United States Patent

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[54] **SHREDDER AND SEPARATOR UNIT**
1 Claim, 5 Drawing Figs.

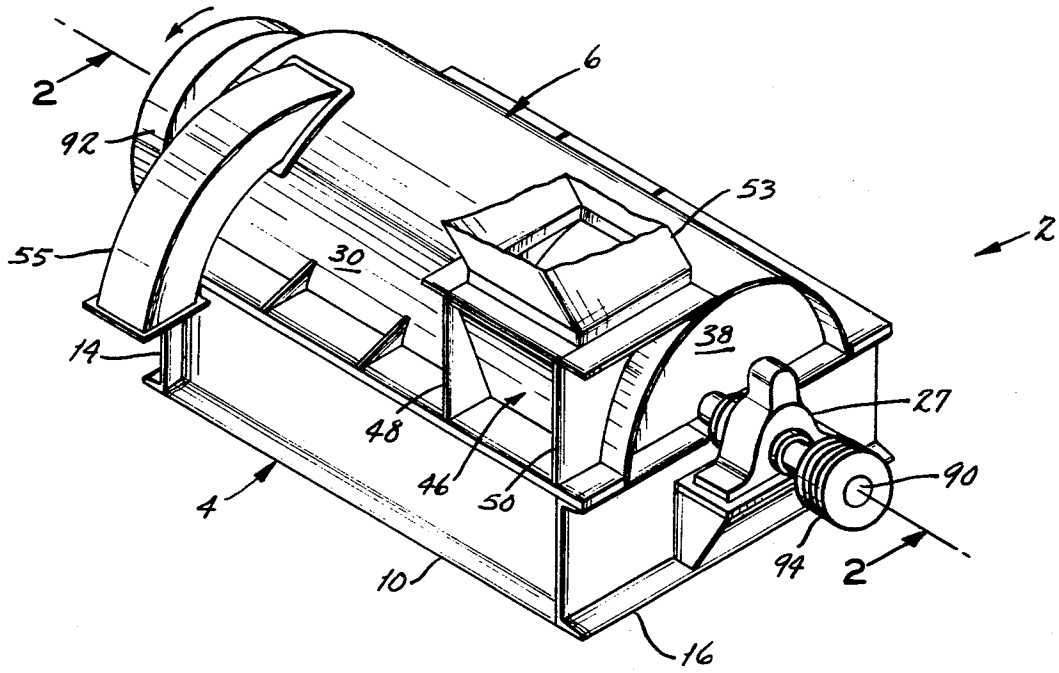
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[51] **Int. Cl.** **B02 13/10,** B02 13/13, B02 13/284
[50] **Field of Search** 241/73, 154, 163, 188, 255; 241/82

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ABSTRACT: A shredder and separator unit for refining, blending, classifying, and reducing composted refuse. The unit includes a cylindrical housing having circumferentially extending shredder bars and screens. A rotor revolves within the housing and is provided with a plurality of canted and straight swingably mounted hammers which pass close to the bars and screens. A downfeed inlet opens into the housing through the shredder bars and a discharge conduit extends tangentially from the upper portion of the housing. An arcuate discharge opening opens into the interior of the housing at the hammer tip circle defined by the endmost hammers.



