April 18, 1967 E. F. BEAUBIEN 3,314,459

WOOD CHIPPING APPARATUS

Filed March 5, 1964 4 Sheets-Sheet 1

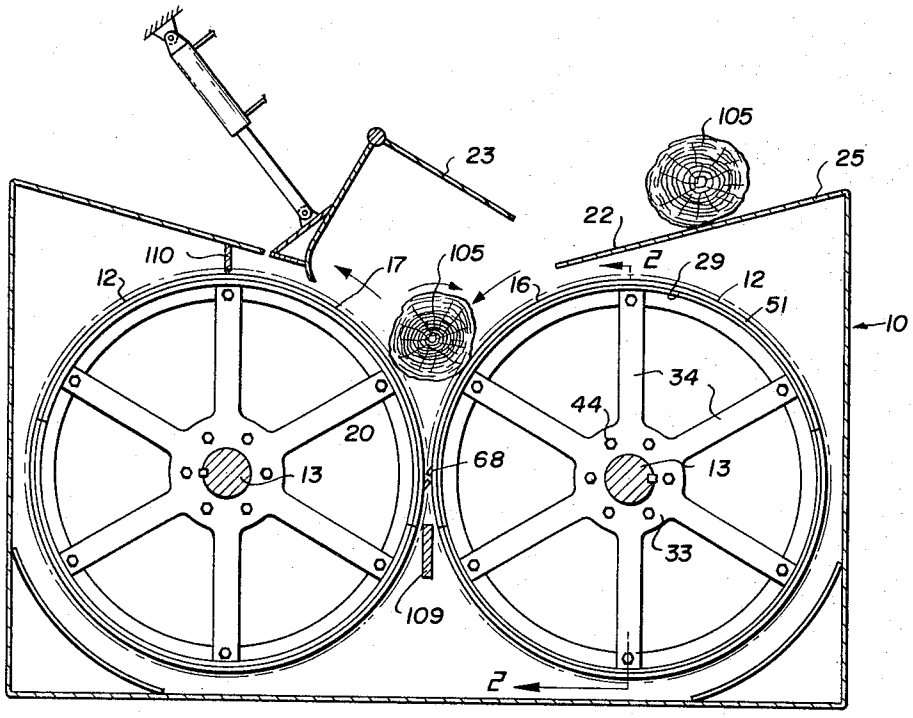


Fig. 1.

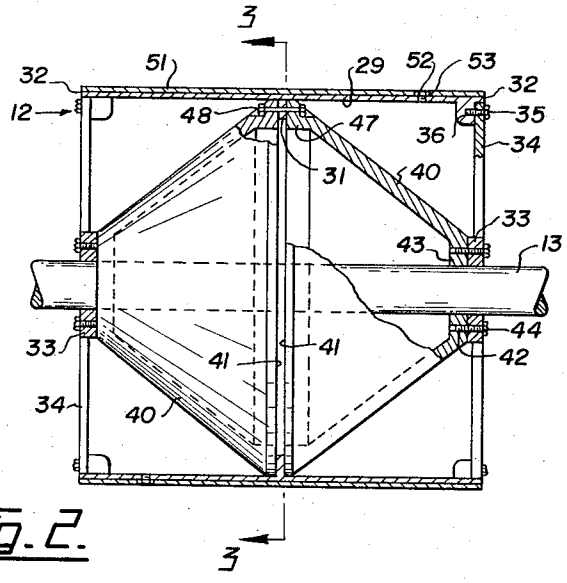


Fig. 2.

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WOOD CHIPPING APPARATUS

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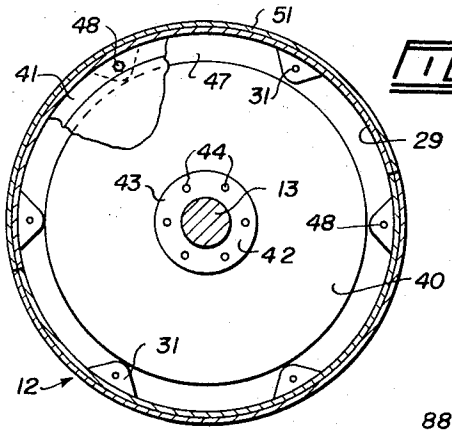


FIG. 3.

