United States Patent [19]

Gaitten

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[45] **Sept. 16, 1975**

[54] **WOOD CHIPPER**

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[21] Appl. No.: **454,255**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 292,158, Sept. 25, 1972, abandoned.

[52] **U.S. Cl.** ..... **241/55;** 241/92; 241/278 R

[51] **Int. Cl.** **B02c 18/14**

[58] **Field of Search** ..... 241/55, 92, 277, 278 R; 144/176

[56] **References Cited**

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3,661,329	5/1972	Smith et al.	241/92 X

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Assistant Examiner—Howard N. Goldberg
Attorney, Agent, or Firm—Finnegan, Henderson, Farabow and Garrett

[57] **ABSTRACT**

A wood chipper having a rotating cutting wheel with radially extending knives mounted on the face of the wheel for cutting chips from lengths of wood with guide means attached to the wheel and forming a radial passage for receiving the chips and providing a smooth continuous flow-directing passage for the chips to the periphery of the wheel to minimize impact damage to the chips and the production of fines.

20 Claims, 8 Drawing Figures

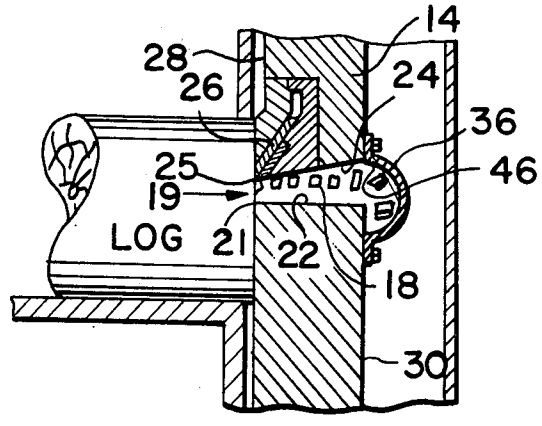
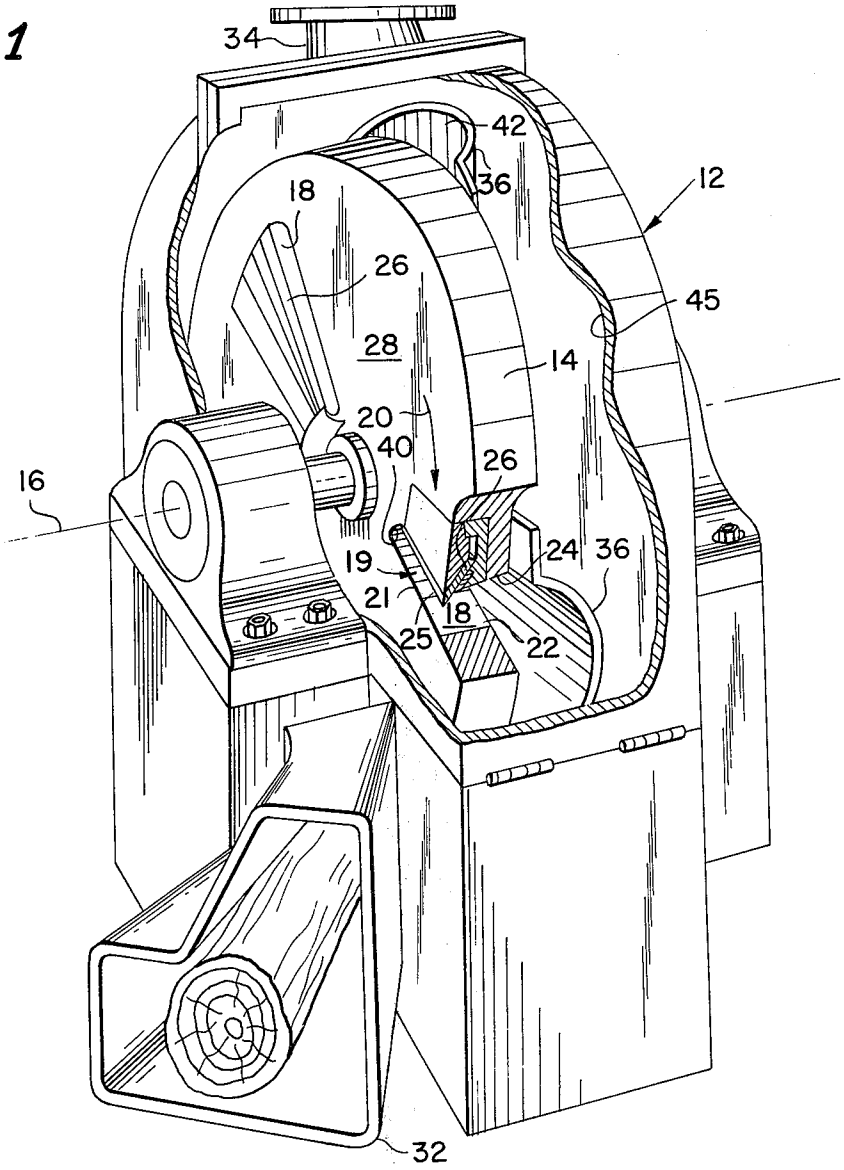


