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MacKissic et al.

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[45] **Sept. 23, 1975**

[54] **DISINTEGRATION APPARATUS**

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[73] Assignee: **Amerind-MacKissic, Inc.**, Parker Ford, Pa.

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[52] **U.S. Cl.**..... **241/152 A**; 241/101.7; 241/154; 241/186.1

[51] **Int. Cl.**[2]..... **B02C 13/04**; B02C 21/02

[58] **Field of Search**..... 241/84, 86, 101.7, 101 M, 241/152 R, 152 A, 154, 185 R, 186.1, 285 B, 186.3, 92, 186 R

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Primary Examiner—Roy Lake
Assistant Examiner—E. F. Desmond
Attorney, Agent, or Firm—Dorfman, Herrell & Skillman

[57] **ABSTRACT**

Disintegration apparatus comprising a housing which provides two chambers disposed side-by-side. In one chamber a chipping assembly receives larger pieces and reduces the same to chips which are fed into the adjoining chamber. In the adjoining chamber, a shredding assembly disintegrates the chips fed from the chipper along with any additional material which is fed directly into the chamber to a predetermined size. A feed chute is provided for feeding the larger pieces into the chipping chamber and a separate feed hopper is provided for feeding smaller pieces directly into the shredding chamber. A chipping assembly includes a rotary chipping disc having a radial slot which mounts a chipping knife. The material is confined in the chipping chamber by a peripheral wall which closely surrounds the disc. The shredding assembly comprises a plurality of rotary plates having pivotally mounted knives which swing freely through the material in the chamber as the plates are rotated. The size of the discharged material is determined by a screen which extends about a predetermined arc and an arcuate casing which continues around the plates, leaving a small opening through which the hopper may feed material into the chamber. A common sidewall separates the two chambers and the material from the chipping chamber is fed into the shredding chamber through a feed aperture in the sidewall.

9 Claims, 6 Drawing Figures

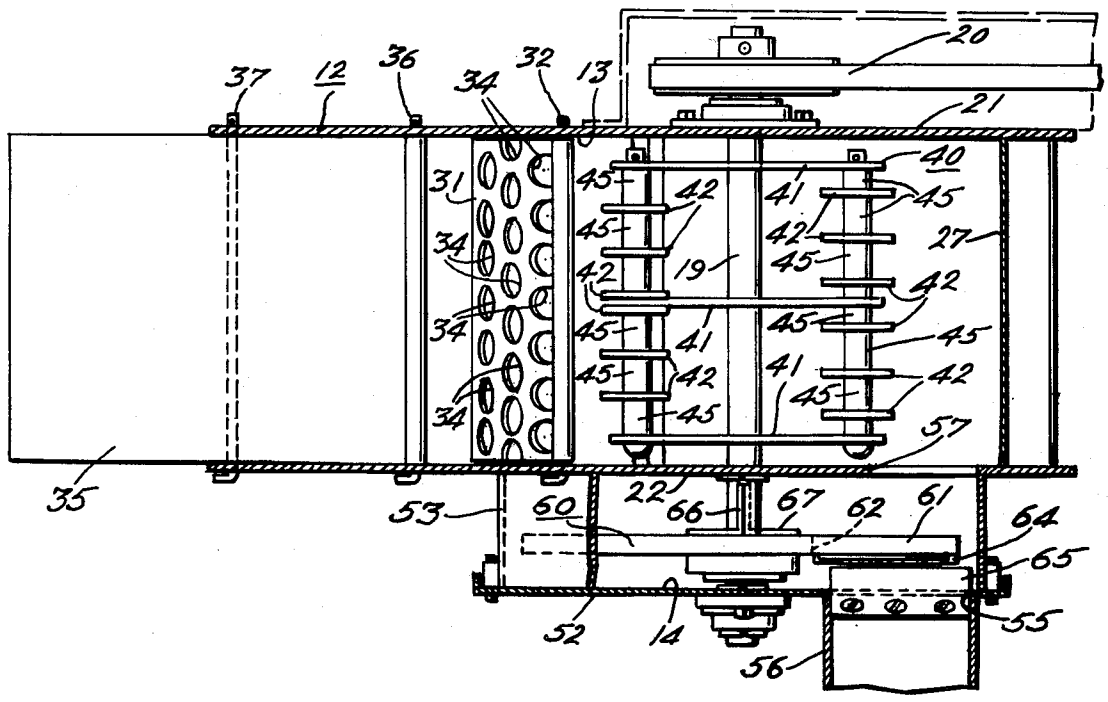


FIG. 1.

