Dec. 20, 1932. D. W. SARVAY ET AL 1,891,245

SHREDDING MACHINE

Filed March 9, 1932 3 Sheets-Sheet 1

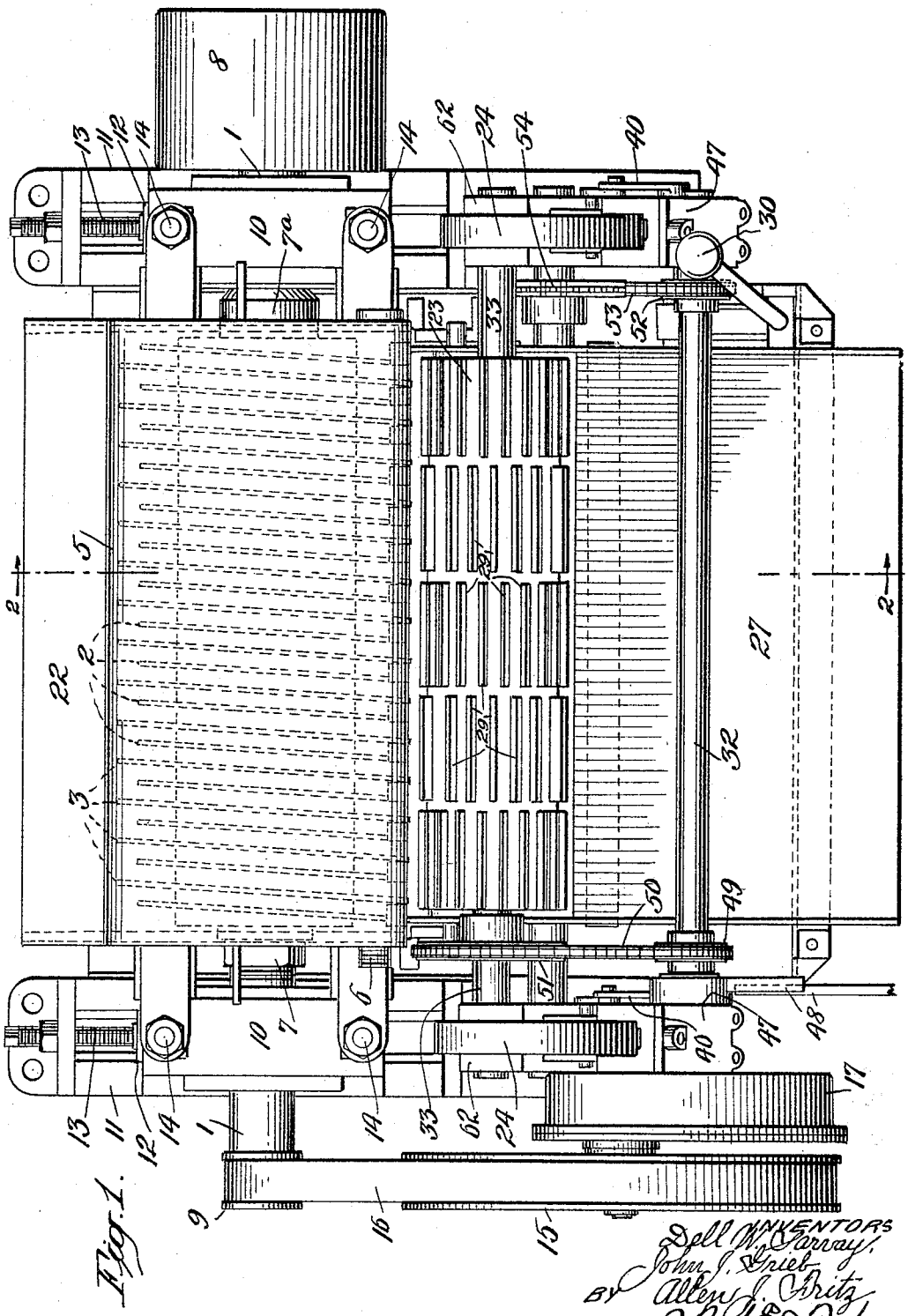


Fig. 1.