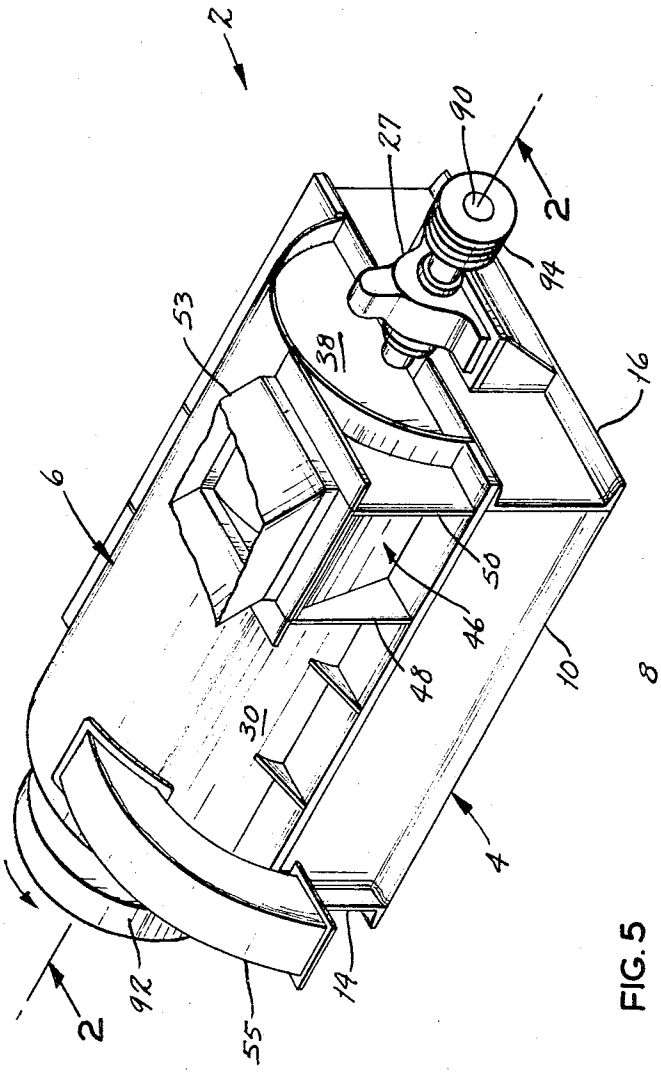


FIG. 1

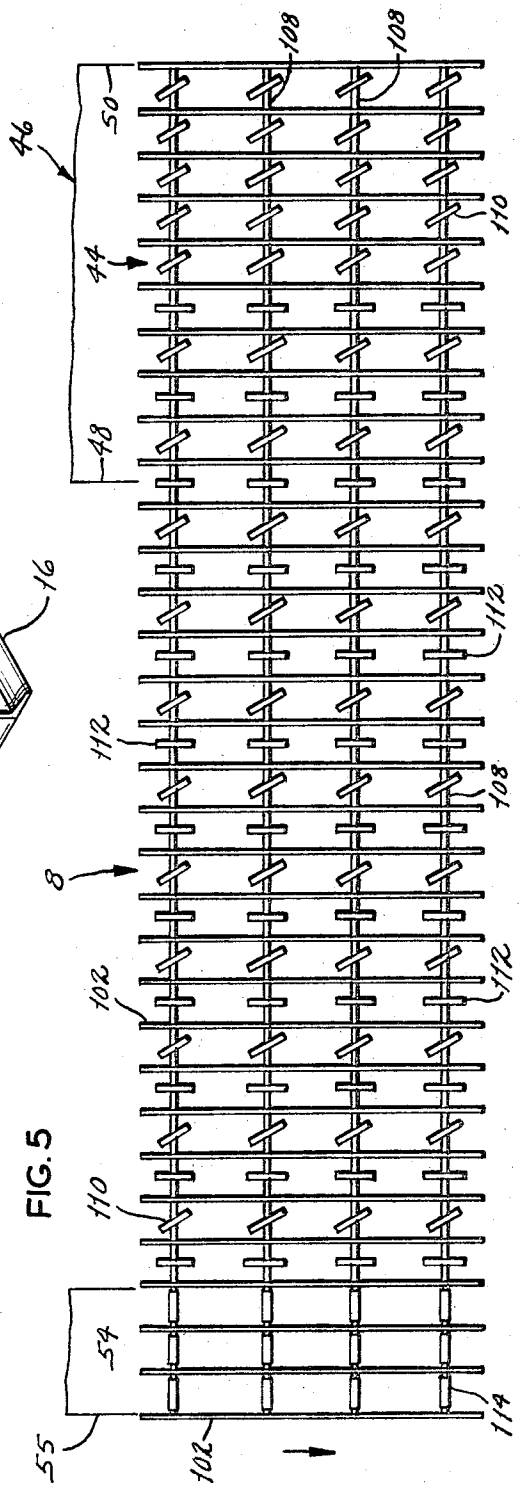


FIG. 5