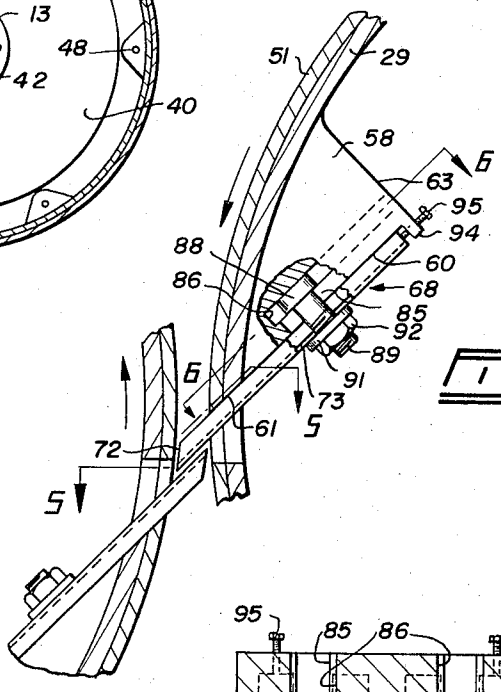


FIG. 4.

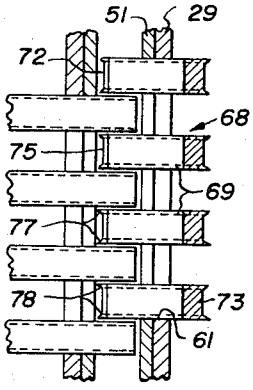


FIG. 5.

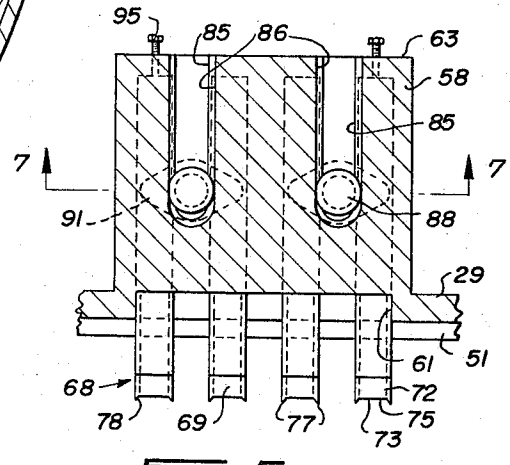


FIG. 6.

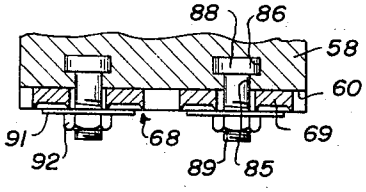


FIG. 7.

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WOOD CHIPPING APPARATUS

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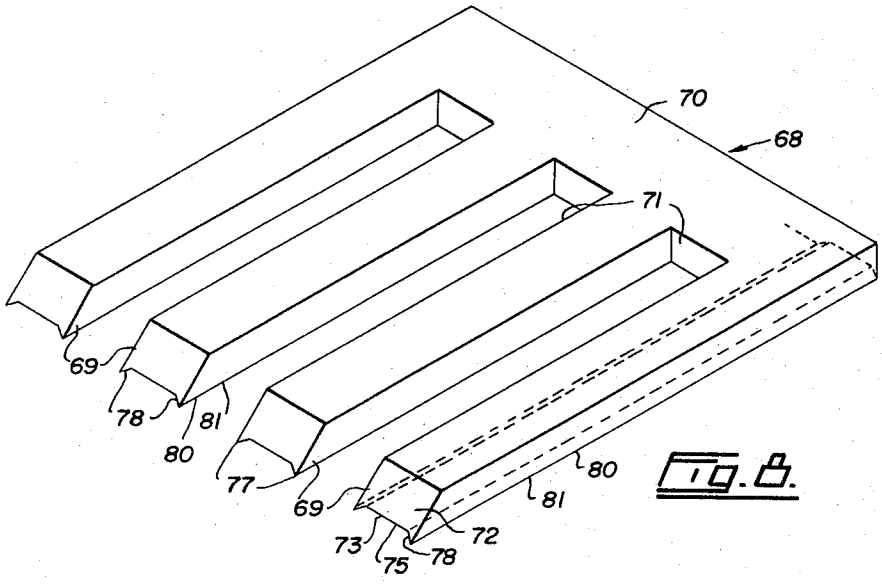


FIG. 8.

