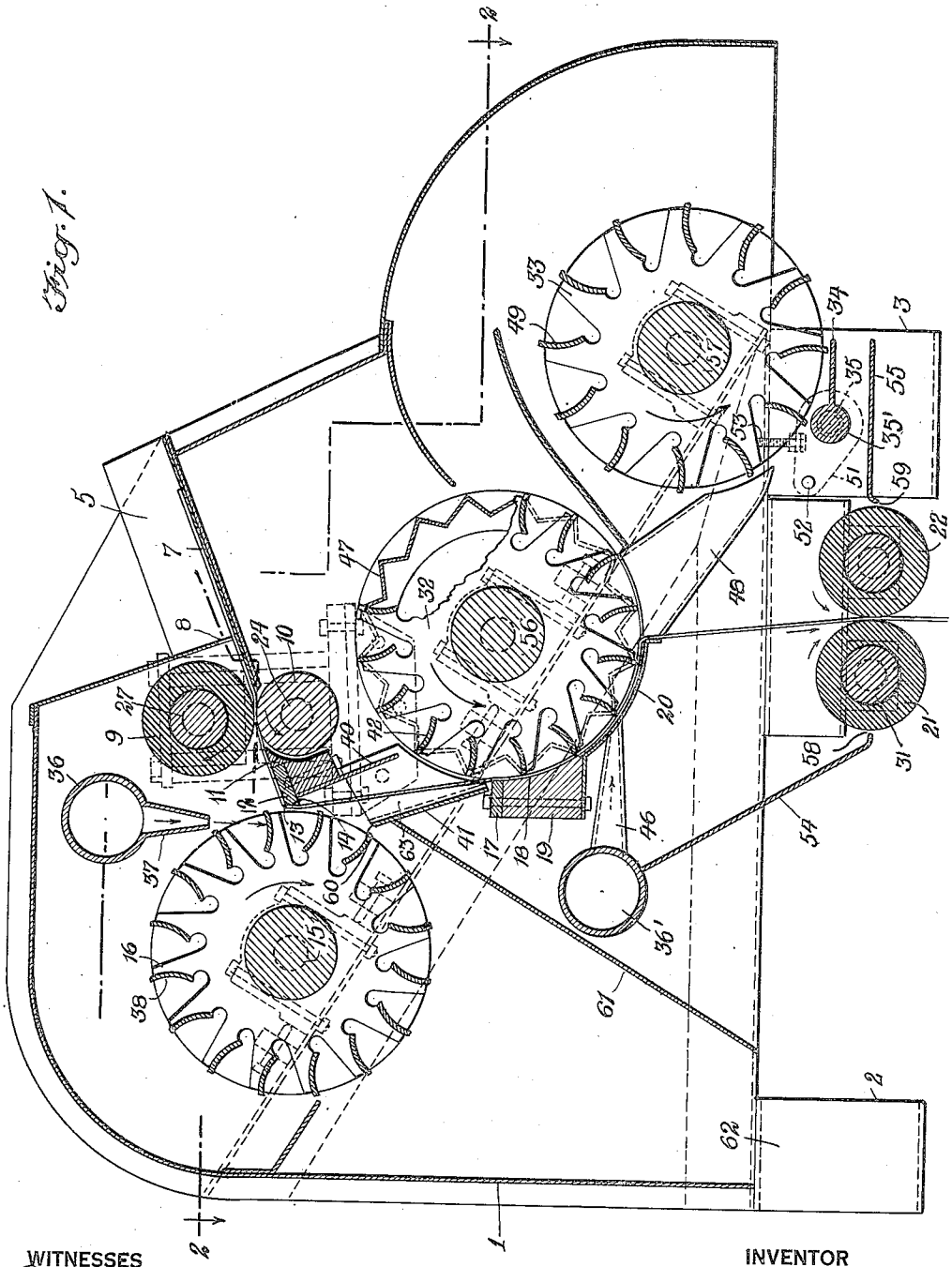
Dec. 4, 1934. J. E. HAYNES 1,983,454

DECORTICATING AND DEFIBERATING MACHINE

Filed Sept. 22, 1933 4 Sheets-Sheet 1

Fig. 1.



