

[54] LEAF SHREDDER WITH IMPROVED MATERIAL FEEDING AND DISCHARGING APPARATUS

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[57] ABSTRACT

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A shredding machine including a feeding mechanism, a shredding device and a discharge unit wherein the feeding mechanism feeds materials to the shredding device which discharges the shredded materials through the discharge unit into a receptacle with the discharge unit having means to vent the receptacle to atmosphere as the receptacle fills with shredded materials.

[52] U.S. Cl. 241/100, 241/101.7, 241/186 R
[51] Int. Cl. B02c 18/12
[58] Field of Search 241/101 M, 101.7, 100, 241/186 R

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11 Claims, 18 Drawing Figures

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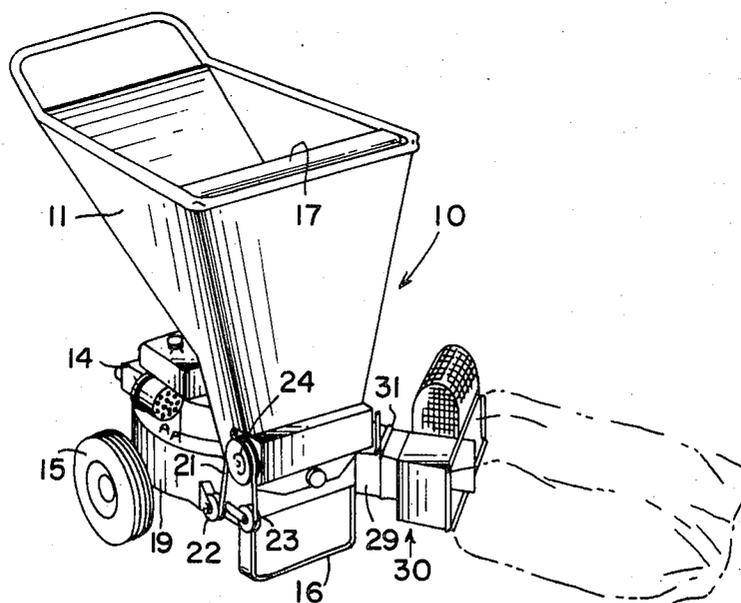