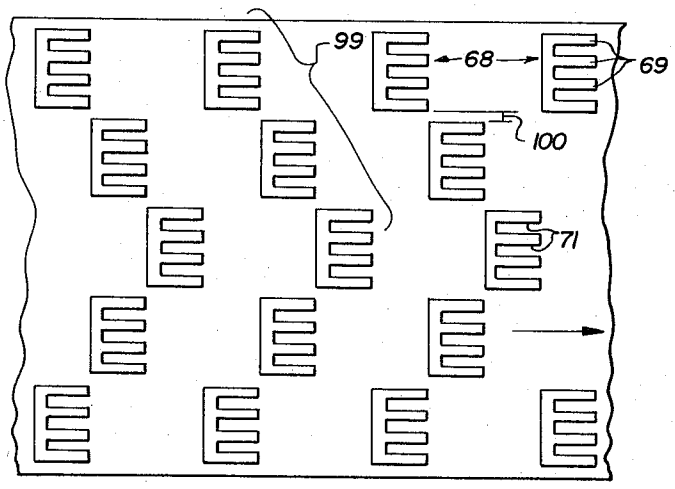


FIG. 9.

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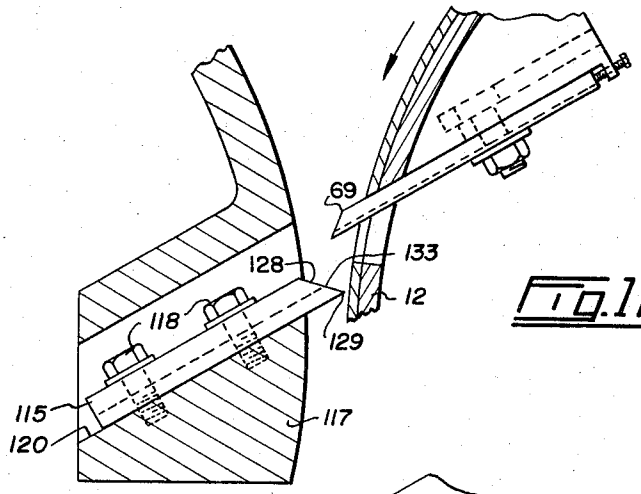


FIG. 10.

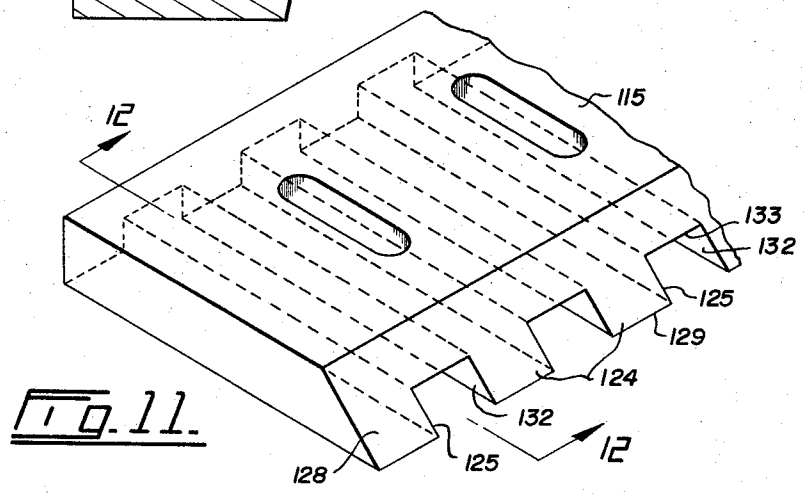


FIG. 11.

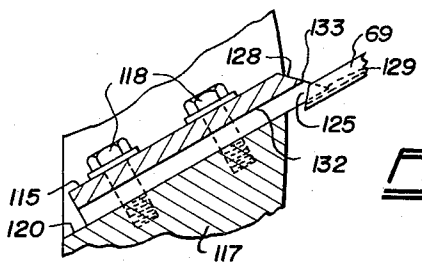


FIG. 12.

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WOOD CHIPPING APPARATUS

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Filed Mar. 3, 1964, Ser. No. 349,051
19 Claims. (Cl. 144—172)

This invention relates to apparatus for converting whole logs and waste wood into chips to be used in the manufacture of paper pulp, and for other purposes.