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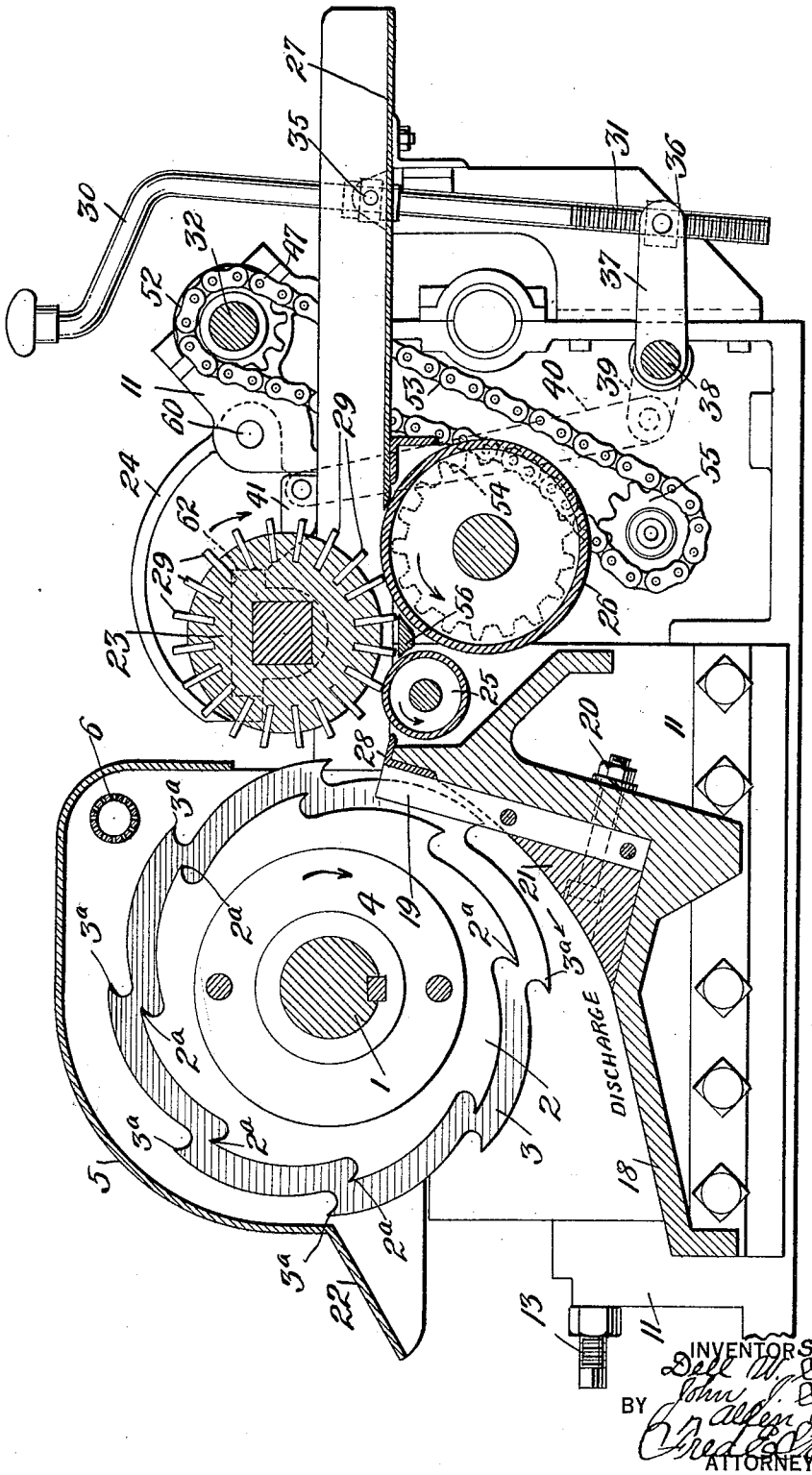


Fig. 2.

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Filed March 9, 1932 3 Sheets-Sheet 3

Fig. 3.

