March 4, 1958 W. O. FORMAN 2,825,373

MACHINE FOR MAKING CHIPS FOR PAPER PULP

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FIG. 1

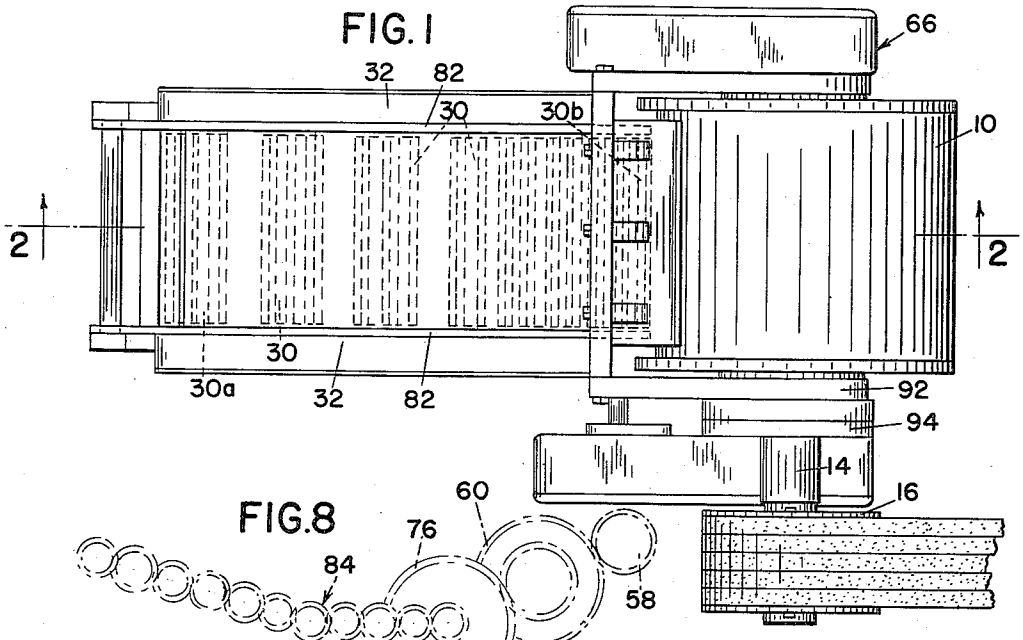


FIG. 8

FIG. 2

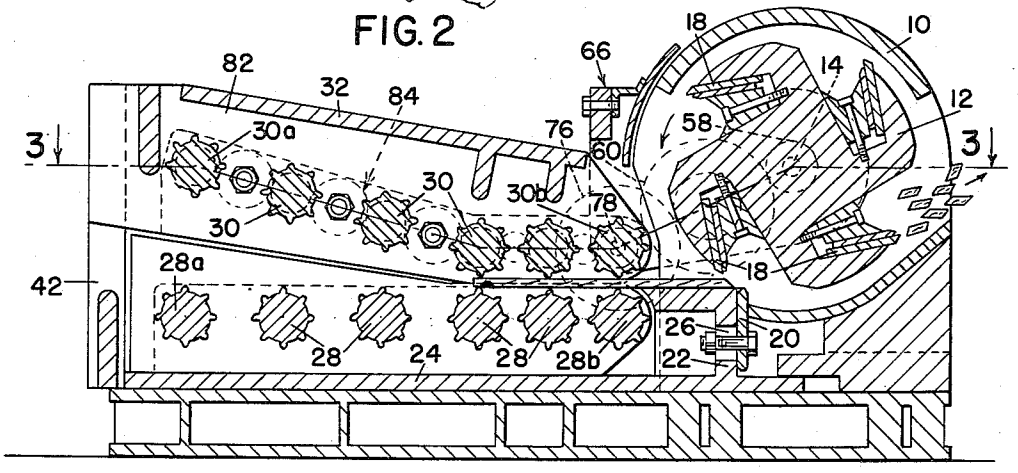
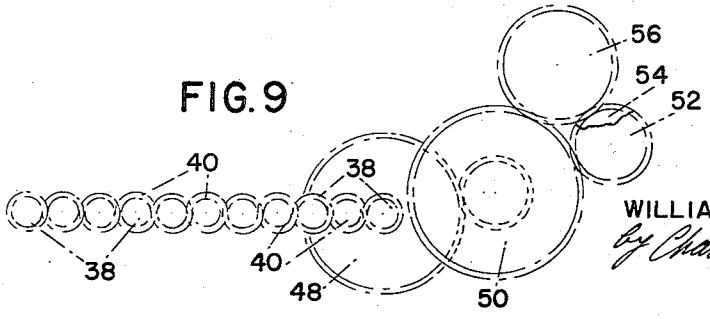


