March 4, 1958 W. O. FORMAN 2,825,371

APPARATUS FOR PRODUCING AND DEBARKING WOOD CHIPS

Filed May 13, 1955

FIG. 1

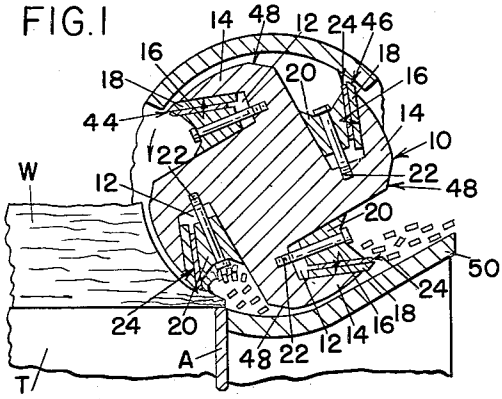


FIG. 2

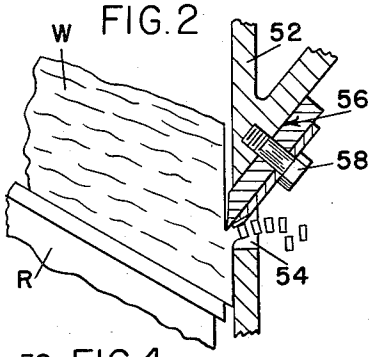


FIG. 3

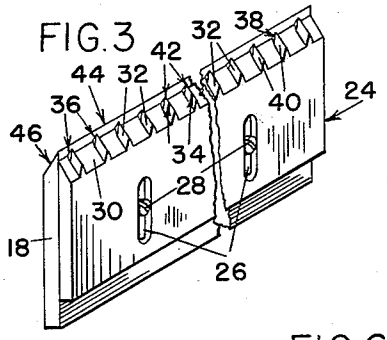


FIG. 4

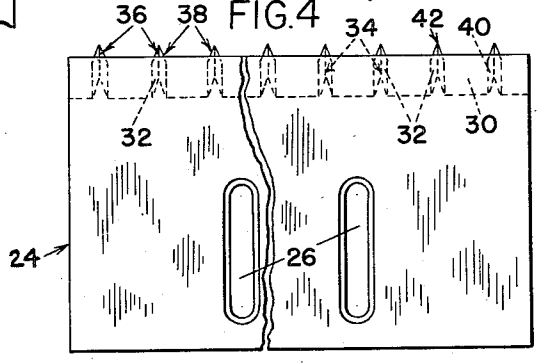


FIG. 6

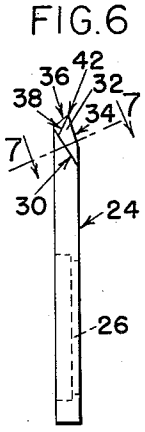


FIG. 7

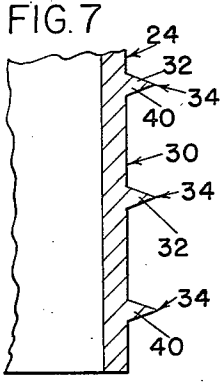


FIG. 5

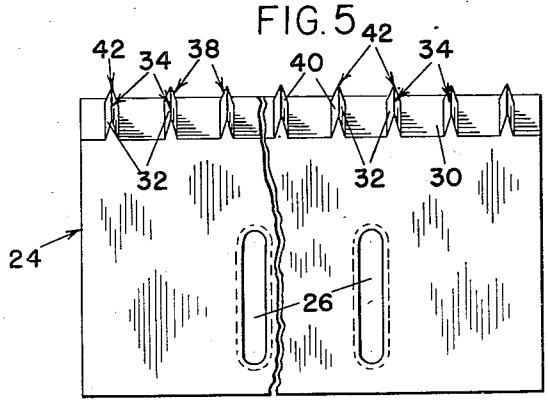
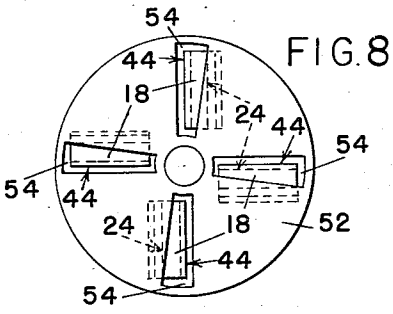


FIG. 8



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APPARATUS FOR PRODUCING AND DEBARKING WOOD CHIPS

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8 Claims. (Cl. 144—41)

In lumber operations generally there is always a large amount of waste, it being estimated that about 40% of all trees cut as timber is waste material insofar as the lumber, paper pulp, and other forest products resulting are concerned. This is one of the factors that leads to depletion of forest reserves and consequent need, well recognized in the art, of reforestation, tree farming, etc.