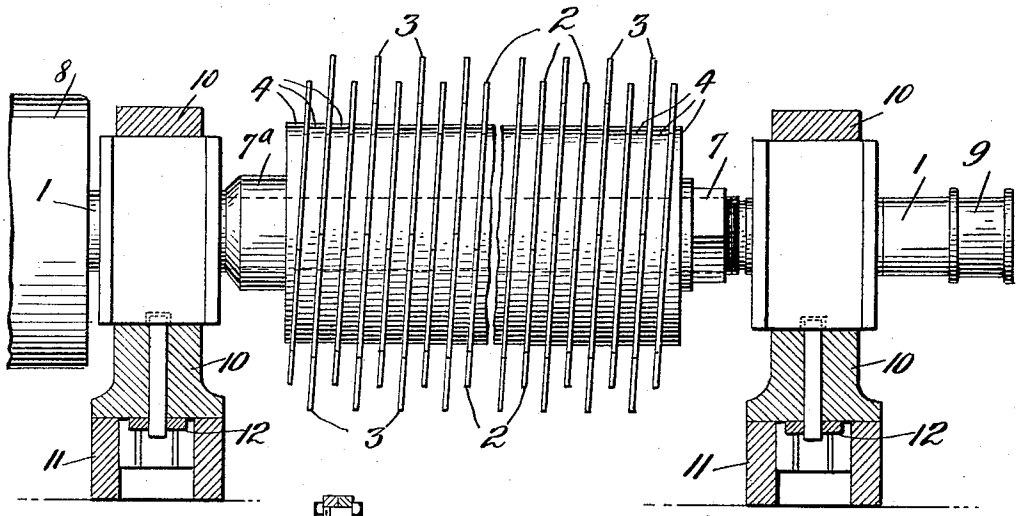


Fig. 4.

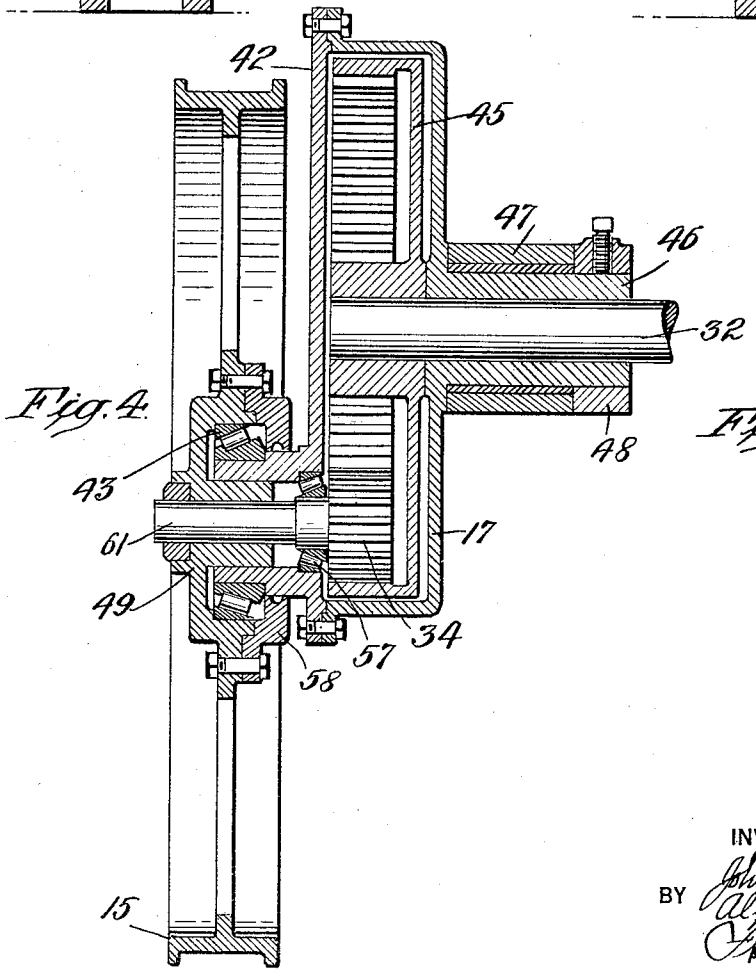
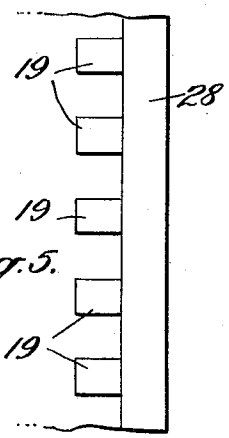


Fig. 5.



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UNITED STATES PATENT OFFICE

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SHREDDING MACHINE

Application filed March 9, 1932. Serial No. 597,670.

This invention refers to certain new and useful improvements in machines for shredding or reducing the various kinds of pulp, old papers, wood and the like, and various kinds of dry paper and similar stock, to prepare the same for the beaters or bleachers in the paper making process, in order that the reduction may be to small particles of a size desirable for hydration. Our improved machine of the class described provides effective and novel devices in the feeding mechanism which carries the material to be shredded into a disintegrating mechanism or toothed devices where the material is reduced to small particles by tearing blades having teeth; and the improvements in the feed devices make it possible to hold the stock with greater force and keep it under better feeding control until a much larger percentage is disintegrated by the shredding blades than has been possible heretofore.