FIG-1

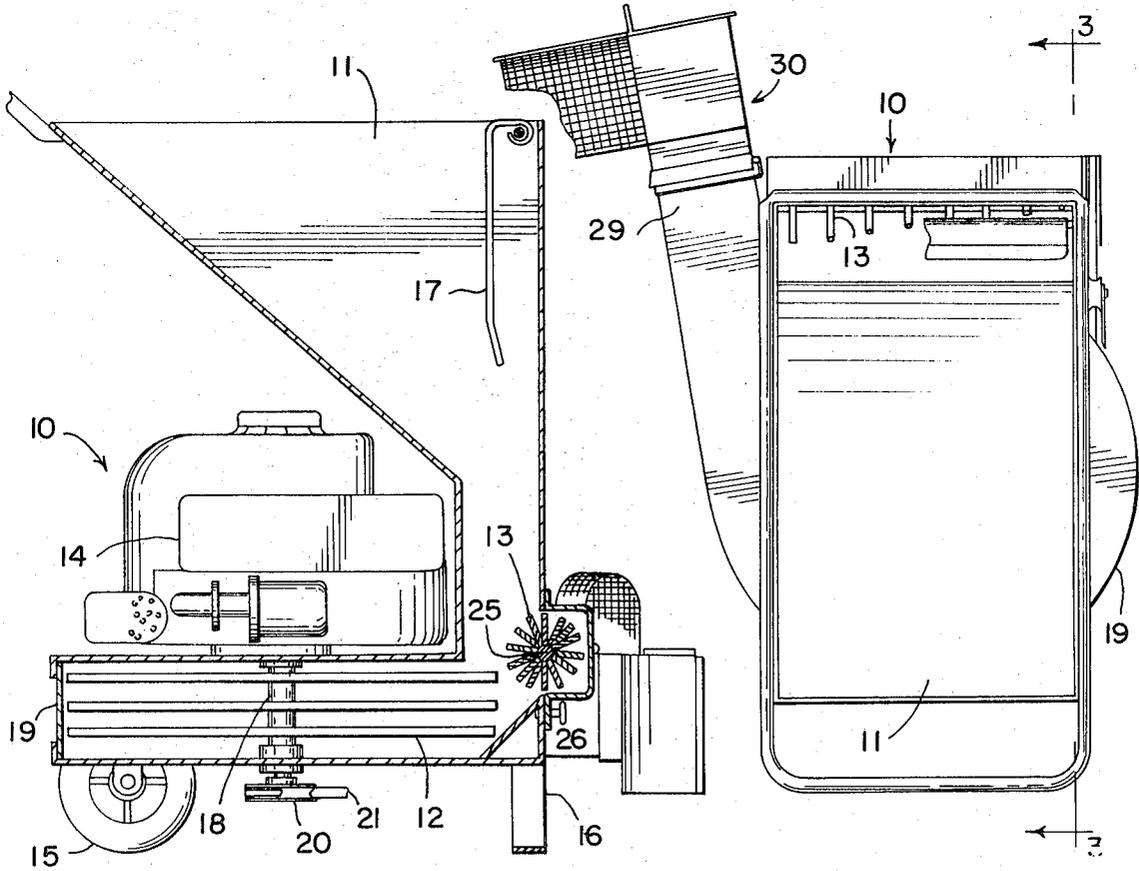
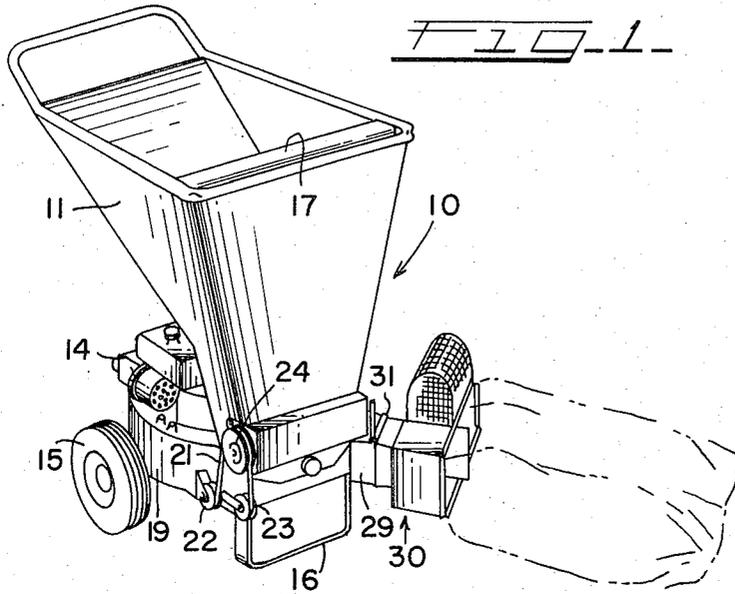


