Dec. 2, 1952 C. E. R. VAZIEUX ET AL 2,620,138

COMMINUTING APPARATUS

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Fig. 1.

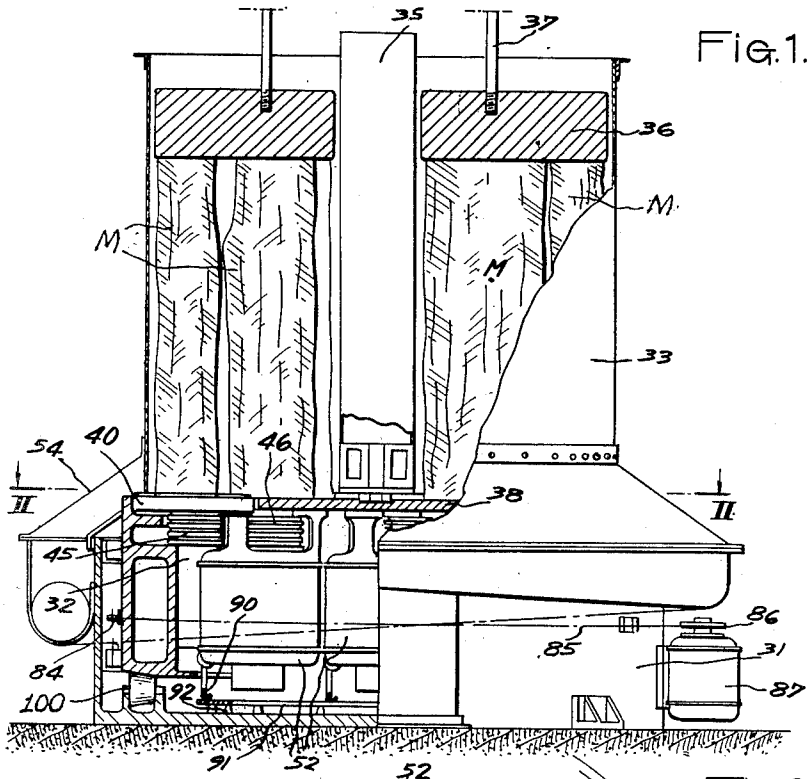


Fig. 2.

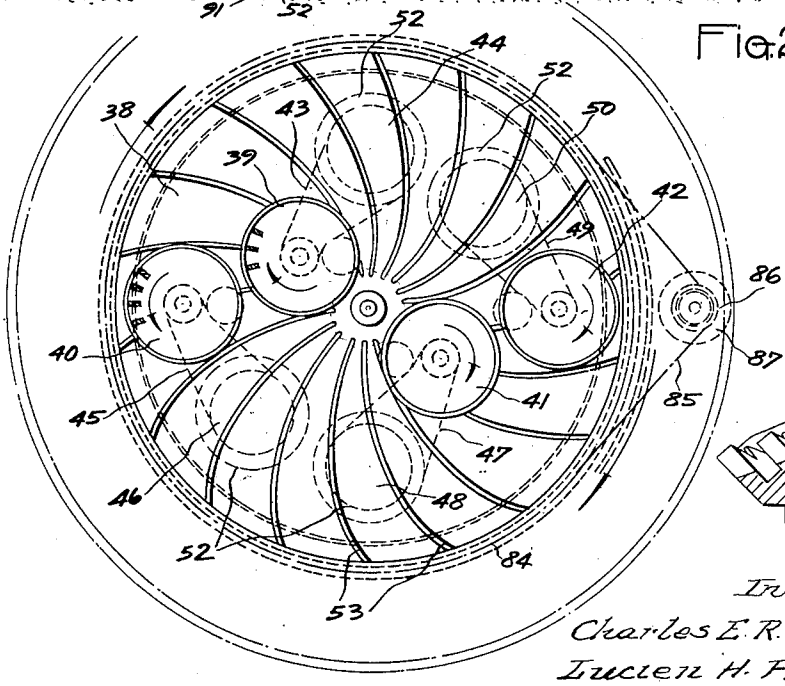
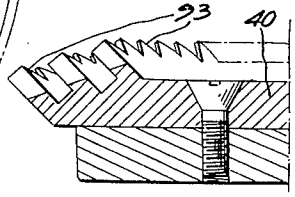