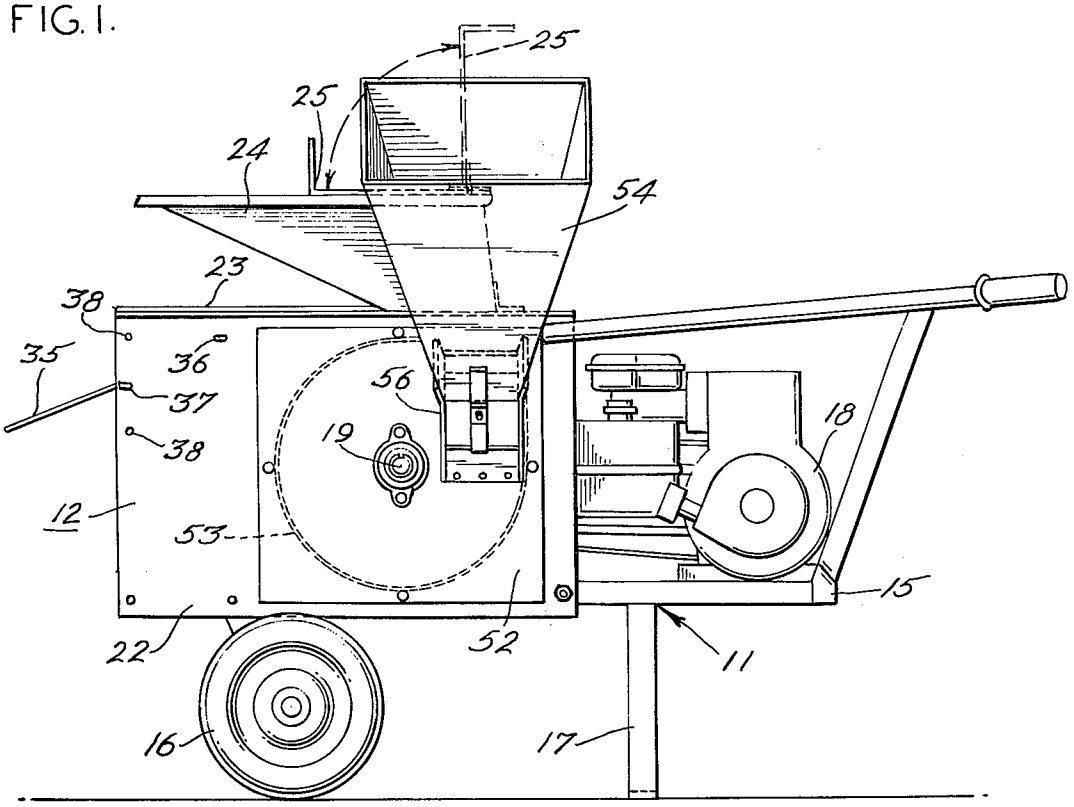

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FIG. 2.

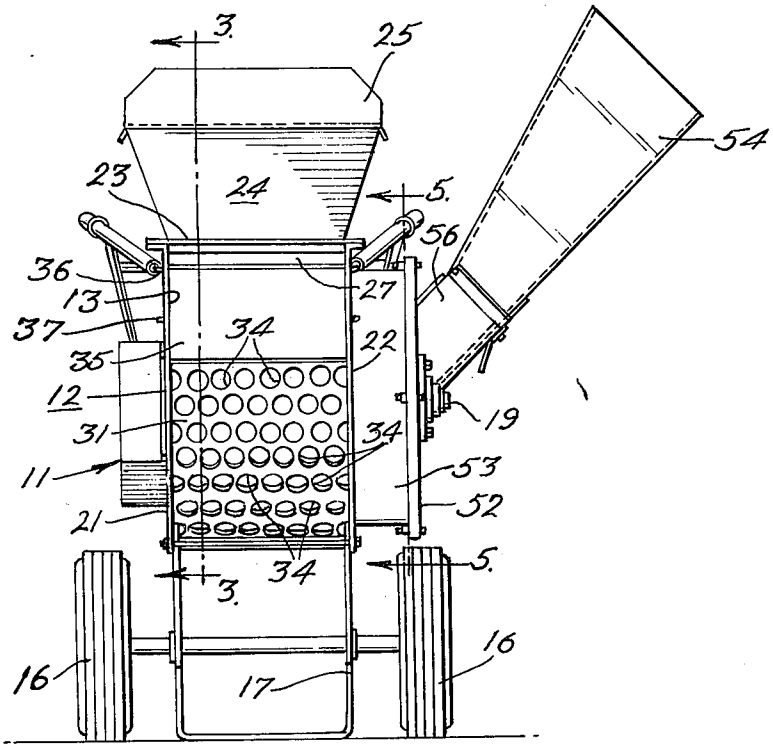

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FIG. 3.