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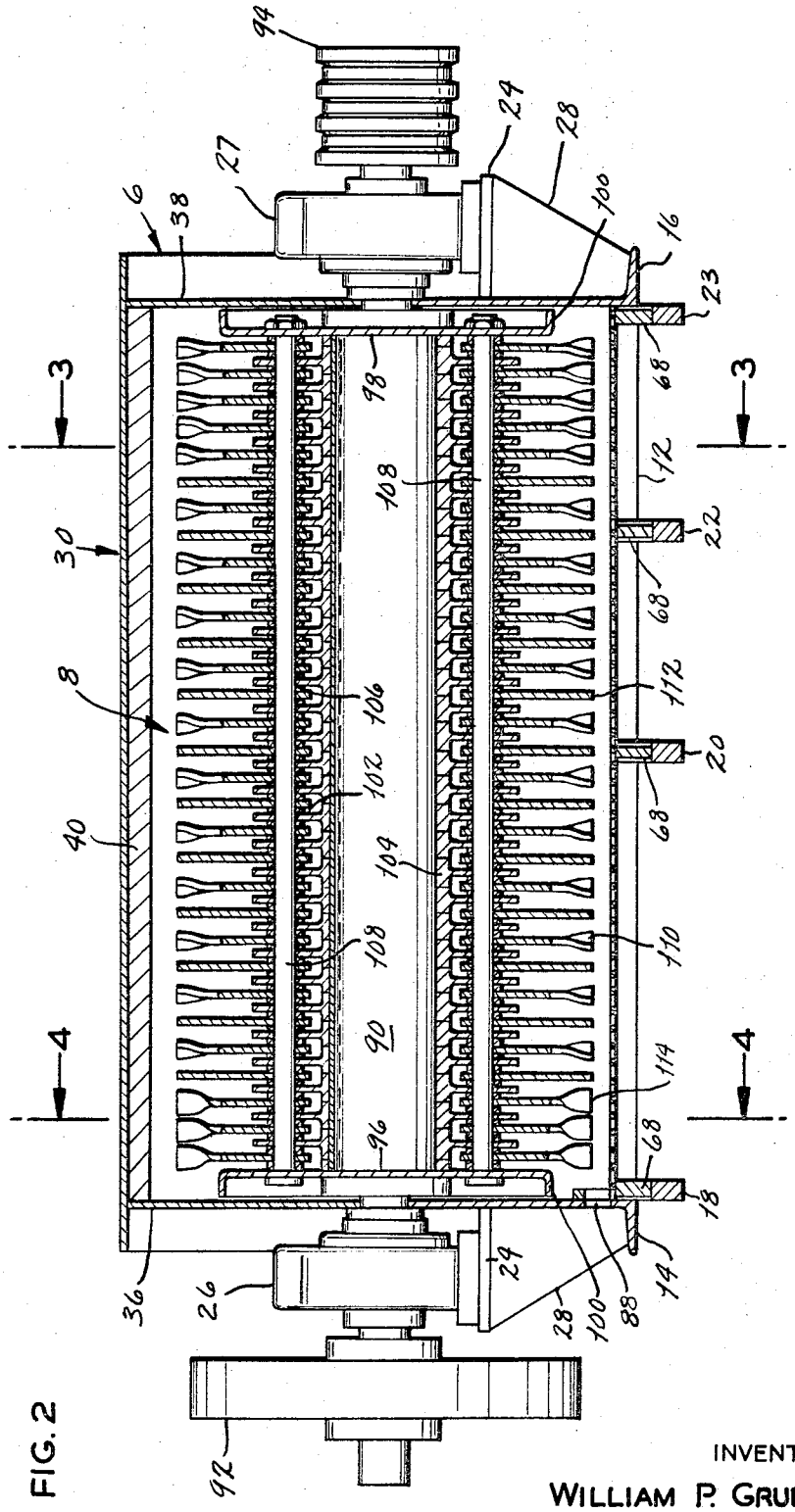