FIG. 1



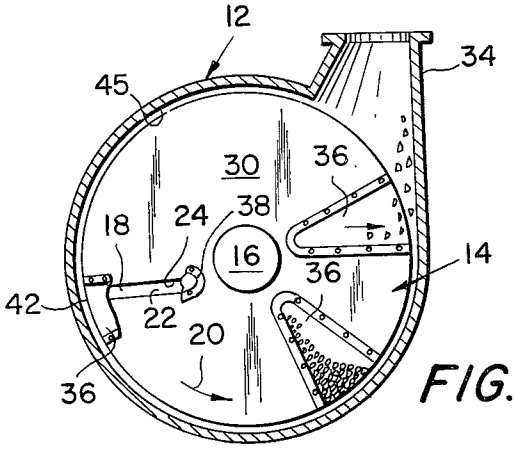


FIG. 2

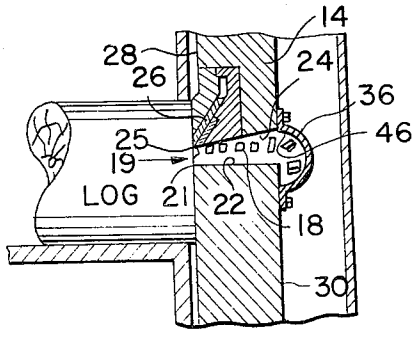


FIG. 3

FIG. 4

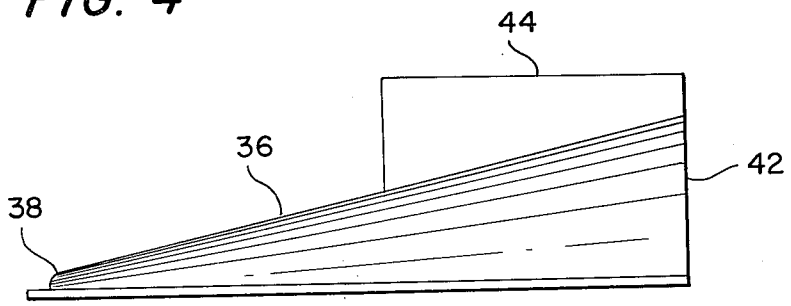
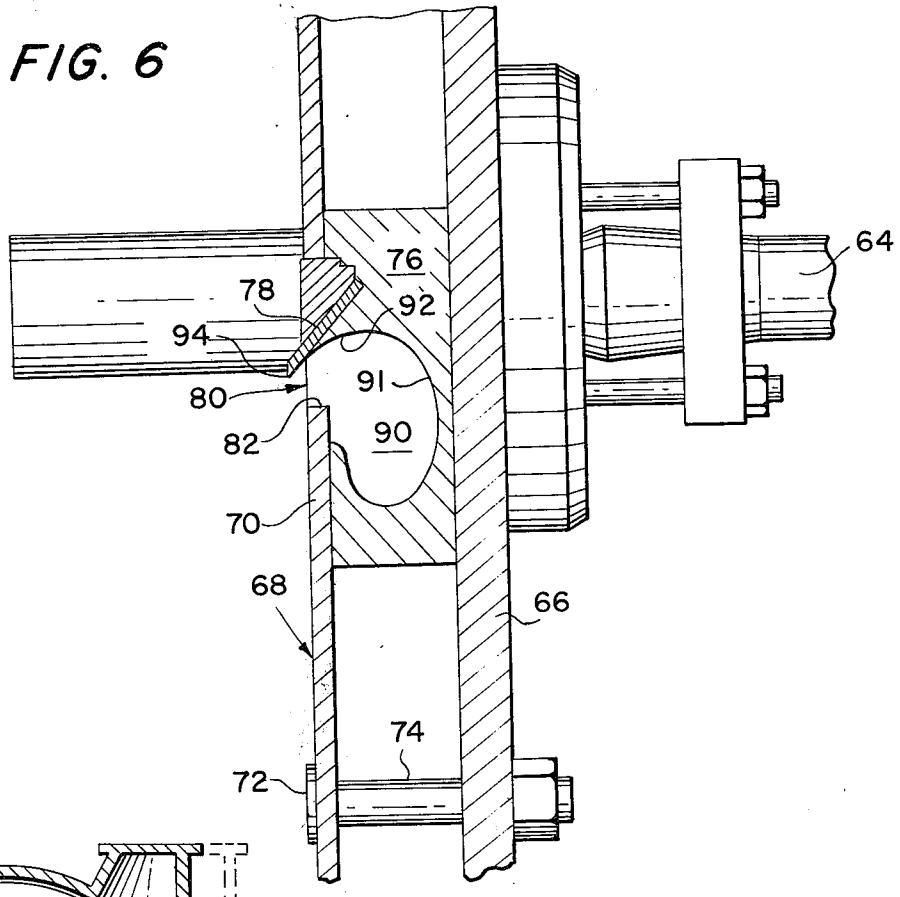


