

March 20, 1962

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3,025,895

MACHINE FOR PRODUCING WOOD PARTICLES

Filed Feb. 1, 1960

3 Sheets-Sheet 1

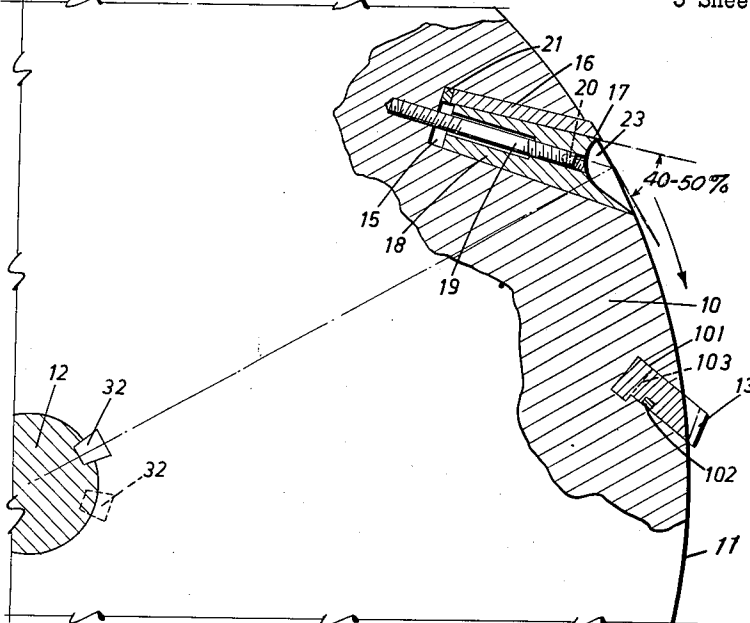


FIG. 1

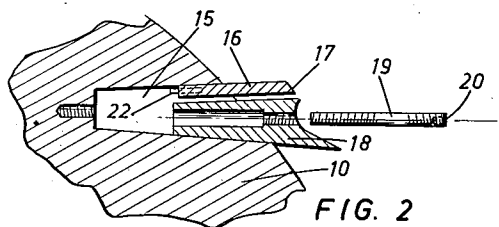


FIG. 2

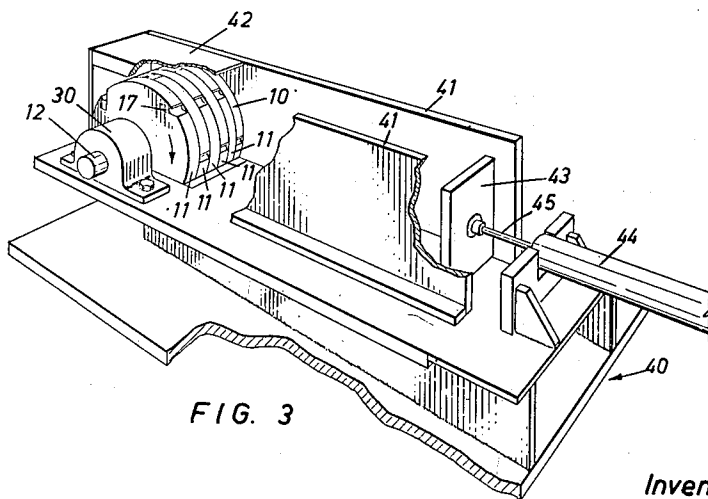


FIG. 3

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3 Sheets-Sheet 2

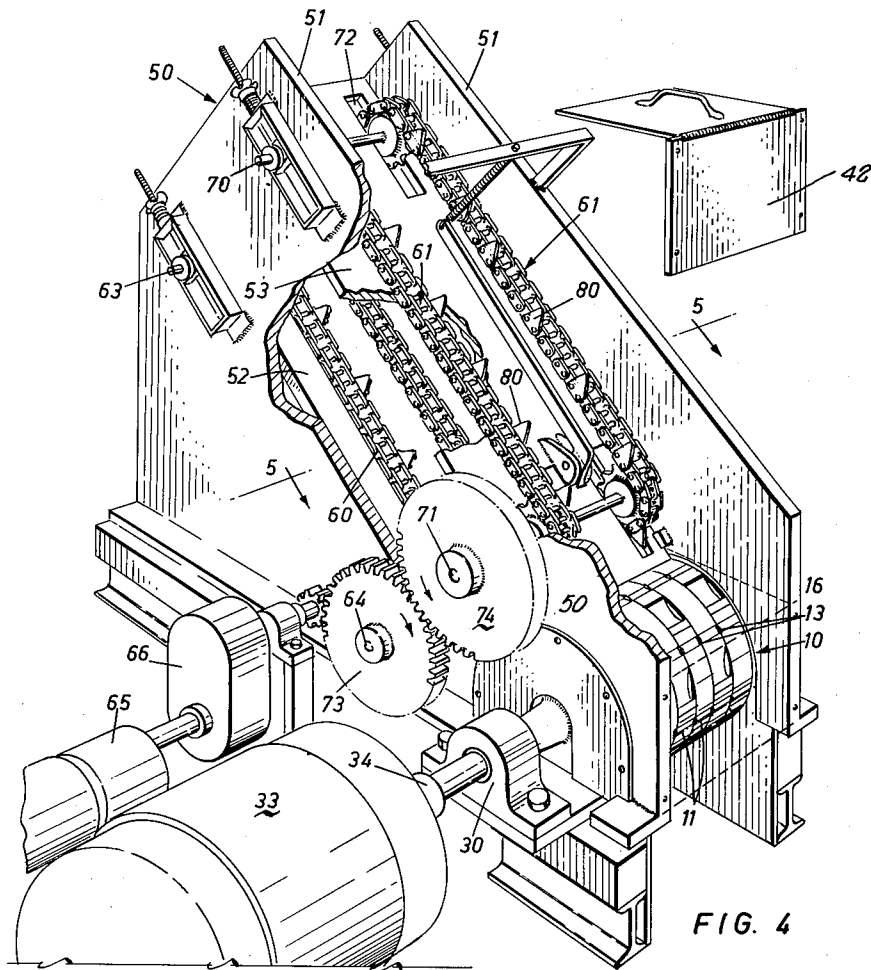


FIG. 4

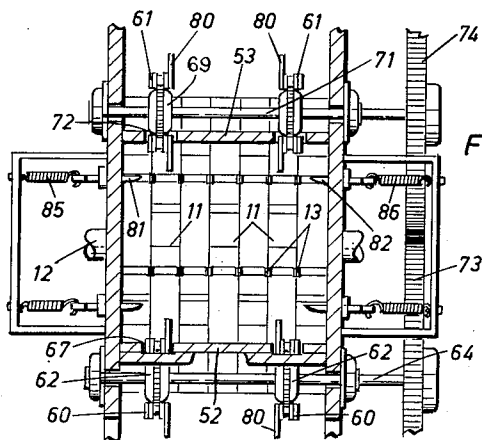


FIG. 5

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3 Sheets-Sheet 3

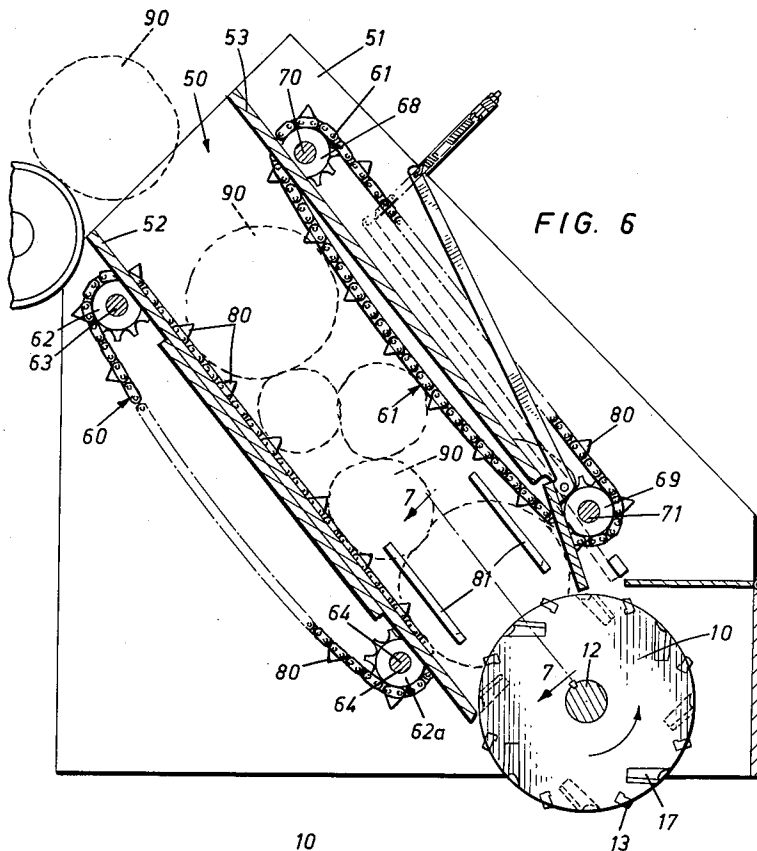


FIG. 6

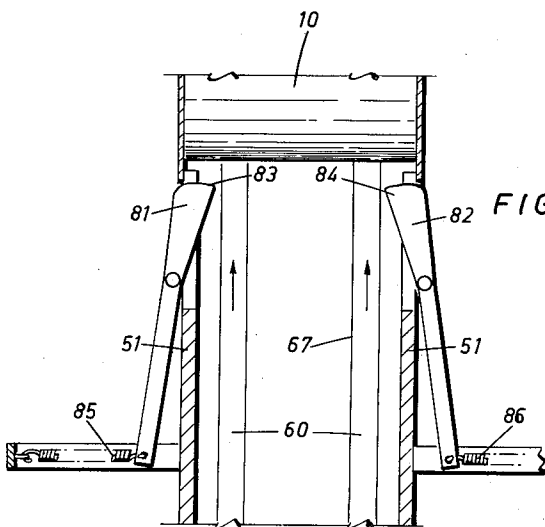


FIG. 7

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3,025,895
MACHINE FOR PRODUCING WOOD PARTICLES
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Filed Feb. 1, 1960, Ser. No. 5,960
5 Claims. (Cl. 144—172)

This invention relates to machines for the production of wood particles or flakes such as are used in the manufacture of wood pulp, paper, and wood sheets, wallboard, wood particle boards and the like.

This application is a continuation-in-part of my application Serial No. 721,158, filed March 13, 1958, and now abandoned.