WITNESSES
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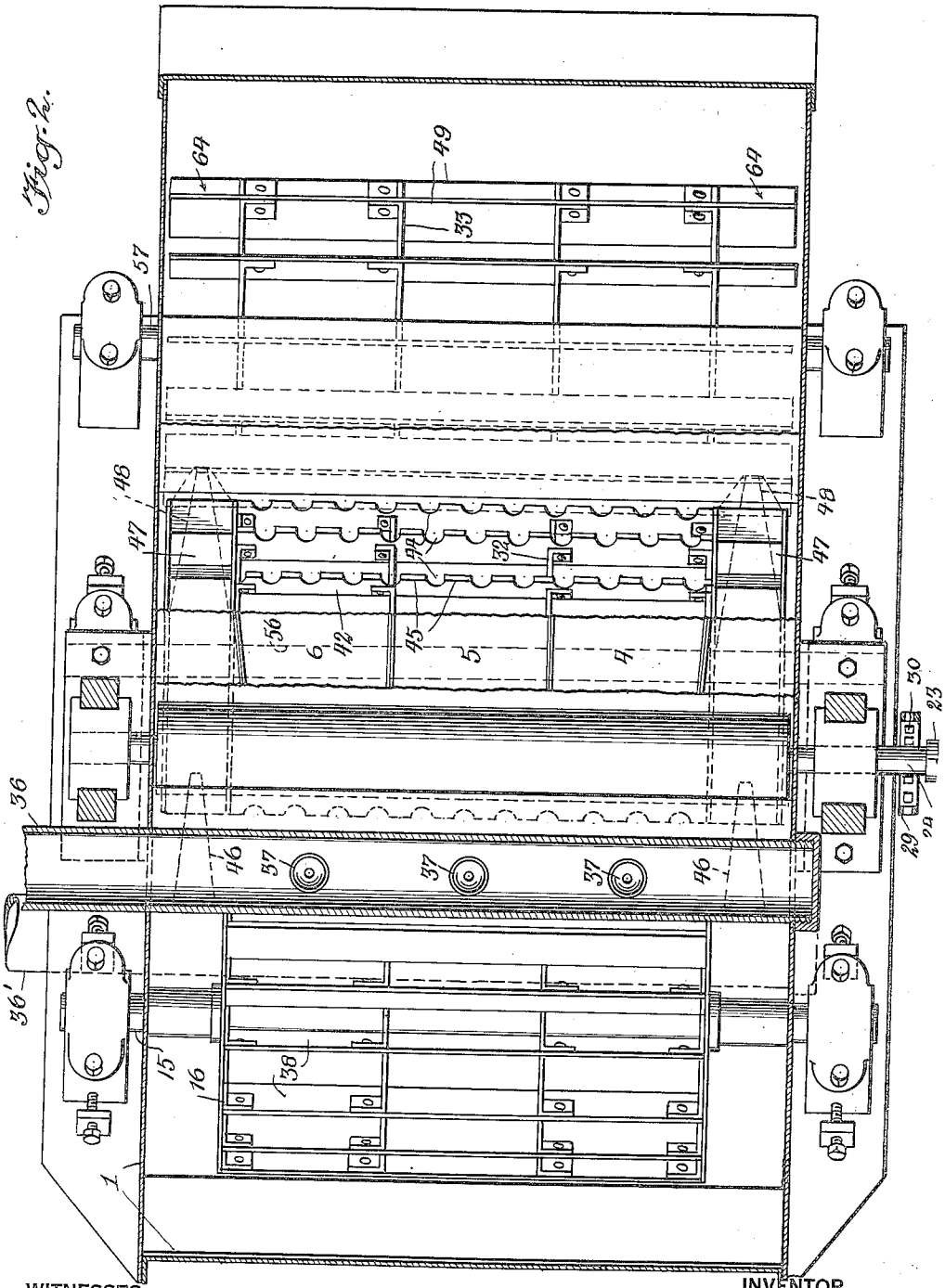
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DECORTICATING AND DEFIBERATING MACHINE

Filed Sept. 22, 1933 4 Sheets-Sheet 2

Fig. 2.



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DECORTICATING AND DEFIBERATING MACHINE

Filed Sept. 22, 1933 4 Sheets-Sheet 3

Fig. 3.