FIG. 9



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FIG.3

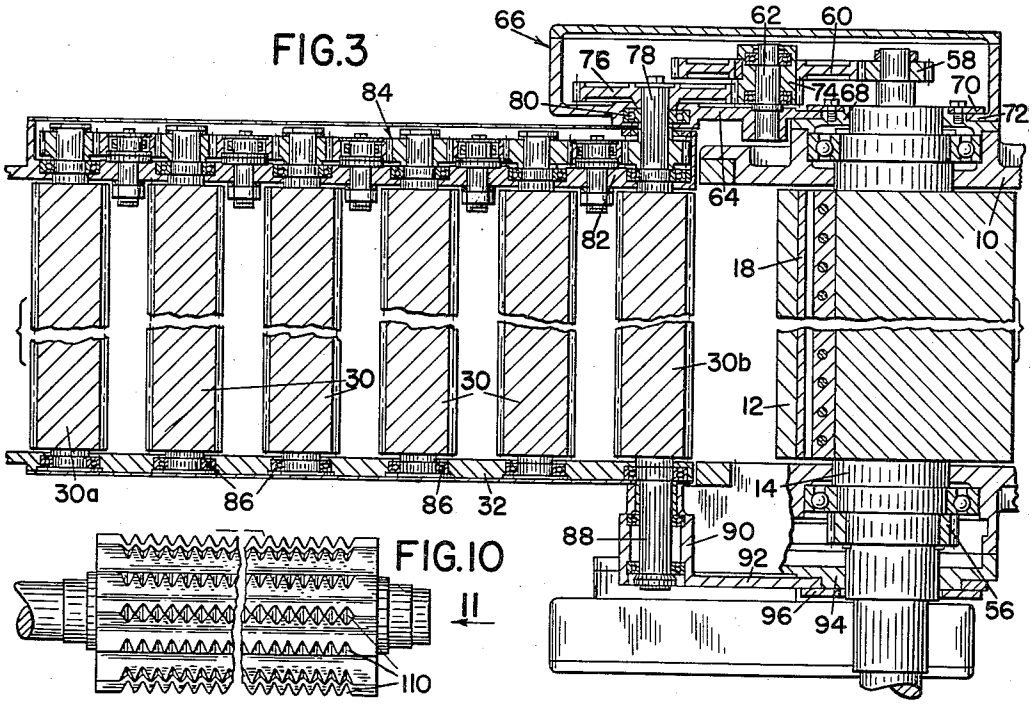


FIG.10

FIG.4

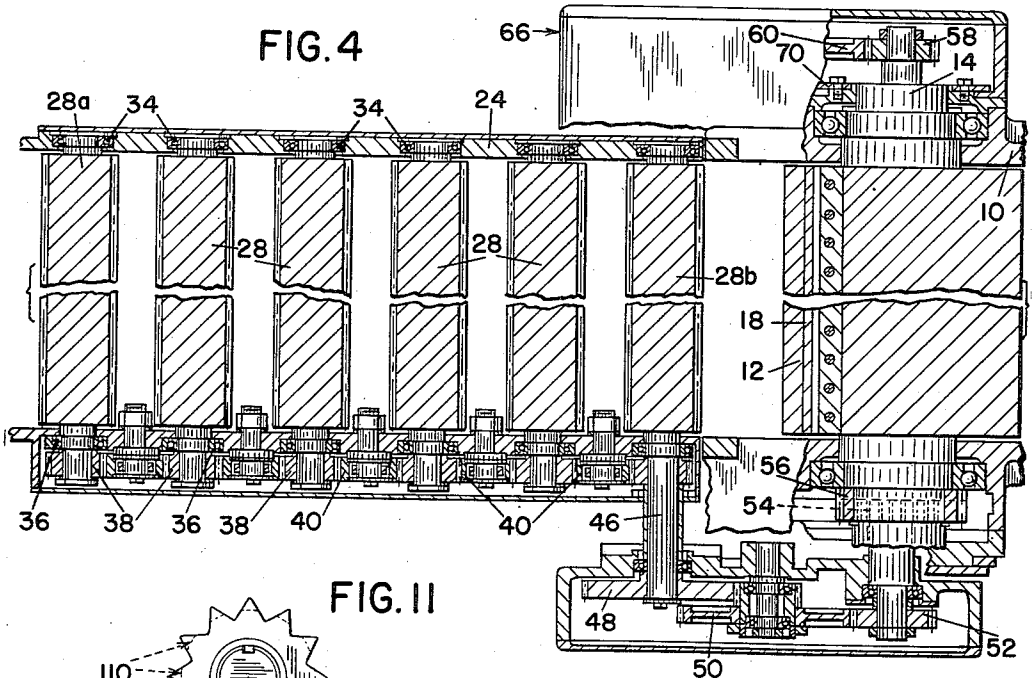
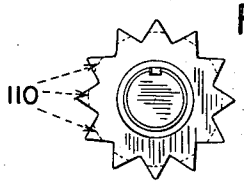