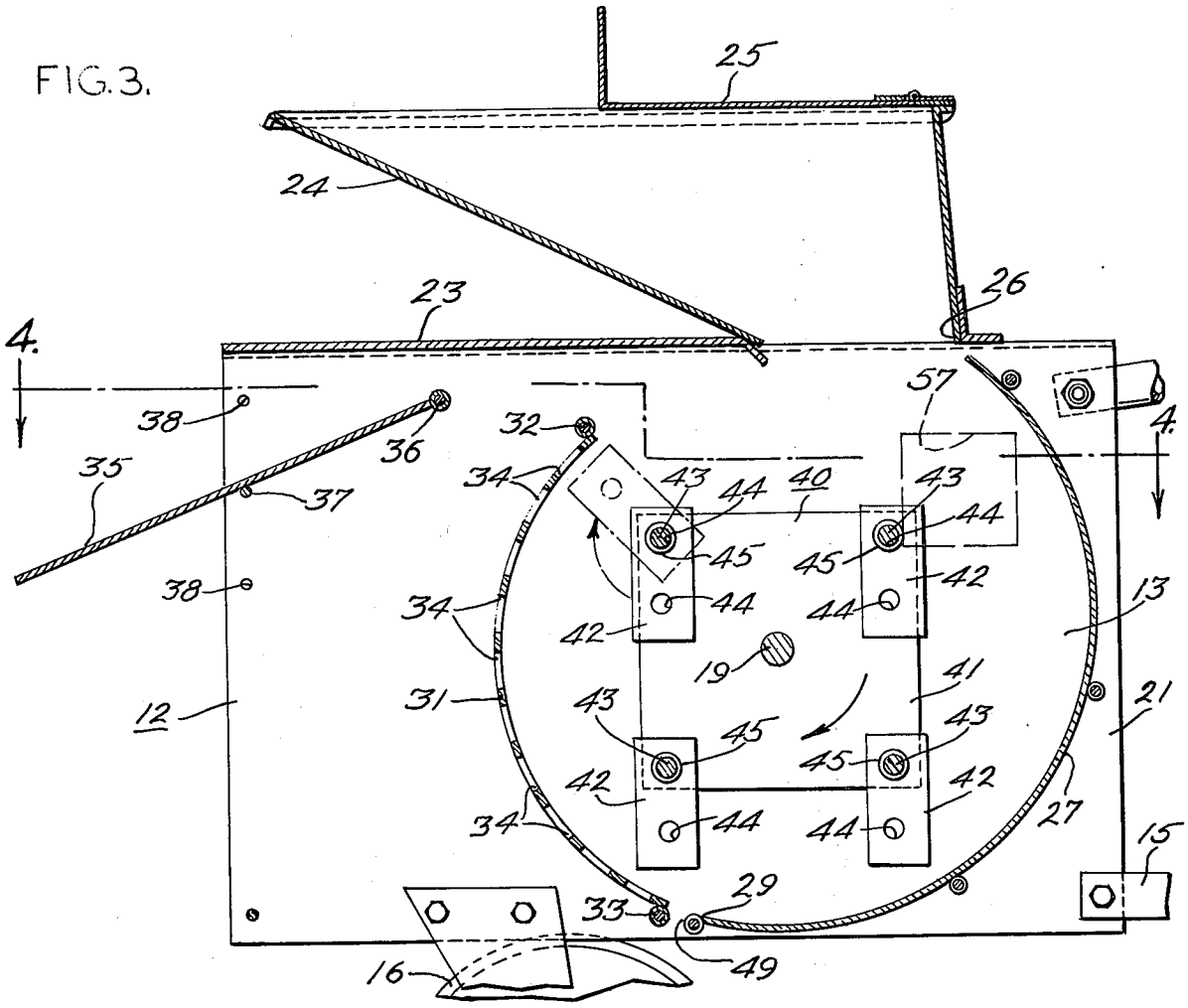

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FIG. 4.

