United States Patent [19]

Nowak

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[54] CUTTER MACHINE

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[73] Assignee: **Munson Mill Machinery Co.**, Utica, N.Y.

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[21] Appl. No.: **104,557**

[52] **U.S. Cl.** **241/189**, 83/665, 83/906, 144/218, 144/237, 241/191

[51] **Int. Cl.**.....**B02c 13/00**

[58] **Field of Search**.....241/73, 243, 241, 189, 191, 241/195, 190; 83/349, 355, 665, 906; 144/237, 218

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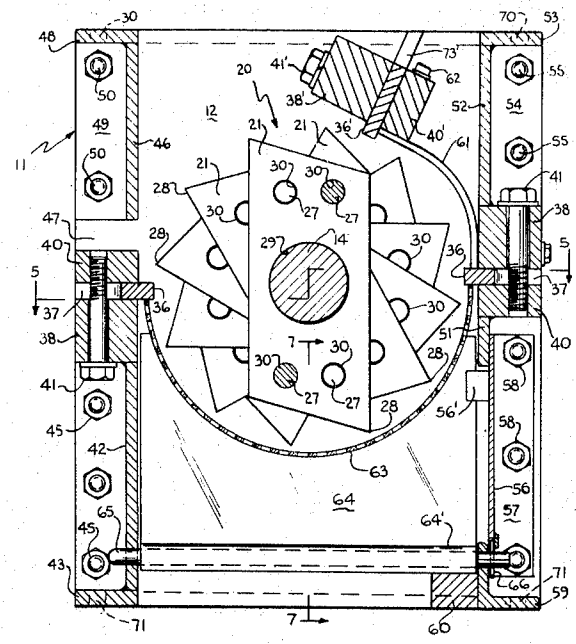
[57] **ABSTRACT**

A machine for cutting and crushing wood, nylon and other plastics and glass fibers, etc. has a rotor shaft carrying a plurality of non-rectangular parallelogram shaped plates centrally apertured for the shaft and each having two pairs of diametrically opposite keying holes equally radially spaced from the shaft, the pairs being angularly spaced. Pins through one pair of holes in each plate and a pair of holes in the contiguous plate key the plates together, the second plate being keyed to the next plate by pins through the other pair of holes, the first plate being similarly keyed to an annular flange integral with the shaft near its driven end. A spacer tube secured to the other end of the shaft clamps all the plates against the flange. A housing is closed at two ends and two sides, the shaft being journalled in the end plates. Fixed blades are adjustably secured in the housing sidewalls, the plates being fixed on the shaft so their acute angle corner edges form teeth presented to the fixed blade edges. A trough-shaped screen is secured in the housing below the rotor and a third fixed blade may be secured above the rotor. One end plate is arranged so the rotor may be withdrawn therethrough and the fixed blades are adjustable from outside the housing and means for readily adjusting the fixed blade are provided.