Fig. 2a



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COMMINUTING APPARATUS

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Fig. 4

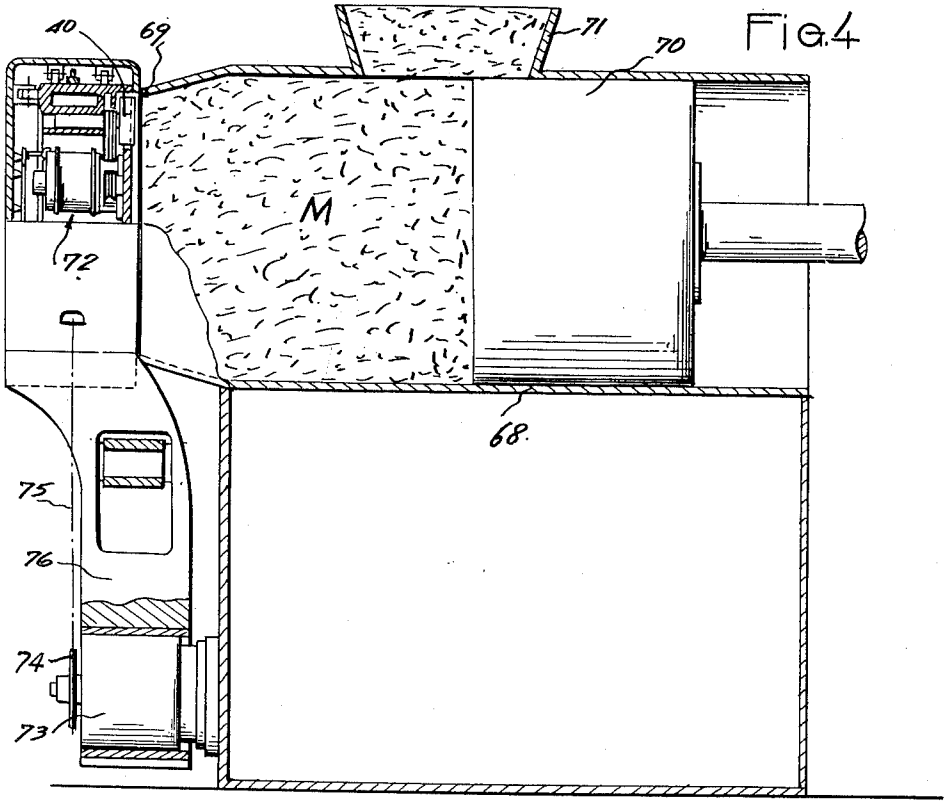
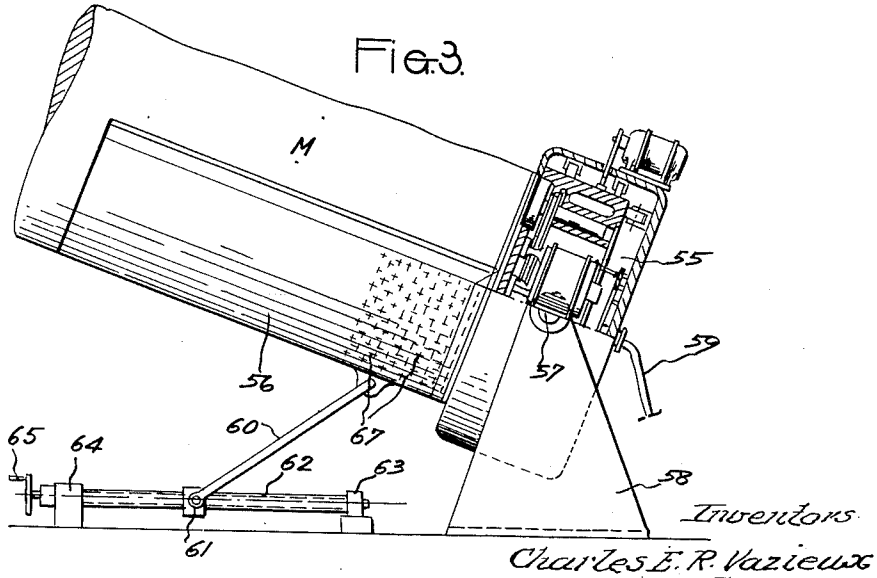