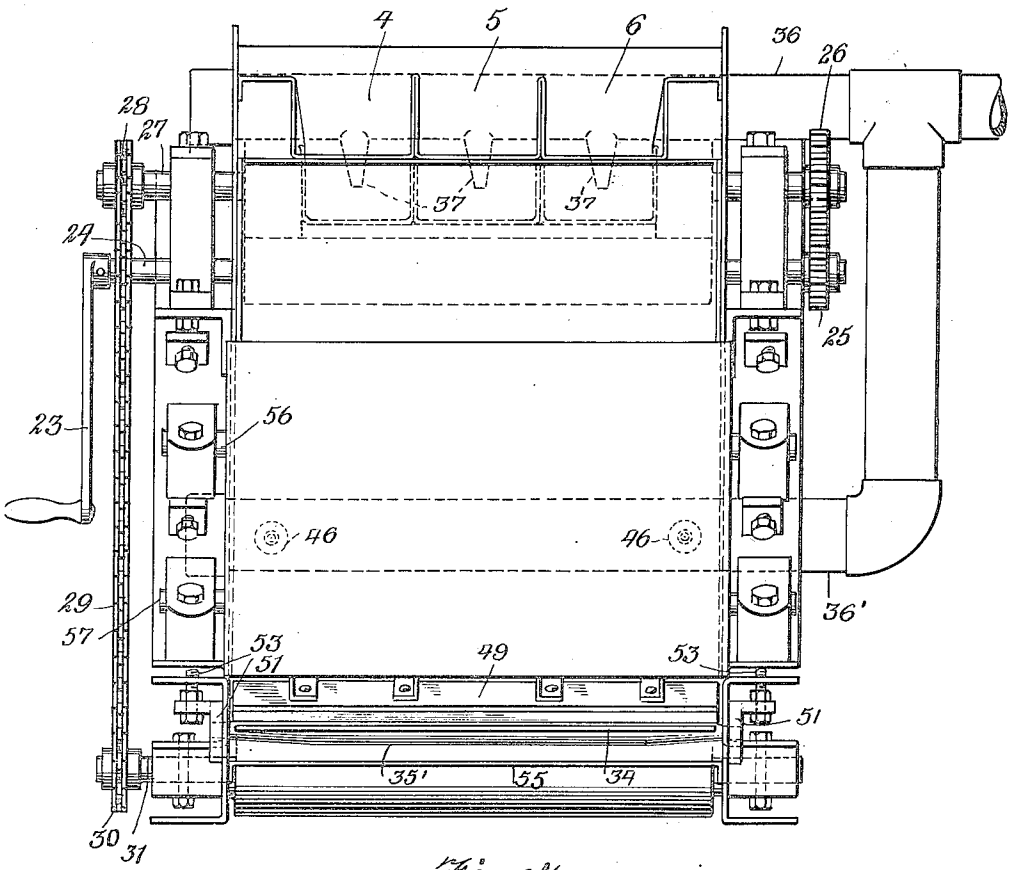
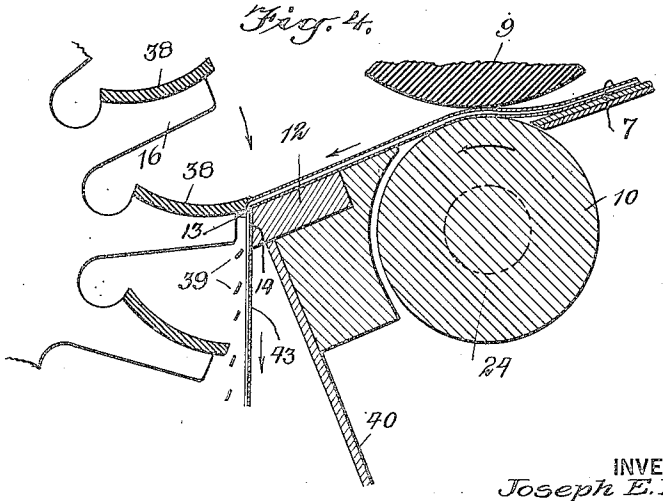


Fig. 4.



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DECORTICATING AND DEFIBERATING MACHINE

Filed Sept. 22, 1933 4 Sheets-Sheet 4

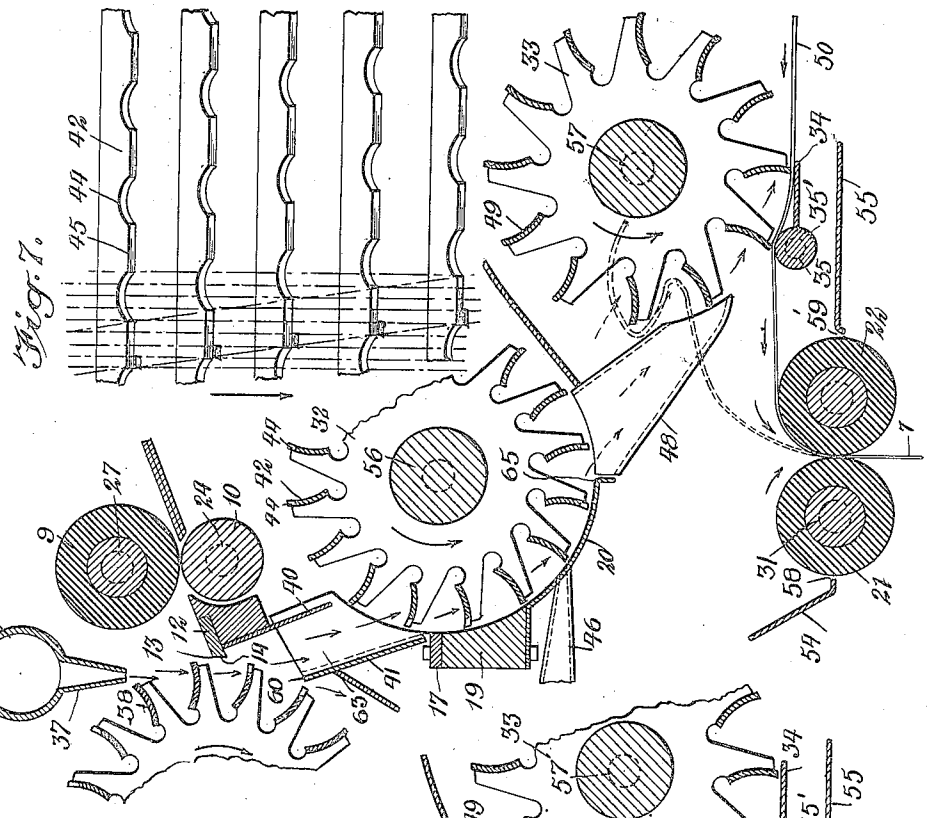


Fig. 7.