4 Claims, 8 Drawing Figures



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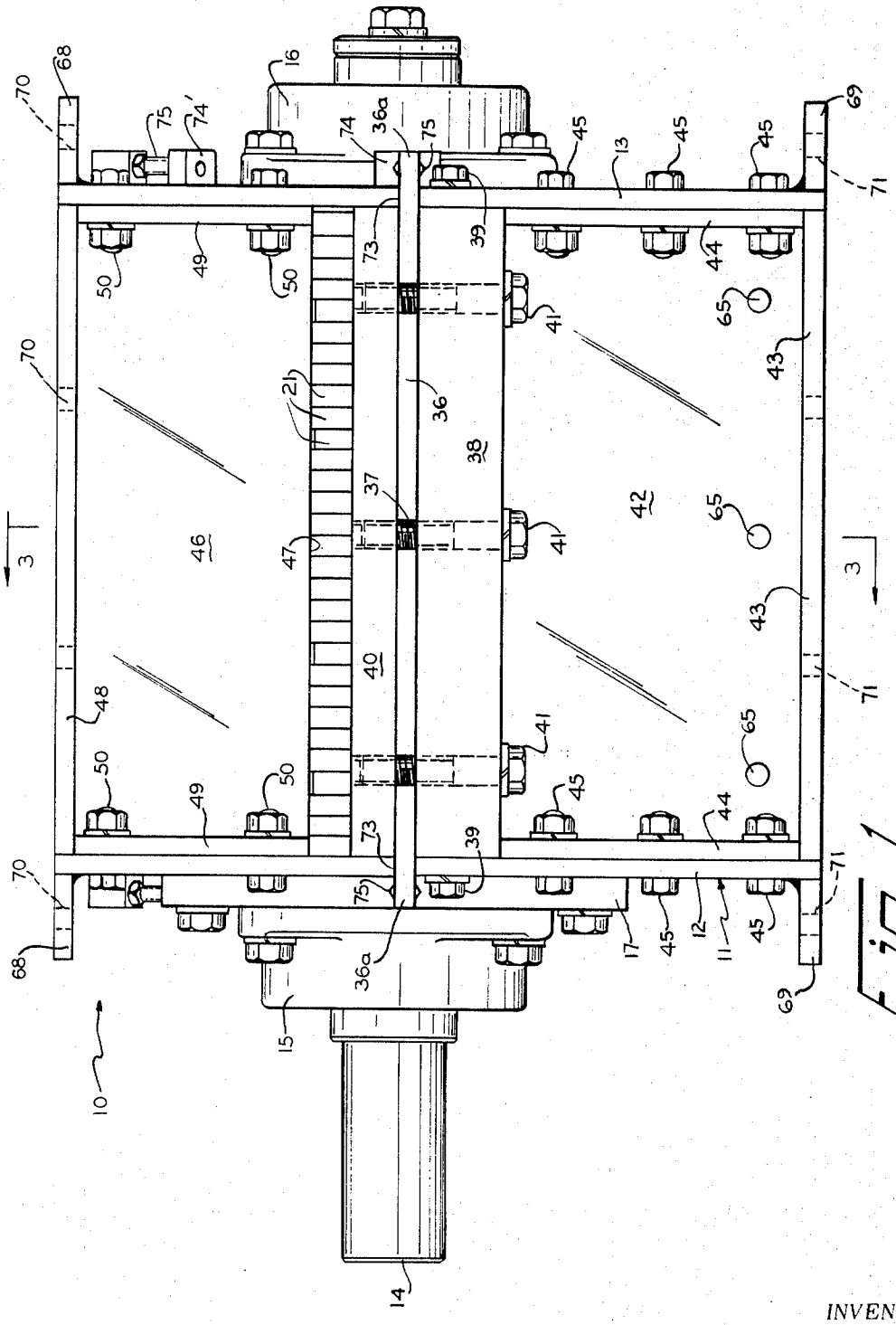

Fig. 1

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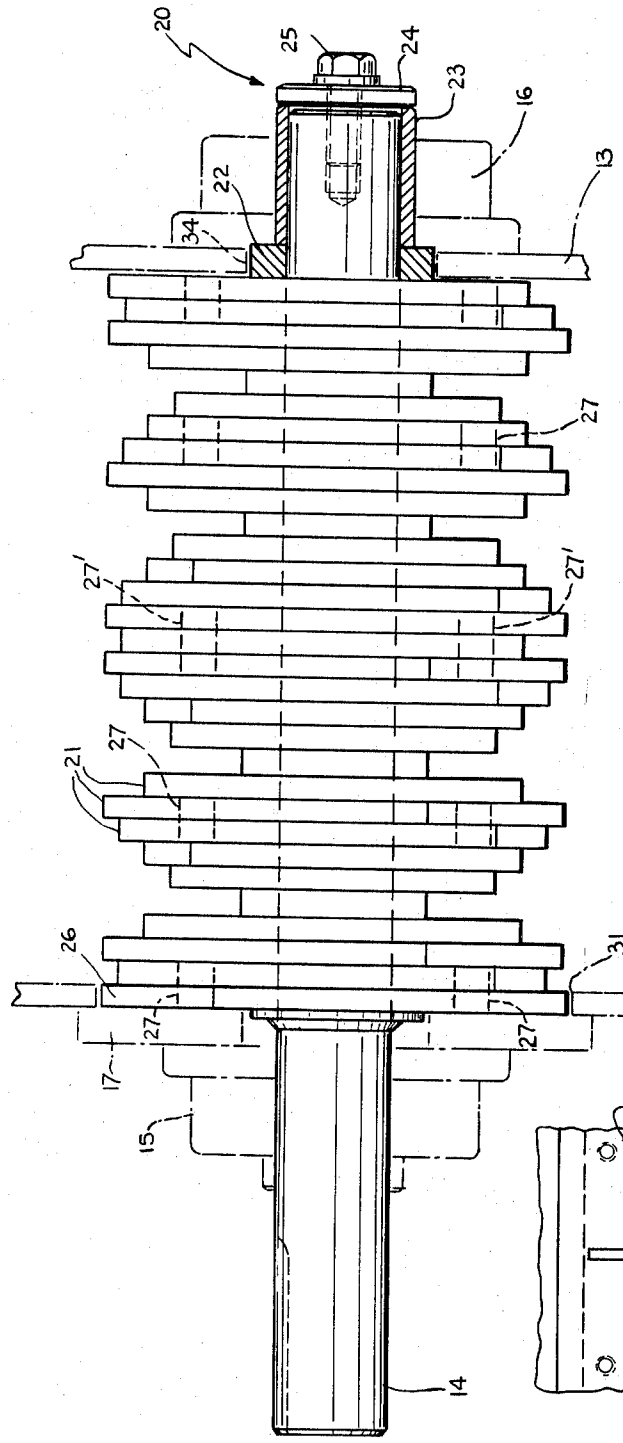