Our invention aims also to provide a paper stock shredder which will tear the material apart in proper lengths with little or no cutting action, thus producing a paper stock with its fiber unimpaired. The fibers of the stock are not cut or compressed by this tearing action but are torn into ragged particles which are susceptible to quick moisture penetration. Our machine seeks to withstand the severe service demanded of equipment of its type and has an incorporated flexibility of design which will render it efficient and applicable under manifold conditions.

With these and various other purposes in view, the invention may therefore be said to consist essentially in the construction, arrangement and combination of parts, and in numerous peculiarities and modifications of the same, substantially as will be hereinafter described and then more particularly pointed out in the ensuing clauses of claims.

In the accompanying drawings illustrating our invention:

Figure 1 is a top plan view of our improved machine for shredding paper stock and the like.

Figure 2 is a vertical section of the same on the line 2, 2, of Figure 1.

Figure 3 is an enlarged detailed front elevation of the shredding mechanism and the supports for its arbor.

Figure 4 is a detail sectional view of the reduction portion of the drive gearing for the feed rolls.

Figure 5 is a detail plan view of a part of the bed or land bars and the adjacent horizontal stock support.

Similar characters of reference denote like parts throughout all the different figures of the drawing.

Power to drive the machine is applied from any suitable source to the machine pulley 8 fast on the blade or rotor arbor 1, which carries the blades or toothed members 2 and 3, spaced apart by the collars 4, all of which are rigidly held together in an assembly by means of the nut 7 against shoulder 7^a. The rotating arbor 1 is supported in suitable bearings carried in adjustable bearing yokes 10 of a suitable and proper type that are supported over slide members 12 mounted on a bottom portion of the main frame 11 of the machine, and in the said bottom portions of the frame are threaded the adjusting screws 13 which are carried by the slide members 12, while suitable screws or bolts 14 serve to hold the caps and other parts of the bearing yokes together, and lock them in position.

The shredding rotor as it may be termed consists of the steel shaft 1, upon which is assembled a series of toothed circular steel blades or shredding devices 2 and 3 of different diameters alternated between spacing collars 4 that are preferably machined to a slight angle from ninety degrees to the axis of the arbor 1, thereby causing a wabble action in the said blades. The blades 2 have teeth 2^a, and the blades 3 have teeth 3^a. These teeth may have any desired special shape and structure for their purpose. The tearing of the stock is accomplished by a shuttle action of the teeth 2^a and 3^a on the shredding blades 2 and 3, which action is brought about by locating blades 2 and 3 in a spaced relation to each other so that their planes are not at right angles to the axis of arbor 1. Then the rotation of the arbor causes the teeth to travel in a circular path

at right angles to the axis of the arbor, but the angle of the parallel blades causes the paths of the teeth to lie in adjacent parallel planes. The shuttle action may be obtained in several ways. The tearing blades may all be set parallel on the arbor so that the shuttle action is in the same direction at any instant for all the blades, or they may be set so that half are in one direction while the other half are in an opposite direction under similar conditions, half of the blades being inclined one way and half the other way. And again, a shuttle action might be accomplished by introducing this movement into the feed mechanism, instead of allowing it to be an attribute of the blades, or shuttling of the disintegrating devices might be caused in both the arbor and the feed devices as a shuttle combination.