Fig. 6.

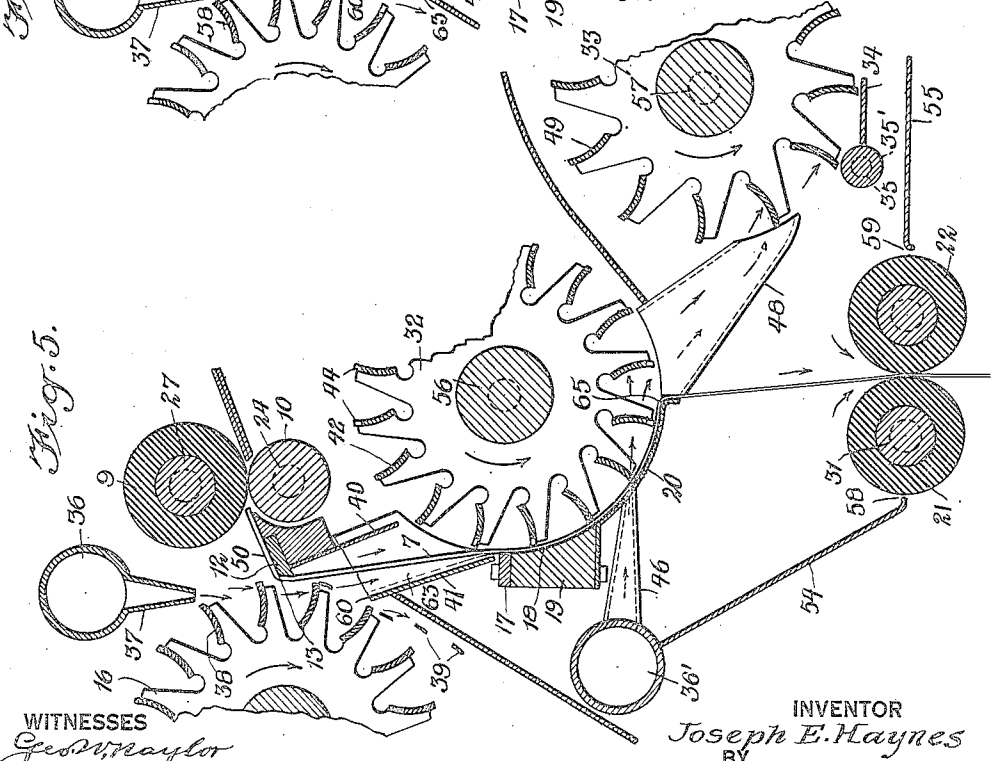


Fig. 5.

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Patented Dec. 4, 1934

1,983,454

UNITED STATES PATENT OFFICE

1,983,454

DECORTICATING AND DEFIBERATING MACHINE

Joseph Edward Haynes, Medellin, Colombia

Application September 22, 1933, Serial No. 690,627
In Colombia July 21, 1933

10 Claims. (Cl. 19—7)

This invention relates to an improved decorticating and defiberating machine, and has for an object to provide an improved device wherein leaves and stalks may be treated efficiently, rapidly and automatically from one end to the other.

The object of my invention is to provide a decorticating, defiberating and fiber washing machine by the simple application of a fluid power element, in which said power element performs all the functions, that is, supplying power to rotate the crushing and chipping wheels, to wash the fiber and to guide the partially cleaned leaf or stalk and the cleaned fibers through the machine in the proper operating sequence.

Another object of my invention is to provide a decorticating and defiberating machine in which a fluid power element is applied in such a way as to produce a scouring, washing and guiding action upon the partially cleaned leaf or stalk and cleaned fiber as they pass through the machine.

Another object of the present invention is to provide a decorticating and defiberating machine which removes the outer skin or shell and pulp material from a fiber bearing leaf or stalk and washes the fiber at the same operation, the structure being such that the leaf or stalk is fed in at a given point in the machine and the removed fiber is automatically fed out at a second point.

A further object, more specifically, is to provide a machine of the character described wherein a leaf or stalk is treated for the most part of its length as it is fed into the machine, and the remaining part is treated at a second point in the machine so that the entire leaf or stalk is treated throughout without being manually touched from the time it is fed into the machine.

This application is a continuation in part of my copending application Ser. No. 605,513.

