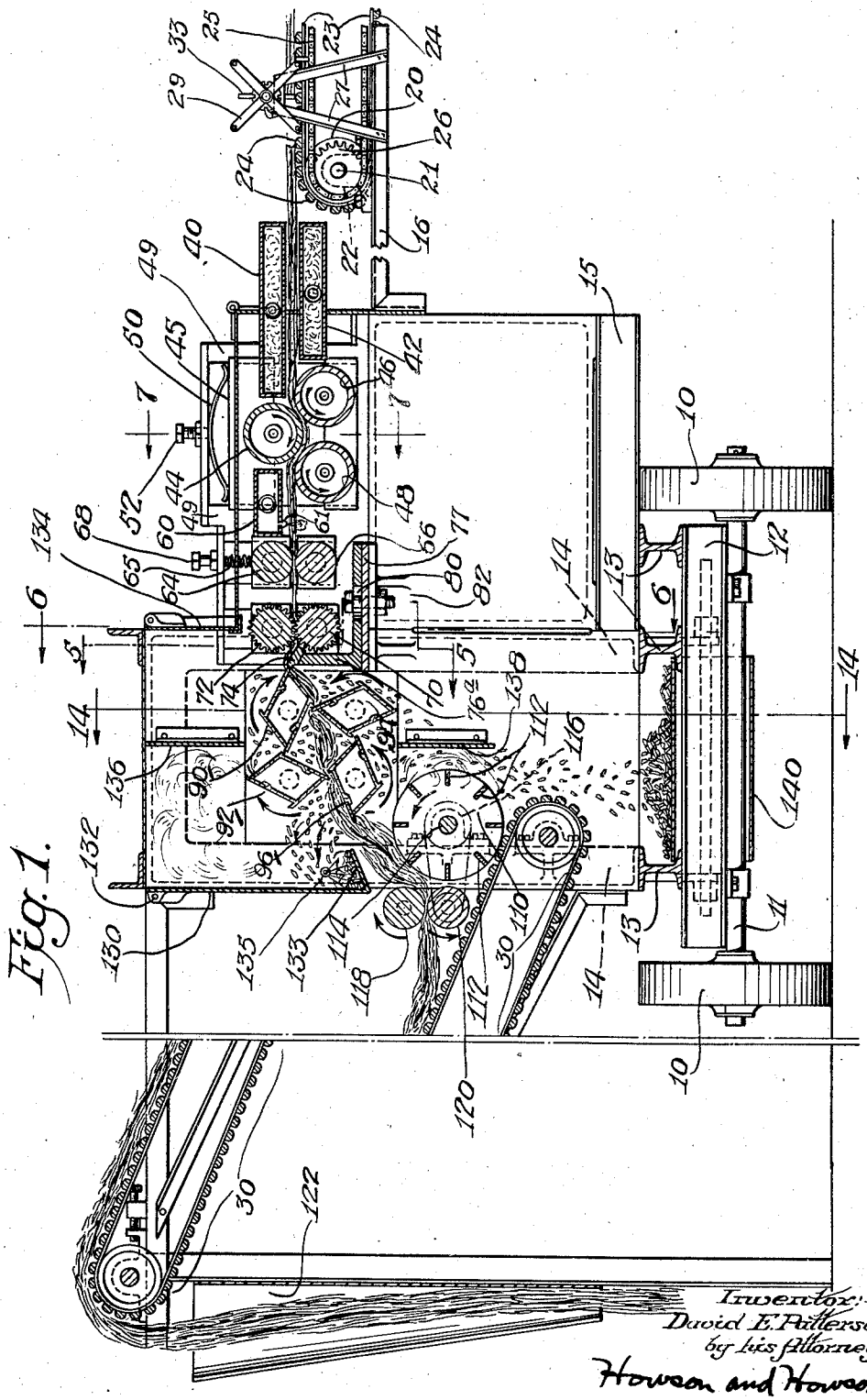


Fig. 1.

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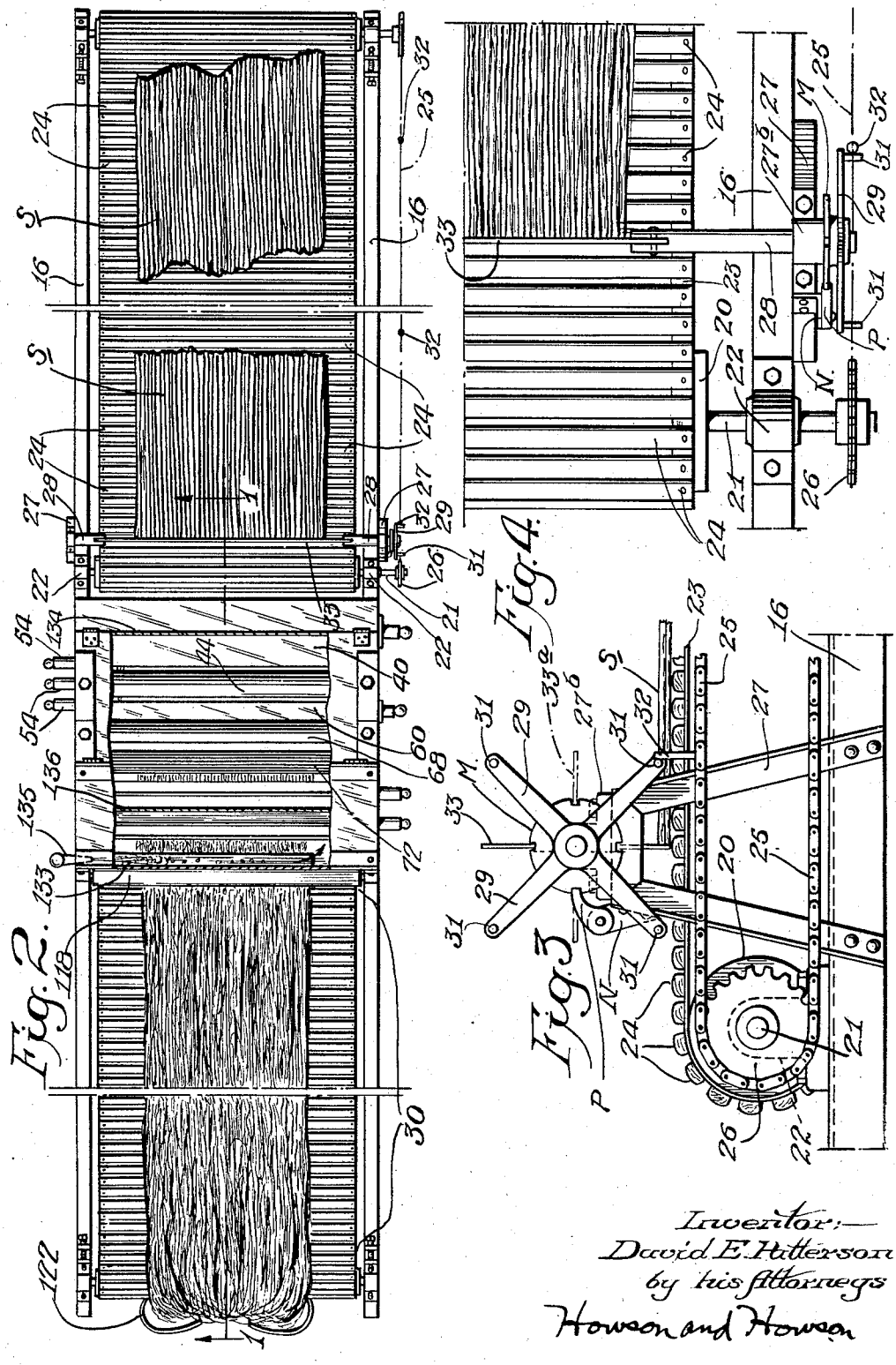