For instance, the slabs and edgings produced in a saw mill are ordinarily completely wasted, and it is usually necessary to convey the same to some point where they may be destroyed by burning without any benefit derived therefrom. This is particularly true in warmer climates where heat is not needed for any purpose, and in many northern mills it is not economical to obtain heat from waste. Saw mills are ordinarily run by electricity generated at a remote point or by gasoline power in the case of small portable mills, although steam power is of course still used in some instances.

In the production of paper pulp, trees are cut down and are topped at approximately five inches in diameter and these tops are completely wasted, as it is not economical to handle the same under prior art practices for the production of paper pulp. This type of waste forms fire hazards if not reduced to chips, or otherwise disposed of. In addition, in making most kinds of paper, it is necessary to remove the bark from the logs before they are converted into chips for making the pulp, and this requires the use of expensive machinery and extensive handling of the logs, so that a great deal of labor is involved in the physical action of handling the logs and removing the bark prior to passing the logs through the machines for comminuting the same. Also it is usually a requirement in making pulp for most kinds of papers that the wood chips going to make up the pulp be of uniform fiber length and correct desired size, having reference to the kind of wood and the type of paper to be made.

In general, it is the basic object of the present invention to provide bark-free wood chips of accurate size and fiber length, particularly for making paper pulp, wherein not only the usual pulp logs may be quickly, easily and accurately processed without prior de-barking, but also wherein all kinds of mill waste may be utilized and the tops of the trees formerly wasted may be utilized at least down to approximately an inch tip; also at the same time the invention provides improved chips, i. e., completely de-barked and of correct size, with much less labor and expensive machinery being required to carry out the process.

Further objects of the invention include the provision of a pulp chipping machine and a method for producing debarked chips for the pulp industry including a cutter head, a cutting knife thereon, and a chip breaker associated with said knife and having such a construction and such a position relative to the cutting edge of the knife blade that all bark is completely separated from the chips being produced simply by reason of the action of

the chip breaker which not only breaks the cut wooden piece into chips of substantially exact size as desired, but also due to the same action separates the bark therefrom; this action being achieved through abruptly changing the direction of the slice of wood being cut and at the same time supplying a blow thereto, the blow being delivered by the chip breaker itself, which engages the slice of wood being cut immediately after the cut, and pushing the slice away from the main workpiece quickly and abruptly, breaks the same into the required chips and knocks the bark therefrom at the same time. This invention provides that all kinds of wood, mill waste, etc. are quickly processed at high speed and the chips and the separated bark are discharged from the machine into any kind of container desired, whereafter automatic means may be provided for dividing the bark pieces from the debarked chips, as for instance by centrifugal action, air-blast devices, etc., so that one man only may produce pulp chips in condition ready for the pulp mill to a degree formerly requiring the labor of at least nine men, who are necessary to operate the de-barking mill of the prior art as well as the machine for comminuting the de-barked logs, etc., with the additional benefit that pulp chips may be made from materials heretofore wasted and thus acting in a very considerable degree to aid in preservation of existing forest reserves.

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 sectional view through a cutter head illustrating the construction and operation of the present invention;

Fig. 2 is a similar view showing a modified type of cutter head;

Fig. 3 is a perspective view of a combined cutting blade and chip breaker;

Fig. 4 is a plan view of the chip breaker;

Fig. 5 is a view from the opposite side thereof;

Fig. 6 is an edge view thereof;

Fig. 7 is an enlarged section on line 7—7 of Fig. 6; and

Fig. 8 is a view in front elevation of a disc-type of cutter to which the present invention may be applied.

Referring now to Fig. 1, there is shown herein a cutter head generally indicated by the reference character **10**. As illustrated, this cutter head is cylindrical in nature and rotates in the direction of the arcuate arrow, i. e. in a counter-clockwise direction. This cutter head may be constructed more or less in accordance with the disclosure of Patent No. 2,634,062 dated April 7, 1953, and is provided with a series of gullets **12** which extend longitudinally of the cutter head and open out at the periphery thereof forming arms **14** each having an inner face **16** against which the flat longitudinal cutting blade generally indicated at **18** is applied. Each gullet is wedge-shaped and wedges **20** may be secured therein by any desired means such as the bolts **22**, to hold and position and the cutter blade.