In the accompanying drawings—

Figure 1 is a longitudinal vertical sectional view through the decorticating and defiberating machine disclosing an embodiment of the invention;

Figure 2 is a horizontal sectional view through Figure 1 approximately on the line 2—2, the same showing most of the parts in the top view;

Figure 3 is an end view of the machine shown in Figure 1, the same looking from the right in Figure 1;

Figure 4 is an enlarged fragmentary sectional view illustrating how the leaf or stalk is first fed into the machine and is first treated;

Figure 5 is a fragmentary view along a section similar to that shown in Figure 1, and illustrating the position of the parts immediately after the end of the leaf has passed the feeding rollers;

Figure 6 is a view similar to Figure 5 except that it shows the relative position of the leaf or stalk a moment after the position shown in Figure 5, that is, the position of the tip-end of the leaf which has been fed last into the machine, immediately after it has been released by the feeding rollers;

Figure 7 is a schematic view illustrating the blades of one of the rotary members and how they function.

Referring to the accompanying drawings by numerals, 1 indicates a casing which may be of metal or other material and of a desired shape for inclosing the various moving parts of the machine. Suitable legs or supports 2 and 3 are connected to the casing for supporting the casing and all parts carried thereby.

In use, fiber bearing material, for instance, leaves or stalks, are placed in one of the guiding chutes 4, 5 and 6, as shown in Figure 3. As shown in Figure 1, the leaf or stalk 7 has been fed into the machine and, in fact, is about half defiberated. As the leaf or stalk is first fed into the machine it passes through the opening 8 and is engaged by the pinching and feeding rollers 9 and 10. These rollers are positively driven and act as retarding rollers as well as feeding rollers, though they have been termed feeding rollers. Passing the rollers 9 and 10 the leaf or stalk moves over a platform 11 upon which is mounted a bending bar 12 made of hardened steel or other suitable material and constructed with a comparatively sharp corner 13 and a surface 14 which may either be a plane surface or a concave surface concentric with the circumference of the wheel 16. The leaf or stalk 7 is bent sharply at the corner 13 and passes forward in straight line downwardly to a breaking plate 17. From the breaking plate 17 the leaf or stalk follows the surface 18 of the supporting block 19, which block is connected to the casing 1 in any desired manner. From the surface 18 the fiber passes loosely over the surface 20 and is then knocked down and out of the stream of fluid coming off surface 20 by the action of the wheel 33 rotating and striking the fiber as it comes off the surface 20. After the fiber has been hit by wheel 33 and knocked out of the stream of the fluid, it then falls down by gravity and is engaged by the rollers 21 and 22 which slowly pull the fibers and discharge the same from the machine. The rollers 9, 21 and 22 all operate at the same speed as they are all driven from the same source.

As shown in Figure 3 there is provided a hand

crank 23 connected to a shaft 24, which shaft extends through the machine and carries a pinion 25 which continually meshes with the gear wheel 26. Gear wheel 26 is rigidly secured to shaft 27 which carries roller 9, said shaft also carrying a sprocket wheel 28 which accommodates chain 29. Chain 29 passes over sprocket wheel 30 rigidly secured to shaft 31, which shaft carries the roller 21. While hand operated driving means has been shown, it is evident that suitable power means could be connected to the parts so that the parts just described including the rollers 9, 10, 21 and 22 might be driven by outside power. It will be noticed that shaft 24 carries the roller 10 so that this roller is positively driven as indicated by arrow in Figure 1. Roller 10 is smaller than roller 9 but has the same peripheral speed, whereby a feed action will be secured in addition to a pinching and squeezing action which will hold the leaf or stalk from moving too fast. The rollers 21 and 22 are rubber tired, that is, covered with a relatively soft resilient rubber. The roller 9 is generally rubber tired also but may be made of metal with a smooth surface or with a fluted surface so as to serve as a crushing and breaking roller as well as a feeding and retarding roller, whenever the construction of the leaf or stalk requires such treatment. The respective wheels 16, 32 and 33 are all driven by a fluid power element directed through the respective parts hereinafter fully described. The wheels 16, 32 and 33 are carried by suitable shafts 15, 56 and 57, respectively, which shafts are loosely supported in suitable bearings which in turn are supported by the casing 1.

When the leaf or stalk 7 is in the position shown in Figure 1 and the machine is operating, the leaf or stalk is passing through the machine at a predetermined speed, but as soon as it has reached the position shown in Figure 5 the wheels 16 and 32 with the assistance of the fluid which travels at a high velocity will quickly pull the untreated end and force the same into wheel 32, and immediately thereafter force the untreated end into the wheel 33, which will quickly move the untreated end to the position shown in Figure 6. The machine continues to function in the usual manner after the parts have assumed the position shown in Figure 6, and the rollers 21 and 22 will continue to move so as to continue to pull the fiber from the machine and the untreated end past wheel 33, plate 34 and shaft 35. The untreated end is treated by the wheel 33 and the members 34 and 35' so that when it leaves shaft 35 nothing but the fiber will remain. As soon as the leaf or stalk has been quickly moved from the position shown in Figure 5 to that shown in Figure 6 a new leaf or stalk is started into the machine so that it will be partly through the machine by the time the first leaf or stalk has been completely treated, thus saving time in the treatment of successive leaves or stalks.

In order that the wheel 16 may function properly a supply pipe 36 is provided, said pipe having a number of nozzles 37 which direct the fluid power element against the various beating and chipping blades 38 carried by wheel 16, and consequently wheel 16 is rotated under the force of the impact of the fluid jets from nozzles 37.