Fig. 2

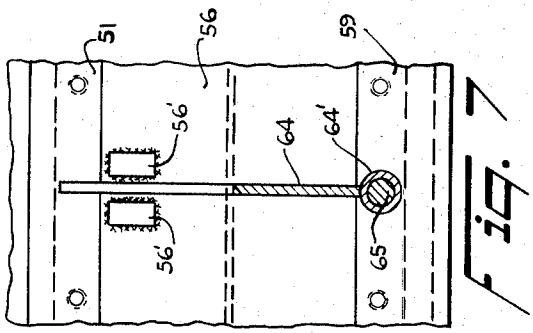

Fig. 7

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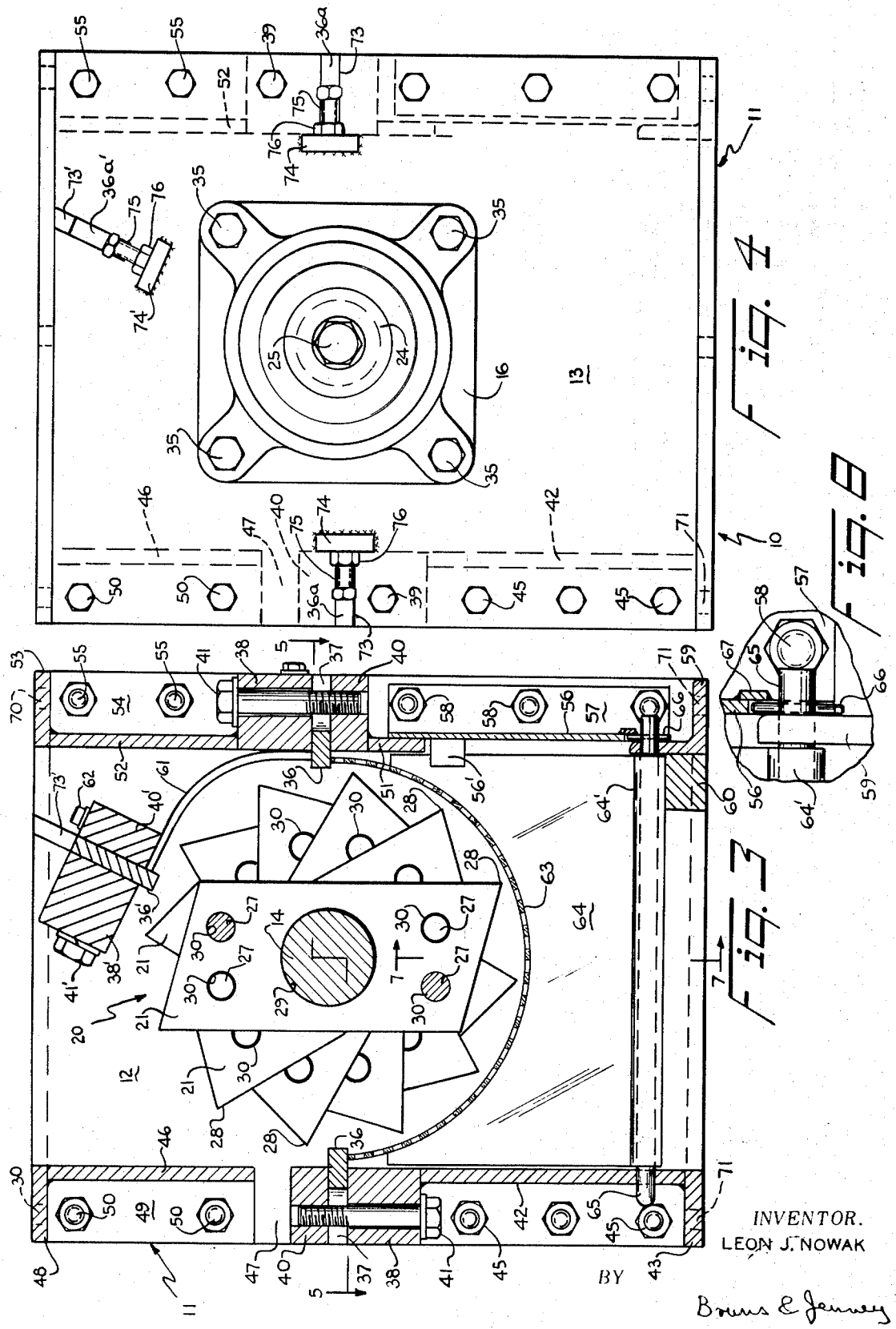