Fig. 3.



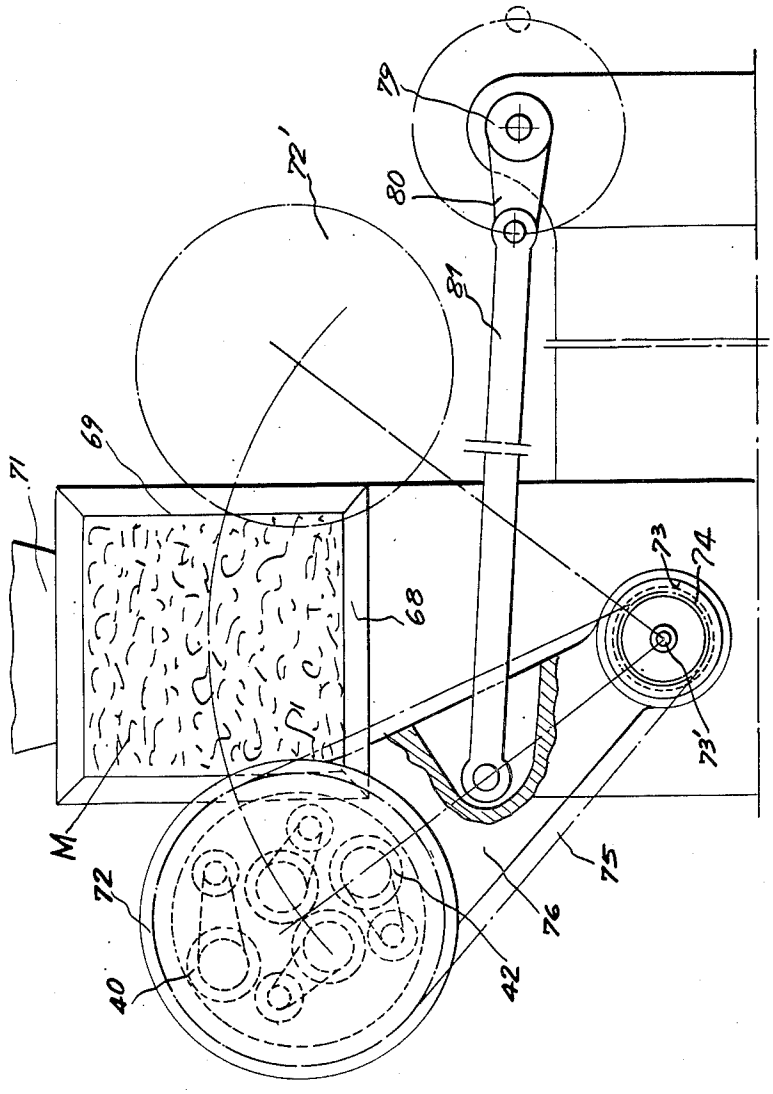
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Fig. 5.