Wedges **20** have bolted thereto at corresponding sides thereof in adjusted relation, a chip breaker which is generally indicated at **24** and is more particularly illustrated in Figs. 3 to 7 inclusive. When it is desired to grind the cutters **18**, the wedges are loosened with the chip breakers **24**, and when the cutters are replaced, the original setting of the chip breaker with relation thereto is thus easily obtained, and it has been found that although the cutters **18** are dulled with use and have to be reground, the chip breakers do not ordinarily become dull and do not need regrinding.

Referring now more particularly to Figs. 3 to 7 inclusive, the chip breakers **24** are each seen to comprise

a relatively flat blade or plate provided with slots **26** whereby they are adjustably securable to the wedges as above stated by headed bolts **28** or the like. Each chip breaker blade or plate is provided with a beveled edge **30** and this is formed with a series of relatively small equally spaced chip breaking teeth, each of which is generally indicated at **32**.

Each tooth is provided with a top sharp edge **34**, and the forward edge of each tooth indicated at **36** is also sharpened by beveling the leading edge of the respective teeth as indicated at **38**. The sharpened edges **34** are formed by the bevels **40**.

It will be seen that sharpened edges **34** and **36** join forming a point **42** for each tooth, and as seen in Fig. 1, this point is spaced from the sharp cutting edge **44** of the cutting blade **18** to the rear thereof and at the side thereof which is away from the main body of the work-piece being processed as indicated at W. The sharp edge **34** is at a considerable angle to the bevel **46** which forms cutting edge **44** and a sharp edge **36** is at a lesser angle with respect thereto, these angular relationships being substantially reversed with respect to the flat side of the cutting blade.

The cutting blades and the chip breakers are adapted to be set so as to leave pockets at the periphery of the cutter and these pockets merge with beveled off portions **48** which are in a leading position with respect to the pockets as the cutter rotates.

There may be a work supporting table or the like T and a bed knife A having an upper end which is adapted to be set with relation to the cutting edge **44** so as to provide for a slicing or shearing action of the latter with respect to the piece being processed, and of course the entire cutter may be conveniently housed as desired. An exit passage is formed to the rear of the cutter by the member **50** and the chips are cut and delivered at a high rate of speed as has been diagrammatically indicated in Fig. 1, these chips being of correct fiber length and mixed with pieces of bark, but in all cases the pieces of bark are completely separated from the wooden chips.

The grain of the wood is indicated in Fig. 1 and this is the manner in which the usual pulp log will be presented to the cutter as well as the edgings, slabs, and the small poles derived from the tops of the logs as above described. As the individual cutters **18** come into contact with the work W, they tend to slice off a relatively thin section of the work, and this section is clearly illustrated as coming in contact immediately after being severed from the work W, with the point **42**, the sharp edge **36**, and the sharp edge **34** of the chip breaker, this action being substantially simultaneous.

The chip breaker being on the "off" side of the cutter blade as respects the work W, the latter is not only sliced, but the slice is given a blow, and at the same time the direction of flow of the cut off slice is abruptly and considerably changed i. e., the slice is sharply bent over to the right in Fig. 1. This action is caused by the chip breaker thrusting the cut off slice away from the work, and this causes the slice of wood cut by the cutter blade **18** to crumble or split off along the grain thereof into chips or strips of equal thickness depending upon the kind of wood and the settings of the blades. However, it has been found that these chips are uniform in thickness and the fiber length is held to a maximum degree of exactness by reason of the adjusted relationship of cutter **18** in the cutter head, and the bed knife A.

Not only are the chips produced by the splitting or breaking thereof along the grain of the wood, but the sharp edges of the chip breakers **32** also initiate a splitting action at right angles to the first split, and the blows mentioned above are sufficient to continue the splitting action so that the strips or chips are divided each according to the spacing of the teeth **32**. Hence the chips are of substantially exact size and fiber length and at the same time all pieces of bark are completely knocked off from any chip to which it might be originally and naturally connected.

After the chips have been thus produced, it is merely necessary to divide the bark pieces from the chips and this is conveniently done by centrifugal means in automatic machinery not forming a part of the present invention, but without the attention of any operator.

It has been found that it takes nine men to handle, de-bark, and chip off pulp logs in comparison to the amount of chips produced by a single machine of the present invention which requires but a single man to feed the material thereto as above described.