27 denotes a feed table, or apron, being a horizontal surface with sides and adapted to receive thereon quantities of the material to be shredded which is passed from the table 27 to the shredding blades by an upper feed roll 23 and two lower feed rolls 25 and 26, the roll 25 being the smaller of the two lower feed rolls. The large upper feed roll 23 is provided with several circular series of longitudinal radial flutes, knives, vanes or blades 29, those in each row being staggered in relation to the members in the adjoining rows, that is to say, they alternate at their ends, as shown in Figure 1. Said flutes or vanes 29 bear on the material to be shredded and cause it to be flattened by the weight of the feed roll 23, so that the material is delivered in a continuous sheet on to the top of a horizontal bed stock support 28, which is contiguous to the circular shredding blades of greater diameter 3, so that the bed 28 and the teeth 3^a may act conjointly on the paper stock. Feed roll 23 is free to rise up in any manner caused by the stock entering the space beneath it, because the journals 33 thereof are supported by bearings 62 carried in arms 24 that are pivoted on pins 60 held revolubly in some suitable part of the main frame of the machine. Thus any stock such as sheets of pulp deposited on apron or table 27 and advanced so as to encounter the nip of rolls 23 and 26 will be drawn into the shredding blades. So that various thicknesses of stock may readily enter the nip between rolls 23 and 26, provision is made so that the operator can raise and hold roll 23 in any position which his judgment may advise him to be best for the proper feeding of such thicknesses of stock as are being used. The position of roll 23 is controlled by the screw 31 or the crank 30 operating through suitable mechanism, an example of which I have shown. At 35 on the main frame is a bearing for the upright crank rod 30, and the screw section 31 engages a nut 36 on the end of a crank arm 37 in which nut the screw may be adjustable. The arm 37 is fast on a horizontal shaft 38 mounted in bearings in the sides of the main frame and having thereon short cranks 39, to which are pivoted long links 40 that extend upward alongside each side of the machine and are pivoted at 41 to the castings that support the journals of the heavy pivoted fluted roll 23, as shown in Figure 2. Therefore our easy method of raising and lowering the upper roll 23 is accomplished by turning the handle and causing the screw and the leverage connected therewith to actuate the roll 23.

The power required to drive the feed mechanism is taken from the arbor 1 of the shredding rotor. On the end of said arbor is a pulley 9 around which passes a belt 16 running to a large pulley 15, which is mounted on the cover 42 of gear case 17, see Figure 4, by means of a suitable ball or roller bearing, as at 43, but the hub 49 of pulley 15 is keyed to the stub shaft 61 of pinion 34, causing said pinion 34 to rotate with the same speed as the pulley 15 revolves. Another ball or roller bearing 57 assists in the easy movement of the stub shaft and is arranged in connection with the cover 42. Plate 58 is bolted to wheel 15. Pinion 34 in turn meshes with and drives the internal gear wheel 45 that is enclosed by the gear case 17 and is keyed directly to the shaft 32, thereby causing it to rotate with the same speed as the internal gear wheel 45. The hub 46 of gear case 17 serves as a bearing for the shaft 32 which also is held in the bearings 47 on the main frame. A lever 48 is attached directly to the hub 46 of gear case 17, so that when it is swung through an arc it constrains the pulley 15 to swing through a concentric arc. Such a movement changes the distances between the centres of pulleys 9 and 15, and causes the belt 16 to be tightened or loosened as the case may be and serves to stop or start the transmission of power over the belt.

Thus the power to drive the feed mechanism is taken from arbor 1 by belt 16. But the very high speed of the arbor as compared to the feed rolls makes it necessary to introduce a speed reduction unit, an example of which we have thus offered and explained. It is also desirable that means be provided for starting and stopping the feed at the will of the operator. Thus a special combination speed reducer and automatic belt tightener is provided for this purpose. When in operation the belt 16 is under moderate tension, but should the load increase the belt tension will be automatically increased to meet the load condition which insures a positive feed at all times. The shaft 32 carries near one end a sprocket wheel 49 over which runs a chain 50 that engages a sprocket wheel 51 on the journal or shaft of the fluted feed roll 23, whereby said feed roll is rotated in the direction shown by the arrow in Figure 2.

On the other end of shaft 32 is another sprocket wheel 52 which through a chain drive 53 to sprocket wheel 54 on the shaft of feed roll 26, causes said roll to rotate in the direction of the arrow, see Figure 2. This chain 53 is usually run around a lower sprocket 55 and engages the sprocket wheel 54 on its opposite side in order to give a reverse rotation to roll 26 from what it would have otherwise, although this is a matter which can be changed and modified as required. Thus the rolls 23 and 26 rotate toward each other and they grip the material between them and feed it forwardly and downwardly.