FIG. 2

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FIG. 3

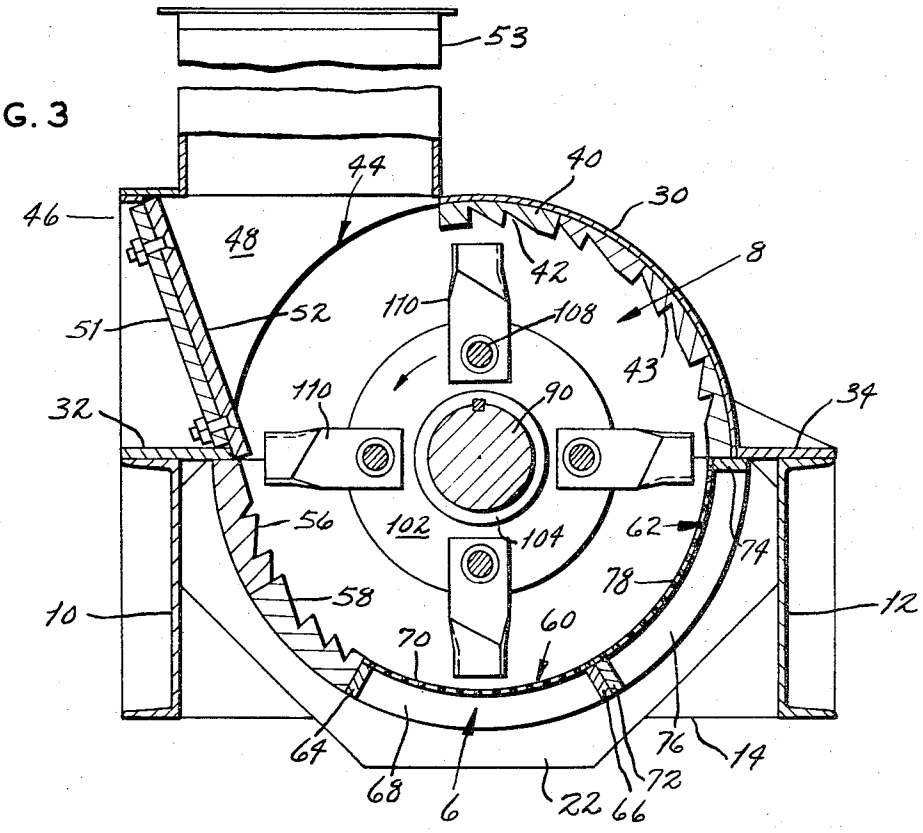
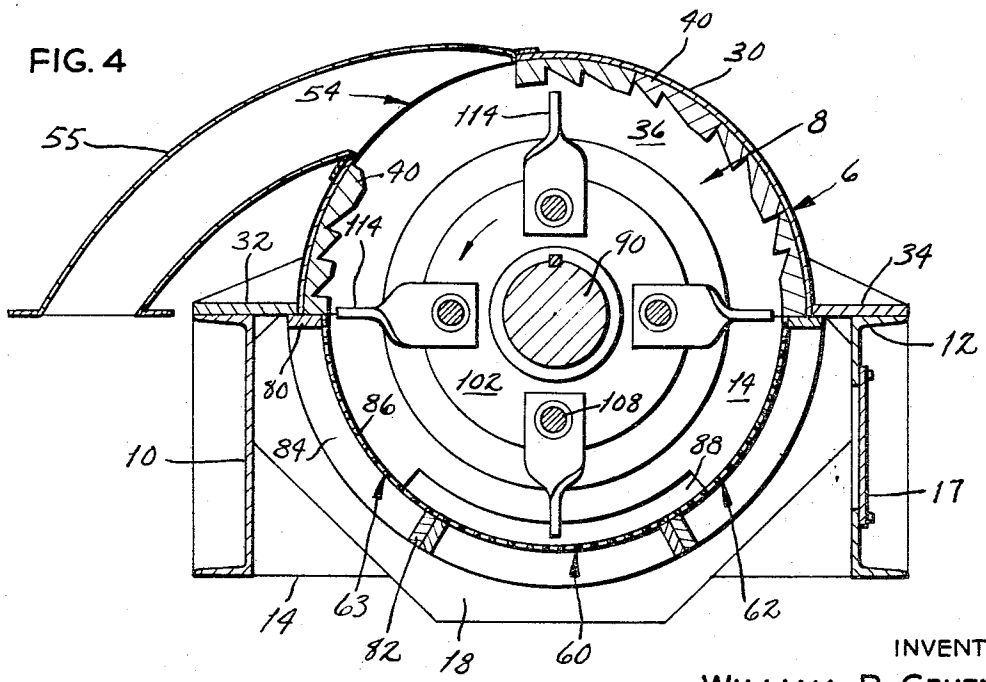