Devices are in existence today for chipping wood. However, the chipper most commonly used is in the form of a large disc having a plurality of radiating blades projecting from a flat face thereof. These blades have cutting edges which just clear an anvil as the blade rotates. The prior chipper takes a comparatively long time to convert wood into chips, and it has a tendency to break off fairly long splinters of wood which tend to clog the machine, and many splinters and pieces are forced past the anvil with the chips so that it is necessary to sift the chips or otherwise to remove these splinters.

Apparatus of the present invention is so designed that it is impossible for splinters or relatively long pieces of wood to pass out into the chips. The apparatus preferably includes two parallel drums rotating side by side with adjacent peripheral surfaces thereof moving in opposite directions, although one of these drums may be used with a stationary anvil. Each drum has a plurality of blades or cutters projecting slightly from the peripheral surface thereof and having cutting ends extending generally in the direction of rotation of the drum. The blades or cutters of one drum are offset axially relative to the blades or cutters of the other drum and positioned so that they pass between each other during rotation of the drums. The spacing of the blades is such that the blades of one drum just clear in a lateral direction the blades of the other drum. The blades of one drum constitute an anvil for those of the other drum, and it is practically impossible for pieces of wood to pass through the nip between these drums without being cut into chips. In addition to this, each blade or cutter is substantially U-shaped in cross section and has a substantially U-shaped cutting edge at its outer end. The outer end or cutting edge of each blade is bevelled so that, as a result of the substantial cross sectional U shape of the blade, two prongs project outwardly from said outer end, one at each side of the blade. Thus, each blade cuts pieces of wood of predetermined lengths, and the blade is so arranged that the cut pieces or chips travel along the U of the blade into the interior of the drum. The blades of each drum are preferably axially spaced and arranged so that they pass between the blades of the other drum, just clearing the latter blades. The blades are preferably arranged in sets of four spaced a blade width apart. The sets of blades are arranged in a pattern in the peripheral surface of each drum, and each set of blades is preferably axially spaced from another set of blades by substantially the width of a blade. If an anvil is used instead of one of the above-mentioned drums, this anvil has blades extending in a direction substantially opposite to the direction of movement of the periphery of the drum as said periphery moves past the anvil. The anvil blades are spaced apart just sufficiently to allow the drum blades to pass therebetween.

An example of this invention is illustrated in the accompanying drawings, in which,

FIGURE 1 is an end view of chipping apparatus having a pair of drums, the near end wall of the casing enclosing the drums being removed,

FIGURE 2 is a longitudinal section through a drum taken on line 2—2 of FIGURE 1,

FIGURE 3 is a cross section through the drum taken on line 3—3 of FIGURE 2,

FIGURE 4 is an enlarged vertical cross section through adjacent walls of the two drums at blades thereof, showing the blades and the holders therefor in elevation,

FIGURE 5 is a sectional view taken on line 5—5 of FIGURE 4,

FIGURE 6 is a horizontal section taken on the line 6—6 of FIGURE 4,

FIGURE 7 is a cross section taken on the line 7—7 of FIGURE 6,

FIGURE 8 is a perspective view of a 4-blade unit,

FIGURE 9 is a flat lay-out of a drum surface, showing a preferred arrangement of the blades thereof,

FIGURE 10 is a view similar to FIGURE 2 of an alternative form of the invention showing a drum blade and an anvil,

FIGURE 11 is a perspective view of a portion of an anvil, and

FIGURE 12 is a cross section taken on the line 12—12 of FIGURE 11.

Referring to the drawings, wood chipping apparatus **10** includes a pair of parallel, identical drums **12** mounted on a pair of shafts **13** and keyed thereto for rotation therewith. These drums are relatively large, and are rotated at fairly high speed. For example, the drums may be about four feet in diameter, and rotated at about 700 r.p.m. The drums are rotated so that adjacent peripheral surfaces thereof move in opposite direction. For example, the portion **16** of one drum moves downwardly while the adjacent portion **17** of the other drum moves upwardly. Logs and/or waste wood are fed to the nip **20** between the drums in any suitable manner. The logs or wood can be directed towards nip **20** by a chute **22**, the lower end of said chute being controlled by a gate arrangement **23**. It is preferable to enclose the two drums **12** within a casing **25**.