FIG-3

FIG-2

FIG - 4 -

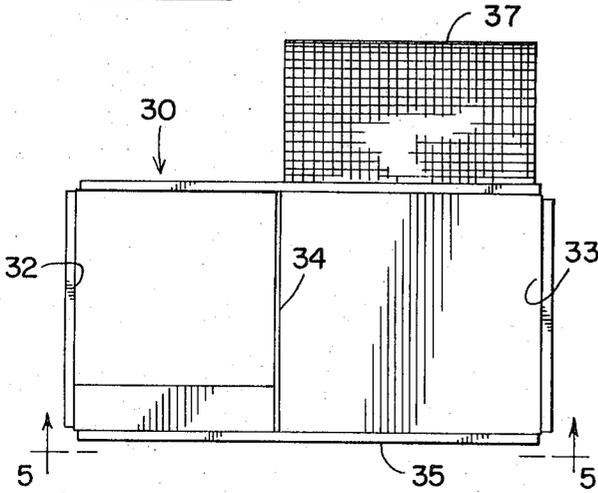


FIG - 5 -

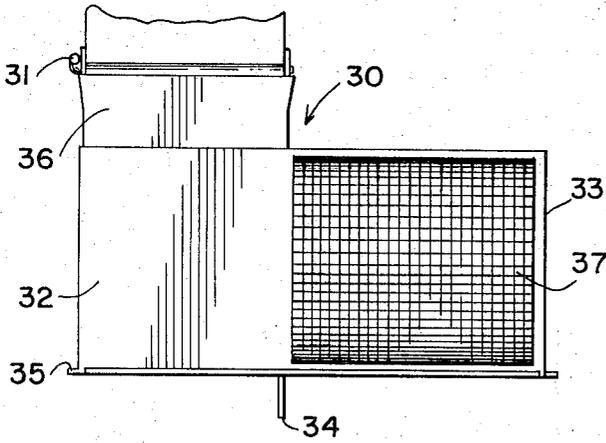
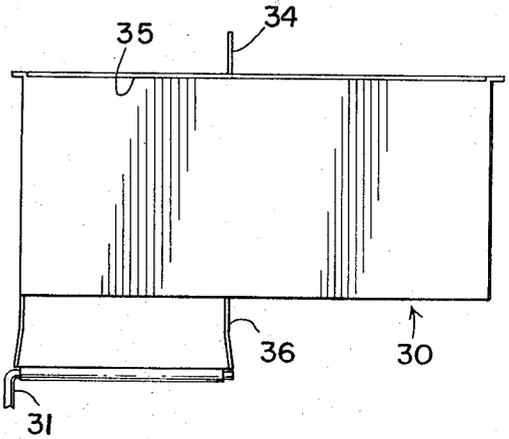