As the surface speed of the rolls 23 and 26 can be varied so as to meet any condition which arises, it is possible to increase, decrease, neutralize or reverse the tendency of a series of dry sheets of stock to slide one on another as they are subjected to the actions of these said rolls, 23, 26, 25, see Figure 2. As the sheets enter between the rolls 23 and 26, the line of travel being at right angles to a line connecting the centers of said rolls, the sheets are directed downwardly, but this is at once reversed when the sheets pass over the table or apron bar 56 and encounter idler roll 25 which feeds the material forward so that the line of travel is now towards a point well above the center of the arbor 1 carrying the shredding blades 2 and 3. This change of direction causes the sheets to slide one on another, and this action may be accentuated, diminished or reversed, depending on the relative speeds with which the top and bottom sheets are carried forward by their respective propelling rolls, and all this has a bearing on the shredding or tearing results. Because when the stock is in the form of sheets, the feed causes a sliding action between the sheets, so that there is an advance of one over another, due to the bending caused by the three feed rolls and influenced by the speed relation of the rolls. This may be utilized to assist in reducing the number of oversize pieces that result when the stock is released by the feed rolls. The bending or tipping up of the stock by the feed rolls is continued by the bed bars 19, of which there is a row near the support 28, and with the upper ends of these bed bars closely contiguous to the teeth 2^a of the shredding blades 2, the ends of said bars and the teeth 2^a act together to tear the stock, at a point above the discharge into which the material thus torn is directed. The bed bars 19 are held to the foundation portion 18 of the main frame by means of bolts 20 that clamp block 21 against said frame member 18, see Figure 2. The side portions of the main frame are sturdily constructed and connected by the heavy spreader casting 18 which supports the bed or land bar assembly. Hence it is evident that while the stock is actually torn at a point well below the center line of the arbor in the horizontal plane, the stock is directed into the shredding blades on a line whose continuation is well above the center of the arbor. This arrangement reduces the tendency to snatch the stock from the feed or so called dragging effect, without reducing the shredding ability of the machine. The drag is still further controlled by the design of the shredding or tearing blades and the relation in which their teeth are placed one to another, thus making it possible to increase or decrease the same.

The paper stock which is carried towards the shredding rotor first encounters the shredding blades 3 which have the greater diameter and they tear wide paths in the stock, leaving a ribbonlike piece supported by bed bars 19 to be advanced to the shredding blades 2. The width of path torn in the stock is determined by the angularity of the shredding blades relative to the axis of the arbor. The tearing effect, which is so important instead of a cutting effect, is obtained by not providing sufficient support for the stock to resist the shredding action. Under the impact of the teeth of the shredding blades the stock gives or yields enough so that the teeth of the blades tear through instead of making a cut which would be the case if the stock were supported so as to sufficiently resist this action. The bed or land bars 19 support the stock to permit its reduction into small pieces by the blades 2.

The action whereby the stock is torn up by the shredding blades 2 has a tendency to drag the stock in the direction of rotation over the edges of bed bars 19. As long as the stock is held in the nip of rolls 23 and 25 the drag is resisted and stock is only permitted to advance in a manner governed by roll 23. Matters are entirely changed however as soon as the stock is free of rolls 23 and 25, because when this takes place the relative mass of stock is small, and the power required to move it is so little that it would quickly vanish under the impulse of the drag of blades 2. While it may not be possible to completely resist this action without a special mechanical device so arranged as to hold the stock on the bed bars 19 until the last fraction of an inch has passed under them to the shredding blades 2; yet it is possible to so arrange the relationship of the blades 2 and 3 that the blades 3 will resist the drag of blades 2 to the point where the resistance to tearing in the stock is overcome by the drag and the action of the teeth in blades 3, thus resulting in much smaller pieces passing through under the drag of blades 2 than would otherwise be the case. From this it will be evident that the relative fineness or coarseness of the shredded stock may be controlled within certain limits by the proper arrangement of the feeding mechanism with regard to position and speed, the relation of the bed bars 19 with regard

to the feed devices and the shredding rotor, also the relation of the shredding blades 2 and 3 both as to design and number of teeth and their relative position one to another when assembled as rotative shredding members. The design of the hood 5 over the shredding blades 2 and 3 is of extreme importance in the utility of the machine for the reasons suggested. The shredding blades 2 and 3 rotate at relatively high speed and carry bits of fiber with them and these may be liberated at any point depending on conditions. Within the hood 5 is a spray or shower pipe 6.

The tearing action of shredding the dry stock tends to loosen a considerable quantity of tiny fibers which float on the air currents as dust and are objectionable as such and also entail a loss of product. This may be overcome by means of a shower which is provided in the hood 5 over the blades, by means of the pipe 6, but in such instances where a shower is not permissible for certain reasons the design of the hood is such that all dust passes out the discharge below spout 22, which discharge may be enclosed so that none is liberated at the intake of the machine. This makes it possible to confine all dust to the discharge where it can be controlled and recovered. This is a very important feature, as it permits dry shredding without encountering the explosion and fire hazard that would be entailed by the dust.