FIG. 6



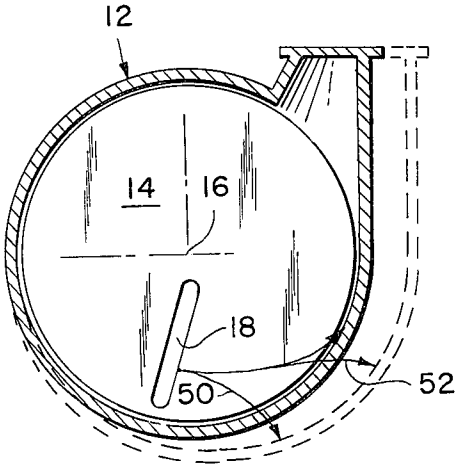
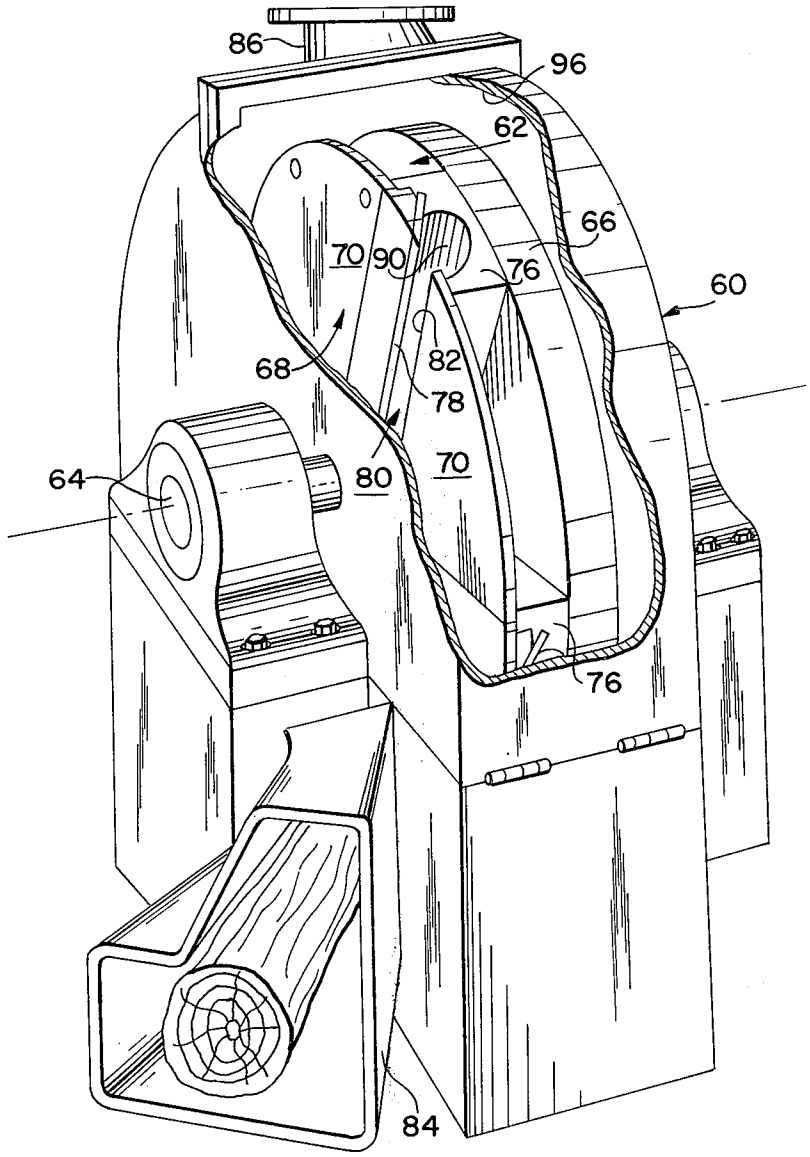