Methods and apparatus are known and are widely used for distintegrating wood, such as in the form of logs and slabs and the like, into chips, wood shavings, wood flour and the like for use in the manufacture of paper and paper pulp. Also, methods and apparatus are known and are in use for producing sawdust, wood particles and wood flakes for use in the manufacture of wood sheets such as are used in pressed wood products.

There are problems in the manufacture of wood particles or wood flakes. Known wood shaving machines have the disadvantages of relatively low production of desired wood particles or flakes in a predetermined period of time and relatively high production and maintenance costs. Also, a large percentage of the product is in the form of particles of random sizes which are not suitable for use in high quality wood sheets, and they leave an undisintegrated remnant or snipe of each piece of wood shaved which must be discarded and which may constitute an appreciable percentage of the weight of the original piece of wood. A further disadvantage of known wood shaving or wood flaking machines is that they will not operate satisfactorily on frozen or on poor quality wood.

A primary object of this invention is to provide a wood shaving or wood flaking machine which is capable of producing wood particles or flakes of predetermined, substantially uniform thickness and of predetermined length and width which can be varied to meet the requirements of individual users; which is capable of a high rate of production within a predetermined time period; which is adapted to disintegrate into particles all of a piece of wood exposed to it with a minimum amount of reject or waste material; which is capable of shaving wood in the form of logs, slabs, wood pieces, wood sheets and the like, regardless of its shape and regardless of whether it is in frozen or unfrozen condition; and which can be constructed, installed and operated relatively inexpensively.

The wood shaving machine of the present invention comprises, in general, a cylindrical shaped cutter head formed of a plurality of circular discs of the same diameter mounted on a shaft for rotation as a unit. A plurality of cutting knives are detachably secured at spaced intervals around the periphery of each of the discs and extend transversely the full width thereof. Each cutting knife extends a predetermined distance beyond the periphery of the disc and at an acute angle thereto measured in the direction of rotation thereof. Each cutting knife is spaced about one-half the distance between two spaced knives mounted transversely on the next adjacent disc. Means are provided for advancing wood at a substantially uniform rate of feed to the working face of the cutter head.