As drums **12** are identical, only one will be described in detail, namely, the right hand drum as viewed in FIGURE 1.

During operation of this apparatus, chips are cut from the logs or waste wood by blades projecting from the drums. The blades are shaped so that the chips are directed into the drums, and these chips are discharged therefrom in any suitable manner. Any hollow drum may be used for this purpose, but a special drum has been designed, which is very practical from the standpoint of manufacture, assembly and maintenance. The illustrated drums **12** are of this special construction.

Drum **12** is formed with a peripheral wall or surface **29** which is preferably divided into two or more segments, said wall having inwardly-extending lugs **31** substantially midway between its end edges **32**. A hub **33** is provided at each end of the drum, said hub having spokes **34** radiating therefrom, the outer ends of which are secured by bolts **35** to lugs **36** mounted or formed on the inner surface of peripheral wall **29**. Hubs **33** may be keyed to shaft **13** to cause drum **12** to rotate with said shaft. Two cones **40** with their bases **41** opposed to each other surround shaft **13** within drum **12**. The apex or outer end **42** of each cone is connected to a hub **43** located adjacent hub **33**, to which it is secured in any suitable manner, such as by bolts **44**. Each hub **43** may be keyed to shaft **13** in addition to or in place of the adjacent hub **33**. Each cone **41** has an inner flange **47** at its end **41** which is secured to drum lugs **31** by bolts **48**. If desired, a wear surface or wall **51** may be placed over the drum surface or wall **29**, said outer wall **51** being secured to inner wall **29** in any suitable manner, such as by bolts **52**, the heads of which are located in recesses **53** in wall **51**. This wall **51** is preferably formed in two or more segments so that it can easily be removed from and secured to the drum peripheral wall. When wear

wall 51 is mounted on the drum, it becomes the effective peripheral wall thereof.

Drum 12 has a plurality of chipper blades mounted therein and projecting from the periphery thereof, said blades extending generally in the direction of rotation of the drum. There may be different arrangements of these blades, but it is preferable to mount them in sets of four, and to arrange the sets in a definite pattern in the peripheral wall 29. For this purpose, a plurality of holders 58 are formed with or mounted on the inner surface of peripheral wall 29. In this example of the invention, each holder 58 is adapted to receive and support four chipper blades. Each block or holder 58 has an inclined face 60 extending to an opening 61 in drum wall 29 and in outer wall 51, if the latter is present. The holder or block has an inner end 63 extending substantially at right angles to face 60.

FIGURES 6, 7 and 8 illustrate a blade unit 68 including four chipper blades 69. For convenience, the inner ends of blades 69 are connected together by a common web 70, and spaces or notches 71 are formed between said blocks, each space or notch having a width that is just a little greater than the width of a blade. The outer end of each blade 69 is formed with a bevel 72, and the undersurface of the blade has a shallow, substantially U-shaped channel 73 formed therein. Channel 73 extends longitudinally of its blade and through web 70 of the unit 68. Bevel 72 and the bottom of channel 73 forms a cutting edge 75 extending transversely of the outer end of the blade. Bevel 72 also results in projections or prongs 77 at the outer end of the blade, one at each side thereof. Channel 73 extends almost the full width of the blade, and it is preferable to form this channel with inclined side walls 78 which extend to the sides 80 of the blade to form longitudinal cutting edges 81 along said sides and extending inwardly from projections or prongs 77.

A blade unit 68 is held against the inclined face 60 of each holder or block 58 with the outer ends of blades 69 of the unit extending through the adjacent opening 61 in the peripheral wall of the drum. Two slots 85 are formed in each holder 58 and extend longitudinally thereof, said slots being located over two of the spaces or notches 71 of unit 68. Each slot 85 is enlarged at 86 along its inner wall to receive the head 88 of a bolt 89, said bolt extending outwardly through slot 85 into the notch between two blades 69. A large washer 91 is fitted on each bolt 89 and held in place by a nut 92. Each washer extends laterally from its bolt and overlaps two of the blades 69 so that the tightening of nuts 92 on the two bolts 89 firmly hold blade unit 68 against face 60 of holder 58. If desired, a flange 94 may be formed on inner end of holder 58, said flange extending outwardly from the holder and overlapping the inner edge of blade unit 68. Two or more bolts 95 are threaded through each flange 94 and bear against the adjacent end of unit 68 so that when nuts 92 are loosened, bolts 95 may be turned to shift blades 69 outwardly relative to the peripheral surface of the drum.