Fig. 2.

Fig. 4.

Fig. 3

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Fig. 5.

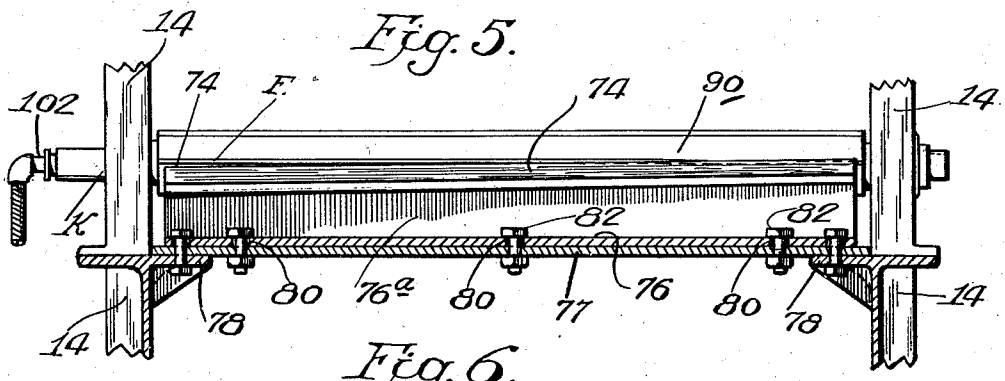


Fig. 6.

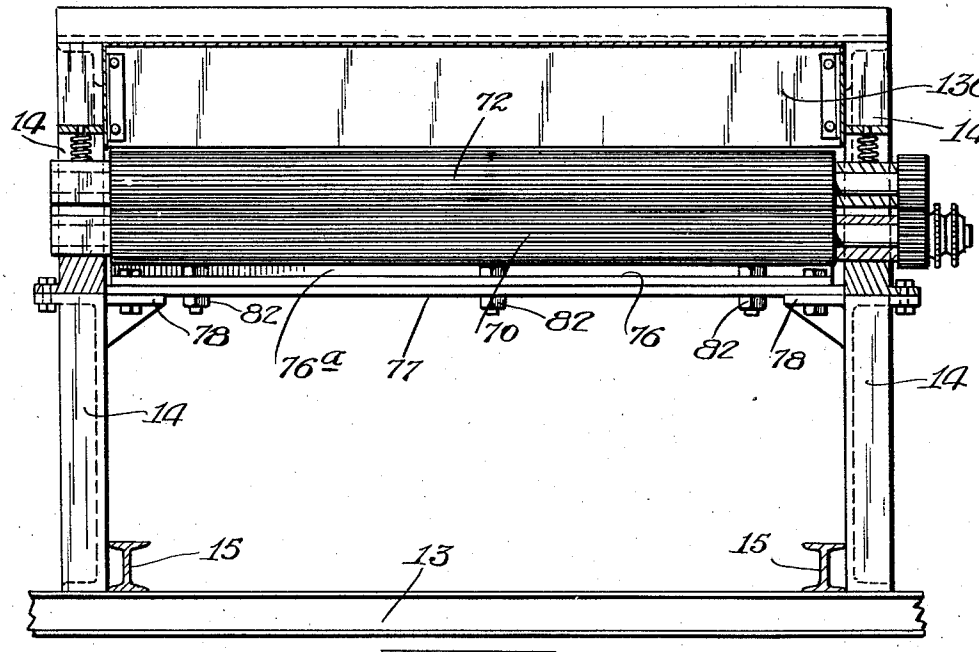
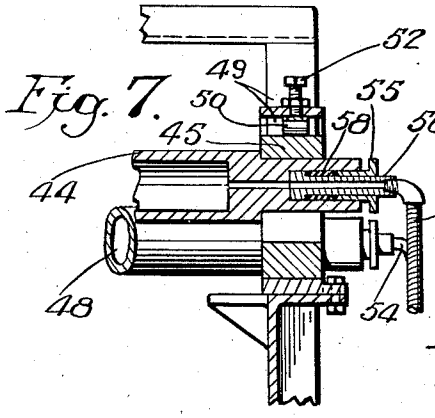


Fig. 7.



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Fig. 8.