An understanding of the wood shaving machine of the present invention can be obtained from the following description, reference being made to the accompanying drawings in which:

FIGURE 1 is a side elevation of a portion of the cutter

head with a preferred arrangement of a knife assembly shown in section;

FIGURE 2 is an exploded view, in section, of an adjustable and removable knife assembly;

FIGURE 3 is a perspective view of an arrangement for advancing wood pieces to and holding them firmly against the the cutter head;

FIGURE 4 is a perspective view of an alternative arrangement for advancing wood pieces continuously at a uniform rate of feed to the cutter head;

FIGURE 5 is a front elevation in section of the cutter head assembly taken along the line 5—5, FIGURE 4;

FIGURE 6 is a side view in section of the assembly illustrated in FIGURE 4; and

FIGURE 7 is a detail view in section taken along the line 7—7, FIGURE 6.

Like reference characters refer to like parts throughout the description and drawings.

Referring to FIGURE 1, the cutter head 10 comprises a plurality of circular discs 11 of the same diameter. The discs are mounted on shaft 12 for rotation as a unit. Each disc 11 is formed of material, such as high carbon steel, which is capable of withstanding the strains to which it is subjected in use.

The periphery of each disc is of a width which either is equal to the greatest length of the desired wood particles, or the particles may cut shorter than the width of the disc by providing an upstanding scoring knife 13, described in detail hereinafter, which scores the wood before it is cut and thus causes the particles to break into desired lengths as they are cut.

The cutter head 10 is comprised of a plurality of discs 11 assembled together in fixed relationship for rotation as a unit to present a working face to the wood subjected to the shaving or flaking operation. An important advantage of the cutter head of this invention is that the discs can be manufactured in standard sizes and assembled to provide a working face of a width desired by a customer to produce wood particles of desired size and thickness at a desired rate per unit of time.

Knife slots 15 are formed transversely of the periphery of each disc at predetermined spaced intervals, the spacing of the knife slots being the same on each disc which forms the cutter head assembly. The discs are assembled together so that the knife slots are arranged in staggered relation in which each slot in the periphery of a disc is positioned about one-half the distance between two spaced slots in the next adjacent disc.

Each knife slot 15 is designed to provide a seat for a knife 16, which is formed with a cutting edge 17 which extends a predetermined, short distance beyond the periphery of the disc, a distance sufficient to produce maximum thickness desired of the wood particles, having regard to the fact that it may be desired, for the purpose of economy, to sharpen the knives in place a limited number of times before changing the knives. The knife 16 is seated in its respective slot 15 so that it extends beyond the periphery of the disc at an acute angle thereto measured in the direction of rotation thereof. The angle at which the knife is to be extended can be determined readily to obtain the most satisfactory cutting action. The angle usually is within the range of from about 40° to 50° to the periphery of the disc measured in the direction of rotation of the disc.

Each knife 16 is firmly, but detachably, secured in its seat or slot, such as by a wedge-shaped clamp 18 which is secured in place in the slot 15 by a clamping and retracting bolt 19 which is threaded into both the clamp 18 and the disc 11. A preferred clamping assembly is illustrated in FIGURE 2 in which the clamping bolt 19 is provided at one end with a right hand thread

and the other end with a left hand thread. The outer end of the bolt is formed with an opening 20 adapted to receive a tool, such as an Allen wrench, for turning it. By rotating the bolt in one direction, the clamp is drawn into its knife holding position, and in the other direction it pushes the clamp out of the slot. The clamp 18 can be provided, if desired, with a device, not shown, which engages the knife 16 and draws it out of the slot with the clamp.

The position of the base of the knife 16 in the slot 15 is adjusted to have knife edge 17 extend a predetermined distance above the periphery of the disc. As the length of the knife is shortened due to sharpening, the desired position of the knife edge relative to the periphery can be maintained constant by adding a fusible metal 21, such as a babbitt, to the base of the knife, or by the use of shims, or by the use of an adjusting screw 22 which can be threaded into the base of the knife and extends to the base of the slot.

Scoring knives 13 are mounted in holders 101 which are held by keys 102 in aligned slots 103 formed at spaced intervals between selected knife slots around the peripheries of the discs. The slots 103 extend the full width of the cutter head with exposed surfaces of the scoring knives extending from the periphery thereof beyond the cutting paths of the knives 16. These scoring knives 13 score paths in the wood at selected, spaced intervals across the face of the wood and the knives 16 cut out the sections of the wood between the paths.

The exposed face of the clamp preferably is formed with a concave shaped cavity which extends in an arcuate curve from the knife edge to the opposite edge of the slot. A wood particle is received in this cavity as it is cut and is carried to its point of discharge at the bottom of the disc. The sides of the cavity 23 can be relieved, if desired or necessary, for heavy flakes.