FIG - 6 -

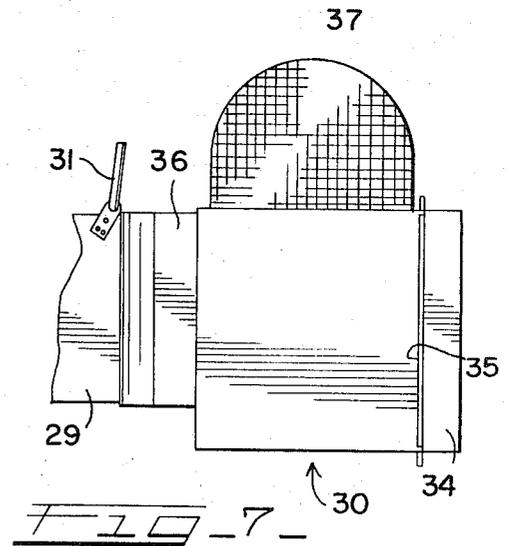


FIG - 7 -

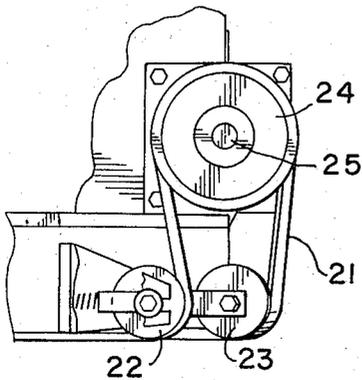


FIG - 8 -

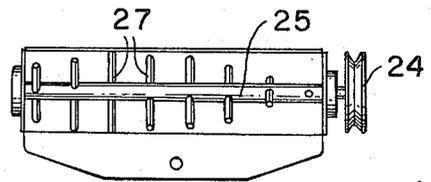


FIG - 9 -

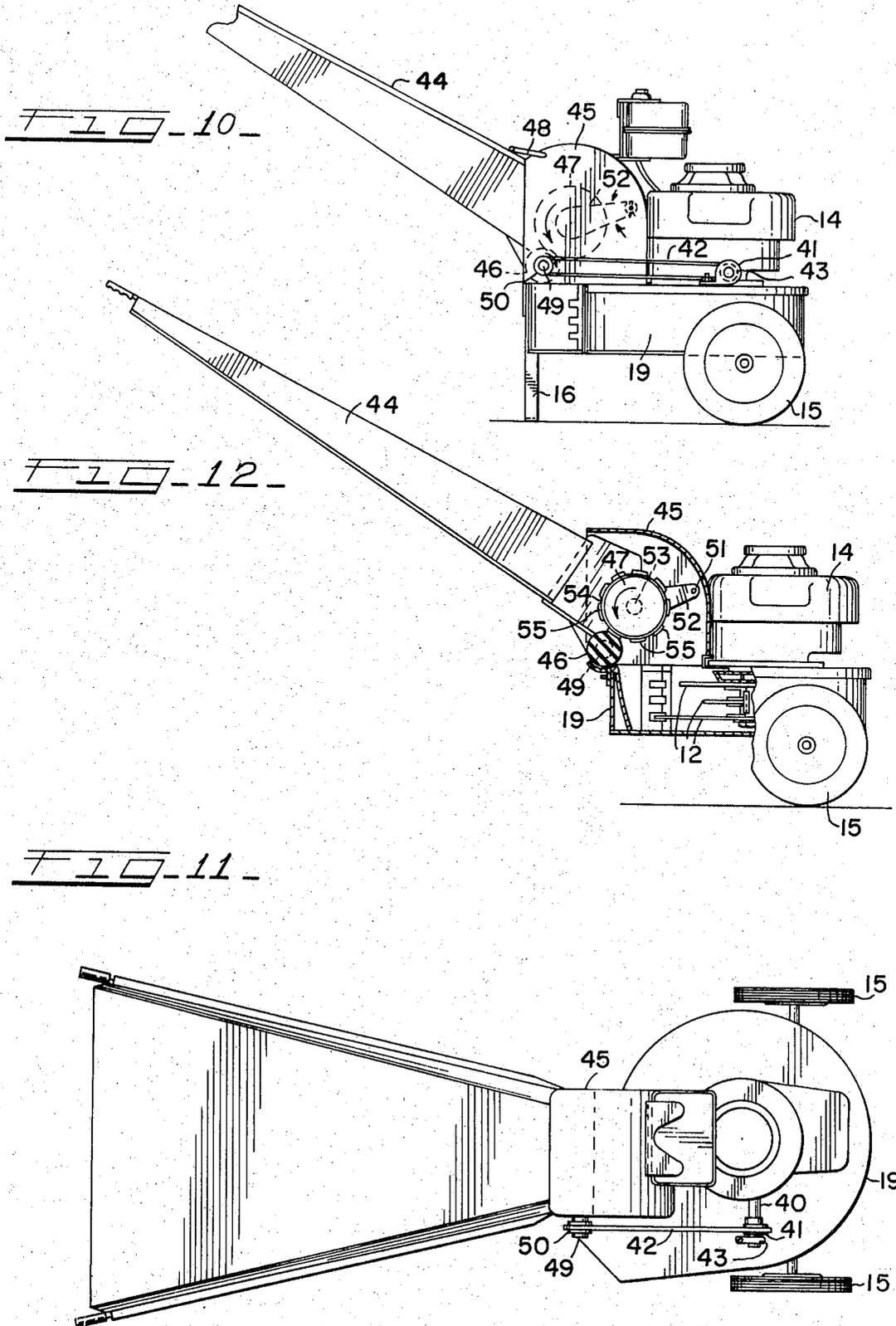