FIG.11



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FIG. 5

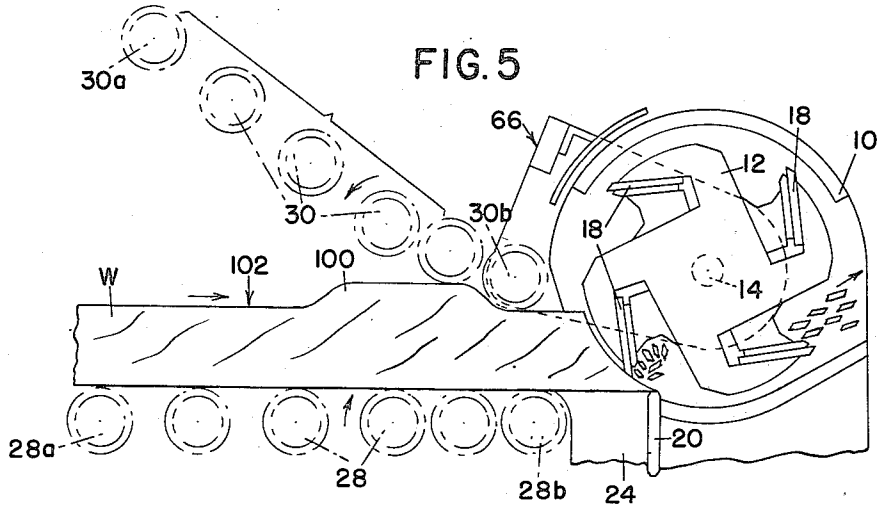


FIG. 7

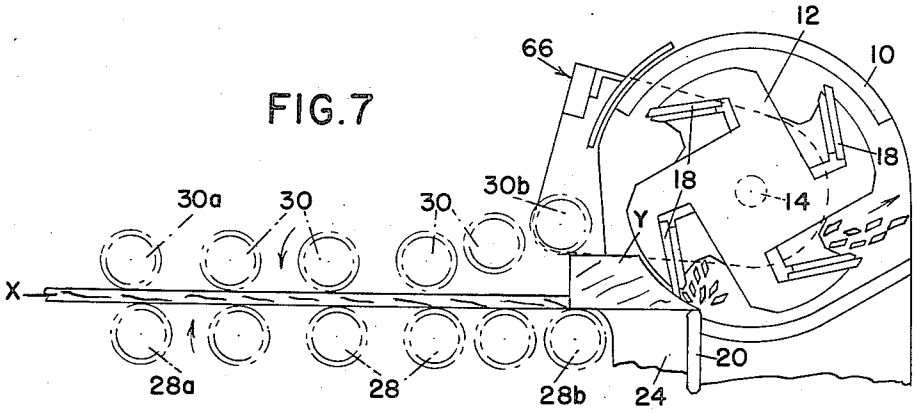
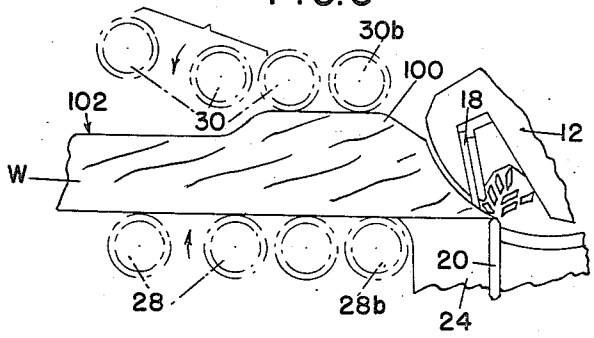