FIG. 8

FIG. 5



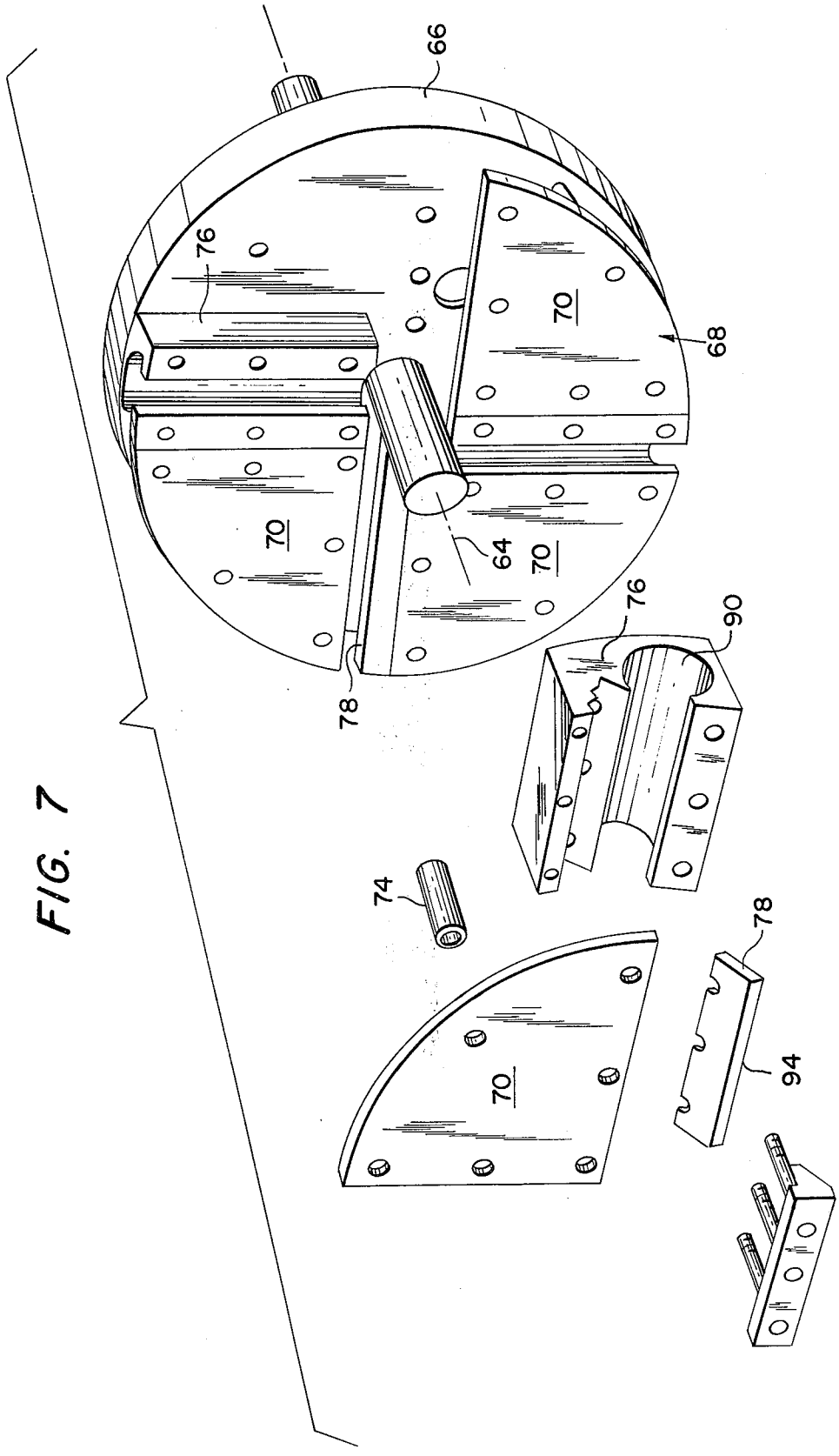


FIG. 7

WOOD CHIPPER

This application is a continuation-in-part of U.S. Pat. application, Ser. No. **292,158,** filed Sept. **25, 1972** now abandoned.

The present invention relates to wood chippers and more particularly to improved wood chippers for minimizing chip damage.

In the making of paper pulp, it is necessary to reduce logs or other large pieces of wood into small chips and one of the most conventional ways of making the chips is with a rotary chipper. In a rotary chipper the lengths of wood are fed at an angle to a rotating cutter disc having a plurality of radially or tangentially extending slots and a knife mounted to the trailing side of each slot. As the rotating disc engages the wood, it slices off chips which pass through the slots and out of the rear face of the disc. Due to the impact of the knives against the wood being cut, the chips fly off with a high velocity, and their passage after leaving the slots is generally toward the back of the housing where they ricochet between the back wall of the housing and the back of the disc and eventually downward toward the bottom of the chipper housing. The chips are then moved around the housing and upwardly to an outlet conventionally located at the top of the housing and tangential to the path of the rotating disc. Such movement is generally accomplished by placing blades or other impact moving surfaces around the rear face and periphery of the cutting disc for propelling the chips toward the discharge outlet.

The ricochetting of the chips within the housing, however, as well as these impact surfaces which engage the chips at high velocities, cause substantial damage to the chips and the production of large amounts of fines unacceptable to, or at least inefficient in, the production of paper-making pulp.