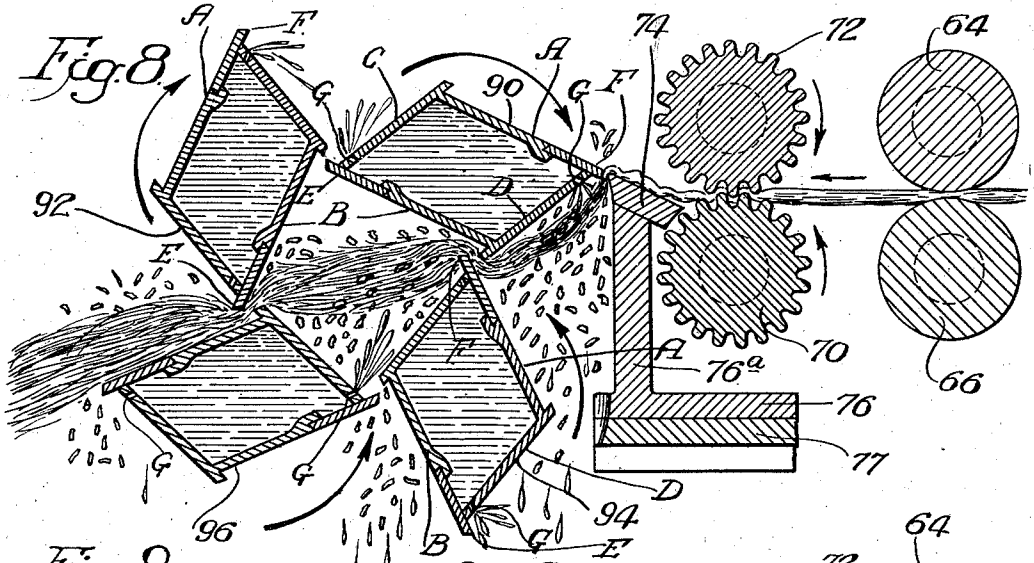


Fig. 9.

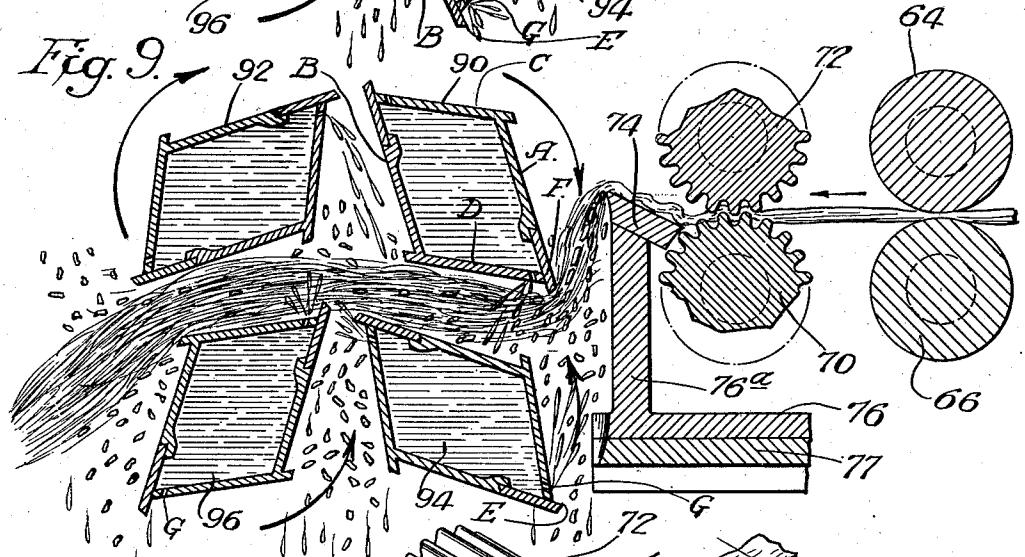
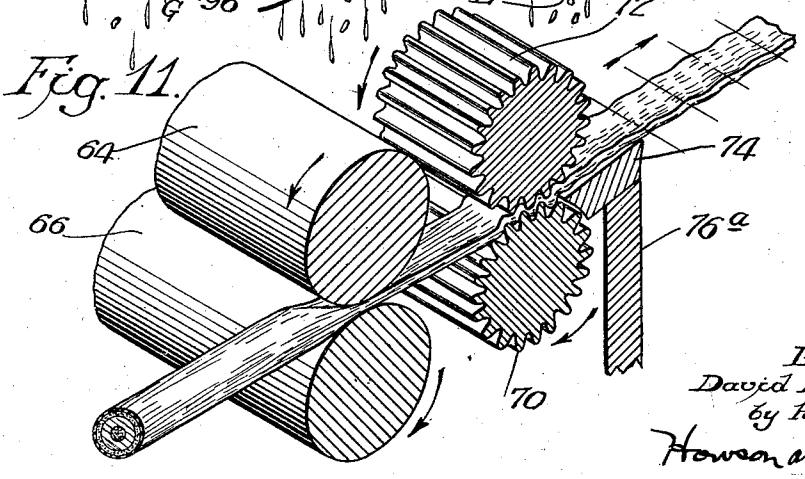


Fig. 11.



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Fig. 10.