Fig. 4

Fig. 3

Fig. 5

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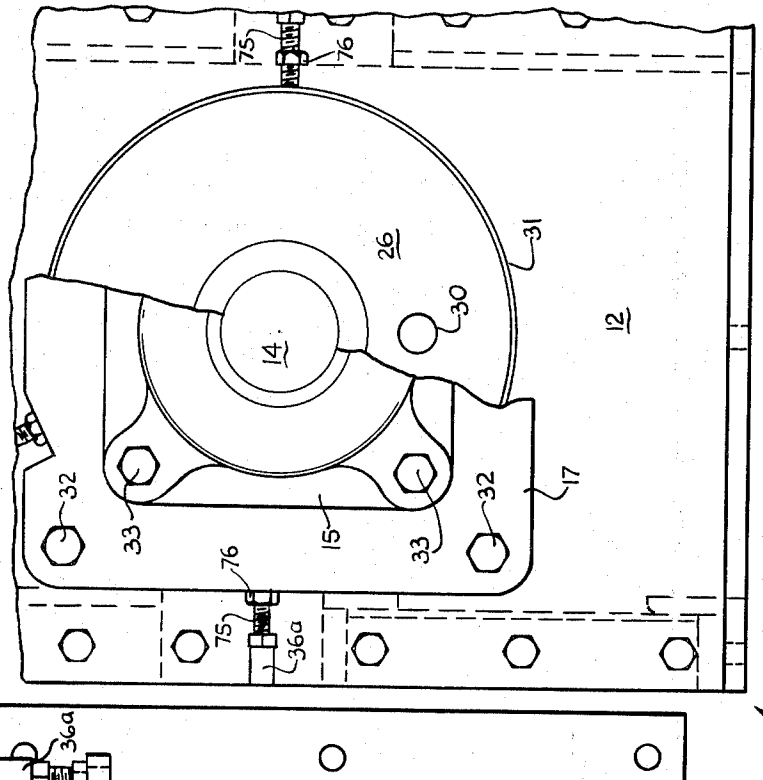