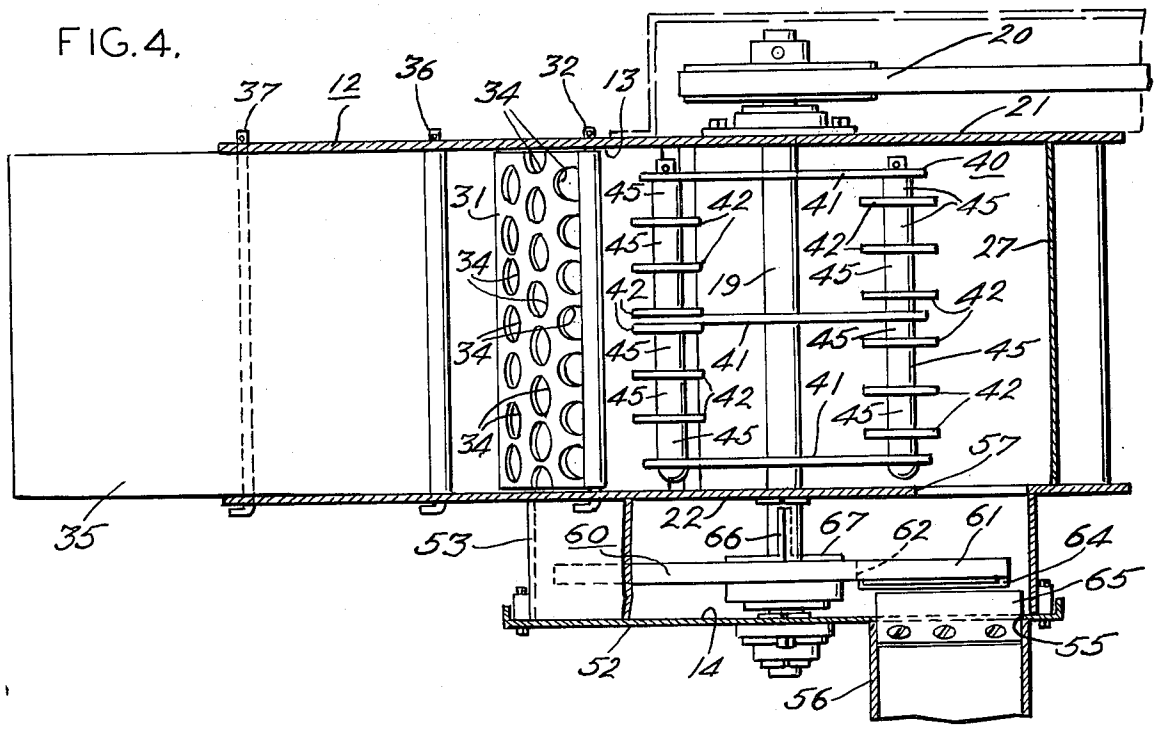

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FIG. 5.

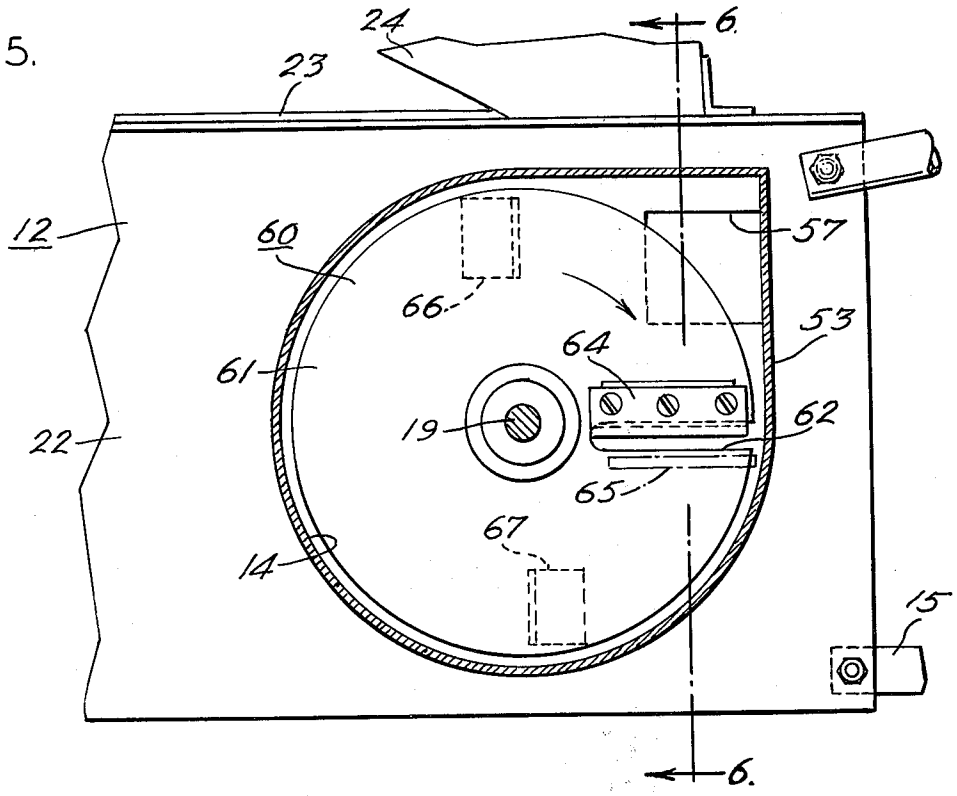
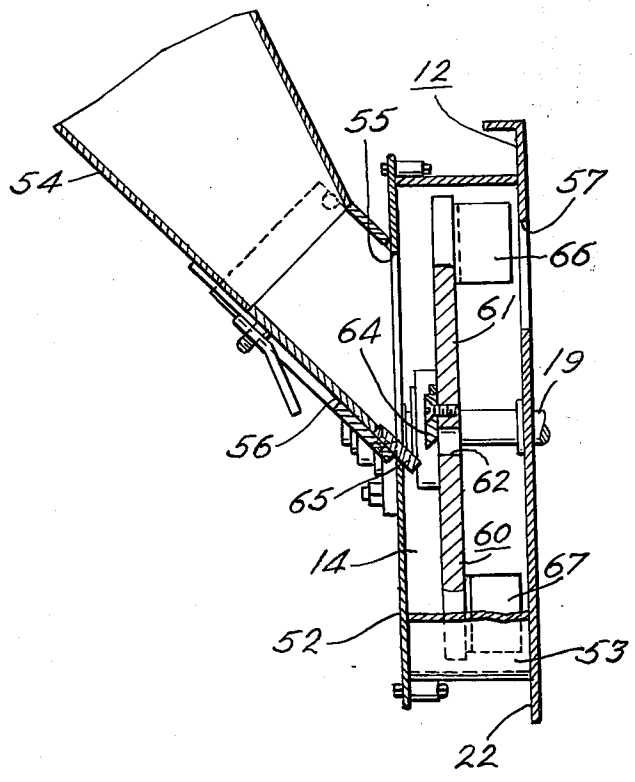