FIG-15

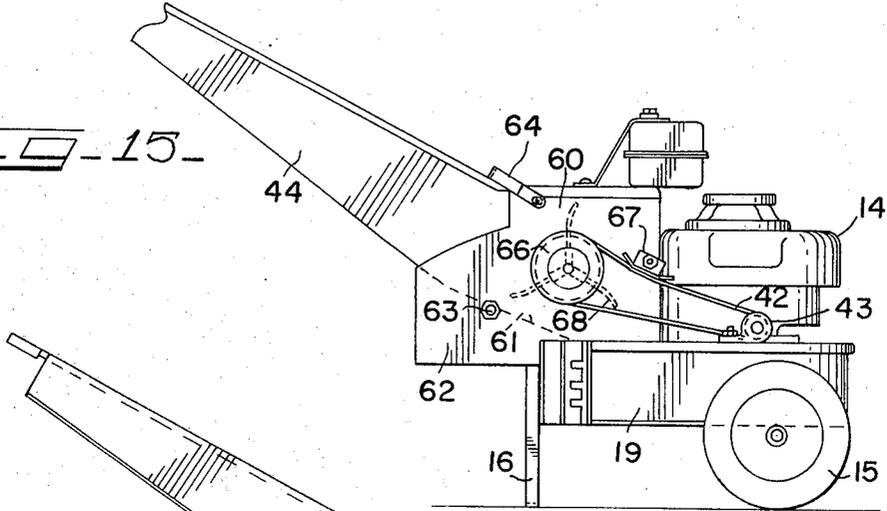


FIG-13

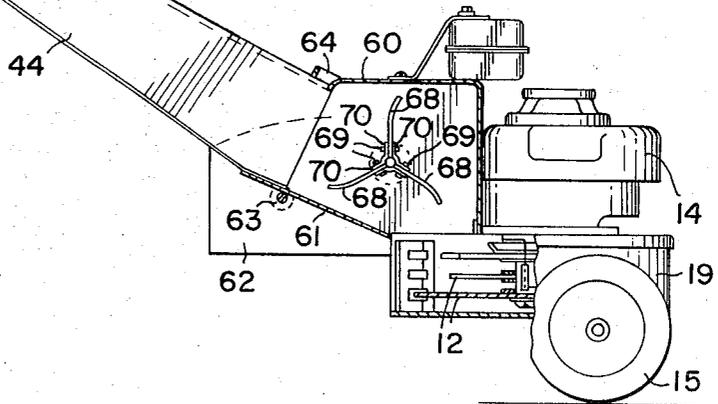
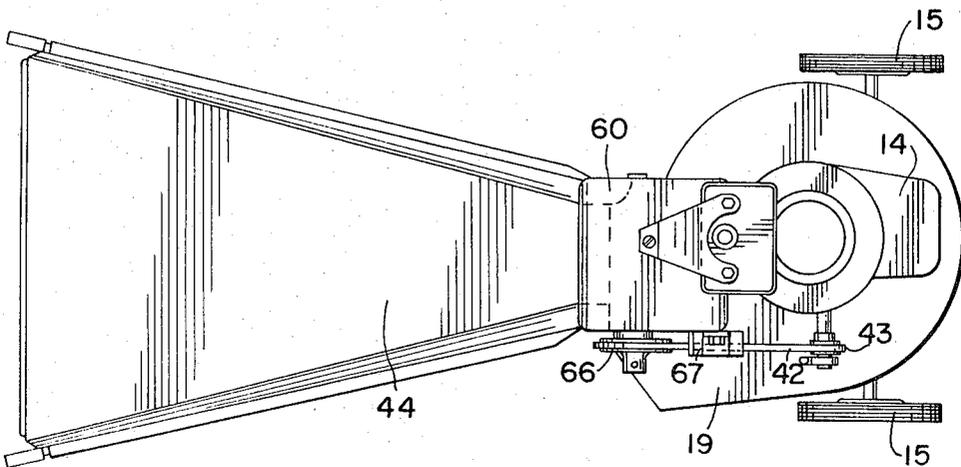
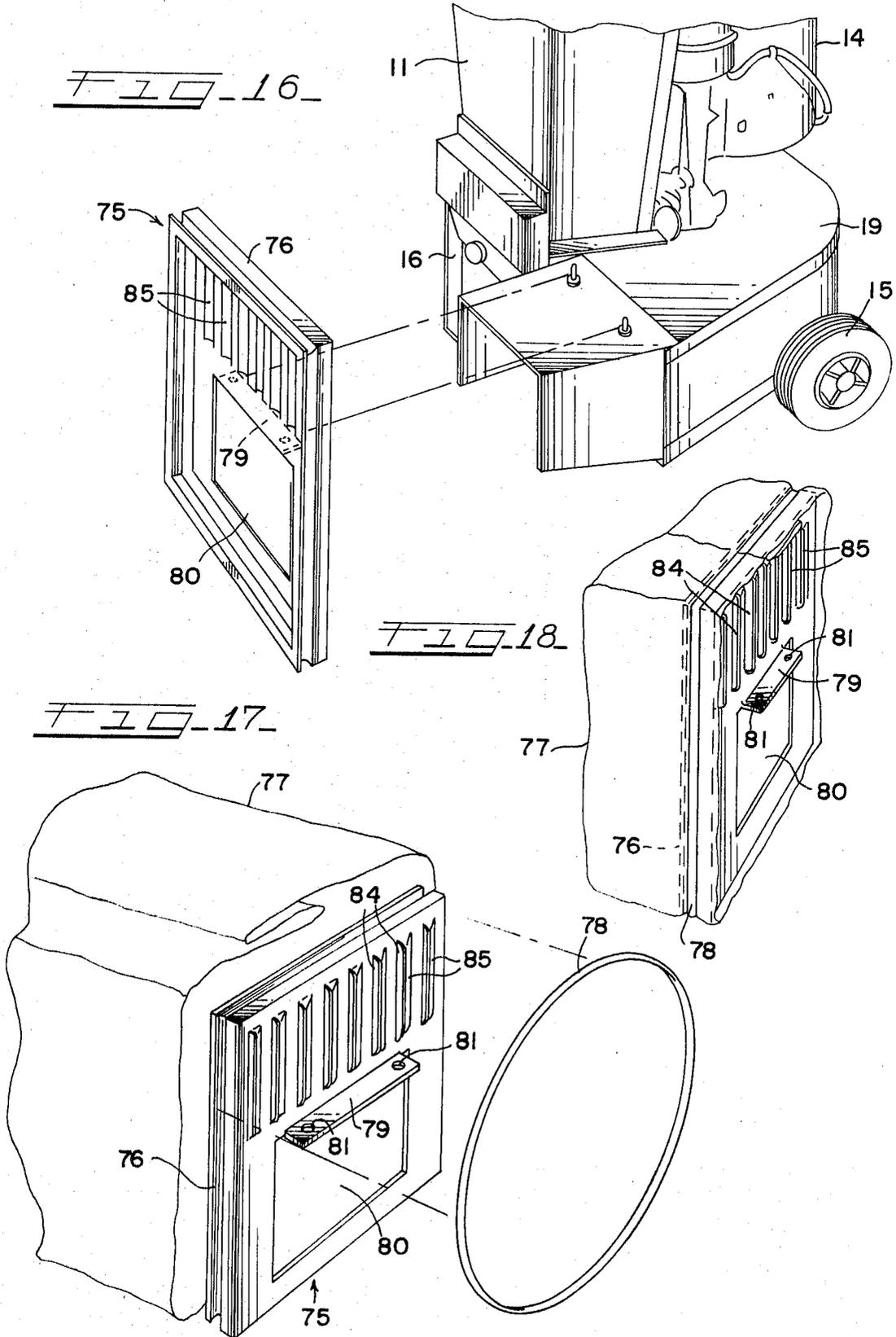