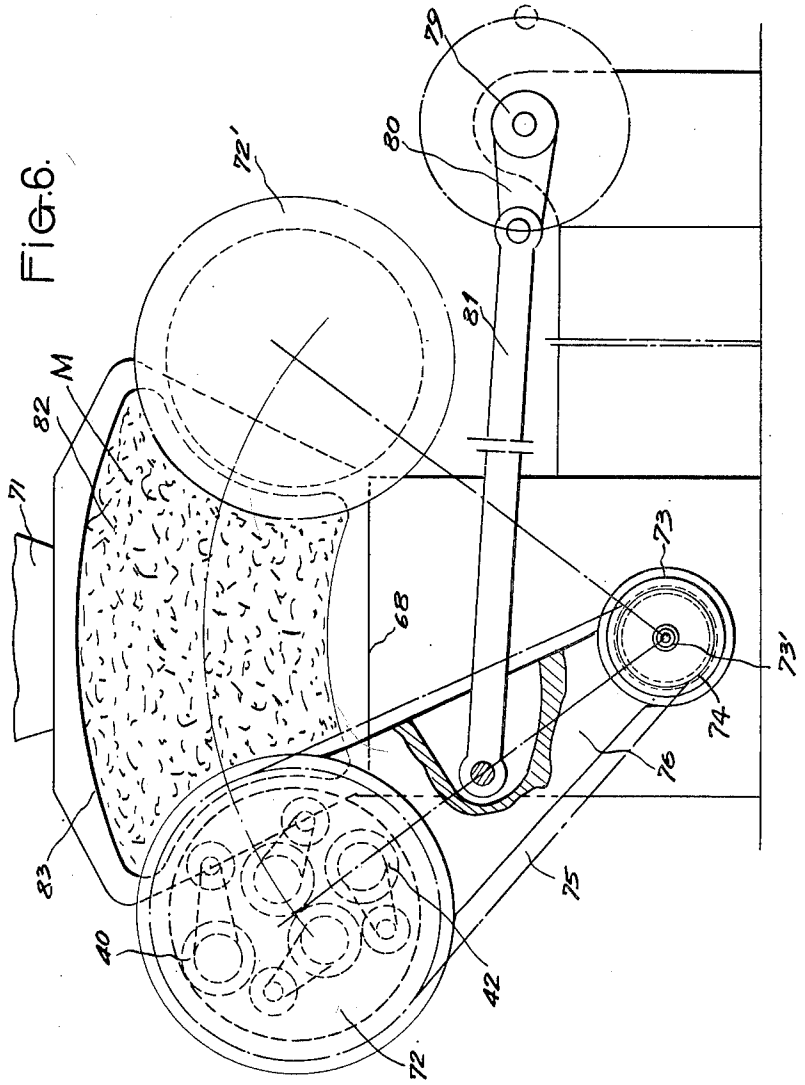
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Fig. 6.



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Patented Dec. 2, 1952

2,620,138

UNITED STATES PATENT OFFICE

2,620,138

COMMINUTING APPARATUS

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Original application July 9, 1947, Serial No. 759,750. Divided and this application September 16, 1948, Serial No. 49,602. In France July 12, 1946

10 Claims. (Cl. 241—265)

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This invention relates to comminuting apparatus and more particularly to machines for comminuting wood and other fibrous and vegetable matter. This application is divided from copending application Ser. No. 759,750, filed July 9, 1947, now Patent No. 2,564,551.

It is a well-known practice to comminute wood and other fibrous or vegetable materials, such as straw, used in many industrial operations. The comminuted material may be used as sawdust or employed for producing a pulp or as an ingredient in a process or composition. It is also advantageous in facilitating transport or storage, as it is less bulky than the original material in its natural state.

It is the principal object of the present invention to provide apparatus for comminuting wood or other fibrous substances that has simplicity of design, economy of construction and efficiency of operation.

Another object of the invention is to provide a machine for comminuting wood and fibrous substances such as straw, papyrus, and other vegetable substances such as manioc, either for immediate use of the comminuted material or for facilitating transport or storing of the material by reducing its volume and its bulk.