FIG. 4



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SHREDDER AND SEPARATOR UNIT

This invention relates in general to a shredder and separator unit and, more particularly, to a combination shredder and ballistic separator for refining, classifying, and reducing composted refuse.

Composting as a means of waste disposal possesses numerous advantages over more conventional processes such as landfill and incineration. Not only is composting a highly sanitary method of disposing of waste, but the compost, being rich in organic matter, can also be sold for use as an organic humus. In such case it is desirable to reduce the composted refuse to a small particle size and to remove from it foreign matter such as iron, plastic and other ungrindable material which would otherwise detract from its value as a soil builder.

Among the several objects of the present invention may be noted the provision of an apparatus for rendering composted refuse suitable for use as an organic soil builder; the provision of an apparatus for reducing, blending, refining, and classifying composted refuse; the provision of an apparatus for shredding and grinding composted refuse to a substantially uniform size while at the same time separating oversized particles and foreign matter therefrom; and the provision of a shredder and separator which is simple and rugged in construction and economical to manufacture. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

FIG. 1 is a perspective view of a separator and shredder unit constructed in accordance with and embodying the present invention;

FIG. 2 is a sectional view taken along line 2–2 of FIG. 1;

FIGS. 3 and 4 are sectional views taken along lines 3–3 and 4–4, respectively, of FIG. 2; and

FIG. 5 is a schematic view of the rotor unfolded showing the location of the canted and straight hammers thereon.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now to the drawings, 2 designates a shredder and separator unit including a frame 4, a substantially cylindrical housing 6 carried by frame 4, and a rotor 8 journaled for rotation primarily within housing 6. Frame 4 consists of a pair of longitudinally extending side members 10, 12, which are transversely connected at their ends by end members 14, 16. Members 10, 12, 14, 16, are preferably channels of identical cross-sectional size and shape which are welded together with their flanges projecting outwardly (see FIGS. 2 and 3). Fitted against the web portion of side member 12 is an inspection door 17. Welded to and interconnecting side members 10, 12, are cradle members 18, 20, 22, 23, each having an upwardly presented arcuate or cradlelike surface upon which the lower portion of housing 6 rests. Attached to and projecting outwardly from end members 14, 16, are bearing support plates 24 and mounted on plates 24 are pillow blocks 26, 27, which carry rotor 8. Bearing support plates 24 are reinforced by gusset plates 28.