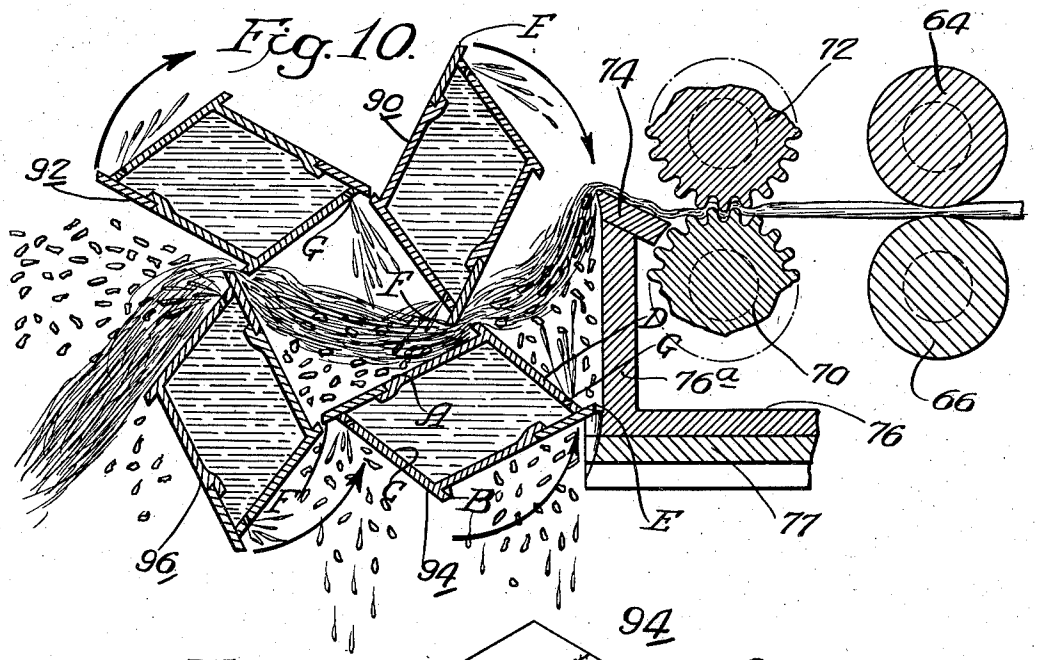


Fig. 12.

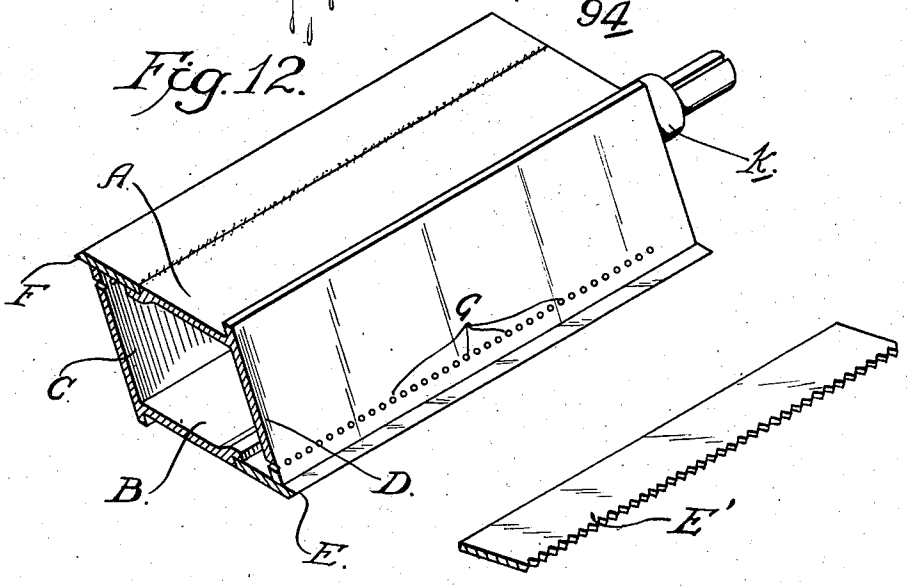


Fig. 13.

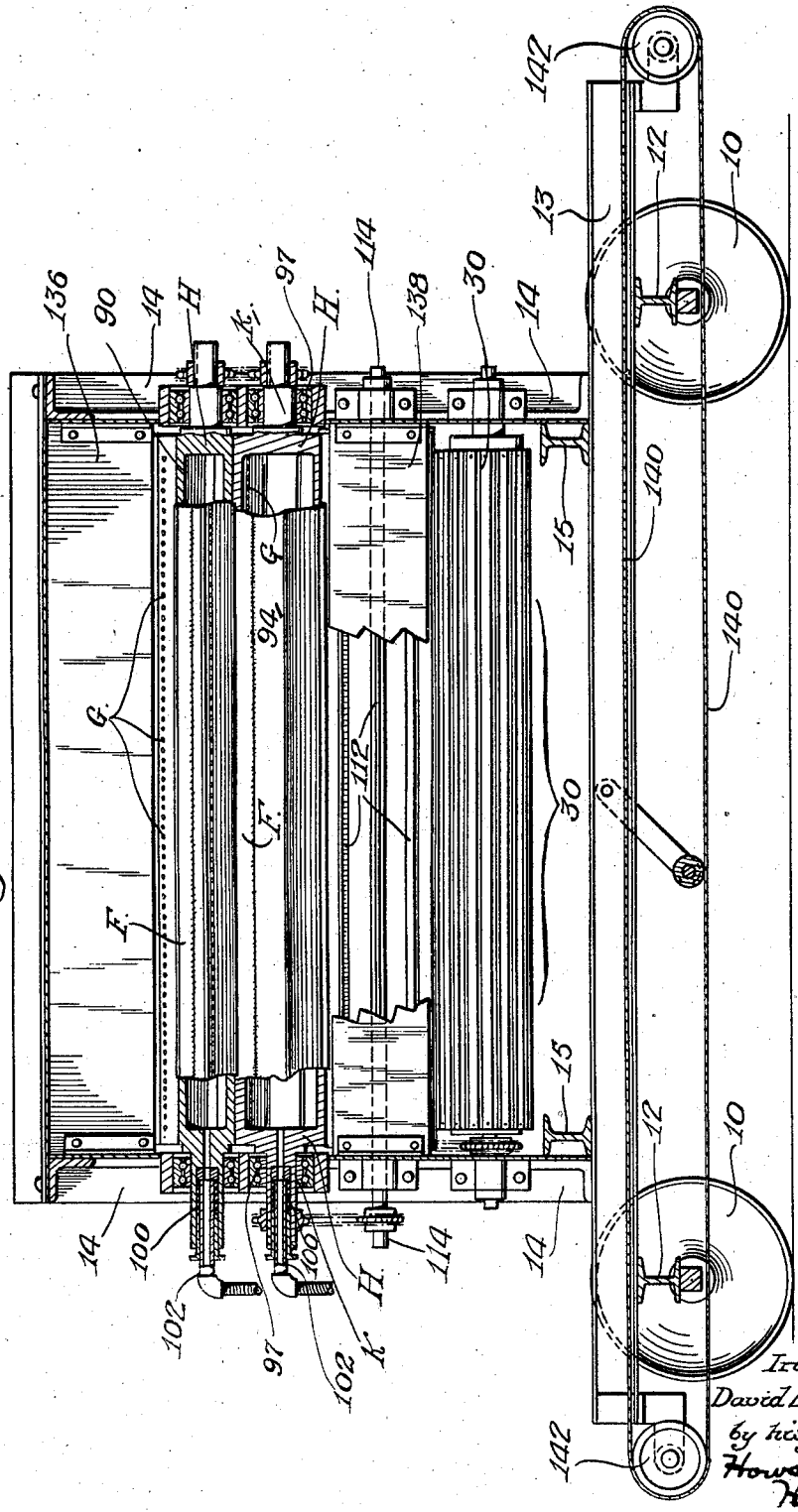
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Fig. 14.