The construction of the blades 69 of each unit 68 is such that the outer ends of the four blades are sharpened merely by grinding the aligned bevels 72 thereof, this grinding action sharpening transverse cutting edges 75 and the prongs 77. Longitudinal cutting edges 81 can be sharpened by grinding the sides 80 of each blade.

FIGURE 9 illustrates a preferred arrangement of the chipper blades 69. Each set of four blades 69 projects outwardly through one of the apertures 61 in the drum peripheral wall. The notches 71 between the blades 69 of one drum are just wide enough to permit similar blades of the other drum to pass through the first-mentioned blades. The prongs 77 of the blades of each drum just clear the peripheral surface of the drum at nip 20 therebetween. The sets of blades are preferably arranged in V-formation, indicated at 99 in FIGURE 9, and each set is spaced axially from the next adjacent set a distance which is just a little more than the width of a blade, said distance being indicated at 100 in FIGURE 9. The apex of each V formation extends in the direction of rotation of the drum. Thus, as the two drums 12 rotate, the blades of one drum pass between the blades of the other drum in nip 20 of said drums. In other words, all the blades of one drum are circumferentially aligned with notches 71 and 100 of the other drum.

When apparatus 10 is in operation, the two drums 12 are rotated so that the adjacent portions 16 and 17 of the peripheral walls thereof are moving in opposite directions. This causes the projecting ends of blades 69 of one drum to move downwardly between the projecting portions of blades 69 of the other drum while the latter blades are moving upwardly, see FIGURES 4 and 5. The log 105 and/or pieces of waste wood are directed into the nip 20 between the drums, see FIGURE 1. As the drums rotate, log 105 is rotated in the direction indicated by arrow 106, and the projecting ends of blades 69 cut through the surface of the log to remove chips therefrom, the length of each chip being determined by the distance between longitudinal side cutting edges 81 of a chipper blade. As each blade approaches the wood, the prongs 77 dig into the wood before transverse cutting edge 75 reaches it. This cuts the wood at the ends of a chip before edge 75 cuts into the wood, and the prongs tend to hold the wood against the drum surface while edge 75 travels through said wood. Thus, a clean chip is removed from the wood. The amount of projection of each blade from the peripheral wall of its drum determines the thickness of the chip being cut away from the wood. The blades may be set at different angles relative to the drum, but it has been found that very good results are attained if the blade extends generally about 53° relative to a radial plane of the drum. Each chip cut from the wood moves up the U of channel 73 of the blade and into the interior of drum 12. Cones 40 act as deflectors to direct the chips towards the ends of the drum and out through the spaces between spokes 34.

If any splinters are torn off log 105, or if long thin pieces of wood are directed into the apparatus, these drop down into nip 20 between the drums. However, with the arrangement shown in the drawings, the blades 69 of the left hand drum 12 which are moving upwardly, act as anvils for the downwardly-moving blades of the other drum, and vice versa, so that the wood pieces are cut into chips by the upwardly-moving and downwardly-moving blades. If desired, a bottom anvil 109 may be mounted just below the nip of the two drums, 12, see FIGURE 1, to strip off any wood that may adhere to the blades of the right hand drum, and an upper anvil 110 may be mounted near the surface of the left hand drum to strip away any wood that may be adhering to the blades of the left hand drum.

The blades of one drum 12 are axially offset relative to the blades of the other drum a distance equal substantially to the width of a blade 69. With this arrangement, one blade of each set or unit 68 of blades of one drum will pass between circumferentially aligned blades of the other drum. In addition to this, the end blade of each set will pass through spaces 100 between the spaced blade units of the other drum. This arrangement, and the V formation 99 of the sets of blades, as illustrated in FIGURE 8, ensure a very thorough cutting up of the wood fed to the apparatus with no possibilty of long slivers getting mixed up with the chips which are directed into the drums. Any lengthy pieces of wood or splinters will remain in nip 20 until they are cut up into lengths small enough to travel along the U channels 73 of blades 69 into their respective drums.