Various structures have been employed in the past to reduce the incidents of chip breakage. In U.S. Pat. No. **3,346,027** to Kirsten, for example, there is shown the use of a radial passage for receiving chips and directing them toward the periphery of the cutting wheel to reduce the amount of impact damage to the chips. While the passageways will prevent the chips from flying around completely free in the chipper housing and will thereby probably reduce somewhat the destruction and breakage of the chips, it can be seen that the structure of such passageways inherently provides its own impact damage to the chips. In Kristen the passageways are formed from a pair of spaced radial webs located on either side and remote from the slot in the chipper disc through which the chips pass. Thus, as the chips are cut from lengths of wood, they will pass through the slots in the disc and will fly back freely until they impact against the rear wall of the radial passageways. This causes unnecessary and considerable breakage of the chips in much the same manner as if the chips had been allowed to pass completely through the chipper disc and strike the stationary rear wall of the housing.

In U.S. Pat. No. **2,663,506** to Vaughan there is also provided a radial passage adjacent the discharge side of each knife for receiving and directing the chips toward the periphery of the cutting wheel. In Vauaghan, however, the passages are constructed for the specific purpose of breaking the chips into smaller size. With reference to the Vaughan patent, it can be seen that the cut chips first strike the trailing wall of the passages because the wall extends forward from the cutting edge of the knife and then against the rear wall which is directly in the path of the chips, causing just as much breakage to the chips as in the Kirsten device.

Accordingly, it is desirable to provide a rotating wood chipper having a radial passage for receiving and directing chips toward the periphery of the disc that overcomes the disadvantages without sacrificing the merits of prior art structures similar to those described above.

To accomplish this objective, the present invention as embodied and broadly described provides in a wood chipper having a rotating cutting wheel with a plurality of elongated and generally radially extending knives mounted on the front face of the wheel and forming apertures in the wheel through which the chips cut from the wood will pass toward the rear of the cutting wheel, guide means covering the discharge side of each aperture and opening toward the periphery of the cutting wheel for receiving and directing the chips passing through the apertures toward the periphery of the cutting wheel, said guide means having an inner, continuous curved surface with the inner surface of the trailing portion of the guide means being aligned generally with the cutting edge of the knife so that the chips are received and guided by one continuous smooth surface until they are discharged from the periphery of the cutting wheel and the housing to thereby minimize the impact damage to the chips.

In accordance with one embodiment and for ready adaptability to a conventional slotted wood chipper, the guide means comprises a semi-conical shaped chute diverging outwardly toward the periphery of the disc and attached over the discharge side of each slot, the inner surface of the trailing wall of the chute being aligned with the trailing wall of the slot, so that the chips passing through the disc swirl radially outward toward the periphery in an uninterrupted and continuous manner.

In accordance with yet another embodiment of this invention, the guide means comprises a radially extending channel located between the front and rear face of the cutting wheel and immediately in back of each cutting knife on the face of the wheel, with the trailing wall of the channel being aligned with the cutting edge of the knife.

While still providing the required continuous and uninterrupted support for the chips as they are directed toward the periphery of the cutting wheel, by providing such passageways within the interior of the wheel, as in Kirsten and Vaughan, the conventional slotted disc can be eliminated and the cutting knives extended closer to the hub and all the way out to the periphery of the wheel. This provides a greater cutting edge for a given wheel diameter, requiring less power consumption and greater efficiency in the chipping operations as will be more fully described below.

In accordance with a preferred embodiment of the invention and for use in combination with either of the above-described embodiments, the housing of the wood chipper is closely spaced from, and is of similar circular configuration to, the periphery of the cutting wheel. This keeps the chips in the guide means until they reach the outlet of the housing and permits the chips to contact the housing at a very low impingement angle, thereby further reducing the incidents of breakage as the chips are propelled out of the guides by the

centrifugal force generated by the rotating cutting wheel.

The accompanying drawings which are incorporated in and constitute a part of the specification illustrate preferred embodiments of the invention and together with the description serve to explain the principles of the invention.

Of the drawings:

FIG. 1 is a perspective view of one embodiment of a wood chipper partially broken away and constructed in accordance with the present invention;

FIG. 2 is a vertical section of the chipper of FIG. 1, schematically showing the flow of chips through the chutes mounted on the rear face of the cutting wheel to the discharge outlet of the housing;

FIG. 3 is an enlarged fragmentary and schematic view looking from the peripheral edge of the rotating wheel of FIG. 1;

FIg. 4 is a side view of one of the chutes;

FIG. 5 is a perspective view similar to FIG. 1, and showing yet another embodiment of the present invention;

FIG. 6 is an enlarged fragmentary and schematic view looking from the peripheral edge of the rotating cutting wheel of FIG. 5;

FIG. 7 is a fragmentary perspective view of the front of the rotating cutting wheel shown in FIG. 5; and

FIG. 8 is a schematic comparison view showing the relationship between the housing and the trajectory of the chips as they are propelled off the edge of the cutting wheel.