FIG. 6



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United States Patent Office

2,825,373

Patented Mar. 4, 1958

2,825,373

MACHINE FOR MAKING CHIPS FOR PAPER PULP

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Application December 1, 1955, Serial No. 550,400

5 Claims. (Cl. 144—172)

This invention relates to new and improved machines for chipping wood into uniform fiber length pieces suitable for pulp making for the paper industry. One of the principal objects of the invention is to utilize waste pieces of wood for this purpose. Many tons of tree-tops, mill edgings and slabs, ends of flooring, split and wooden products of any nature, faulty sheets of veneer, and other waste are burned or otherwise uselessly disposed of daily, and in fact disposition of such waste forms a problem of its own; yet, it is well recognized that the forests are being depleted at a rate to cause great concern in the industry. Much of the pulp wood for the paper industry is imported at great expense, and each year the available forest for production of pulp diminishes and becomes more distant and harder to cut and transport.

Therefore, it would be clearly advantageous to make use of the great waste tonnage for pulp if this could be done, but heretofore it has not been possible to so process tops and odd sizes and shapes of waste as to produce uniform fiber length chips capable of producing satisfactory pulp.

Machines have been made for making chips of waste but in the past the chips produced have been so variable in fiber length as to be useless for paper pulp. Shavings, excelsior, sawdust, cattle bedding, mulching, etc. have all been successfully produced, but these products do not have the economic value of paper pulp and are comparatively easy to produce since exact fiber length is not a consideration.

Also, the preparation of uniform pulp chips from reasonably uniform pulp logs is relatively uncomplicated and easy to accomplish, but the present problem is very different and much more difficult to solve. This invention presents the first solution to the problem, and together with the incorporation of means to separate the bark from the chips, as disclosed in copending application Serial No. 508,228, filed May 13, 1955, forms a complete unit to provide additional and cheaper supplies of wood chips for the paper pulp industry.

Another object of the invention is to provide a machine that will accomplish the results desired in a simple and effective manner without complicated and costly fine feed, knife, and hopper adjustments, and in which the capital investment for the pulp maker is relatively small, so that those in the wood product industries in general will be encouraged to enter the pulp field and thus help themselves economically while helping to preserve the pulp forests.

A further object of the invention resides in the provision of a machine of the class described including a positive feed that will grip any size or shape of waste product and feed the same evenly and at a desired predetermined uniform, controlled rate to a high speed cylindrical rotary cutter, so that all chips cut will be the same in length, short end will be generally uniformly cut with little variation even though not gripped by the feed device at the last inch or two of travel, and all

of the available cutter area is productive in capacity and self-feeds the said short ends; and the provision of a gear-driven fluted roll feed of a nature to grip all small or large waste wood pieces therebetween and travel the same to the cutter at a uniform rate, producing uniform length chips, the lengths of the chips cut being a function of the rate of feed relative to the speed of the cutter.

Other objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings, in which

Fig. 1 is a top plan view of a machine according to the invention;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1;

Fig. 3 is a section on line 3—3 of Fig. 2;

Fig. 4 is a view similar to Fig. 3 but taken through the lower feed rolls;

Figs. 5, 6 and 7 are diagrammatic views illustrating the manner of feed of thick, thin, and irregular pieces;

Figs. 8 and 9 are diagrammatic views showing the methods of driving the work feed rolls;

Fig. 10 is a front view of a modified roll; and

Fig. 11 is an end view thereof, looking in the direction of arrow **11** in Fig. 10.