FIG-14





LEAF SHREDDER WITH IMPROVED MATERIAL FEEDING AND DISCHARGING APPARATUS

BACKGROUND OF THE INVENTION

In shredding machines heretofore available it has been the practice to provide a so-called bagging attachment for more or less loosely securing a plastic trash bag in somewhat generally associated relationship with the discharge outlet of the machine or in the general area of such outlet but not directly in communication with the outlet because it was necessary to allow the air to escape from the bag as it filled with shredded materials. Such arrangements were intended to facilitate the loading of lawn and garden wastes such as leaves, twigs and clippings into bags for disposal without burning, but these arrangements were unsatisfactory for the reason that the loosely associated bags allowed much of the discharged materials from the machine to escape onto the surrounding ground area which necessitated repeated cleaning up operations until all of the material was bagged. In addition there was a strong tendency toward clogging of the inlet regardless of whether the bagging operation was being utilized or if the materials were discharged otherwise. These prior devices lacked a feeding mechanism at the inlet and consequently feeding problems were encountered also with or without the bagging operation.

OBJECTS OF THE INVENTION

It is a primary purpose of the invention to provide a shredding machine for disposing of garden waste materials by finely shredding the materials and loading the shredded materials into plastic trash bags or other suitable receptacles without permitting any of the materials to escape during the loading operation.

The principal object of the invention is the provision of a shredding machine having feeding means followed by shredding apparatus which discharges shredded material through a discharge housing into a receptacle with vent means in the housing for escape of air from the receptacle during loading.

An important object of the invention is to provide a shredding machine including a shredding compartment having an inlet with a rotary feeding device extending partially above the inlet, feeding materials to a shredding apparatus in the shredding compartment, which discharges shredded materials through a discharge housing having an air vent for a receptacle attached to the housing to receive the shredded materials.

Another object of the invention is the provision of a shredding machine wherein one or more rotary shredding knives operate on a vertical axis and a rotary feeder mechanism operates on a horizontal axis with power driving means for the rotary knives and including a right angle drive to drive the rotary feeder mechanism.

Another object of the invention is to provide a shredding machine having one or more rotary shredding knives operating on a vertical axis with power means having a mechanical driving connection with the shredding knives and a rotary feeder mechanism operating on a horizontal axis having a belt drive from the power means.

A still further object of the invention is to provide a shredding machine having one or more power driven rotary shredding knives for shredding materials fed to

the knives and a rotary feed mechanism for feeding materials to the rotary shredding knives.