Fig. 5

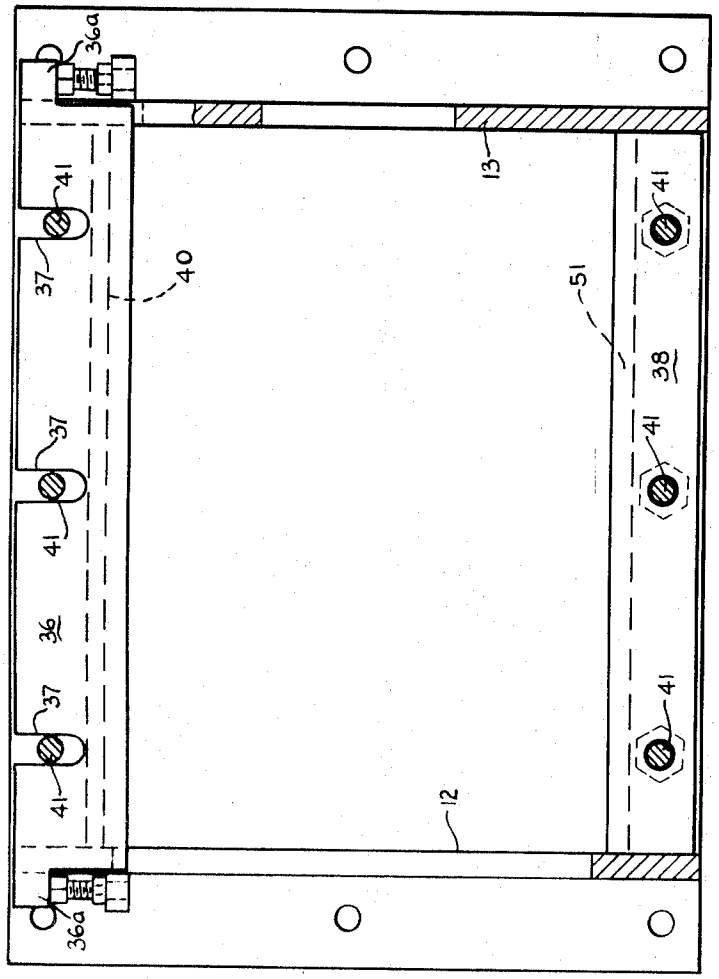

Fig. 5

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CUTTER MACHINE

BACKGROUND OF THE INVENTION

This invention relates to improvements in machines for cutting, granulating, pulverizing, crushing, or shredding a wide variety of materials. More particularly it relates to improvements in the rotary blades used, in their accessibility for sharpening, in their arrangement on the shaft and in the accessibility for adjustment and removal of the fixed blades used.

Heretofore such machines have had rotary blades keyed directly to the shaft or, where they have had rotary blades keyed to a shaft driven member at a point spaced radially from the shaft, the keying means have been screws or bolts which are laborious to remove or the rotary blades have had teeth or blade edges secured thereto by screws which have to be removed for sharpening.

Furthermore such machines that have rotary blades with knife edges are not suited for cutting materials such as hard wood or tough plastic materials such as nylon. In the case of many such machines, it is necessary to completely disassemble the machine to replace the blade edges or to remove them for sharpening.

SUMMARY OF THE INVENTION

The present invention contemplates using rotary blade teeth in the form of steel plates of substantial thickness having a non-rectangular parallelogram configuration, each plate having a centrally located hole for mounting on the rotor shaft. The opposite acute angle corner edges of the plates are disposed so as to be the forward corners as the shaft rotates to serve as reinforced teeth for cutting the material to be cut or pulverized.

The plates also have two pairs of diametrically opposite pairs of keying holes therethrough, all equally spaced radially outward of the shaft, one opposite pair being angularly spaced from the other pair by a chosen angle. A plurality of pins in these holes key each plate to the next, each pin keying contiguous pairs of plates together. A pair of pins in one opposite pair of holes keys the first plate to the second and a pair of pins in the angularly spaced holes of the second plate keys the second plate to the third, and so on, so that the acute angle teeth edges of the plates are helically staggered around the shaft.

An annular flange on the driven end of the shaft has a similar pair of holes and a pair of pins therein to key the flange to the first blade. The plates have substantial mass and are all keyed together at a radius substantially spaced from the shaft resulting in a unitary rotor driven by the shaft with teeth edges which meet the material to be shredded at successive intervals. A tubular spacer secured to the other end of the shaft clamps the plates against the shaft flange.

The shaft is journalled in the end plates of a housing having two ends and two sides and fixed knives are secured to the sides of the housing for engaging the material to be shredded between the fixed knives and the rotating teeth edges of the rotor. A trough-shaped sieve is secured in the housing between the two side blades and below the rotor for screening the shredded material, as is usual.

The two fixed blades extend through the sidewalls of the housing to the outer surface for adjustment of the blades inward and a portion of the blade ends extend through slots in the end plates for adjustment of the blades outward, screw jack means secured to the end plates being provided for adjustment of the fixed blades outward. The fixed blades are slotted transversely and each blade is provided with a support and nut means. Screws extending through each support, the blade slots and the nut means are used to adjustably secure the blades in place. These screws are accessible from outside the housing. A third fixed blade extending between end plates above the rotor may be provided if desired.

The end plate at the driven end of the shaft has a hole therethrough large enough so that the rotor assembly can be withdrawn therethrough for removing or replacing the rotor plates. The shaft flange is adapted to rotate in the hole in the end plate and an end thrust plate covering the hole is removably secured over the hole and carries the shaft journal at this end.