The novel features that are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawings, wherein like reference characters indicate like parts throughout the several figures and in which:

Fig. 1 is a cross-sectional view taken on a vertical plane through the axis of a machine according to the present invention, showing parts in elevation;

Fig. 2 is a cross-sectional view taken substantially along the line II—II of Fig. 1 looking down as indicated by the arrows;

Fig. 2*a* is a partial cross-section of a cutter;

Fig. 3 is a side view in elevation of a modification;

Fig. 4 is a cross-sectional view taken on a vertical plane through the axis of another modification;

Fig. 5 is a front view in elevation of the modified machine shown in Fig. 4; and

Fig. 6 is a diagrammatic view of the outlet

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section of a hopper for the modification shown in Figs. 4 and 5.

Referring now to the drawings, specifically to Figs. 1 and 2, a machine in accordance with the present invention comprises a base 31 supporting a series of wheels 100 on which is rotatably mounted a comminutor block 32 and a hopper 33 to receive material M to be comminuted, such as logs. A shaft 35 extends vertically in the center of said hopper, so that the material M is located in an annular chamber between the shaft 35 and the cylindrical wall of the hopper 33. An annular piston 36, connected to rods 37, is adapted to press the material M towards the comminutor block 32.

The comminutor block 32 includes a rotatable plate 38, having openings for receiving rotary milling cutters 39, 40, 41 and 42, which are journalled on the block 32 and are respectively driven by belts 43, 45, 47, and 49 from pulleys 44, 46, 48 and 50. The openings are so arranged that the four cutters 39, 40, 41, 42 extend across the bottom of the entire annular chamber formed between the shaft 35 and the wall of the hopper 33. The pulleys 44, 46, 48, 50 are all driven by electric motors 52 which are carried by the block 32. Said motors are supplied with electric current by brushes 90 which slide on a conducting ring 91, supported through isolating means 92 on the base.

The drives are effected in such a manner that one or more cutters are driven in opposite directions to the others, thereby further increasing the fragmentation. The complete comminutor block comprising the plate 38 in which are fitted the rotary cutters 39, 40, 41, 42 and their drives, is given a rotary movement by means, for instance, of a chain 85 driven by a pinion 86 and meshing with the toothed wheel or ring 84 provided on said block or depending peripheral anti-friction supported wall structure thereof.

The cutters 39 to 42 are preferably provided with a series of inclined teeth 93, according to Fig. 2*a*, so as to engage gradually a certain height of fibre, cutting said fibre into very small particles, as more completely disclosed in copending application Serial No. 759,750. The sawdust or comminuted material so produced is discharged through a duct 54. As best shown in Fig. 2, grooves 53 are formed in the plate 38 to facilitate the discharge of the sawdust or other comminuted material to the duct 54. These grooves are preferably of arcuate shape, so that the centrifugal force cooperates in the removal of the particles which penetrate therein.

Fig. 3 shows a modification in which the machine, similar to that shown in Fig. 1, comprises a comminution block 55 with cutters arranged and driven in the same manner as shown and described in connection with Figs. 1 and 2, and a loading hopper 56. The block 55 is supported on a pivot 57 mounted on supports 58. The current for the electric motors is supplied through a cable 59. The comminution block 55 and the hopper 56 are secured together and can be swung as a unit about the pivot 57. The hopper 56 has a connecting rod 60 pivotally secured thereto, which, in turn, is pivotally secured to a threaded collar 61 that is mounted on a screw-threaded bar 62 for movement therealong. The bar 62 is rotatively supported in two bearings 63, 64 and connected to a crank handle 65. Holes 67 are provided at the base of the hopper 56 to discharge the comminuted fragments or sawdust.

In operation, upon rotation of said crank handle 65 the collar 61 is threaded along the screw-threaded bar 62 in one direction or the other, depending upon the direction in which the crank is turned. The movement of the collar 61 effects the raising or lowering of the hopper 56 which contains the log M. With this modified construction it is possible to maintain in this instance, by the gravity of the log constant pressure on the comminution block 55 by gradually lifting the hopper 56 as the log M is consumed and consequently decreases in weight.