With reference to FIG. 1, the wood chipper of this embodiment includes a housing 12 and a rotating cutting wheel 14 mounted for rotation within the housing on a horizontal axis 16. Wheel 14 has a plurality of generally radially extending slots 18 and rotates in a clockwise direction, as shown by arrow 20. Slots 18 have a leading wall 22 and a trailing wall 24, and a knife 26 is mounted to the front face 28 of rotating wheel 14 adjacent the trailing wall 24 of each slot 18. The cutting edge 25 of each knife forms an elongated aperture 19 on the face of the wheel with the forward edge 21 of leading wall 22, the aperture communicating directly with the slots 18.

As logs or other large pieces of wood are fed against the front face 28 of wheel 14 and, as best shown in FIG. 3, revolving knives 26 are mounted so as to cut chips from the wood, the chips passing through apertures 19 and slots 18 toward and out of the rear face 30 of the wheel. To feed the logs against the wheel, chipper housing 12 is provided with inlet means for the wood and, as embodied, the inlet means comprises an inlet chute 32 inclined and offset with respect to axis 16 of cutting wheel 14 with its inner end terminating adjacent the front face 28 of the wheel. The logs can be fed in either by mechanical means or the chute can be inclined in an upward direction so that the weight of a log itself causes it to be brought into contact with revolving cutter 14.

Chipper housing 12 is also provided with outlet means for discharging the chips from the housing and, as embodied, the outlet means comprises a discharge outlet chute 34 located on the top of housing 12 and tangential to the path of rotating cutter 14. As best shown in FIGS. 1 and 2, outlet chute 34 is spaced from and around the path of rotation of the wheel from inlet chute 32.

Cutting wheel 14 can be of any conventional design, the knives 26 extending generally in a radial direction either along the radii of the wheel or offset from it, as is conventional in the art. While flat face-type cutting wheels have been shown, it is to be understood that the invention is also applicable to conical shaped cutting wheels.

In accordance with the present embodiment and to eliminate impact damage to the chips and the production of fines and broken chips, the trailing wall 24 of each slot 18 slopes back from and is aligned with the cutting edge 25 of the knife and guide means are provided covering the discharge side of each slot 18 that open toward the periphery of the chipper wheel, the guide means having an inner, continuous curved surface with the trailing portion of the guide means being aligned with trailing wall 24 of each slot 18. As embodied, the guide means comprises a plurality of chutes 36, having a semi-circular and cone-shaped inner surface mounted to the rear face 30 of cutting wheel 14 and covering each slot 18 with the apex 38 of each chute located inwardly of the inner end 40 of slot 18 and the open base portion 42 adjacent the periphery of cutting wheel 14.

As best shown in FIG. 3, the inner surface of the trailing wall 46 of each chute 36 is aligned with the trailing wall 24 of slot 18 so that, as the chips pass through and out of the slots and into the chutes, they slide along one smooth continuous surface without impacting any relatively stationary objects, thereby minimizing any damage to the chips.

The velocity imparted to the chips by the impact from knives 26 and the centrifugal force, as well as the flow of air generated by the revolving wheel, propel the chips outwardly through the chutes and then tangentially out of the housing through outlet chute 34, as is more fully described below.

The diverging walls of cone-shaped chutes 36 prevent clogging and swirl the chips so that they slide around as they pass through the chutes and prevent any inpingement of the chips against the walls of the chutes and against each other.

The outer ends of each chute are preferably shaped to conform to, and are contiguous with, the circular periphery of the wheel. In accordance with a preferred embodiment, the inner surface 45 of the housing 12 is circular and closely spaced from the periphery of the wheel so that the chips essentially remain in the chutes while they slide around the housing until they reach the area of outlet chute 34 where they are propelled out from the housing. This prevents the chips from flying around freely in the housing where they could ricochet between the wheel and the housing or be impacted by blades or other objects attached to the wheel or the inside walls of the housing. Moreover, as the chips contact the inner surface 45 of housing 12, they contact it at a very small impingement angle due to the close location of the housing and the speed and path of the chips rotating near the periphery of the wheel. With this arrangement, the chips will actually slide onto and pass around the housing with a sliding motion until they reach outlet chute 34.