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FIG. 6.


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DISINTEGRATION APPARATUS

The present invention relates to disintegration apparatus and has particular application to apparatus for comminuting brush and other natural refuse to render it in condition for disposal, for example by use as a mulch or by bagging and hauling away. The invention has particular application to a device which may be designed for use around the home and which also may be designed for use commercially.

For several years shredder-grinder units have been available which are particularly effective for reducing tree trimmings, garden refuse, leaves and the like to a comminuted material which is readily handled and compacted for quick disposal, decomposition or recycling. One such unit comprised a grinding chamber having a shredding mechanism therein consisting of a plurality of plates having swinging knives secured to the periphery thereof to act upon the material fed into the chamber. A screen mounted around the periphery of the chamber permits the discharge therefrom of material which is reduced to a size less than the openings in the screen. While this unit is satisfactory for comminuting materials having stems or stalks up to one and a half inch in diameter, it is not designed for disposing of limbs or branches of a larger size.

Commercial units are available which will accept brush of large size, but such commercial units are not entirely satisfactory for use around the home, or are too expensive for the normal homeowner. Domestic units have been provided which are likewise unsatisfactory because of the inefficiency in the operation or because of the danger of damage to the equipment or to the operator in the hands of an unskilled or a careless handler. Such units are shown in prior U.S. Pat. Nos. 3,593,930 and 3,674,220.

With the foregoing in mind, the present invention provides an improved disintegration apparatus having a shredding chamber for comminuting material of small size and a separate chipping chamber for reducing larger sized articles to a size which may be properly handled by the shredding chamber.

More particularly, the present invention provides an apparatus having a shredding chamber and a chipping chamber disposed side-by-side with a common partition therebetween, the partition having a feed aperture for discharging the comminuted material from the chipping chamber into the shredding chamber.

The present invention provides a device of the stated type with a highly economical construction and efficient operation.

Another object of the present invention is to provide a device of the stated type whose design may be accommodated to provide any desired capacity in a highly efficient and effective manner.

All of the objects of the invention are more fully set forth hereinafter with reference to the accompanying drawing, wherein:

FIG. 1 is a side view of apparatus embodying the present invention;

FIG. 2 is a front elevation of the apparatus shown in FIG. 1;

FIG. 3 is an enlarged fragmentary longitudinal sectional view taken along the line 3—3 of FIG. 2 illustrating the shredding chamber with the position of the feed aperture indicated in broken lines;

FIG. 4 is a transverse sectional view as seen from the line 4—4 of FIG. 3 illustrating the shredding assembly and chipping assembly;

FIG. 5 is an enlarged fragmentary sectional view taken on the line 5—5 of FIG. 2 illustrating the chipping chamber; and

FIG. 6 is a fragmentary sectional view taken on the line 6—6 of FIG. 5.

With reference to the drawings, a mobile unit 11 shown therein comprises a housing 12 having a main chamber 13 therein for shredding material, and an auxiliary chamber 14 disposed alongside the main chamber 13 for housing a chipping assembly. The housing is mounted on a chassis 15 having wheels 16, a stand 17 and a drive motor 18 thereon. In the present instance, the drive motor 18 is gasoline powered and is coupled to the drive shaft 19 of the shredding and chipping assemblies by a belt transmission 20.

The shredding chamber 13 is defined by a pair of sidewalls 21 and 22 and in which the drive shaft 19 is journaled. A topwall 23 spans across the tops of the sidewalls 21 and 22 and mounts a feed hopper 24 having a pivoted cover 25 thereon. The feed hopper communicates with the chamber 13 through a restricted opening 26 in the topwall 23. Between the walls 21 and 22, toward the rear of the unit 11, the shredding chamber 13 is closed by an arcuate wall 27 which is generally concentric to the main drive shaft 19, extending from the feed opening 26 down and under the shaft 19 as shown in FIG. 3.