DESCRIPTION OF THE DRAWINGS

The foregoing and other and more specific objects of the invention are attained by the structure and arrangement illustrated in the accompanying drawings, wherein:

FIG. 1 is a general perspective view of a shredding machine in accordance with this invention;

FIG. 2 is a top plan view thereof;

FIG. 3 is a vertical sectional view taken on the line 3—3 of FIG. 2;

FIGS. 4, 5, 6 and 7 are detail front elevational, bottom plan, top plan and side elevational views, respectively, of a ventilated bag filling device;

FIG. 8 is a detail view of one form of drive for the arrangement illustrated in FIG. 1;

FIG. 9 is a detail view of the feeder device shown in FIGS. 1 and 3;

FIG. 10 is a view, partially in section, illustrating a shredding machine having a belt driven multiple roller feeding mechanism;

FIG. 11 is a top plan view of the FIG. 10 machine;

FIG. 12 is a side elevational view of this machine;

FIG. 13 is a view, partially in section, showing a shredding machine having a paddle type feeding mechanism;

FIG. 14 is a plan view of the machine illustrated in FIG. 13;

FIG. 15 is a side elevational view of this machine; and

FIGS. 16, 17 and 18 are detail perspective views of a bagging attachment.

SUMMARY OF THE INVENTION

This invention comprises what is generally known as a lawn or garden shredder and in use is a shredding machine for taking garden waste or refuse such as leaves, prunings, clippings and twigs or the like and shred these materials to a finely pulverized state for bagging directly from the machine without the necessity for burning or for conditioning such materials for mulching or composting. The shredding machine includes a hopper chute whereby materials to be shredded are directed into the machine and has a housing which includes a shredding compartment defining a shredding space. One or more rotary shredding knives are operatively mounted in the shredding compartment and are mechanically driven from a suitable power source. A power driven feeder mechanism feeds the materials to the shredding apparatus.

This feeder is mounted in the loading chute adjacent to an inlet leading to the shredding compartment and partially overlies the inlet opening but does not extend fully into the opening so that a portion of the opening remains free. The shredding apparatus after final shredding of the materials discharges them through a discharge outlet from the shredding compartment. At this point the materials are more or less finely pulverized. A bagging attachment is mounted adjacent to the discharge outlet and this attachment receives the shredded materials discharged from the machine. The bagging attachment includes an opening in communication with the discharge outlet and this opening leads through the attachment to a receptacle such as a plastic

trash bag removably secured to the bagging attachment.

A louvered vent disposed in side-by-side relationship with the first opening is disposed in communication with the receptacle and provides a means of venting the receptacle to atmosphere to permit the air to escape therefrom as the plastic bag fills with the shredded materials.

DESCRIPTION OF THE FIRST EMBODIMENT

The shredding machine 10 illustrated in FIGS. 1-9 comprises a hopper 11, shredder knife mechanism 12, a rotary feeder device 13 and a power means 14 consisting of a commercially available internal combustion engine. The shredding machine is mounted on wheels 15 for mobility and a rest or support 16 at the opposite end of the machine from the wheels affords a means for maintaining the machine level and fixing its position. A hinged damper plate 17 mounted in the hopper 11 may be utilized to overlie materials loaded into the chute.

The multiple shredding knives 12 are driven from the engine 14 by means of vertical drive shaft 18 and these knives are enclosed within a shredding housing 19 into which the loading chute 11 discharges. The drive shaft 18 extends through the bottom wall of the housing 19 and has a pulley 20 mounted on its lower end driving a belt 21. The belt 21 drives the rotary feeder device 13 through the medium of direction changing idler pulleys 22 and 23 (see FIG. 8) and then around the driven pulley 24 mounted on the projecting end of the shaft 25 of the rotary feeder.

The feeder mechanism 13 is mounted in a housing 26 and is located adjacent to the discharge area from the loading chute 11 where the materials in the chute enter the shredding chamber 19. The feeder housing 26 is mounted on the hopper 11 with the rotary feeder 13 projecting at least partially into the entrance to the shredding chamber so that the materials from the loading chute will be engaged by the rotary action of the feeder, driven by the belt 21, and propelled into the chamber 19 for shredding by the multiple knives 12. The rotary feeder device 13 includes a plurality of radially projecting fingers 27 mounted in the shaft 25 and those fingers may be spirally arranged on the shaft 25, if desired, as best indicated in FIG. 9.