As the rollers 9 and 10 pull the leaf or stalk into the machine and limit the forward movement, the leaf or stalk passes the bending bar 12 and consequently comes in contact with the blades 38 of wheel 16 and therefore is turned down over corner 13, and as it makes the turn over corner 13 both the front and back shell or skin will be broken as illustrated particularly in Figure 4. The front skin or coating is knocked off in small pieces 39 by the various chippers or blades 38. The rear shell, however, is left in place though broken. The blades 38 act in the capacity of chippers and chip or rub off the small particles, and in addition to this fluid from the nozzles 37 not only washes away all the loose particles, but because of its high discharge velocity also subjects the partially cleaned fibers to an intensive scouring treatment which materially aids in the decorticating process. In the accompanying drawings three nozzles have been shown but, if desired, a greater or even less number might be used without departing from the spirit of the invention. The deflector plate 41 is set into the machine in such a way that the beveled edge 60 splits into two streams the jets of fluid from nozzles 37 shortly after the fluid of the jets has passed beyond the arc with the blades 38 of wheel 16. The stream of fluid which passes down the left hand side of deflector plate 41, that is, the side facing wheel 16, carries with it the waste substance extracted from the leaf or stalk by the combined actions of the blades 38 of wheel 16 and the friction of the fluid from nozzles 37. This mixture of fluid and pieces of shell and pulp passes out of the machine through exit 62, plate 61 acting as a baffle to prevent the reentrance of the mixture into the further working parts of the machine. The stream of fluid which passes down the right hand side of the deflector plate 41, that is, the side facing the wheel 32, forms a film of fluid which forces and guides the partially cleaned fiber and the remaining shell towards wheel 32 and breaking plate 17 where the blades 42 act thereon. Deflector plate 41 is constructed with two side plates 63 which act as baffles to direct the film of fluid toward the center of breaking plate 17, thus preventing the partially cleaned fiber from fanning out and coming in contact with the impulse blades or buckets 47 on wheel 32. The blades 42 on wheel 32 chip the opposite face of the leaf or stalk, namely, the broken surface 43 as shown in Figure 4, and remove the entire broken outer shell as the leaf or stalk passes over the curved surface 18.

As shown in Figure 7 the chipping blades 42 on wheel 32 are each provided with notches 44 and with chipping sections 45. The chipping sections 45 are successively set off from each other to one side so that it requires four or five sections to cover the entire lateral surface. It will be seen that the first section will chip off a part as wide as the section but each succeeding section will only take off about one-fourth of its own width. This allows the succeeding sections to remove one-fourth of new matter and the remaining part of the old loose matter. The main or principal feature of the notches in the edge of the blades is to provide spaces wherein the loose fiber which has previously been cleaned or broken away from the skin may escape, thereby avoiding undue stresses on the clean fiber by reason of the continuous operation of the various blades. It is to be noted that the fiber broken loose from the skin will follow the fluid, and as the fluid takes the path of least resistance it follows that the clean fiber will follow the fluid into the notches and thereby avoid or escape further harsh action by the blades. By reason of

this method the machine is adapted to recover almost all the fiber content of the leaf or stalk.

While the different sections 45 are functioning to chip off the broken shell and pulp, the fluid is also acting on the broken particles, as a large part of the fluid coming off from wheel 16 is deflected between the plates 40 and 41 on to wheel 32. In addition wheel 32 is driven by the fluid from pipe 36', projected through nozzles 46 on to the water wheels 47, secured to or formed integral with the wheel 32, which are provided with inclined surfaces or buckets for receiving the impact of the fluid from nozzles 46. Below the block 19 there is provided an arc-shaped guard 20 having an aperture for each of the nozzles 46. This guard is spaced further from the wheel 32 than the surface 18 so that any loose material left in the fiber is quickly washed out by the fluid at this point. A large portion of the fluid from the respective nozzles 46 passes down to the respective chutes 48, arranged at opposite sides of the machine. The chutes 48 discharge fluid against chipping blade extension 64 of wheel 33 so as to rotate this wheel. The wheels 16 and 32 rotate at a relatively high speed depending upon the sizes of the wheels 16 and 32, the sizes of the nozzles 37 and 46 and the pressure of the fluid power element used. The wheel 33 rotates at a much lower speed because it is actuated by a discharge fluid stream which has already given up considerable of its energy in driving the wheel 32, but the speed is still sufficient to permit the blades 49 on wheel 33 to remove the remaining skin and pulp on the leaf or stalk tip 50 which has not previously been entirely defiberated and cleaned by wheels 16 and 32.