Means are provided at one side of the housing for access to the screen and its supports and the top and bottom of the housing are provided with flanges which may be secured to hopper or chute means for loading or to conveyer or other means for loading or unloading.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a machine according to the invention;

FIG. 2 is an elevational view of the rotor assembly thereof, portions of the journal portions of the end walls being fragmentarily shown in broken lines;

FIG. 3 is a sectional view on the line 3—3 of FIG. 1;

FIG. 4 is an end view as viewed from the right in FIG. 1;

FIG. 5 is a sectional view of the housing on the line 5—5 of FIG. 3;

FIG. 6 is a fragmentary end view as viewed from the left in FIG. 1, portions of the thrust plate and journal means being broken away;

FIG. 7, on sheet 2, is a fragmentary view of a portion of the interior of the housing as viewed in the direction of the arrows 7—7 of FIG. 3; and

FIG. 8, on sheet 3, is a fragmentary, enlarged view of a portion shown in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 the cutter machine 10 has a housing 11 substantially open at top and bottom with end plates 12 and 13 and with two sides substantially enclosed as hereinafter described. A rotor shaft 14 is journalled in bearing assemblies 15 and 16 secured by bolts, respectively, to a thrust plate 17 at one end and to the end plate 13 at the other, the thrust plate 17 being bolted to end plate 12.

The rotor 20 comprises the shaft 14, having one end, the left in FIG. 2, adapted to be motor driven, a plurality of teeth plates 21 mounted thereon, an annular spacer 22, a tubular spacer 23 which is preferably the inner race of the ball bearing assembly 16, and an end washer 24, the latter three parts being secured on the other end of the shaft by a bolt 25. Shaft 14 has an integral annular flange 26 thereon adjacent its driven end, preferably welded to the shaft.

Flange 26 is keyed to its adjacent plate 21 by a pair of diametrically opposite pins 27 and each successive

plate 21 is keyed to its contiguous plates by pairs of like pins 27, some of the pins being shown in FIG. 2.

As best seen in FIG. 3, the teeth plates 21 are identical and comprise non-rectangular steel plates of parallelogram configuration and substantial thickness, each plate end being inclined at a small angle, here 15°, from the normal to the parallel sides. Each plate, therefor, has two acute angle corner edges 28 comprising the teeth, the teeth being the leading edges in the direction of rotation.

Each plate 21 has a central hole 29 and two pairs of diametrically opposite holes 30, all equally radially spaced from hole 29, the pairs being angularly spaced at a small angle, here 30°. The hole 29 is sized for a slide fit on shaft 14 and holes 30 are sized so that pins 27 have a slide fit therein. As shown in FIG. 3, the top plate 21 therein has a pin 27 in each of the trailing pair of holes 30 keying this plate to the next plate, not shown, on top of it and a pin 27 in each of the leading pair of holes 30 keying this plate to the plate below. It will be noted that the plates 21 are wide enough to overlie the pins 27 carried in adjacent plates. Each plate 21 is thus keyed to the plate next to it and the plate next to the flange 26 is keyed to the flange so that the rotor 20 rotates as a unit driven by the shaft, the key pins 27 all being at a substantial distance from shaft 14 for providing keying means of greater strength than the conventional key and keyway. Where great strength is not required, a single pin 27 may be used to key each plate to the next.

The teeth edges 28 are arranged in a helical spiral along shaft 14 to the center where a pair of longer pins 27', FIG. 2, are provided for keying together three plates 21 so that the spiral is reversed for moving the material to be shredded toward the center of the rotor.

The shaft flange 26 rotates in a comparatively large hole 31 in end plate 12, as seen in FIG. 6 and the thrust plate 17 is secured to cover hole 31 by the bolts 32. Bearing assembly 15 is secured to plate 17 by bolts 33.

At the other end of the shaft, the annular spacer 22 is free to rotate in a smaller hole 34, FIG. 2, and the tubular spacer 23, part of bearing assembly 16 and secured on shaft 14 by washer 24 and bolt 25, rotates in its assembly 16 which is secured to end plate 13 by bolts 35 as shown in FIG. 4. The hole 31 in plate 12 is large enough for withdrawal of the entire rotor 20 therethrough when thrust plate 17 is removed.

Fixed blades 36 are secured along each side of housing 11, as best seen in FIG. 3, one above and the other below the level of the axis of shaft 14, as shown. Blades 36 are slotted at 37, as shown in FIG. 5, and are supported by the square bar, blade support members 38 extending between end plates 12 and 13. The blade supports may be bolted to the end plates at 39, as best seen in FIG. 1.