Above the forward terminal end 29 of the arcuate wall 27, a screen 31 is removably mounted between the walls 21 and 22. In the present instance, the screen is mounted by rods 32 and 33 which extend between the walls 21 and 22 at the upper and lower ends respectively of the arcuate screen. In the illustrated embodiment of the invention, the screen 31 is perforated with circular holes 34 which control the size of the material discharged from the shredding chamber, for example to 1-inch size. When it is desired to reduce the size of the material discharged, the screen 31 is replaced by a screen having smaller apertures, and conversely, when it is desired to increase the size of the material, the screen 31 may be replaced with a screen or grating having larger apertures, or the screen even may be removed completely. A deflector plate 35 is provided forwardly of the screen to direct the discharged material downwardly. In the present instance, the deflector plate 35 is pivoted between the walls 21 and 22 as indicated at 36 and the angle of the plate is determined by the position of a stop rod 37 which may be positioned in holes 38 at selected levels between the sidewalls 21 and 22.

The material in the chamber within the screen 31 and the wall 27 is disintegrated by a shredding assembly 40 which in the present instance comprises a plurality of shredding plates 41 mounted for rotation with the shaft 19. In the present case, the plates are square and at each corner of the plates 41, flail knives 42 are pivotally mounted for free swinging movement on pins 43. As shown in FIG. 4, the knives 42 are spaced apart from each other between the plates 41 by spaces 45. In order to provide the desired disintegrating action, the distance of the knives 42 from each plate 41 at each corner differs from the distance at the other corners so that each knife follows a path of rotation in a different plane as the plates are rotated. As shown in FIG. 3, the

length of the knives 42 is such that when the plate rotates, the knives pass closely to the interior surfaces of the screen 31 and the arcuate wall 27 and serve to impact against any material which may be lodged thereon. The impact of the knives against the material disintegrates the material and shreds it so that when the material is sufficiently disintegrated, it may pass out of the shredding chamber through the apertures 34 in the screen 31. It is noted that each of the knives 42 is provided with a pair of sockets 44 so that the knife may be reversed endwise when it becomes dull or loses its cutting edge. The mounting of the knives also permits the knives to be reversed facewise so as to expose a different cutting edge to the material as the plates 41 are rotated with the shaft 19.

The drive shaft 19 rotates the shredding assembly 40 clockwise as seen in FIG. 3, and the feed opening 26 overlies the plates 41 to feed material thereto at the 1:00 o'clock position. Thus the rotation of the plates flings the material rearwardly against the imperforate 27 which extends from the feed opening at the 1:00 o'clock position circumferentially of the housing to beyond the 6:00 o'clock position. The interaction between the rotary plates 41 and knives 42 on the one hand and the wall 27 on the other hand operates to disintegrate the material introduced through the opening 26.

When shredding fibrous material such as cornstalks, it is desirable to shred the material first without the screen to avoid "roping" of the product within the shredding chamber. This enables the product to pass directly through the shredding chamber. If further disintegration is desired, the shredded material may be mixed with other, less fibrous, material. When it is desired to reduce the material to fine particles, it may be preferred to first disintegrate the material through a screen with large openings, and thereafter reduce the size of the material by disintegrating it through a small-opening screen.

It is noted that there is a small clearance space which leaves an opening 49 at the 6:30 o'clock position in the shredding chamber between the terminus 29 of the arcuate wall 27 and the mounting rod 33 of the screen 31. This opening permits discharge of "junk," such as small stones and other trash, which does not readily disintegrate and pass through the openings of the screen. Where the work material includes a large amount of "junk," it may be desired to enlarge the clearance space 49 to afford removal of such "junk."

The chipping chamber 14 is used to disintegrate material which is not readily disintegrated by the flail knives in the shredding chamber. To this end, the chipping chamber 14 is disposed alongside the shredding chamber 13 and utilizes the sidewall 22 of the shredding chamber as one of its sidewalls. The other sidewall of the chipping chamber consists of a cover plate 52 which is mounted in spaced parallel relation to the sidewall 22. Arranged substantially concentrically with the shaft 19 which passes through the walls 22 and 52, a continuous peripheral wall 53 encloses the chipping chamber. The strength and thickness of the wall 53 is sufficient to prevent any chips from flying radially outward from the chipping chamber 14.