Figure 6 is meant to illustrate the treatment of the end or tip of the leaf or stalk. When the end or tip of the leaf or stalk is released from the feeding rollers 9 and 10 there is nothing to hold it back against the combined pull of the blades 38 on wheel 16, blades 42 on wheel 32 and the discharge fluid from wheel 16. Therefore that piece of leaf or stalk between the tip freed from feeding rollers 9 and 10 and the point 65 of the arc-shaped guard 20 is rapidly pulled along with the blades 38 and 42 of wheels 16 and 32 respectively and finally thrown over into contact with the blades 49 of wheel 33. The tip of the leaf or stalk is thus caught between the blades 49 of wheel 33 and pulled around with them over the enlargement 35' of shaft 35 and outer end plate 34 until the fibers are again taut from the point where they pass between delivery rolls 21 and 22. The rolls 21 and 22 are continuously pulling the fibers towards them and thus the tip fibers are pulled back across the enlargement 35' of shaft 35 in the opposite direction of the rotation of wheel 33 and, consequently, the blades 49 of wheel 33 chip and clean the remaining shell from the tip end of the leaf or stalk. The fluid from nozzles 37 that passes into wheel 32 continues along the arc-shaped guard 20, and on to the wheel 33 so as to wash the fibers extracted from the tip of the leaf or stalk by wheel 33. The shaft 35 is supported by suitable fixtures which are pivotally mounted at 52 and adjustably held in place by various screws 53.

From Figure 1 it will be noted that there are aprons 54 and 55 which are incorporated into the machine design for the purpose of deflecting some fluid into the gaps 58 and 59 between the edges of aprons 54 and 55 and the rollers 21 and 22. The fluid thus deflected forms a film that runs down to the bottom side of rolls 21 and 22 serving to wash off any small pieces of fiber which may adhere to the rolls 21 and 22 and at the same time preventing the cleaned fibers from sticking to the rolls 21 and 22 and from winding around them.

It will be seen that the fluid power element acts as a power means for driving all the chipping elements, while an outside power is used for driving the feed rolls and the remaining rollers that remove the cleaned product from the machine. After a leaf or stalk has been started into the machine it is left alone as far as manual control is concerned and passes through the machine automatically, coming out between the rollers 21 and 22 completely decorticated and defiberated. As shown in Figure 3 there are three chutes so that three leaves or stalks may be treated simultaneously, but the machine may be made larger and with a larger number of chutes without departing from the spirit of the invention. As soon as one leaf or stalk has disappeared from the guiding chutes 4, 5 and 6, the operator feeds another leaf or stalk, and this operation continues as long as the machine functions.

I claim:

1. A decorticating and defiberating machine including a plurality of wheels, each wheel having a plurality of crushing and chipping blades, means coacting with each wheel for holding a fibrous member in position to be acted upon by the blades of the respective wheels, means for feeding the fibrous member into the machine, a pair of rollers for pulling the fiber from the machine, and a plurality of means for directing fluid under pressure against the respective wheels to rotate the wheels and to wash the material being treated and also guide the partially cleaned leaf or stalk and cleaned fiber through the machine in the proper operating sequences.

2. A decorticating and defiberating machine including a feed mechanism for feeding the fibrous leaf or stalk into the machine, a bending bar arranged adjacent the feeding mechanism over which the leaf or stalk is adapted to be bent and the brittle part thereof broken, a wheel having a plurality of crushing and chipping blades coacting with said bending bar for removing the broken skin from one surface of the fibrous leaf or stalk, means for directing fluid under pressure against said wheel for rotating the same and against the matter being treated for washing the same, a second wheel positioned to crush and chip the fibrous leaf being treated after it has passed the bending bar, a breaking plate coacting with said second wheel, said second wheel having a plurality of crushing and chipping blades formed with spaced notches with the notches arranged in offset relation, means for engaging and pulling the cleaned fiber from the machine, and means operated independently of the respective wheels for driving the means for pulling the fiber from the machine.

3. A decorticating and defiberating machine including a plurality of crushing and chipping wheels, means for causing two of the wheels to act on opposite faces of a fibrous leaf or stalk fed into the machine for removing the skin and pulp therefrom, a fluid under pressure directed against said wheels for rotating the wheels and at the same time washing the skin and fibrous matter as they are operated on by said wheels, a third wheel acting on the end of said leaf last fed into

the machine for removing the skin and pulp therefrom.

4. A decorticating and defiberating machine including a rotating crushing and chipping wheel having crushing and chipping blades, means for directing a plurality of jets of fluid against said wheel, a bending bar arranged near said wheel, means for directing a fibrous leaf or stalk to be treated so as to be bent over one corner of said bending bar and thereby be treated so that the skin on both sides will be broken, said wheel acting to remove the broken skin from one surface of said leaf or stalk, a second wheel having a plurality of crushing and chipping blades for treating the opposite surface of said leaf or stalk after the first wheel has functioned, a breaking plate coacting with said second wheel, a block having a curved surface also coacting with said second wheel and the blades thereof for removing the skin and pulp from the other surface of said leaf or stalk, said second wheel having blades formed with straight edges and with spaced notches in the respective blades, said notches being offset from each other whereby as the blades press the material being treated against said breaking plate and said block the loose portions of the matter being treated may pass into the opening in said blades and be washed away by said fluid, said leaf or stalk being treated for most of its length by the time it passes the second wheel, means coacting with the second wheel for moving the untreated portion of the leaf or stalk past the second wheel, a third crushing and chipping wheel acting on said untreated end for removing the skin and pulp therefrom, means coacting with said third wheel presenting a surface against which the untreated end may be rubbed for removing the pulp and skin, means for directing fluid from the second wheel to the third wheel to operate the third wheel and at the same time wash the fiber as the same is being treated, and a pair of pulling rollers positioned to engage and pull the cleaned fibers first from the second wheel and secondly from the third wheel.