On the opposite surface of each blade 36 from the support 38, a nut member 40 extends between the end plates with threaded holes therethrough for engagement with blade clamping bolts 41 which extend through appropriate holes in supports 38 and through the slots 37 of the blades, as best seen in FIG. 1.

As best seen in FIG. 3, blade support 38 on one side is welded to a side plate 42, the side plate being provided with a lower flange 43 and end flanges 44 bolted at 45 to the end plates as shown in FIG. 1. Above the blade nut 40 on this side a side plate 46 extends between the end plates. Side plate 46 may be spaced from the nut member 40 leaving a space 47 in the side wall through which sheet material may be fed to the rotor blade plates. Side plate 46 has a top flange 48 welded thereto and end flanges 49 bolted to the end plates at 50.

On the other side of housing 11, the blade nut 40 has a pendant side member 51 welded thereto and the blade support 38 has a side plate 52 welded thereto extending upward to a welded top flange member 53. The side plate 52 is also provided with welded on end flanges 54 bolted to the end plates at is also provided with welded on end flanges 54 bolted to the end plates at 55. Below the nut member 40 on this side, a removable side plate 56 is provided having end flanges 57 bolted at 58 to the end plates. An angle 59 along the bottom of the housing provides a bottom flange on this side and there may be a longitudinally extending stiffening member 60 alongside the angle 59, as shown in FIG. 3.

A third blade 36' may be provided above the rotor 20 supported on the support member 38', as shown in FIG. 3, extending between the end plates and secured thereto by means not shown. A nut member 40' is provided for engagement with bolts 41' through support 38' and the slots in blade 36'. A curved filler piece or guard 61 may be provided between blade 36' and the adjacent blade 36 secured, as by screws 62, to the nut member 40'.

Under the rotor 20, a trough-shaped screen 63 extends between the end plates and extends transversely from one blade 36 to the other. A plurality of support plates 64 having a curved top edge for contacting screen 63 and best seen in FIGS. 3 and 7 have a tubular bottom portion 64' through which a rod 65 extends, the rod extending through appropriate holes in plate 42 at one end and angle 59 at the other end. The portion of rod 65 projecting from the angle 59 has a pin 66 therethrough lying in an appropriate slot in side plate 56, as shown in FIG. 8, and a tab 67, pendant from and welded to the side plate 56, overlies the pin 66 securing the pin 66 between angle 59 and the tab for preventing endwise movement of rod 65.

As shown in FIGS. 3 and 7, blocks 56' are welded to the inner surface of side plate 56 on either side of each support plate 64 to maintain the support plate erect. By removing the bolts 58, the side plate 56 and its attached end flanges 57 may be removed, the support plates 64 swung down, and screen 63 removed for cleaning.

End plates 12 and 13 have projecting top flanges 68 and projecting bottom flanges 69 welded thereto, as shown in FIG. 1. Holes 70 are provided in top flanges 68, 48 and 53, and holes 71 are provided in bottom flanges 69 and 43 and the bottom flange of angle 59. Bolts through the holes 70 of the top flanges may be used to secure housing 11 pendant from a hopper or conveyer for loading material into the shredder and holes 71 in the bottom flanges may be used to secure a conveyer or receptacle beneath housing 11 for receiving the shredded or ground material falling through the screen 63.

It will be appreciated that the fixed blades 36 and 36' must be precisely adjusted with respect to the edges 28 of the rotor plates. Since the blades 36 extend through

the housing side walls and blade 36' is accessible at the top, adjustment of the blades inward is easily accomplished. For moving the blades outward, each blade 36 has a portion 36a projecting through an appropriate slot 73 in end plates 12 and 13, as best seen in FIG. 1. A slot 73' in each of the end plates is provided, as shown in FIGS. 3 and 4.

On plate 13, blocks 74 and 74' are welded to the plate's exterior surface spaced from the blade portion 36a and 36a', as shown in FIG. 4. A jack screw 75, threaded into the block 74 or 74', is provided for forcing the fixed blade away from the rotor and a lock nut 76 may be provided thereon. On plate 12, shown in FIG. 6, the thrust plate 17 is drilled and threaded for carrying the jack screws 75.