The cutter head illustrated in the drawings is mounted on a shaft 12, the spaced ends of which are journaled in bearings 30 which are secured to and supported by a frame 50. The individual discs which form the cutter head can be secured to the shaft 12 for rotation therewith by conventional means, such as by keys 32 driven into key-way slots formed in the walls of the central bores of the discs.

The cutter head is driven by a motor 33, preferably through a direct connected coupling 34.

The motor 33 can be of the constant speed type and the speed selected to produce optimum cutting results.

It is necessary to bring the wood to be "flaked" to and hold it firmly, without vibration or rotation at the working face of the cutter head. If the wood piece being cut is permitted to vibrate or "bounce" or rotate, the wood particles produced are not of uniform size and thickness. Rather, they are of random sizes and there is a tendency to tear the particle away from the piece rather than cut it cleanly.

Suitable assemblies for advancing the wood pieces to the working face of the cutter head are illustrated in FIGURES 3 and 4.

The assembly illustrated in FIGURE 3 for advancing wood pieces to and for holding them against the working face of the cutter head comprises an elongated frame formed of a base 40 and side walls 41 spaced apart the width of and extending to but stopping short of the cutter head, leaving sufficient clearance for the free rotation of the cutter head but insufficient for the escape of wood pieces. Preferably, a cover 42 is provided over the frame to prevent the escape of wood particles and to hold the wood pieces in general alignment as pressure is applied to advance them to and hold them against the cutter head.

The forward end of the frame is open to the working face of the cutter head. Means are provided such as a hydraulically operated ram 43, to advance the wood pieces to and hold them against the cutter head. The

ram 43 is movable from a position at the rearward end of the frame to a preselected point adjacent to the working face of the cutter head. This ram 43 is adapted to press wood pieces in the frame firmly with a predetermined pressure against the working face of the cutter head. This ram can be actuated by any conventional means but, preferably, is actuated by air or hydraulic fluid which is fed under pressure into a cylinder 44 which actuates the piston 45 on the forward end of which the ram is mounted. Continuous, uniform predetermined pressure is applied to the ram on its forward motion. The cylinder 44 can be provided, if desired, with a quick opening valve which operates automatically at the end of the piston stroke or which can be operated manually at any point of its stroke to return the ram to its starting position with a snap action.

Referring to the assembly illustrated in FIGURES 4, 5 and 6, the cutter head, knives, and cutter head assembly are as described above. The cutter head is mounted adjacent to the discharge end of a chain conveyor which is mounted in the frame 50 which can be considered as a feed chute. The frame preferably is constructed of steel or cast iron and comprises spaced side walls 51 and spaced bottom and top members 52 and 53, respectively, which define the chute.

A pair of endless, transversely spaced bottom chains 60 extend the length of the chute 50 from a point adjacent to the feed end to a point adjacent to the cutter head. A pair of endless, transversely spaced top chains 61 extend, preferably in alignment with the bottom chains, from the feed end of the chute to a point adjacent to the cutter head. The bottom chains 60 are extended over sprockets 62—62a which are mounted on shafts of which the forward shaft 64 is driven in a forward direction by variable speed means, such as a hydraulic motor 65 and speed reducer 66 combination. The speed reducer is meshed with a gear 73 mounted on shaft 64. The shafts 63—64, which are journaled in bearings carried by the sides of the frame, are positioned such that the sprockets 62—62a extend through slots 67 formed in the bottom member, thus carrying the chains above the bottom of the chute in their forward direction of travel.

The top chains 61 are mounted in a manner similar to the bottom chains. That is, they are extended over sprockets 68—69 which are mounted on shafts 70—71 journaled in bearings carried by the sides of the frame above the top of the frame at the rearward and forward ends thereof. The shafts are positioned such that the sprockets extend through slots 72 formed in the top of the chute. A gear 74, which is meshed with gear 73 on shaft 64, is mounted on the forward shaft 71 and drives that shaft at the same speed at which the lower shaft is driven.

Uprstanding projections 80 are carried by each of the chains at spaced intervals to engage the outside peripheries of the wood pieces and advance them towards and to the working face of the cutter head.

A pair of spaced gripper members 81—82 are at the forward end of the chute at transversely aligned points as close as possible to the working face of the cutter head. These members are formed with forward ends 83—84 which extend through the side walls 51 into the chute. They are pivotally mounted exteriorly of the feed chute with the forward ends normally urged into the chute such as by the springs 85—86 or other conventional means such as air operated pistons.