Material is fed into the chipping chamber through a chute 54 opening into the chamber through a restricted opening 55 in the cover plate 52. The chute is removably mounted on the cover plate by a mounting bracket 56 surrounding the feed opening 55. Material is discharged from the chipping chamber through a discharge opening 57 in the common wall 22 between the chipping chamber and the shredding chamber. As shown in FIGS. 4, 5 and 6, the opening 57 is disposed in the upper righthand corner of the chipping chamber within the outline of the peripheral wall 53. The opening 57 is within the confines of the shredding chamber 13 defined by the arcuate wall 27 and the screen 31 so that the material discharged from the chipping chamber is subjected to the shredding action of the shredding assembly 40 in the shredding chamber. The opening 57 is at the 2:00 o'clock position above the shredding assembly 40 to allow the material to be disintegrated by the interaction between the assembly 40 and the wall 27.

As the material is passed through the chipping chamber, it is partially disintegrated by a chipping assembly 60. To this end, the shaft 19 has mounted thereon a chipping disc 61 spaced parallel to the walls 22 and 52. The disc has a radial slot 62 therein providing a chipping throat through which chips may pass. The chipping operation is effected by a chipping knife 64 mounted along the trailing radial edge of the throat 62. Material fed into the chipping chamber through the chute 54 bears against the face of the chipping disc 61 which is rotating. As the disc rotates, the knife 64, which is mounted on the disc with its sharpened cutting edge disposed outwardly from the surface of the disc a distance corresponding to the thickness of the knife, operates to shave or chip the material introduced through the chute 54. To insure proper chipping or shaving action, a wear plate or anvil 65 is mounted at the bottom of the chute and is adjusted so as to mate with the cutting edge of the chipping knife 64 with a limited clearance. Thus, as the chipping disc 61 rotates clockwise, the chipping knife 64 operates to shear the foremost portion of the material which is being introduced through the chute 54.

The chipping knife is especially useful for tree limbs and branches having a diameter in excess of one and a half inches and the consistency of the wood in such limbs and branches provides an effective disintegration or chipping action by the chipping knife. The chips generated by the chipping action may fly through the throat 62 directly into the shredding chamber 13 through the discharge opening 57 or may be deflected into the outer periphery of the chipping chamber by the centrifugal action of the rotating chipping disc 61. The chipping chamber is cleared of chipped material by clearing flanges 66 and 67 mounted on the rear face of the chipping disc. The chipping flanges are formed by a pair of angle irons, each having one leg secured to the disc 61 and the other leg (which forms one of the flanges 66 and 67) projecting at right angles thereto. As mounted on the disc, there is limited clearance between the outer edges of the flanges 66 and 67 and the wall 22. As the disc rotates, the flanges wipe the chipped material along the wall 22 toward the opening 57 through which the chips may be discharged into the shredding chamber 13.

The flanges are normally not subjected to any substantial wear, but in the event of damage, they may be readily replaced by replacing the angle irons. The chipping knife 64 and the anvil 65, on the other hand, are subject to substantial wear and are even more readily replaced. To replace these elements, the cover plate 52

is removed to expose the chipping disc **61** with the knife fastened to its exposed face. Likewise the inner surface of the cover plate exposes the attachment of the anvil **65** to the mounting bracket **56** in the opening **55**.

The present invention is highly effective to chip and shred material in a highly economical and effective manner. The use of a separate chipping chamber alongside the shredding chamber permits the economical fabrication of the chambers to permit the chipping chamber to withstand the radial impingement of the chips against the peripheral wall so that there is little danger to the operator and bystanders from flying chips. The arrangement of the chipping mechanism feeds the chips into the shredding chamber from above at one side of the shredding chamber in which they are further disintegrated or reduced.

The arrangement utilizing the side-by-side chipping and shredding chambers also affords economy in the manufacture and assembly of the units since when it is desired to increase the capacity of the shredding chamber, the only required modification is in the width of the arcuate wall **27**, the screen **31** and the baffle plate **35** along with the length of the drive shaft and the number of carrier plates **41** and flail knives **42** carried thereby. Since the chipping operation is separated from the shredding operation, the strength and thickness of the metal forming the arcuate wall **27** and the screen **31** in the shredding chamber may be optimized to provide minimum cost without sacrificing safety or likelihood of damage from flying chips.

While a particular embodiment of the present invention has been herein illustrated and described, it is not intended to limit the invention to such disclosure but changes and modifications may be made therein and thereto within the scope of the following claims.