In still another modification, as shown in Figs. 4 and 5, the machine is more particularly adapted for use in comminuting fibrous materials such as straw or the like. This machine comprises a horizontal receiver and compression chamber 68 in which material is compressed and fed toward a reduced discharge end having a discharge opening 69 by a piston 70, the material being loaded on a vertical supply hopper 71 on the top of the horizontal receiver 68. A cutter supporting block 72, similar to the blocks shown in Figs. 1 and 2, is journalled on an arm 76 and driven by a motor 73 by means of a pulley or pinion 74 and belts or chains 75.

The cutter block 72 is pivotally supported by the arm 76 for oscillation about the shaft 73' of the motor 73, as indicated by the full line position and the dotted line position 72' in Fig. 5. The cutter block 72 sweeps the entire face or cross-section of the compressed material as it is fed from the hopper discharge opening 69. This oscillating movement can be imparted by means of a driven shaft 79 carrying a crank 80 which is connected by a rod 81 to the arm 76.

During the movement of the cutter block 72, its cutters completely sweep the cross-section of the compressed material at the discharge opening 69, the thickness of which engaged by the teeth of the cutters is comminuted to very small fragments. The cross-section of the compressed substance at the discharge 69 is slightly smaller than the surface swept by the two outer cutters 40 and 42 as described in connection with Fig. 1, so that the entire cross-section of the substance is comminuted. As shown in Fig. 6, the outlet cross-section of the disharge 69 may have a segmental shaped opening 82, the wall 83 of the receiver, defining the discharge opening 69 being profiled in the shape of a segment, the segmental opening accommodates the oscillatory movement of the block 72 on the arm 76 and therefore the entire surface of the material of

the opening 82 is subject to uniform action relative to the milling cutters.

The shaft 79 can be driven by means of a hand-crank or of a motor, and may be adapted not only to actuate the connecting rod 81 which moves the fragmentation block 72, but also to impart the reciprocating motion to the compression piston 70.

The invention, thus, is adapted to efficiently comminute wood, which may be treated in multiple logs, as shown in Fig. 1, or in a single large log, as shown in Fig. 3, in which the considerable load exerted by the large log M on the comminution block can be regulated. In the case of straw or other ligneous substance, use may advantageously be made of the machine shown in Figs. 4 and 5, in which the products are inserted vertically into the hopper and gradually compressed and fed by the piston 70.

In certain cases, for example, in order to avoid fire hazards, the comminution plate may advantageously be cooled; this can be effected by forming fins thereon to increase the heat exchange surfaces or by providing a circulation of a cooling fluid, such as water. In other cases, on the contrary, particularly for comminuting certain kinds of wood, the comminution plate may be heated, for example by means of electricity, steam, water, gas, or the like.

Although certain specific embodiments of the invention have been shown and described, it is obvious that many modifications thereof are possible. The invention, therefore, is not to be restricted except in so far as is necessitated by the prior art and by the spirit of the appended claims.

What we claim is:

1. A machine for comminuting fibrous materials, comprising a base, a comminution block rotatably mounted on said base and including a plate having an operative surface with inner and outer circular recesses in said surface, rotary milling cutters journalled on said block and disposed in said plate recesses parallel with said plate surface, said milling cuters having obliquely directed teeth, means carried by said block for rotating said milling cutters, means for rotating said block as a unit, and a guide for directing fibrous material to be comminuted toward said plate surface as said block and milling cutters are respectively rotated, said recesses and their respective milling cutters being in radially overlapping relation in said plate to span and slightly exceed the transverse area of said guide.

2. A machine as defined in claim 1 wherein said drive means drives said rotary milling cutters in opposite directions.

3. A machine as defined in claim 1 wherein said plate is provided with curved radially extending grooves in its face for centrifugally discharging the comminuted material from the milling cutters to the periphery of said plate.