This type of conveyor can be designed of a size such as to convey the sizes of wood normally handled by the plant in which it is used. I have found that the provision of the rigid top and bottom members serve to retain the wood pieces in general alignment with the cutter head. Also, as the chains must terminate clear of the working face of the cutter head, the wood piece or pieces at the cutter head are retained there firmly by the pressure of wood pieces behind them rather than by the chains. As the

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wood is fed into the chute by the chains, the forward ends of the gripper members are forced outwardly causing the sharp edges to bite into wood, thus preventing rotation of the wood and stabilizing it during cutting.

Wood pieces, such as in the form of logs 90 can be fed into the feed end of the chute manually or by a conventional conveyor assembly.

The machine for producing wood particles of the present invention possesses many important advantages. The knives can be quickly detached from the discs and replaced by sharpened knives. Alternatively, they can be sharpened in situ by a conventional knife sharpening machine.

The machine has a high productive capacity of wood particles of substantially uniform length, width and thickness. The discs can be designed of any desired diameter and length having regard to the diameter and length of the wood to be flaked. The arrangement of the knives can be designed to produce wood flakes of predetermined length, width and thickness with maximum production per unit of time.

What I claim as new and desire to protect by Letters Patent of the United States is:

1. A machine for producing wood particles which comprises a rotatable, cylindrical cutter head formed of a plurality of circular discs of the same diameter mounted on a shaft for rotation as a unit, a plurality of cutting knives detachably secured at spaced intervals around the periphery of each of said discs and extending transversely the full width thereof, each cutting knife extending a predetermined distance beyond the periphery of the disc at an acute angle thereto measured in the direction of rotation thereof and spaced about one-half the distance between two spaced knives mounted transversely of the next adjacent disc.

2. A machine for producing wood particles which comprises a rotatable, cylindrical cutter head formed of a plurality of circular discs of the same diameter mounted on a shaft for rotation as a unit, a plurality of cutting knives detachably secured at spaced intervals around the periphery of each of said discs and extending transversely the full width thereof, each cutting knife extending a predetermined distance beyond the periphery of the disc at an acute angle thereto measured in the direction of rotation thereof and spaced about one-half the distance between two spaced knives mounted transversely of the next adjacent disc, means for rotating said cutter head, and means for bringing wood pieces to and for holding them firmly against the working face of said cutter head.

3. A machine for producing wood particles which comprises a rotatable, cylindrical cutter head formed of a plurality of circular discs of the same diameter mounted on a shaft for rotation as a unit, a plurality of cutting knives detachably secured at spaced intervals around the periphery of each of said discs and extending transversely the full width thereof, each cutting knife extending a predetermined distance beyond the periphery of the disc at an acute angle thereto measured in the direction of rotation thereof and spaced about one-half the distance

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between two spaced knives mounted transversely of the next adjacent disc, and at least one scoring knife mounted between spaced cutting knives and extending transversely of the disc to which it is secured beyond the cutting paths of said cutting knives by at least the thickness of the wood particles to be cut thereby.

4. A machine for producing wood particles which comprises a rotatable, cylindrical cutter head formed of a plurality of circular discs of the same diameter mounted on a shaft for rotation as a unit, a plurality of cutting knives detachably secured at spaced intervals around the periphery of each of said discs and extending transversely the full width thereof, each cutting knife extending a predetermined distance beyond the periphery of the disc and at an acute angle thereto measured in the direction of rotation thereof and spaced about one-half the distance between two spaced knives mounted transversely of the next adjacent disc, means for bringing wood pieces to the working face of the cutter head, and means for gripping and holding the wood pieces firmly against rotation at the working face of the cutter head.

5. A machine for producing wood particles which comprises a rotatable, cylindrical cutter head formed of a plurality of circular discs of the same diameter mounted on a shaft for rotation as a unit, a plurality of cutting knives detachably secured at spaced intervals around the periphery of each of said discs and extending transversely the full width thereof, each cutting knife extending a predetermined distance beyond the periphery of the disc and at an acute angle thereto measured in the direction of rotation thereof and spaced about one-half the distance between two spaced knives mounted transversely of the next adjacent disc, means for advancing wood pieces to the working face of the cutter head which comprises a feed chute, spaced upper and lower endless travelling chains mounted in said feed chute, means for driving said chains, and means adjacent the cutter head for gripping and holding against rotation wood pieces advanced to the cutter head by said chains.

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