In carrying out the present invention, one form thereof has been illustrated, but it is to be recognized that the invention may assume other forms and constructions while still coming within the spirit thereof.

To this end, there is provided a generally cylindrical casing indicated at **10** which houses a rotary cylindrical cutter **12** adapted to be mounted upon or integral with a shaft **14** journaled in suitable bearings, etc. mounted in the end walls of housing **10**. The cutter is adapted to be driven, preferably at a high speed, by any means, that here shown being a pulley **16** which directly drives shaft **14**.

The cutter-head **12** is provided with a series of cutting knives indicated at **18**, these knives extending longitudinally of the cutter-head at the surface thereof and cooperating in their cutting action with an adjustable bed knife **20** which is mounted on a web **22** of a frame or support **24**. This support in turn may be mounted as desired on the frame-work of the machine or on the floor. The bed-knife is adjustable vertically by means of a bolt-and-slot connection **26** and the cutter head in coaction with the bed-knife may be said to be substantially on the order of the relationship of these same parts in my patent application above identified.

It is to be appreciated that other types of cutter heads might be used in carrying out the invention, and the principal part of the present invention resides in the construction and method of the feeding means for the waste pieces so as to control the speed of feed to the cutting knives where the uniform chips are positively produced.

The frame or support **24** which is of any construction desired but is preferably strong and heavy, provides support for a series of heavy fluted rolls indicated at **28**. These rolls are all positively driven at a predetermined, controlled rate of speed, and are mounted on fixed parallel axes in the frame, forming a feed table for feeding workpieces to the cutter in conjunction with the like fluted upper rolls **30** mounted in a bodily movable frame **32**.

The frame **32** is preferably heavy and rugged and assists the rolls **30** to positively grip and feed workpieces, regardless of shape or size, to the cutter, in combination with the lower feed rolls **28**. All of the feed rolls are preferably made of heavy material and are provided with the flutes as shown for the purpose described, i. e., to feed the work at a controlled rate.

The fixed rolls **28** are journaled in bearings **34** located

in the framework 24 as shown in Fig. 4, and at the opposite ends thereof, they are likewise journaled in bearings at 36 and each is provided with a gear 38 driven by intermediate gears 40. Gears 40 of course provide for rotation of rolls 28 in a uniform direction.

As shown, there are six of these rolls, but this number may be varied as desired or required and the first three rolls at the intake side of the machine 42 are more widely spaced than the three rolls adjacent the cutter head, as is apparent in Fig. 2.

The same is true as to the six rolls in the movable frame 32, and it is to be noted that the three more widely spaced rolls 30 are located on an incline, so that the initial rolls 28*a* and 30*a* are widely spaced in a vertical plane but the last three pairs of driving rolls are closely spaced. This is for a reason that will appear hereinafter.

The last roll of the fixed roll series is indicated in Fig. 4 at 28*b*, and this roll is provided with an elongated shaft 46 having a gear 48 at the end thereof in mesh with a reduction gear 50 in turn driven by gear 52, the latter being fixed to a jack shaft upon which is mounted a larger gear 54 in mesh with a gear 56, gear 56 being mounted on shaft 14 upon which the cutter head is mounted or is made integral therewith. Since shaft 14 is driven by the prime mover through pulley 16, it will be seen that this same power is used to drive the first rolls 28 which rotate in a clockwise direction in Fig. 2, and the relation between the speed of feed and the speed of rotation of the cutters is easily predetermined.

At the opposite end of shaft 14, the same is provided with a gear 58 in mesh with a gear 60 on a shaft 62. Shaft 62 is journaled in a plate or web 64 (see Fig. 3) which forms a part of a housing generally indicated at 66. This housing is provided with an opening at the inner side thereof that receives a fixed plate 68 and is rotatably held thereto by means of an annular ring 70 which overlies an inwardly directed annular flange 72 on the housing. Thus housing 66 is oscillatable about the axis of shaft 14, i. e. the cutter shaft, and at the same time shaft 62 moves with housing 66 and carries with it the driven gear 60.