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Patented Nov. 25, 1941 2,263,591

UNITED STATES PATENT OFFICE

2,263,591

SCUTCHING MACHINE

David E. Patterson, Philadelphia, Pa., assignor to Consolidated Fibre Products, Limited, Nassau, Bahama Islands, a corporation of the Bahama Islands

Application June 9, 1939, Serial No. 279,132

3 Claims. (Cl. 19—5)

This invention relates to improvements in apparatus for treating fibrous material and particularly to apparatus for liberating the fibre from fibrous plants such as flax, hemp, jute, ramie, and the like.

It is a general object of my invention to provide a new and improved form and arrangement of parts for improving the scutching action of apparatus of the above type.

In treating some fibre bearing plants it is desirable to dry the stalks so that the inner woody portions shall be brittle when they undergo the scutching operation. Flax, hemp, ramie, jute, and the like, which have the woody portions inside the fibrous exterior are of this type of plant.

In plants such as ramie, which have an outer bark covering the fibres in addition to the inner woody portion, it is desirable to wet or "scald" the stalks to remove the outer bark, then to dry the stalks so that the inner woody portion shall be brittle when they undergo the scutching operation.

In other plants of the hard fibre types, such as sisal, manila, hemp, pita, it is desirable to scutch the plants wet with a plentiful flow of water to wash away the external and internal gums which bind the fibres.

It is an object of my invention to make a machine which can be used to decorticate or scutch fibrous-bearing plants of various kinds, whether a wet or dry process is required, said machine being provided with means allowing variation of the process and flexibility of use of the machine to suit particular requirements in various places and countries.

Another object is to condition the materials as they pass through the apparatus toward the scutching elements, by subjecting the materials to means for drying or wetting them, as may be required by the particular material being treated.

Another object is to provide means to subject the material to the combing and cleaning action of air or water while it is undergoing treatment by the scutching elements.

Another object is to provide means to even up the butt ends of the stalks, as the material is conveyed into the apparatus, and to intermittently feed the aligned stalks into the apparatus.

Another object of my invention is to provide improved apparatus for breaking the woody portion into small sections, or hurds, or shives, and to subject the fibrous portion to a scraping, beating and shaking action to thoroughly cleanse them to remove the shives or hurds therefrom.

Other objects and advantages will occur to those skilled in the art as my invention is described in connection with the accompanying drawings.

In the drawings—

Fig. 1 is an elevational section view taken along line 1—1 of Fig. 2 of a scutching machine embodying the principles of my invention;

Fig. 2 is a plan view of the machine shown in Fig. 1 with a part of the casing broken away;

Fig. 3 is a detail view showing in side elevation the stalk feed-control device;

Fig. 4 is a detail plan view of the stalk feed control device of Fig. 3;

Fig. 5 is a detail section view taken along line 5—5 of Fig. 1 and showing the relation of the breaker bar and the beater which cooperates with it;

Fig. 6 is a detail vertical section view taken along line 6—6 of Fig. 1;

Fig. 7 is a detail vertical section view taken along line 7—7 of Fig. 1 and showing the steam rollers;

Figs. 8, 9 and 10 are detail section views showing diagrammatically the relation of the feed rollers and rotary scutching devices and breaker bar, with the scutching devices in three different positions 45° apart;

Fig. 11 is a detail perspective view showing a stalk passing between the crushing and holding rollers;

Fig. 12 is a fragmentary perspective view of a rotary scutching device;

Fig. 13 is a detail perspective view of a blade which may be used with the scutching device of Fig. 12;

Fig. 14 is a section view partly broken away, taken along line 14—14 of Fig. 1;

Referring now to the drawings, the machine is housed within a casing having several hinged covers which may be raised to expose the interior mechanism, as will hereinafter be more particularly described. Referring particularly to Figs. 1 and 14, the machine may conveniently be mounted upon a mobile chassis comprising wheels 10 on axles 11, channel girders 12 supported upon the axles 11, and supporting channel beams 13 running transverse to the axle girders and joining them. Supported upon the beams 13 are posts 14 which support the framework of the machine and most of the machine parts. For the purpose of supporting that portion of the apparatus which is designed to subject the material fed to the machine to either heat or water treatment, beams 15 are secured upon two

of the main supporting beams 13, as shown in Fig. 1, in position to extend laterally therefrom. The details of the supporting framework for the machine need not be further described since they may be varied within the skill of the mechanic, as requirements of use of the invention may dictate.

Supported from the framework above the extension beam 15 are parallel angle frame members such as 16, which support one end of a feed conveyor; but it will be understood that this feed conveyor might be supported on a separate structure and connected with the machine in any suitable fashion.

The conveyor and stalk feed control device

The material is fed to the machine by the feed conveyor, which comprises a pair of spaced rotating rollers, such as 20, which are mounted upon axles, such as 21, supported in bearing brackets 22 mounted upon the beams 16. Passing around the rolls 20 are flexible belts 23 upon which are secured a plurality of closely spaced parallel transverse slats 24 upon which the stalks S of the material to be treated may be laid by hand. The rolls 20 may be driven by any suitable mechanism (not shown) and may be connected together by a chain 25 passing over sprocket wheels 26 mounted upon the axles 21.

A take-off conveyor, designated generally by the numeral 30, similar in principle and general construction to that just described, may be employed to remove the fibres resulting from treatment of the stalks by the machine.