To control the discharge of these small bits as well as the larger pieces of shredded stock the casting supporting the bed bars 19 is made with an expanding outlet 22 while the hood 5 which serves as a cover over the shredding blades 2 and 3 and the expanding outlet for the discharge at 22 is so arranged that its inside edge is in close relation to the teeth of shredding blades 3 and serves to cut off sharply the volume of air that would be carried along by the blades as they rotate.

From the point of cut-off to the shower pipe 6 is an enclosed expansion area that culminates in a restricted space available for the discharge. The shape at this point is such that the air stream is directed within the periphery of the shredding blades and towards spacing collars 4 so that there is no tendency to liberate any fibers that are in the air stream. In fact small particles released between roll 23 and hood 5 will be drawn into the air stream and discharged at the outlet provided, thus making dry shredding possible without the attendant dust.

The importance of this design is further apparent when we consider the results when a shower pipe 6 is used. The tiny streams from the pipe are directed into the controlled air stream which takes them in charge and mingles them with the multitude of shredded particles that are torn off by the shredding blades. Due to the tearing, the edges of this stock act like a blotter and the shower is at once absorbed by the stock which leaves the machine at the discharge in a much reduced state of dryness. This close mingling and rapid absorption are highly important to prevent waste when bleach or some other process agent is used as the shower to expedite the processes.

Many changes may be made in the various combinations and details of combinations set forth herein in order to suit and adapt the machine for use in various locations and we therefore reserve the liberty of modifying the construction as far as may be necessary and within the scope of the appended claims.

What we claim, is:

1. In a machine of the class described, the combination of a rotatable arbor, a plurality of larger shredding blades having teeth and mounted on said arbor in spaced relation, a plurality of smaller shredding blades having teeth and mounted on said arbor in alternate relation with the larger blades, a bed or support adjacent to the larger blades and a series of bed bars adjacent to the smaller blades, and feeding rolls for the stock adjacent to the shredding mechanism, together with a gear mechanism operatively connected with the rotary shredding devices and the feed rolls for positively driving each feed roll independently of the other, said gear mechanism including a speed reducer and automatic belt tightener, and means for adjusting the top feed roll at any desired elevation with relation to the lower feed roll.

2. In a machine of the class described, the combination of a rotatable arbor, a plurality of larger shredding blades having teeth and mounted on said arbor in spaced relation, a plurality of smaller shredding blades having teeth and mounted on said arbor in alternate relation with the larger blades, a bed or support adjacent to the larger blades and a series of bed bars adjacent to the smaller blades, and feeding rolls for the stock adjacent to the shredding mechanism, together with a gear mechanism operatively connected with the rotary shredding devices and the feed rolls for positively driving each feed roll independently of the other, said gear mechanism including a speed reducer and automatic belt tightener, and lever mechanism for controlling the speed reducing mechanism, together with means for adjusting the top feed roll at any desired elevation with relation to the lower feed roll, the same including manually-operated screw mechanism for elevating and lowering said top feed roll.

3. In a shredding machine, the combination with a shredding rotor consisting of a rotating arbor and a plurality of shredding blades having teeth and mounted in spaced relation on said arbor and inclined to the axis of said arbor, a bed or support adjacent to the blades, and bed or land bars also adjacent to said

blades, and feeding means for carrying the material to the said blades, of a hood covering the shredding mechanism and provided with a discharge, said hood being designed to eliminate air currents, and a means for supplying moisture within the hood to penetrate the shredded stock.

4. In a shredding machine, the combination with a shredding rotor consisting of a rotating arbor and a plurality of shredding blades having teeth and mounted in spaced relation by means of intervening collars on said arbor, a bed or support adjacent to the blades, and bed or land bars also adjacent to said blades, feeding means for carrying the material to the said blades, a hood covering the shredding mechanism and provided with a discharge, said hood being designed to eliminate air currents, and a shower pipe within the hood for spraying the disintegrated stock.

5. The combination with mechanism for disintegrating paper stock, of means for actuating the same, including a pair of feed rolls, mounted in cooperative relation to the disintegrating mechanism, and gear mechanism for positively driving the feed rolls independently of each other, but at the same correlative speed proportional to the speed of the disintegrating mechanism, said gear mechanism including a lever-controlled gear speed reducer.