Housing 6 includes a semicylindrical top wall 30 having a pair of outwardly extending flange plates 32, 34, which rest upon the upper flanges of side members 10, 12. At its ends top wall 30 is closed by a pair of end walls 36, 38, which rest upon the upper flanges of end members 14, 16, so as to completely enclose the upper portion of rotor 8. Bolted to and covering substantially the entire inwardly presented face of top wall 30 are a plurality of abutting upper shredder bars 40 having longitudinally extending grooves 42. Each groove 42 is partially defined by a radially extending impact face 43 presented toward the direction of rotation of rotor 8 (FIG. 3).

Adjacent end wall 38, top wall 30 is provided with a feed opening 44 and extending upwardly from the margins of feed opening 44 is an inlet 46 including a pair of spaced vertical

walls 48, 50, which are connected by an angled connecting wall 51 having a breaker plate 52 fastened thereto (FIGS. 1 and 3). Connecting wall 51 and breaker plate 52 extend downwardly to but no lower than the centerline of rotor 8. Both feed opening 44 and inlet 46 extend transversely from flange plate 32 almost to the longitudinal centerline of top wall 30 so that unit 2 is of the down-running variety. Extending upwardly from inlet 46 is a hopper 53.

At its opposite end top wall 30 is provided with a discharge opening 54 which is also located intermediate flange plate 32 and the longitudinal centerline of top wall 30. Connected to top wall 30 in surrounding relation to discharge opening 54 is a discharge conduit 55 (FIG. 4), which extends approximately tangentially from top wall 30.

Attached to and extending between cradle members 22, 23, are a pair of lower grooved shredder bars 56, 58, the former of which abuts against the underside of flange plate 32 while the latter abuts against the former so as to form a continuous circumferentially extending grooved breaker face. Shredder bars 56, 58, extend longitudinally no further than the distance occupied by feed opening 44, and arcuately they extend through less than a quadrant of cylindrical housing 6. They are grooved similarly to shredder bars 40.

The remainder of the lower portion or half of housing 6 is defined by three arcuate screens 60, 62, 63. Screen 60 includes a pair of longitudinally extending ribs 64, 66, which are interconnected by arcuate connecting ribs 68, and extending across the frame defined by ribs 64, 66, 68, is a perforated plate 70. Longitudinally extending rib 64 abuts against the end of lower shredder bar 58 directly beneath opening 44, while arcuate ribs 68 rest upon cradle members 18, 20, 22, 23, thereby providing subjacent support for screen 60 and perforated plate 70. Similarly, screen 62 includes a pair of longitudinally extending ribs 72, 74, arcuate connecting ribs 76, and a perforated plate 78. Rib 72 abuts against rib 66 of screen 60 while rib 74 is located immediately beneath flange plate 34. Similarly, ribs 76 rest upon cradle members 18, 20, 22, 23. Completing the lower half of housing 6 is screen 63 including a pair of longitudinally extending ribs 80, 82, which are transversely connected by arcuate ribs 84 to provide subjacent support for a perforated plate 86. Screen 63 extends from the inner ends of shredder bars 56, 58, to end member 14 and its rib 82 abuts against rib 64 of screen 60 while its rib 80 is located directly beneath flange plate 32 and the adjacent shredder bar 40 (FIG. 4). Immediately above the end of screen 60 and adjacent corners of screens 62, 63, the wall-forming end member 14 is relieved in the provision of an arcuate discharge slot 88.