5. A decorticating and defiberating machine for decorticating and defiberating fiber bearing leaves and stalks to remove the fibers therefrom in one continuous operation, consisting of a plurality of crushing and chipping wheels for operating on opposite sides of the leaf or stalk as the leaf or stalk passes through the machine, means for engaging and pulling the clean fiber from the machine, and a plurality of means for directing fluid under pressure against the respective wheels to rotate the same and at the same time wash the matter being treated and guide said matter being treated in the proper operating sequences as it passes through the machine.

6. A decorticating and defiberating machine including a bending bar, means for feeding leaves or stalks to be treated over said bending bar, a wheel coacting with said bending bar for removing the skin from one surface of the leaf or stalk and some of the pulp, a second wheel for removing the skin on the opposite surface and the remaining pulp, said second wheel being provided with a plurality of crushing and chipping blades and a plurality of power buckets at the end, means for directing jets of fluid under pressure against said buckets for rotating said second wheel, said first and second wheels treating most of the leaf but leaving an untreated end portion, said second wheel with the assistance of the fluid directed against the same being adapted to move the untreated end to a given position, and means including a third crushing and chipping wheel for removing the skin and pulp from said untreated end.

7. A decorticating and defiberating machine of the character described adapted to use a fluid power element under comparatively high pressure including water, comprising a plurality of crushing and chipping wheels formed with crushing and chipping blades positioned to receive said power element so that said wheels will be rotated by said power element, means for guiding fibrous material to be treated past said wheels, said power element including water acting on the fibrous material to produce a scouring action by reason of the high velocity thereof, means for guiding the matter being treated so that first one face will be treated and then the other face, and means for engaging the clean fiber from the fibrous material, said means acting to pull the fibers from the machine.

8. A decorticating and defiberating machine of the character described, adapted to use a fluid power element with a high pressure including water, comprising a plurality of crushing and chipping blades positioned to receive said power element so that said wheels will be rotated by said power element, means for guiding fibrous material to be treated past two of said wheels, said power element including said water acting on the fibrous material to produce a scouring action by reason of the high velocity thereof as the said wheel treats the fibrous material, one of said wheels treating the fibrous material on one face and the other wheel treating the fibrous material on the opposite face, said first and second wheels acting to treat all of said fibrous material except one end thereof, means for directing said untreated end to a given point, a third wheel acted upon by said power element for treating said untreated end, and means engaging the clean fiber from said fibrous material for removing the same from the machine.

9. A decorticating and defiberating machine of the character described, comprising a bending bar over which a fibrous leaf or stalk to be treated is adapted to pass, a primary crushing and chipping wheel coacting with said bending bar for breaking the front and back skin of said leaf or stalk, said wheel acting also to chip off small pieces of the skin on one face of said leaf or stalk and some of the pulp, means for directing fluid power under pressure against said primary wheel and the matter being treated for rotating said primary wheel and washing away all foreign matter, a secondary crushing and chipping wheel acting to chip off the opposite face and remove the remaining pulp from said leaf or stalk, a fluid power element exercising the double function of rotating said second wheel, and simultaneously washing away all foreign matter, said second wheel being adapted to quickly swing the end of said fibrous leaf to a given point from the first wheel when the end of the fibrous material has reached said bending bar, and a third crushing and chipping wheel actuated by said fluid power element as it leaves said second wheel for removing the skin and pulp from said end, said fluid power element also washing away all foreign matter from said third wheel said third crushing and chipping wheel structure including a plurality of crushing and chipping blades, and means coacting with the blades of said third wheel for causing the blades of the wheel to have a crushing and chipping action.

10. A decorticating and defiberating machine including a primary crushing and chipping wheel having crushing and chipping blades on the periphery, said wheel being adapted to operate at a high rate of speed, a bending plate coacting with said wheel for bending the fibrous leaf or stalk to be treated and breaking the skin thereon, a fluid power element positioned to be directed against the blades of said wheel and against the leaf or stalk to be treated for scouring the leaf or stalk and removing loose skin and pulp therefrom, a second crushing and chipping wheel, a breaking plate coacting with said second wheel for holding said leaf or stalk in a position to be crushed and chipped by the second wheel, means acting as a water motor connected with said second wheel, means for directing a stream of water against the means acting as a water motor, and means for pulling from the machine the fiber removed from said leaf or stalk.

JOSEPH EDWARD HAYNES.