In operation, the rotor 20 is driven to rotate counterclockwise in FIG. 3 and material, loaded into the shredder from the top or through space 47, is engaged by the plate teeth 28 and carried down against the upper edge of the first fixed blade 36 and then upward against the lower edge of the next fixed blade 36. If a third fixed blade 36' is used the filler plate 61 guides the material being shredded up to the edge of fixed blade 36'. The material being shredded is continually driven past the fixed blades until it is shredded to a particle size allowing it to fall through the openings in screen 63.

The fixed blades 36 and 36' are shown with square teeth but sharper angled teeth may be provided when grain or other softer material is to be ground in the shredder. The screen 63, which is easily removable, may be replaced by another screen with different sized openings when it is desired to grind or shred material to a different particle size.

The fixed blades are easily removable for sharpening by removing the bolts 41 and drawing the blades outward. The rotor 20 is also easily removed by removing the bolts 32 and the thrust plate 17, and then removing bolt 25, the whole rotor then being withdrawn through the hole 31 in end plate 12 and blades 21 may then be removed for sharpening. The steel plate construction of the plates, of course, means economy in construction of the rotor and the plates are easily sharpened. No separate teeth have to be removed from the plates and the plates themselves may be stacked with sides and ends aligned and clamped together for being all ground in one operation to ensure that all the plates are precisely alike.

I claim:

1. A cutter machine comprising a housing having at least two ends and two sides enclosed, a motor driven shaft extending longitudinally of the housing and journalled in the housing ends, a plurality of rotor blades on the shaft, each rotor blade being a plate having a non-rectangular parallelogram configuration and having a central hole for the shaft, means for keying the plates to one another and means for keying at least one plate to the shaft, at least one elongated fixed blade extending longitudinally of the housing, the fixed blade being transversely slotted, blade supports and nut means in a sidewall of the housing, bolts passing from the supports through the blade slots to the nut means for adjustably securing the fixed blade in place, the fixed blade extending transversely through the housing sidewall to the outer surface so as to be accessible for adjustment inward, each end of the fixed blade having a portion projecting through a slot in the housing end wall, and jack screw means secured to each end wall for adjustment of the fixed blade outward, the rotor blades being arranged on the shaft with their acute angled corners forward with respect to the chosen direction of rotation of the shaft for forming teeth presented toward the fixed blade.

2. A cutter machine comprising a housing having at least two ends and two sides enclosed, at least one elongated fixed blade extending longitudinally of the housing, a motor driven shaft extending longitudinally and journalled in the housing ends, the shaft having an annular flange adjacent its driven end within the housing, a plurality of rotor blades on the shaft, the rotor blades being plates of substantial thickness having a non-rectangular parallelogram configuration, each plate being centrally apertured for the shaft and having its acute angle corner edges presented as teeth toward the fixed blade, the plates and the flange having keying holes therethrough uniformly spaced radially of the shaft, and keying pins in the holes for keying the plates and flange together, at least some of the plates having a pair of keying holes, one hole of the pair being angularly spaced about the shaft by a chosen small angle whereby contiguous plates may be angularly staggered about the shaft.

3. A cutter machine as defined in claim 2, each plate having two pairs of identical diametrically opposite keying holes therethrough uniformly spaced radially of the shaft, the opposite pair of holes being angularly spaced about the shaft by a chosen small angle, the flange having a like opposite pair of holes, and the pins in one opposite pair of holes extending from one plate to the next for keying contiguous plates together, the pins in the other opposite pair of holes of each plate keying that plate to the next plate, whereby the plate teeth edges are helically staggered about the shaft.

4. A rotor for a cutter machine comprising a shaft having an integral annular flange adjacent one end, a plurality of blades on the shaft, the blades comprising metal plates having a non-rectangular parallelogram configuration, all the plates being centrally apertured for the shaft and having at least two keying holes therethrough radially equally spaced from the shaft, one hole in each plate being angularly spaced from the other by a chosen small angle, at least one keying hole in the flange, key pins in the holes extending from the flange to the contiguous plate and from one plate to the next, the pin in one hole of each non-end plate keying it to the contiguous plate on one side and the pin in the other hole keying it to the contiguous plate on the other side, the plates being of such width as to overlie the end of the pins carried separately by its contiguous plates, at least one pin being of such length as to extend through the keying holes of three contiguous plates, the acute angled corners of the plates being arranged around the shaft for forming teeth helically staggered therearound in one direction along one portion of the shaft and in the other direction along another portion of the shaft, and removable means on the shaft for securing the plates contiguously against the flange, whereby the plates may be easily rearranged.

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