In conventional wood chippers, as shown, for example, in the above-cited Kirsten patent, it was considered desirable to have a spiral-shaped housing that increased the distance between the outer peripheral edge of the cutting wheel and the inner surface of the housing as

the wheel rotated toward the outlet of the chipper. In a conventional machine using such a housing, however, and with reference to FIG. 8, it has long been the experience in the art that the chips followed a path indicated by the arrow 50, impacting the inner surface of the housing at a rather high angle causing not only considerable damage to the chips but also to the housing at this point. The use of radial passages decreased the angle and breakage somewhat, the chips generally following a path indicated by arrow 52. In accordance with the present invention, however and by providing not only radial passages but a circular housing, as opposed to a spiral housing, and locating the inner surface of the housing closely adjacent the outer peripheral edge of the cutting wheel, the housing in combination with the guide means permits the chips to contact the housing at a very low impact angle, thus further minimizing the damage to the chips as well as to the housing.

To increase the revolving flow of air in the wood chipper and as best shown in FIG. 4, chutes 36 are preferably provided with an exterior radially extending fin 44 mounted on the outer surface of each chute 36. This is similar to the blades commonly used on chippers in the past to propel the chips out of the housing, but since in the present invention the chips are contained within chutes 36, fins 44 will not interfere with or cause any damage to the wood chips.

Thus, it can be seen that this embodiment of the present invention provides a new and improved wood chipper having chutes mounted over the slots of the chipper wheel and opening toward the periphery of the wheel, the chutes being mounted in such a way as to receive the chips that pass through the wheel and direct then around to the discharge outlet of the chipper in an impact-free manner to thereby minimize the production of fines and increase the efficiency of pulp recovery.

In accordance with yet another embodiment of this invention and with respect to FIGS, 5–7, there is also provided a vood chipper having guide means for receiving and directing the flow of chips but in combination with a "no-slot" wood chipper. In contrast to a conventional slotted wood chipper and, as discussed above, the knife edges in a "no-slot" chipper extend all the way to the peripheral edge of the wheel permitting a decrease in the size of the wheel for a given cutting edge and a corresponding decrease in power input requirements.

With reference to FIG. 5, the wood chipper of this embodiment includes a housing 60 and a rotating cutting wheel 62 mounted for rotation within the housing on a horizontal axis 64. Wheel 62 consists essentially of a rear disc 66 and a front disc 68, comprising a plurality of pie-shaped wear plates 70. Plates 70 are mounted in space relationship to the front of rear disc 66 by bolts 72 with suitable spacers 74 and a plurality of spaced web members 76 bolted between the two discs. A knife 78 is mounted in a conventional manner to the leading edge of each plate 70 and to a web member 76, forming a generally radially extending elongated aperture 80 with the trailing edge 82 of the next adjacent plate 70. As best shown in FIGS. 5 and 7, knives 78 and corresponding apertures 80 extend all the way to the periphery of cutting wheel 62.

In similar manner with respect to the above-described embodiment, logs or other large pieces of wood are fed against the front faces of cutting wheel 62 through an inlet chute 84 whereby revolving knives 78 on the wheel cut chips from the wood, the chips passing through apertures 80 toward the rear of the cutting wheel. Similarly, outlet chute 86 located on top of housing 60 and tangential to the path of rotating cutting wheel 62 is provided for discharging the cut chips from the chipper housing. Preferably, outlet chute 86 is spaced from and around the path of rotation of the cutting wheel from inlet chute 84.

In accordance with the present embodiment, the guide means for receiving and directing the chips toward the periphery of the cutting wheel comprises a radially extending channel 90 formed within web member 76, which cover the discharge side of each aperture 80 and open toward the periphery of cutting wheel 62. As best shown in FIG. 6, each channel 90 has an inner, continuous curved surface 91 with the trailing portion 92 of the surface being aligned with the cutting edge 94 of its respective knife 78. Thus, in a manner similar to that described above, the chips pass through apertures 80 and are continuously supported by and slide along one continuous smooth surface in channels 90 toward the periphery of the cutting wheel without impacting any relative stationary objects in their path to thereby minimize any damage to the chips. Again, with reference to FIG. 6, the inner surface 91 of channels 90 extends around to a point adjacent the inner surface of plate 70 and set back slightly from the trailing edge 82 of the plate.

The outer ends of each web member 76 and blade 78 are shaped to conform with the circular periphery of the cutting wheel. This allows for the inner circular surface 96 of housing 60 to be closely spaced from the periphery of cutting wheel 62, so that the chips essentially remain in channels 90 while they slide around the housing until they reach the area of outlet chute 86 where they are propelled out of the housing. This prevents the chips from flying around free and impacting stationary objects including inner surface of the housing.

In the embodiment shown, channels 90 have essentially parallel walls from the hub to the periphery of the cutting wheel, but it is to be understood that the walls could diverge outwardly as in the previous embodiment without departing from the scope of the present invention. Further fins similar to fins 44 could be mounted to the rear face of rear disc 66, if necessary, to increase the flow of air in the housing. Since the chips are essentially contained within channels 90 until they are discharged through outlet chute 86, such fins would not interfere with, or cause any damage to, the wood chips.