We claim:

1. Apparatus for disintegrating materials comprising a housing, a rotary drive shaft extending through said housing, means to rotate said shaft in a clockwise direction, said housing including a pair of sidewalls and a cover plate disposed parallel to one another and substantially perpendicular to said rotary shaft, arcuate wall means intermediate said sidewalls to define a shredding chamber surrounding said shaft, said arcuate wall means being discontinuous providing openings for radial infeed of raw material into said chamber and radial discharge of shredded material out of said chamber and including an imperforate wall extending from approximately the 1:00 o'clock position past the 6:00 o'clock position, said housing including a circumferential wall surrounding said shaft intermediate one of said sidewalls and the cover plate to define a chipping chamber, said one sidewall being stationary and having an opening receiving said rotary shaft, said stationary wall extending radially from said shaft outwardly beyond said arcuate wall and said circumferential wall, said one sidewall constituting a common sidewall separating said shredding chamber and said chipping chamber, said cover plate having a feed opening therein positioned radially outward of said shaft and confronting said stationary wall for introducing material to be chipped into said chipping chamber, and said stationary sidewall having a discharge opening positioned radially outward of said shaft at a position corresponding to 1:00 o'clock for discharging chipped material from said chipping chamber into said shredding chamber, a shredding assembly in said shredding chamber to shred the material introduced thereinto and to discharge the shredded material radially through said discharge openings, a chipping assembly in said chipping chamber for chipping material introduced through said feed opening in the cover plate and for discharging the chipped material through said discharge opening in said one sidewall, said chipping assembly comprising a disc mounted for rotation with said drive shaft between said stationary wall and said cover plate and having a slot therein defining a chipping throat radially outward of said shaft, means providing a cutting edge adjacent said throat and operable to travel past said feed opening in the cover plate to chip said material and deflect the chipped material through said throat against said stationary wall, and means between said disc and said wall to wipe said chipped material circumferentially of the shaft along the wall between the rotary disc and the stationary wall and to direct the chipped material through said discharge opening.

2. Disintegrating apparatus according to claim **1** including a chassis for mounting said housing with said rotary drive shaft substantially horizontal, said discharge opening in the common sidewall being positioned above the level of said rotary drive shaft.

3. Disintegrating apparatus according to claim **2** including wheels and a drive motor on said chassis and drive connection from said motor to said rotary drive shaft.

4. Apparatus according to claim **2** including a mounting bracket surrounding said feed opening in the cover plate, and a feed chute extending angularly upward from said cover plate and releasably mounted on said mounting bracket.

5. Disintegrating apparatus according to claim **1** wherein said feed opening in the cover plate is provided with an anvil element projecting from said opening into close proximity to said disc and adapted to register with said cutting edge so as to provide a limited clearance between said cutting edge and said anvil when said disc rotates the cutting edge past the feed opening.

6. Disintegrating apparatus according to claim **1** including flanges on the opposite face of said disc extending outwardly therefrom toward said common sidewall whereby upon rotation of said disc said flanges sweep material along said common sidewall into said discharge opening therein.

7. Apparatus according to claim **1** wherein said shredding assembly comprises a series of square carrier plates mounted on said rotary drive shaft for rotation therewith, and a series of flail knives at each corner of said plates in relatively-spaced relation therebetween, said flail knives being mounted for free swinging movement into close proximity to said arcuate walls means as said plates are rotated by said drive shaft.

8. Apparatus according to claim **1** wherein said arcuate wall means includes a screen having a plurality of openings of a predetermined size to constitute the radial discharge openings for said shredding chamber, and releasable fastening means for mounting said screen intermediate said sidewalls.

9. Apparatus for disintegrating materials comprising a housing, a rotary drive shaft extending through said housing, said housing including a pair of sidewalls and a cover plate disposed parallel to one another and substantially perpendicular to said rotary shaft, arcuate wall means intermediate said sidewalls to define a

shredding chamber surrounding said shaft, said arcuate wall means being discontinuous, providing openings for radial infeed of raw material into said chamber and radial discharge of shredded material out of said chamber, said housing including a circumferential wall surrounding said shaft intermediate one of said sidewalls and the cover plate to define a chipping chamber, said one sidewall being stationary and having an opening receiving said rotary shaft, said stationary wall extending radially from said shaft outwardly beyond said arcuate wall and said circumferential wall, said one sidewall constituting a common sidewall separating said shredding chamber and said chipping chamber, said cover plate having a feed opening therein positioned radially outward of said shaft and confronting said stationary wall for introducing material to be chipped into said chipping chamber, and said stationary sidewall having a discharge opening positioned radially outward of said shaft for discharging chipped material from said chipping chamber into said shredding chamber, a shredding assembly in said shredding chamber to shred the material introduced thereinto and to discharge the shredded material radially through said discharge openings, a chipping assembly in said chipping chamber for chipping material introduced through said feed opening in the cover plate and for discharging the chipped material through said discharge opening in said one sidewall, said chipping assembly comprising a disc mounted for rotation with said drive shaft between said stationary wall and said cover plate and having a flat circular face interrupted by a single radial slot, said slot defining a chipping throat, means providing a cutting edge adjacent said throat and operable to travel past said feed opening in the cover plate once for each revolution of the disc, to chip the foremost portion of said material and deflect the chipped material through said throat against said stationary wall, and means between said disc and said wall to wipe said chipped material circumferentially of the shaft along the wall between the rotary disc and the stationary wall and to direct the chipped material through said discharge opening.

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