Although it is preferable to use two rotating drums as illustrated in the drawings, one drum only may be used, for example, right hand drum 12, and an anvil provided close to the peripheral wall of this drum and having a plurality of blades projecting upwardly therefrom and

so positioned that the blades of drum **12** move downwardly between the anvil blades. In other words, the anvil would have stationary blades in place of the upwardly-moving blades of left hand drum **12**. This is not considered to be as good as the preferred form of the apparatus, but it comes within the scope of this invention.

FIGURES 10, 11 and 12 illustrate apparatus including an anvil **115** in place of the left hand drum of FIGURE 1. This anvil extends the length of drum **12** and is mounted on and projects from a suitable base **117** in any suitable manner, such as bolts **118**. The anvil is mounted on a sloping surface **120** so that it extends in an incline towards the peripheral surface of drum **12** and in the opposite direction to blades **69** of said drum.

Anvil **115** is formed with blades **124** along an edge thereof, each blade being just wide enough to pass through the notches **71** of blade units **68** of the drum. Blades **124** are separated from each other by notches or spaces **125** which are just wide enough and deep enough to permit blades **69** and their prongs **77** to pass therethrough. The edge of anvil **115** is ground to form a bevel **128**, and this bevel forms transverse cutting edges **129** on the outer ends of blades **124**. A substantially U-shaped channel **132** is formed in the undersurface of anvil **115** in line with each space or notch **125** and opens out through bevel **128** so that a transverse cutting edge **133** is formed at the bottom of each space or notch **125**. By referring to FIGURE 10, it will be seen that the cutting edges **129** of anvil blades **124** just clear the peripheral surface of drum **12**, while the transverse cutting edges **75** and prongs **77** of each chipper blade **69** just clear the transverse cutting edge **133** of the anvil as the blade passes through notch **125**.

The apparatus of FIGURES 10 to 12 functions in substantially the same manner as that described above. The main difference is that the chipper blades of anvil **115** are stationary, whereas the chipper blades of the left hand drum of FIGURE 1 are moving in the opposite direction to the chipper blades of the right hand drum.

What I claim as my invention is:

1. Wood chipping apparatus comprising a rotatable hollow drum having a plurality of axially spaced openings in a peripheral wall thereof, a plurality of chipper blades mounted in the drum one at and projecting outwardly from each opening, each blade being inclined in the direction of rotation of the drum and having a cutting edge on an outer end thereof facing substantially in said direction of rotation, an anvil extending axially of said drum and spaced from the drum peripheral wall, and a plurality of axially spaced blades on the anvil extending in substantially the opposite direction to the drum blades, said drum blades being axially offset relative to the anvil blades and positioned to pass therebetween when the drum is rotated, each drum blade being of inverted U-shape in cross section with reference to the direction of rotation of the drum, whereby chips cut by each drum blade can travel within the latter blade into said drum.

2. Wood chipping apparatus as claimed in claim **1** in which each drum blade has a transverse cutting edge with two spaced side cutting edges depending therefrom.

3. Wood chipping apparatus comprising a drum, a plurality of axially spaced chipper blades projecting from the periphery of the drum and having cutting edges on outer ends thereof facing substantially in the direction of rotation of said drum, an anvil extending axially of said drum and spaced from the drum periphery, and a plurality of axially spaced sharpened blades on the anvil extending in substantially the opposite direction to the drum blades, said drum blades being axially offset relative to the anvil blades and positioned to pass therebetween when the drum is rotated; each drum blade having a bevelled outer end, and a channel formed in an under surface of said drum blade extending longitudinally thereof and opening out through the bevelled outer end to form a transverse cutting edge at said end and prongs at the sides of the blade projecting outwardly from the outer end.

4. Wood chipping apparatus as claimed in claim **3** in which side walls of the channel of each blade are bevelled outwardly and laterally of the blade to side edges thereof to form side cutting edges extending longitudinally of the blade.

5. Wood chipping apparatus as claimed in claim **1** in which ends of the drum are open, and including baffle means mounted in the drum to deflect chips travelling into the drum along the blades thereof to said open ends.

6. Wood chipping apparatus comprising a pair of parallel drum having adjacent peripheral surfaces close to each other and moving in opposite directions when the apparatus is in operation, and a plurality of axially spaced chipper blades projecting from the periphery of each drum and having cutting edges on outer ends thereof facing substantially in the direction of rotation of said drum, the blades of one drum being axially offset relative to the blades of the other drum and positioned to pass therebetween when the drums are rotated, the blades of the two drums acting as anvils for each other and at the same time cutting wood between the drums into chips.