4. A machine for comminuting fibrous materials, comprising a base, a comminution block rotatably mounted on said base and including a plate having an operative surface with inner and outer circular recesses in said surface, rotary milling cutters journalled on said block and disposed in said plate recesses parallel with said plate surface, said milling cutters having obliquely directed teeth, electric motors carried by said block for rotating said milling cutters, means for rotating said block as a unit, a guide hopper for containing the fibrous material to be comminuted and for directing said material to-

ward said plate surface as said block and milling cutters are respectively rotated, said recesses and their respective milling cutters being in radially overlapping relation in said plate to span and slightly exceed the transverse area of said guide, and piston means movably supported for movement through said guide hopper for pressing the material toward said plate surface and milling cutters.

5. A machine for comminuting fibrous materials, comprising a base, a comminution block mounted on said base for rotation about a vertical axis and including an axially disposed plate having a horizontal operative surface with inner and outer circular recesses in said surface, horizontal rotary milling cutters journalled on said block and disposed axially in said plate recesses parallel with said plate surface, said milling cutters having obliquely directed teeth, motors carried by said block and respectively drivingly connected with said milling cutters for rotating said milling cutters, means for rotating said block as a unit, a vertical cylindrical guide hopper concentric with the rotary axis of said block, a vertical shaft disposed axially within said guide hopper and cooperative with said guide hopper in defining an annular chamber for the fibrous material to be comminuted, said recesses and their respective milling cutters being in radially overlapping relation in said plate to span and slightly exceed the transverse area of said annular chamber, and an annular piston movable through said annular chamber for pressing the fibrous material toward said plate surface as said block and milling cutters are respectively rotated.

6. A machine for comminuting fibrous material, comprising a base, a comminution block rotatably mounted on said base and including a plate having an operative surface with inner and outer circular recesses in said surface, rotary milling cutters journalled on said block and disposed in said plate recesses parallel with said plate surface, said milling cutters having obliquely directed teeth, means carried by said block for rotating said milling cutters, means for rotating said block as a unit, a guide rigidly secured to said base for directing fibrous material to be comminuted toward said plate surface as said block and milling cutters are respectively rotated, said recesses and their respective milling cutters being in radially overlapping relation in said plate to span and slightly exceed the transverse areas of said guide, means pivotally supporting said base for angular adjustment of said plate surface about a horizontal axis perpendicular to the axis of rotation of said block, and means for adjusting the angular position of said base and guide about said horizontal pivot axis.

7. A machine as defined in claim 6 wherein

said adjusting means comprises a threaded shaft journalled in a plane perpendicular to said horizontal pivot axis, a collar threaded on said shaft, a connecting rod pivotally connected at one end to said collar and at the other end to said rigidly connected base and guide, and means for turning said shaft for adjusting said collar relative to said horizontal pivot axis and thereby adjust through said rod the angulation and said base and guide.

8. A machine for comminuting fibrous materials, comprising a base, a comminution block rotatably mounted on said base and including a plate having an operative surface with inner and outer circular recesses in said surface, rotary milling cutters journalled on said block and disposed in said plate recesses parallel with said plate surface, said milling cutters having obliquely directed teeth, means carried by said block for rotating said milling cutters, means for rotating said block as a unit, a guide hopper for fibrous material to be comminuted and having a discharge opening, a piston operative in said guide hopper to press the material toward said discharge opening, a pivotally mounted arm supporting said base with said plate surface disposed in a plane substantially parallel to and closely spaced from said guide hopper discharge opening, and means for rocking said arm about its pivotal mounting to oscillate said base in front of said guide hopper and engage the material in said discharge opening by said plate surface as said block and milling cutters are respectively rotated, said recesses and their respective milling cutters being in radially overlapping relation in said plate to span and slightly exceed the transverse area of said guide hopper discharge opening.

9. A machine as defined in claim 8 wherein said guide hopper discharge opening is of segmental shape.

10. A machine as defined in claim 9 wherein said guide hopper discharge opening is of truncated helicoidal shape.

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