For the purpose of regulating and controlling the feed of the stalks to the machine, a control device is provided. This device may be mounted upon a pair of vertical frames 27 on opposite sides of the machine and supported by the beams 16 and made of inclined angle members joined at their tops by a horizontal angle bar. Upon these frames may be mounted bearing brackets 27*b* in which are supported aligned horizontal stub shafts 28, on one end of which is mounted a four-armed rotary member 29. On the end of the arms are pins 31 extending in a direction parallel to the shafts 28 and in position to be engaged by lugs 32 secured to the chain 25 in a manner and for a purpose to be more fully described hereinafter. For the purpose of halting the stalks S as they are conveyed along toward the machine by the feed conveyor, a stop or abutment plate 33 is secured between and to the shafts 28 in position to extend in diametrically opposite directions from their axis a sufficient distance so that when the plate 33 extends vertically, the lower edge will be in position to have the stalks butt up against the plate and be held by it. In order to turn the plate into a horizontal position when a sufficient number of stalks have piled up against it, a lug 32 is attached to the chain 25 so as, at the proper time, to engage one of the pins 31 on one of the arms of member 29 and thereby cause it and shafts 28 and plate 33 to rotate through 90°. After such rotation the lug 32 will have cleared the pin 31 and will continue on its way with the chain 25. The abutment plates will then be in horizontal position as shown in dotted lines at 33*a* in Fig. 3. In this position of the plates, the stalks are permitted to pass on by action of the conveyor into the machine. At a subsequent time, determined by the position at which another lug is attached on the chain, such lug, similar to 32, will engage the pin 31 on the arm following the previously engaged pin and arm and the stop plates will again be rotated through 90° into a vertical position to stop the feed of the stalks. From the foregoing, it may be seen that the spacing between the lugs which turn the plate 33 horizontal and those that turn it vertical again should be at least the length of the stalks which are being fed to the machine.

In order to hold the plate 33 in the position into which it is turned by one chain lug 32 until another lug causes the plate to turn again, a disc M may be affixed to the shaft 28 and provided with peripheral notches spaced 90° apart into which a pawl may drop. The pawl P may be pivotally mounted on an arm N extending from the upper part of the frame 27, in position to drop by gravity into one or another of the notches as the disc M turns. As the succeeding lug engages the member 29 the pawl will be lifted out by the turning action of the disc.

Preliminary treatment of material

Within the housing of the machine and supported upon the beams 15 is the portion of the apparatus which subjects the material to a preliminary treatment involving either heat or pressure or both, or heat or pressure and water treatment. The type of treatment will depend on the raw material. The apparatus for subjecting the material to this treatment may be mounted upon any suitable framework (not shown in detail).

As the material leaves the feed conveyor, it passes between upper and lower steam chests 40 and 42 which are provided with live steam connections (not shown) and may be of such length as to subject the material to heat for the proper length of time considering the speed at which the material is passed through the machine. The steam chests will be equal in width to the machine width. Upon passing out from between the steam chests, the material is fed to three rollers 44, 46 and 48 which are mounted transversely of the machine, the roller 44 being above and having its axis between rollers 46 and 48 which are lower and have their axes horizontally spaced. The upper roller 44 rests on the lower rollers 46, 48 and has its ends supported by a bearing member 45 embracing the upper half of the end of that roller. The bearing may be supported for vertical movement in the parts 49 of the frame and a leaf spring 50 whose tension may be adjusted by an adjustment bolt 52 located in the top of the framework of this portion of the machine may bear on the bearing members 45 to apply pressure to the roll 44. The rollers 44, 46 and 48 may, and preferably are, hollow and are provided with connections to steam conduits 54. Suitable packing glands may be provided, such as a sleeve 56, taking into a collar 55 in the hollowed out end of the roll 44 which is reduced and extends into the bearing member 45, which may only bear against the upper surface of the hub of roll 44. The sleeve 56 may be secured to the conduit 54 and packing 58 may prevent escape of steam. Since the pressure of the roll 44 on the rolls 46 and 48 may be adjusted and since the temperature of the steam chests and the steam rollers may also be regulated by supplying high or low temperature steam, the amount of heat and pressure to which the material is subjected in passing through this portion of the apparatus may be varied to suit the particular condition of the material being treated.

As the material passes from between the steam

rollers, it goes under a tank **60** located just above the path of the material and at about the same height as the steam chest **40**, but on the opposite side of the roller **44** from the steam chest **40**. This chest **60** may be suitably supported from the machine framework. The tank may be filled with air under pressure or with water or steam, depending upon the treatment to which the material is to be subjected. The chest **60** is provided in its lower surface with a row of openings or nozzles directing the jets or currents of air, steam or water, on the material passing below. In the case of air treatment, the currents of air will tend to remove moisture which may be remaining after the heat and pressure to which the material had previously been subjected. The air blast and the pressure of the rolls **64** and **66** which are cool tends to cool off the material and to make the inner woody portion of stalks of flax, hemp or ramie type very brittle and easy to break up into small sections or shives in the subsequent scutching operation.

After the material receives its treatment under the air tank **60**, it passes to flattening rollers **64** and **66** which are located one above the other with the roller **64** adjustable vertically. A spring **65**, whose tension is adjustable by an adjustment bolt **68**, presses upon the bearing of the roll **64** so that the pressure of the roll **64** upon the roll **66** may be varied. The bearings of the rolls will be located in the framework of the machine and their construction need not be described in detail. The rolls **66** and **64** only supply enough pressure to flatten the stalks which are then fed to a pair of rollers **70** and **72** whose surfaces are corrugated and serve only to hold the material as it passes over a breaker bar **74** to scutching devices presently to be described. The rollers **70** and **72** are located in vertical alignment and may have their bearings supported in the framework of the machine with the upper roller adjustable. I have found it desirable to present the stalks in unbroken condition to the scutching devices. Therefore the corrugated rolls are set for each material so as to exert the least amount of pressure it is possible to exert and still hold the stalks firmly, it being the purpose of these rolls to hold but not to break the stalks.