7. Wood chipping apparatus as claimed in claim **6** in which each blade is of inverted U-shape in cross section with reference to the direction of rotation of the drum, whereby chips cut by each drum blade can travel within the blade into said drum.

8. Wood chipping apparatus as claimed in claim **7** in which each blade has a transverse cutting edge with two spaced side cutting edges depending therefrom.

9. Wood chipping apparatus as claimed in claim **6** in which each blade has a bevelled outer end, and a channel formed in an under surface of said block extending longitudinally thereof and opening out through the bevelled outer end to form a transverse cutting edge at said end and prongs at the sides of the blade projecting outwardly from the outer end.

10. Wood chipping apparatus as claimed in claim **9** in which side walls of the channel of each blade are bevelled outwardly and laterally of the blade to side edges thereof to form side cutting edges extending longitudinally of the blade.

11. Wood chipping apparatus as claimed in claim **6** including adjusting means in each drum at each blade thereof for shifting said blade longitudinally thereof relative to the drum periphery to adjust the amount of blade projecting from the latter.

12. Wood chipping apparatus as claimed in claim **6** in which the blades of each drum are arranged in sets axially spaced from each other substantially the width of a blade, and the blades on the respective drums are so arranged that each blade of one drum passes between axially spaced blades of the other drum during rotation of said drums.

13. Wood chipping apparatus as claimed in claim **12** in which each set of blades of each drum is axially spaced from another set of blades by substantially the width of a blade.

14. Wood chipping apparatus as claimed in claim **7** in which ends of each drum are open, and including baffle means mounted in each drum to deflect chips travelling into the drum along the blades thereof to said open ends.

15. Wood chipping apparatus as claimed in claim **12** in which the blade sets of each drum are arranged in V formation with the apex of each V extending in the direction of rotation of the drum.

16. Wood chipping apparatus comprising a rotatable drum, a plurality of axially spaced chipper blades projecting from the periphery of the drum and having cutting edges on outer ends thereof facing substantially in the direction of rotation of said drum, said blades being arranged in sets with the blades of each set and the sets

themselves axially spaced from each other substantially the width of a blade, an anvil extending axially of said drum and spaced from said periphery of the drum, and a plurality of blades on the anvil extending in substantially the opposite direction to the drum blades, said anvil blades being axially spaced from each other substantially the width of a blade, said anvil blades being substantially the same width as the drum blades and offset and positioned relative to the latter so that the drum blades move between the anvil blades during rotation of the drum.

17. Wood chipping apparatus as claimed in claim 16 in which each of the drum and anvil blades has a bevelled outer end, and a channel formed in an under surface of said blade extending longitudinally thereof and opening out through the bevelled outer end to form a transverse cutting edge at said end.

18. Wood chipping apparatus as claimed in claim 17 in which the bevel of each drum blade extends inwardly in a longitudinal direction relative to said blade from the under surface thereof, thereby forming prongs at the sides of said blade projecting outwardly from the blade outer end, and the bevel of each anvil blade extends outwardly in a longitudinal direction relative to the latter blade from the under surface thereof.

19. Wood chipping apparatus comprising in combination a plurality of similar parallel chipper blades in a common plane spaced from each other; each blade having upper and lower surfaces, said lower surface having a shallow substantially U-shaped channel therein extending longitudinally of the blade and substantially the width thereof, a longitudinal side wall on the lower surface at each side of the channel at the outer end of the blade, said blade being bevelled at the outer end thereof to form a transverse cutting edge along the lower surface, said bevel and the longitudinal side walls forming prongs projecting from the blade outer end at said cutting edge; and an anvil adapted to be mounted in opposition to said blades, said anvil having upper and lower surfaces and a bevelled outer end forming a transverse cutting edge at said lower surface, said bevelled outer end of the anvil having notches formed therein, each wide enough to permit a chipper blade to pass therethrough and forming between said notches blades of a width to pass through the spaces between said chipper blades, said anvil including a substantially U-shaped channel in the lower surface thereof opening into each notch in the bevelled end of the anvil to form a transverse cutting edge at said notch.

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