A rotor 8 includes a rotor shaft 90 which extends axially through housing 6 and is journaled near its ends in pillow blocks 26, 27. Keyed to shaft 90 beyond pillow block 26 is a flywheel 92 and similarly keyed to shaft 90 beyond pillow block 27 is a multigroove pulley 94 over which a plurality of V-belts are trained for transmitting power from a suitable primer mover. Secured to rotor shaft 90 for rotation adjacent end wall 36 and end member 14 is an end disc 96 and similarly affixed to shaft 90 adjacent end wall 38 and end member 16 is an end disc 98. Both discs 96, 98, are provided with axially projecting annular flanges 100, the annular end edges of which rotate in close proximity to their respective end walls and end members. Keyed to shaft 90 at spaced intervals intermediate end discs 96, 98, are a plurality of intermediate discs 102 having abutting spacer hubs 104 which encircle shaft 90. Discs 102 as well as discs 96, 98, are provided with a plurality of axially aligned apertures 106 located along equally spaced radii and inserted through each series of aligned apertures 106 is a hammer rod 108 which is held fast by means of nuts threaded onto its ends and against the dish-shaped portion of end disc 98. Swingably mounted on rods 108 in the spaces between discs 102 are hammers 110, 112, 114, the ends of which pass in close proximity to shredder bars 56, 58, and screens 60, 62, when rotor 8 is revolved, thereby defining a plurality of hammer tip circles. The ends of hammers 110 are

provided with a one-quarter twist in a direction which will cause matter within housing **6** to be propelled toward end wall **36** and end member **14** as rotor **8** revolves. Hammers **112**, on the other hand, are not canted at their ends, and these hammers primarily reduce the compost material by way of shearing, impact, attrition, and grinding. Only hammers **110** are located in the spaces between the several discs **102** adjacent the far end of feed opening **44**. Beyond this point, which is located at the approximate midpoint of feed opening **44**, to the inner margin of discharge opening **54** rotor **8** carries both hammers **110** and **112** in alternately staggered relation. Hammers **114** are carried at the opposite end of rotor **8** and sweep past discharge opening **54**. These hammers are provided with a one-half twist and thereby act as a centrifugal fan or blower for hurling ungrindable material out of discharge opening **54** and into discharge conduit **55**. The exact disposition of hammers **110, 112, 114**, with respect to one another as well as with respect to feed opening **44** and discharge opening **54** is shown in FIG. **5**, which illustrates rotor **8** unfolded from its actual cylindrical configuration.

In operation, shredder and separator unit **2** receives composted refuse through hopper **53**. This refuse falls through inlet **46** into the path of revolving hammers **110, 112**, which engage the refuse and draw it across shredder bars **56, 58**, thereby grinding the refuse as well as tearing it into shredded bits. That portion of the refuse which is fine enough to pass through screens **60, 62, 63**, leaves housing **6** by that route and is collected beneath shredder and separator unit **2** for subsequent use as an organic humus. The composted refuse remaining in housing **6** is transposed axially as well as circumferentially by canted hammers **110** acting upon it, and due to the substantial axial length of housing **6** that refuse passes across shredder bars **40** as well as **56, 58**, many times before it arrives at discharge opening **54**. Further shredding and grinding takes place as a result of hammers **110, 112**, acting upon the compost and more of the compost falls through screens **60, 62, 63**. That portion of the composted refuse which remains in housing **6** even after the spiral journey toward end wall **36** and end member **14** is completed is finally propelled outwardly by hammers **114** along a substantially tangential path through discharge opening **54** and conduit **55**. This portion of the original compost is also collected and used primarily as a sanitary landfill. Heavy ungrindable material such as tramp metal, plastic and the like is propelled outwardly through arcuate discharge slot **88**. It should be noted that the material introduced into housing **6** through its inlet **46** is reduced upon contact with hammers **110, 112**, by deflection, impact, shear attrition, and grinding. At the same time, unit **2** serves as a separator, ballistically separating ungrindable material, tramp metal, and the like from the original charge. Accordingly, shredder and separator unit **2** refines, reduces, blends and classifies the compost material introduced into housing **6** through inlet **46**.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A shredder and separator unit comprising a housing having shredder bars and a screen; an inlet opening into said housing; and outlet also opening into said housing in axially spaced relation from said inlet; a discharge opening which opens into the bottom of said housing adjacent said outlet; and a rotor journaled for rotation within said housing about a substantially horizontal axis and including hammers adapted to sweep past and in close proximity to said shredder bars; at least some of said hammers being canted so as to propel said material through said housing from said inlet toward said outlet and said discharge opening.