The breaker bar **74**, over which the stalks are fed to the beaters or scutching device, is a flat steel bar with a tapered edge and is mounted upon a vertical portion **76***a* of a supporting structure or carriage **76**, of which a horizontal portion lies upon and slides over a horizontal supporting plate **77**. Plate **77** rests upon angle brackets **78** secured to the posts **14** of the machine framework. The horizontal portion of the carriage **76** is provided with slots **80** through which pass adjustment bolts **82**, by means of which the carriage may be secured in various positions of adjustment. The vertical portion **76***a* of carriage **76**, on which the breaker bar **74** is secured, preferably by welding, has one end higher than the other so that the breaker bar is higher at one end than at the other. As will hereinafter be more particularly described, the breaker bar is adapted to cooperate with a rotary scutching device which rotates upon a horizontal axis and which has straight edges which rotate in a cylindrical path. By reason of the difference in elevation of the ends of the breaker bar, the striking action of the scutching device upon the stalks passing over the edge of the breaker bar progresses from one end to the other gradually. This progressive striking action avoids the severe strain on the beaters and breaker bar which would occur if the stalks were struck all at one time.

The rotary scutching devices

The devices which actually accomplish the breaking up of the woody portion of the stalks into small sections or shives and separate the shives from the fibrous portion of the stalks consists of four rotary members or beaters **90**, **92**, **94**, **96** which are identical in construction. Two of these devices **90**, **92** have their axes of rotation horizontally spaced and vertically aligned with the other two **94**, **96** of the devices. The two lower devices also have their axes in horizontal alignment. The devices which are in vertical alignment thus form successive pairs which cooperate with each other and beat, shake and scrape the fibrous material passing between them in such a manner as to remove the shives therefrom.

Each rotary scutching device or beater comprises a parallel-walled structure as may best be seen by reference to Figs. 8, 9, 10 and 12. Since the devices are identical, a description of one will suffice. Referring to the beater **94** it will be noted (see Fig. 12) that opposite walls are parallel to each other and that two walls (A and B) are wider than the remaining two (C and D). Each of the walls has an overhanging ledge. The overhanging portions E and F of the walls A and B are separate parts which are secured to or welded to the remainder of the wall. These parts comprise the breaking edges of the beater. In order that leafy materials, such as sisal, may be treated in the apparatus, breaking edges E′ of the type shown in Fig. 13, with serrated borders, may be used instead of the straight breaking edges illustrated in Fig. 12.

It will be noted that the walls forming the beater enclose a hollow interior. One of the novel features of my invention is the provision of connections to this interior whereby it may be filled with any fluid desired to assist in the scutching operations. Air, water, steam or other fluid may be used as the occasion requires. For the purpose of applying the fluid to the material, a row of ducts or holes G is made in the plates C and D beneath the breaking edges E and F.

At their ends, the rotary beaters have walls H (see Fig. 14) on which are hubs K which are adapted to turn in suitable bearings **97** in the machine frame. One hub of each device will preferably be bored to permit connection therewith of a conduit through which the air, steam or water may be fed to the interior of the beater (see Fig. 14). A collar and suitable packing gland **100** fitting within a recess in the hub K may be provided to maintain a tight joint with a sleeve **102** on the end of the steam, air or water conduit.

In operation, the position of the breaker bar carriage **76** is first adjusted in relation to the breaking edge of the rotary beater **90**, it being known that the diameters of the various fibre bearing plants, such as flax, hemp, ramie, jute, and the like, vary considerably and the breaking clearance for one plant might cause damaging of another plant if it were forced through the machine without re-adjustment of the breaking clearance, or failure to properly adjust the clearance might result in the machine failing to clean the fibre satisfactorily.

Referring to Fig. 8, it will be noted that as the material is fed over the breaker bar 74, it is struck by a breaking edge, such as F, of the rapidly rotating beater 90, the stalks being struck in succession with the striking progressing laterally along the edge of the beater and breaker bar from one side to the other by reason of the higher elevation of one end of the breaker bar than the other. Preferably the feed of the fibre will be adjusted so that the fibre will be struck a second time by the opposite edge E of the beater when the fibre has progressed linearly an amount equal to its diameter or a distance approximating that amount. It will be understood by those skilled in the art that although this adjustment and breaking distance is the preferred adjustment, nevertheless under some conditions it may be advisable to increase or decrease the number of strikes by varying the rate of feed or beater speed so that the material will be struck at distances greater or less than the thickness of the stalk. The cooperation of beater 90 with the lower beater 94 may be observed in Figs. 8 and 10.

In Fig. 8 it may be seen that the overhanging edge of the shorter wall D of the upper beater 90 will cooperate with the breaking edge F of the lower beater 94 in such manner that the fibrous material is scraped on both sides by these cooperating portions of the beaters and thereby the shives are loosened and to some extent removed from the fibrous material before the material reaches the second set of beaters 92 and 96 in which a similar operation will cause final cleaning of the material. Referring now to Fig. 9, it will be noted that the fibre is freed, to some extent, as beaters rotate into the position shown in Fig. 9 but that the fibre is almost immediately acted upon again as the beaters rotate into the position of Fig. 10, wherein the breaking edge F of the upper beater 90 cooperates with the overhanging edge of the wall D of the lower beater 94 to scrape and clean the fibre. It should be noted that this scraping action takes place each time the fibre has advanced a distance equal to the distance between successive strikes on the fibre passing over the edge of the breaker. Thus the fibre is subject to multiple rubbing, shaking and beating as it passes between the two pairs of rotary scutching devices. The operation of the second set of beaters 92 and 96 is quite similar to that of the first set 90 and 94 except that the material does not pass over a breaker bar in proceeding into the field of action of the second set.

When the beaters are filled with compressed air, the air will issue from the orifices G continuously and will give a combing effect to the fibre so as to aid the removal of the shives and dust and as a result a cleaner fibre will issue from the machine.