Gear 60 is keyed to and rotates a hub 74 which drives another gear 76. Gear 76 drives shaft 78 which is journaled at 80 in the inner wall of the housing 66 and also in a plate or frame member 82 which forms a portion of framework 32. Shaft 78 drives the final roll 30*b* and also a gear train generally indicated at 84 which provides for driving of all of the rolls 30. These rolls as seen in Fig. 3 are journaled at their opposite ends in bearings 86 in the opposite side of the framework 32.

The shaft 78 in effect continues axially through the final roll 30*b* and terminates in an extension 88, this being journaled in a barrel or the like 90 formed on a plate or web 92 which is oscillatably mounted about shaft 14 as a center, on a plate 94 surrounding shaft 14 and held in position by an annular ring 96 similarly to the function of the annular ring 70.

The effect of the above described construction is that the frame 32 floats or is floatingly mounted and pivots about the axis of final roll 30*b*, i. e. about the axis of the shaft 78. The housing 66 is oscillatable as described about the axis of shaft 14, and thus either end of the frame 32 may be lifted while the other end of the frame stays in position. Frame 32 may rock in a fore-and-aft direction and also it may rise vertically, or it may assume any position between a bodily raised position and an inclined position in either the fore or aft direction.

The cutter head is preferably made according to my patent application above identified, and as the pieces are fed into it by the rolls, pulp chips as indicated in Fig. 2 and in the diagrams Figs. 5, 6 and 7, are formed at very high speed and are thrown out of the machine.

Referring now to Fig. 5, a workpiece W which has an irregularity or hump 100 in it has entered the machine and is being acted upon by the cutter as seen in this figure. The housing is now tilted up to a fairly extreme degree because of the reaction of the final roll 30*b*. This is clearly provided for because housing 66 as well as frame 32 may move in a clockwise direction in Fig. 5 if forced to do so by the work while feeding the same at a fixed predetermined rate of speed to the cutter head.

Referring now to Fig. 6, it will be seen that the irregularity 100 has moved forwardly to an extent where the final roll 30*b* is a maximum height and the penultimate roll 30 now rests on the irregularity 100, allowing the frame 32 to start to tilt down. The housing 66 is at an even higher point than before, being caused to move upwardly by reason of the said irregularity 100 acting on the final roll 30*b*.

When the irregularity 100 has passed through the cutter head or substantially so, the rolls 30 will then of course descend under influence of gravity and rest on the more uniform portion of the workpiece at 102. In the event that the ultimate roll 30*b* is raised as in Fig. 7 by the large workpiece as shown there, and the ensuing workpiece X is relatively narrowed or thin like a piece of veneer, the initial roll 30*a* will descend upon the workpiece and feed the same forwardly at the predetermined rate of speed of the workpiece which is indicated at Y, even though workpiece Y is so much greater in thickness or possibly has a hump in it such as at 100.

It will be seen from the above that regardless of the nature of the workpiece, whether it is a mill edging, a piece of veneer, or an irregularly shaped log or treetop with knots, etc., the fluted rolls will cause the same to be fed to the cutter head at a precisely uniform and predetermined rate of speed, and this fact ensures that all pieces of work passing through the machine will be chipped to exactly the same length, which is a requisite in the production of satisfactory pulp chips.

The speed of the feed is easily and quickly changed by the use of any commercial speed changer or merely by substituting pairs of gearing as driven from shaft 14. Since the cutter shaft drives the feed rolls, the speed of feed is always constantly related to the speed of the cutter blades, and therefore the length of the pulp chips is easily predetermined and varied when necessary to an exact desired length.

It is pointed out that not only mill waste but also treetops from a thickness of 4" to about 1½" may be utilized for pulp chips, it being recognized that tops of trees 4" or less in diameter are ordinarily left on the ground during lumbering operations and are wasted, so that in addition to mill wastes, wasted forest products are also usable in providing for satisfactory paper pulp chips as contemplated in this invention.