Alhough the invention has been shown above as applied to a cylindrical cutter, it may also be applied to a disc-type of cutter as illustrated in U. S. Patent No. 2,130,457 dated September 20, 1938, and this construction has been shown in Figs. 2 and 8, wherein the work support is illustrated at R and the disc is indicated by the reference numeral **52**. This disc is provided with slots **54** and a series of inclined knife-receiving edges **56**. The cutting knife **18** and the chip breaker **24** are substantially the same as above described and the action of these is the same also. However, it is more convenient in this particular construction to bolt the two blades in relatively adjusted position to the cutter head through surface **56** as illustrated by the bolt **58**, since this type of cutter does not utilize the wedges **20**.

It will be seen that this invention provides a method and apparatus for producing de-barked chips for the wood pulp industry and providing for the utilizing of waste pieces, the saving in wood amounting to thousands of acres of timber a year, so great is present-day paper production. Not only is wood saved and better pulp chips produced, but also the labor involved is reduced to a minimum as well as the necessity for costly capital equipment insofar as de-barking machines are concerned.

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. Apparatus for making bark-free wood chips comprising a cutter head, an edged cutting blade thereon, a chip breaker, means holding the chip-breaker to the blade, said chip-breaker comprising a blade having a series of spaced teeth thereon, said teeth extending away from the cutting blade in inclined relation thereto and terminating in points spaced from the cutting blade.

2. Apparatus for making bark-free wood chips comprising a cutter head, an edged cutting blade thereon, a chip breaker, means holding the chip breaker to the blade, said chip breaker comprising a blade having a series of spaced teeth thereon, said teeth extending away from the cutting blade in inclined relation thereto, and being located inwardly of the edge of the cutter blade to engage the work substantially to the cutting action of the cutting blade, said teeth each having a sharp edge normal to the edge of the cutting blade and a contiguous edge inclined relative to the edges of both the cutting blade and the said sharp edge.

3. Apparatus for making bark-free wood chips comprising a cutter head, an edged cutting blade thereon, a chip breaker, means holding the chip breaker to the blade, said chip breaker comprising a blade having a series of spaced teeth thereon, said teeth extending away from the cutting blade in inclined relation thereto, and being located inwardly of the edge of the cutter blade to engage the work substantially to the cutting action of the cutting blade, said teeth each having a sharp edge normal to the edge of the cutting blade, and a second sharp edge inclined with relation to the first sharp edge, said sharp edges forming a point spaced from the cutting blade.

4. A cutter head for making bark-free wood chips comprising a body, a recess therein, a wood-cutting blade secured in the recess in position to expose the cutting edge thereof, and a chip breaker on the body and held against

the cutting blade, said chip breaker being at the side of the blade facing away from the main part of the work to be chipped, said chip breaker comprising a plate having an edge and a series of spaced teeth on the chip breaker blade, said teeth facing away from the cutting blade, said chip breaker blade teeth each having an edge portion located at an incline with respect to the cutting blade and another edge on an incline with respect to the cutting blade and the first-named tooth edge.

5. A cutter head for making bark-free wood chips comprising a body, a recess therein, a wood-cutting blade secured in the recess in position to expose the cutting edge thereof, and a chip breaker on the body and held against the cutting blade, said chip breaker being at the side of the blade facing away from the main part of the work to be chipped, said chip breaker comprising a plate having an edge located inwardly of the edge of the cutting blade and a series of spaced teeth on the chip breaker blade, said teeth facing away from the cutting blade and being located inwardly of the edge of the latter, said chip breaker blade teeth each having an edge portion located at an incline with respect to the cutting blade, each tooth having a sharpened edge at an angle relative to the first edge portion, said tooth edges joining to form a point.

6. A cutter head for making bark-free wood chips comprising a body, a recess therein, a wood-cutting blade secured in the recess in position to expose the cutting edge thereof, and a chip breaker on the body and held against the cutting blade, said chip breaker being at the side of the blade facing away from the main part of the work to be chipped, said chip breaker comprising a plate

having an edge located inwardly of the edge of the cutting blade and a series of spaced teeth on the chip breaker blade, said teeth facing away from the cutting blade and being located inwardly of the edge of the latter, said chip breaker blade having an edge portion located at an incline with respect to the cutting blade, the teeth being located on the inclined portion and each tooth having a sharpened edge generally parallel to said inclined portion, and another sharpened edge substantially normal to the inclined portion.

7. The cutter head of claim 6 wherein the sharpened edges of each tooth join and form a point located in position to strike the severed piece cut by the edge of the cutting blade.

8. The cutter head of claim 6 wherein the sharpened edges of each tooth join and form a point located in position to strike the severed piece cut by the edge of the cutting blade, the sharpened edges engaging the wood and splitting the same.

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