6. The combination with mechanism for disintegrating paper stock, of means for actuating the same, a pair of feed rolls, mounted in cooperative position relatively to the disintegrating mechanism, gear mechanism for positively driving the feed rolls independently of each other but at the same correlative speed proportional to the speed of the disintegrating mechanism, said gear mechanism including a lever-controlled gear speed reducer, and manually-controlled means for raising and lowering the top feed roll, together with a third feed roll that cooperates with the top feed roll to change the direction of the material that is being fed forward so that it may enter the disintegrating mechanism at a proper angle for thorough shredding.

7. In a material shredding machine, a rotatable arbor, a plurality of parallel circular shredders mounted in spaced relation on said arbor and at an angle to the axis of the arbor, a bed or support adjacent to said shredders, conveying means for feeding the material to be operated upon, said means including an upper adjustable blade-provided roll, and means cooperating with said upper feed roll for moving it to compress the material as it is fed upon the support consisting of a manual device and a screw and lever mechanism actuated thereby.

8. A shredding machine, comprising a frame, a series of rotary shredding devices mounted in the frame in position to co-act, means for rotating the rotary shredding devices, feed rolls mounted in the frame adjacent to the shredding devices, the upper feed roll having a series of staggered blades, and gearing operatively connected with the rotary shredding devices and with the feed rolls for positively driving each feed roll independently of the other but at the same correlative speed and proportionate to the speed of rotation of the disintegrating shredding devices, said gearing including a speed reduction gear together with means for adjusting the elevation of the top feed roll.

9. A shredding machine comprising a frame, a series of rotary shredding blades mounted in the frame in position to co-act, some of the blades being of greater diameter and some of smaller diameter, a stationary support arranged in relation to the blades of greater diameter, and stationary bars arranged in relation to the blades of smaller diameter, means for rotating the aforesaid rotary shredding blades, feed rolls mounted in the frame adjacent to the shredding blades, transmission gears operatively connected with the means for rotating the rotary shredding blades and also with the feed rolls for positively guiding each feed roll independently of the other at a speed proportionate to the speed of the rotary shredding blades, means for reducing and changing the speed of the transmission gearing, and means for adjusting the height of the top feed roll in relation to the lower feed roll.

10. A shredding machine comprising a frame, an arbor, a series of circular toothed blades mounted on the arbor at an angle deviating from a right angle to the axis of the arbor and spaced apart by correspondingly shaped washers, the blades and washers being secured together and to the arbor to constitute a compact cylindrical shredding implement, feed rolls mounted in fixed bearings on the frame and a third feed roll mounted as an idler in the frame, together with means for moving the top roll in and out of cooperative position with the other lower roll, a transmission gearing operatively connected with the rotary shredding blades and also with each of the feed rolls for positively driving each driven feed roll independently of the other and at a speed proportionate to the speed of the rotating circular shredding blades.

11. The combination with mechanism for disintegrating paper stock, consisting essentially of a series of circular blades of a certain diameter and an alternate series of circular blades of a smaller diameter, all of said blades being mounted in a parallel inclined position, with means for actuating the disintegrating mechanism, and a pair of feed rolls rotatively mounted in cooperative position relatively to the disintegrating mechanism, a transmission gearing for positively

driving each of the feed rolls independently of the other but at the same correlative speed to the speed of the disintegrating mechanism, said gearing including speed reduction means and a hand lever for controlling the same, an idler roll contiguous to the pair of feed rolls, and stationary cooperating tearing members arranged for conjoint action with the disintegrating mechanism.

12. The combination with mechanism for disintegrating dry paper stock and with means for actuating the same, of a pair of feed rolls rotatably mounted in cooperative position with the disintegrating mechanism, a transmission gearing connected with the means actuating the disintegrating mechanism, and with the feed rolls, for positively driving each feed roll independently of the other, a lever-controlled speed reduction means forming a part of the transmission gearing, means for regulating the elevating of the top feed roll, a third idler feed roll, and a hood surrounding the shredding mechanism and having a discharge mouth.

13. In a shredding machine, the combination with a bidiametered shredding rotor for disintegrating the paper stock, and means for actuating the same, of a feed roll rotatively mounted adjacent to the shredding mechanism, and a top feed roll mounted in bearings affixed to movable supports above the other feed roll, said top roll having a series of staggered blades, means for moving the supports, a transmission connected with the means which actuate the shredding mechanism and with the feed rolls for positively driving each feed roll independently of the other at a speed correlative to the speed of the disintegrating mechanism.

In testimony whereof we hereunto affix our signatures.

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