The take-off mechanism

Below and following the second set of beaters is a take-off reel comprising a circular series of parallel bars 112 carried by disc-like end supports 110 which are mounted upon a shaft 114 turning in bearing brackets 116. The bearing brackets 116 are secured to the posts 14 of the machine frame. The reel is positioned below and beyond the beaters 92 and 96, in position to catch and pass along the fibre issuing from the beaters. From this take-off reel the fibre is delivered to take-off rollers 118 and 120 which are located one above the other in position to receive the fibre and remove it from the machine. The lower roll 120 is positively driven from any suitable source and at a peripheral speed equal to the speed of the material entering the scutching devices. The top roll 118 rests idly on the lower roll and is driven only by friction with the lower roll so that any tendency to pull the fibre back into the scutchers will not be prevented but will be permitted. In this connection it should be noted that due to the difference in dimensions of the adjacent surfaces of the beater elements, there is constantly an intermittent back-pull on the fibre leaving the machine because the narrow faces C, D of the beaters tend to permit a movement of the fibre out of the machine farther than the following wider surfaces A, B. Thus when a wide face comes into action it tends to pull back the fibre slightly. The extent of pull is not great but can be felt if the fibre is held in hand as it leaves the scutching devices. This backward pull of the fibre is important, owing to the fact that the broken and partly loosened shives are scraped or scutched from the outer fibres. This is caused by the beaters revolving in a direction opposite to the backward pull of the fibres. It is for this purpose that the beaters have major and minor diameters. The construction of the take-off rolls 118 and 120 takes this into account and saves the fibre from damage.

The delivery from the take-off rollers 118 and 120 is to the conveyor 30 which preferably is inclined and delivers the fibre from its end into a chute 122.

The machine casing

Due to the fact that the rotation of the beaters develops considerable air currents which, acting upon the partially cleaned fibre, as well as upon the fibre completely cleaned and issuing from the scutching devices, have a tendency to blow it around in an undesirable manner, I have found it advisable to encase at least the scutching end of the apparatus and to provide vertical baffles in certain positions to control the air currents and to put them to advantageous use. As may best be seen from Fig. 1, a cover 130 is provided at the discharge end of the machine and is hinged at 132 so that it may be raised up for the purpose of inspecting or repairing the scutching devices or other mechanism within the casing. For a similar purpose, a hinged cover 134 is provided above the rolls 72 at the inlet end of the machine. Side walls and a top wall may be provided to enclose the remainder of the machine. In order that the air currents generated by the rotation of the scutching devices shall not act in an undesirable manner upon the material during treatment, vertical baffle plates 136 and 138 are secured to the walls and are positioned to extend from the top wall of the casing down toward the scutching devices in mid-position between them. The baffle 138 is preferably in vertical alignment with the baffle 136 and may be secured to the walls of the casing.

In order to keep the shives which are driven out from the fibre by the second set of the beaters 92 and 96 from falling down into the clean fibre which is leaving the machine, an inturned lip or ledge 133 is provided on the lower edge of the hinged cover 130, and an air blast consisting of a nozzle 135 in one side wall machine casing is directed along the trough formed by the lip to drive the loose shives to one side of the casing away from the fibre where they may fall down out of the way of the fibre.

For the purpose of catching these shives and also other shives removed from the fibre during the process of cleaning, a belt conveyor **140** may be provided at the bottom of the machine running over rollers **142** which may be driven by any suitable source of power to remove the shives from the machine.

Operation

In operating on jute, flax, hemp and the like, the wet or partly dried stalks of material will be fed into the machine by the conveyor and in passing between the hot steam chests **40, 42** and being pressed between the hot steam rolls **44, 46, 48,** will be materially dried. Then in passing beneath the air tank **60** jets of air will play on the hot fibre, further drying it, and cooling it. The cooling will be carried on further as the stalks contact the cool surface of the rolls **64, 66.** Thus in coming to the scutching devices the stalks will be dry and very brittle. As the stalks pass over the breaker bar **74** the woody portion is broken into small pieces or shives. The shives are removed by the scutching action of the beaters **90, 92, 94, 96** and the cleaned fibre is removed by the take-off reel **110** and take-off rolls **118, 120.** Air will issue from the scutching devices **90, 92, 94, 96** to aid the cleaning.

In operating on materials requiring wet processing, the material is wet with water issuing from the jets under the tank **60.** The water may be hot, or steam may be used. The remainder of the process is the same as described above except that instead of using straight edged beaters the serrated edges of Fig. 13 may be employed, and except that steam or hot water may be used in the scutching devices **90, 92, 94, 96,** instead of air.

From the foregoing, it will be apparent that I have provided a machine which is comparatively simple in construction but which is extremely effective in operation in cleaning fibre bearing materials of the woody portions. An advantage of this invention is that the machine can be moved around with comparative ease as compared with many of the machines of the prior art which were exceedingly large and cumbersome and had to be almost completely dismantled to be moved.

Another advantage of the invention is the ability to supply air, steam, water or other fluid for treating the materials when the materials are of such nature as to require water treatment. Thus my invention possesses a degree of flexibility in use and adaptability of all kinds of fibres, which has not been possible in any prior machine.

Many variations within the scope of the invention will occur to those skilled in the art. Therefore I do not limit myself to the more specific embodiments shown and described.

I claim:

1. Apparatus for conveying stalks comprising a moving platform on which the stalks are laid, a stop plate above the platform in position to be abutted by the stalk ends, means travelling along with said platform, means for operating said stop plate, said travelling means engaging with and actuating said operating means at predetermined intervals to permit passage of a group of stalks and to replace said stop plate in position to accumulate another group.

2. Apparatus for conveying stalks comprising a moving platform, a stop plate above the platform in position to be abutted by the stalk ends, means to rotate said plate into a horizontal position to permit passage of a group of stalks, means travelling along with said platform and engaging with said rotary means to actuate it into successive horizontal and vertical positions for permitting passage and stopping passage of the stalks.

3. Apparatus for conveying stalks comprising a moving platform, chain and sprocket means for driving said platform, a stop plate located above said platform and rotatable into vertical and horizontal positions to stop and to permit passage of stalks, a rotary member for moving said plate, means on said chain engaging with said rotary member to move said plate into its several positions at predetermined intervals.

DAVID E. PATTERSON.