The gearing and power drive of the present construction is essentially simple, rugged and fool-proof, deriving from each side of the cutter head as above described. The action of the floating frame 32 is adequate for all purposes and is made uniform from side-to-side, by the double construction of the oscillatable housing 66 and the web 92, and thus any tendency towards twisting of this frame by lop-sided or uneven workpieces is avoided while still maintaining the primary consideration of exact uniformity of rate of speed of the workpieces, regardless of shape or size.

In the event of possible side slip of the work when the same is very smooth material such as veneer log cores, the rolls may be notched as at 110 to preserve the exact feed-speed relationship described.

The entire machine can be arranged at any desired degree of inclination with respect to the horizontal, but in any event the speed of feed of the workpieces will still be the same with reference to the speed of the cutter head, the work being firmly and positively held by the heavy fluted rolls cannot bounce nor be thrown about while

being fed to the cutter head, nor can the work become canted, thus obviating difficulties of prior art machines which gave non-uniform chip fiber lengths in cases where the work was not adequately and positively held.

It is also to be observed that the work is engaged by a cutter before the feed causes the work to engage the cutter head. The cutter may be set forwardly or outwardly in order to accomplish this purpose if necessary but this does not affect the fiber length of the chips, which depends on the rate of feed of the work and the speed of the cutter head. Also it is believed it will be clear that if the weight of the upper frame and rollers should not be sufficient as processing over large workpieces, to hold the work as stated, the upper roll frame may be spring-loaded or weighted in order to accomplish the desired result.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:

1. A pulp wood chipping machine comprising a cylindrical cutter head, blades on the cutter head, a feed table leading to the cutter head, a set of fluted rolls on the feed table, means to drive the rolls, a frame resting on the feed table, said frame being movable toward and away from the feed table, a set of fluted rolls on the frame for cooperation with the rolls on the feed table, and means to drive the rolls on the frame to positively engage the work and feed the same at a uniform predetermined rate to the cutter head, said driving means including a second movable frame and a gear train therein, said gear train including a final gear connected to drive the rolls in the first frame, the latter being pivotable about the axis of said final gear.

2. A pulp wood chipping machine comprising a cylindrical cutter head, blades on the cutter head, a feed table leading to the cutter head, a set of fluted rolls on the feed table, means to drive the rolls, a frame resting on the feed table, said frame being movable toward and away from the feed table, a set of fluted rolls on the frame for cooperation with the rolls on the feed table, and means to drive the rolls on the frame to positively engage the work and feed the same at a uniform predetermined rate to the cutter head, said driving means including a second movable frame and a gear train therein, said gear train including a final gear connected to drive the rolls in the first frame, the latter being pivotable about the axis of said final gear, and a first gear in the gear train, said second frame being pivotable about the axis thereof.

3. A chipping machine to produce paper pulp chips from waste pieces of wood comprising a cylindrical cutter head, a cooperating bed-knife, a feed table in fixed position in line with the bed-knife, a floating feed means above the feed table, means mounting the feed means for motion to and away from the feed table and for tilting in a fore-and-aft direction, said floating feed means being relatively heavy and normally resting in substantial contact with the feed table, said feed means comprising a set of fluted rolls and means to drive the rolls including a swingable gear train.

4. A pulp chipping machine comprising a cylindrical cutter head, a cutter blade thereon, means to rotate the cutter head, a work feed for the cutter head, means to drive the work feed, said work feed driving means being operatively connected to the cutter head for actuation thereby, said work feed including a pair of roll series, one superposed on the other, separate means driving each roll series from the cutter head, one roll series being driven at one end of the cutter head shaft and the other roll series being driven from the other end of the cutter head shaft.

5. A chipping machine to produce paper pulp chips from waste pieces of wood comprising a cylindrical cutter head, a cooperating bed-knife, a feed table in fixed position in line with the bed-knife, a floating feed means above the feed table, means mounting the feed means for motion to and away from the feed table and for tilting in a fore-and-aft direction, said floating feed means being relatively heavy and normally resting in substantial contact with the feed table, said feed means comprising a series of driven rolls and means to drive the rolls from the cutter head, the last-named means comprising a shaft floating with the feed means and means to drive the shaft.

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