Thus, it can be seen that in this embodiment of the present invention the objectives of supporting the chips in an impact-free manner through their travel are also provided while permitting an essentially no-slot construction and hence a decrease in power requirements and an increase in operating efficiency. The channels 90, similar to chutes 36, are positioned with respect to cutting knives 78 so that they receive and direct the chips toward the periphery of the cutting wheel and the discharge chute of the housing in an impact-free manner, thereby reducing the production of fines and increasing the efficiency of pulp recovery.

The invention in its broader aspects is not limited to the specific details shown and described and departures may be made from such details without departing from the principles of the invention and without sacrificing its chief advantages.

What is claimed is:

1. A wood chipper comprising:

a. a rotating cutting wheel having a front and rear face and a plurality of elongated and generally radially extending knives mounted on the front face of the wheel;

b. a housing surrounding said wheel and having inlet means for feeding lengths of wood against the face of the wheel to cut chips from the wood and outlet means for discharging chips from the housing;

c. elongated apertures in the front face of the cutting wheel extending along in front of the cutting edge of each of said knives so that the chips cut from the wood will pass through the apertures toward the rear of the cutting wheel; and

d. guide means covering the discharge side of each aperture and opening toward the periphery of the cutting wheel for receiving the chips passing through the apertures and directing them in a generally radial direction toward the periphery of the cutting wheel, said guide means having an inner curved surface with the inner surface of the trailing portion of the guide means being generally in alignment with the cutting edge of the knife so that the chips will be supported and will slide along one continuous smooth surface until they are discharged from the periphery of the cutting wheel to thereby minimize impact damage to the chips.

2. The chipper of claim 1, wherein the wheel consists of a solid disc and includes elongated slots in the disc communicating said elongated apertures in the front face of the disc with the rear face of the disc, the trailing wall of said slots being aligned with the cutting edge of the knife and the trailing portion of the inner surface of the guide means with the trailing wall of the slot.

3. The chipper of claim 2, wherein the trailing wall of the slot diverges rearwardly from the cutting edge of the knife to the trailing wall of the chute so that the slot enlarges from the front to the rear face of the disc.

4. The chipper of claim 2, in which said guide means comprises a chute having a semi-circular inner surface mounted to the rear face of the disc over each of said slots.

5. The chipper of claim 4, wherein the inner surface of the chutes diverge outwardly toward the periphery of the disc and swirl the chips as they flow through the chutes.

6. The chipper of claim 5, wherein the inner surface of the chutes is semi-cone shaped, the apex of the cone being located adjacent the inner end of the slots and the open base portion adjacent the periphery of the disc.

7. The chipper of claim 4, wherein the outer peripheral end of the chute conforms to, and is contiguous with, the periphery of the disc.

8. The chipper of claim 4, wherein the chute has an exterior fin to increase the flow of revolving air in the housing.

9. The chipper of claim 1, wherein the periphery of the wheel is circular and the housing is closely spaced from, and is of similar configuration to, the periphery of the cutting wheel.

10. The chipper of claim 1, wherein the inlet means comprises a chute inclined and offset with respect to the axis of the cutting wheel and having an end terminating adjacent the front face of the wheel.

11. The chipper of claim 1, wherein the outlet means comprises a chute extending tangentially outward from the housing with respect to the path of rotation of the cutting wheel and spaced around the wheel in its direction of rotation from the inlet means.

12. The chipper of claim 1, wherein the guide means comprises a radially extending channel located between the front and rear face of the cutting wheel.

13. The chipper of claim 12, wherein the channels have an inner, circular surface, the inner surface of the trailing portion of the channel being aligned with the cutting edge of the knife.

14. The chipper of claim 13, wherein the cutting wheel consists of spaced front and rear discs, the inner surface of the channels extending rearwardly from the knife edge around and in front of the rear disc to the back of the front disc at a point adjacent the leading edge of the elongated aperture.

15. The chipper of claim 14, wherein the channels are contained in a plurality of spaced web members connecting the front and rear discs and located adjacent the apertures.

16. The chipper of claim 15, wherein the web members comprise a single block having formed therein the channels for receiving the chips passing through the apertures and for discharging them at the periphery of the cutting wheel.

17. The chipper of claim 15, wherein the apertures and knives extend to the periphery of the cutting wheel.

18. The chipper of claim 17, wherein the front disc of the cutting wheel comprises a plurality of pie-shaped plates mounted in spaced relation to the rear disc, the trailing edge of each plate forming the leading edge of each elongated aperture.

19. The chipper of claim 17, wherein the periphery of the wheel is circular and the outer peripheral end of the web members and knives conforms with the circular periphery of the cutting wheel.

20. The chipper of claim 19, wherein the housing is closely spaced from, and is of similar circular configuration to, the periphery of the cutting wheel.

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