The bagging attachment for this version of the shredding machine is shown in detail in FIGS. 4, 5, 6 and 7 and is best shown applied in FIG. 1. The bagging attachment comprises a housing 30 which is hingedly and removably mounted on the discharge outlet 29 from the shredder housing 19 and this hinged mount is effected by means of a removable hinge pin 31. The housing 30 includes chambers 32 and 33 disposed in side-by-side relationship separated by a dividing wall 34. A flange 35 is disposed on all four sides of the housing 30 and a receptacle for receiving shredded materials discharged from the shredding chamber 19 through the discharge outlet 29, such as a plastic bag, may be secured over this flange by means of a rubberband or O-ring (not shown). The dividing wall 34 between the chambers 32 and 33 projects beyond the housing 30 into the receptacle to act as a baffle against the possibility of materials short circuiting directly from the material discharge chamber 32 into the vent chamber 33. The housing 30 is provided with a mounting hood portion 36 projecting inwardly from the chamber 32 for securing the housing on the discharge outlet 29 of the

machine. This hood extends across the top and down the two sides but the bottom area is left open as a means of admixing air with the discharging materials to facilitate the feeding thereof through the discharge chamber into the plastic bag receptacle. The chamber 32 is open straight through from the discharge outlet 29 into the plastic bag but the vent chamber 33 is open only to the plastic bag whereby the discharged materials are deposited in the bag and the accumulated air passes into the chamber 33. The top side of the chamber 33 is covered by domed screen 37 which provides an extended surface outlet for the escape of air but prevents the passage of shredded materials while substantially avoiding any clogging tendencies by reason of the extended screen area and the curvature of the dome.

SECOND EMBODIMENT

The shredding machine illustrated in FIGS. 10, 11 and 12 is generally similar to the machine hereinbefore described in the provision of a wheel mounted shredding chamber and engine driven shredding knives and therefore the same reference characters are applied to these parts. This engine 14, however, is provided with a cam shaft driven power take-off 40 for a purpose hereinafter referred to. The power take-off 40 actually is an extension of the engine cam shaft and such engines are commercially available. The power take-off drives a pulley 41 which drives a belt 42 and the outer end of the shaft 40 is supported in a bearing 43.

In this machine an upwardly open chute 44 directs the materials loaded thereon into the feeder mechanism. The feeder mechanism includes a housing 45 enclosing the mechanism and which is mounted on the shredder housing 19 to overlie the inlet to the shredding chamber. The feeding mechanism is driven by the belt 42 and comprises a pair of rollers 46 and 47 mounted in the housing 45 above the inlet.

The axes of the rollers 46 and 47 are parallel to one another and disposed above the plane described by the uppermost blade 12 during rotation thereof. The axes are transverse to the direction of flow from the chute to the inlet.

The chute 44 is shown in the up position where it is secured by removable fastening 48 but the chute is hingedly mounted on the roller shaft 49 and may be lowered to a ground engaging position for receiving the materials to be loaded thereon for shredding. The belt 42 drives the roller 46 by means of a pulley 50 mounted on the outer end of the roller shaft 49. The roller 46 is rubber faced, as best shown in FIG. 10, and this roller in turn drives the roller 47 which is an idler roller and the positioning of this idler roller in relation to its driving roller 46 is important in the feeding operation of moving materials into the knives 12 for shredding. The relative positioning of the rollers 46 and 47 is important to the operation of the feeding mechanism.

The idler roller 47 has its axis offset in relation to the axis of the driving roller 46 and this offset of the driven roller is forwardly and above the driving roller toward the shredding mechanism 12 so that the roller is disposed in directly overlying relationship to at least a portion of the shredding chamber and whether the loading chute 44 is disposed in the up position or in the ground engaging position, the offset is such that the line of contact, or the engagement of the rollers through the materials passing therebetween, is tangential to a line at the point of contact whereby in operation the flow

of material feeding to the shredding chamber is directed toward this tangential line. This relationship assures continuous feeding of the materials through the rollers as compared to the direct flow of material against the feeding devices in the standard hopper of typical design.

The driving roller 46 also is positioned adjacent the inlet at the bottom of the chute 44 and is located to be the lower roller of the pair and is fabricated of a material, such as rubber, to provide a frictional surface and rotate on a fixed axis, but the driven, or idler roller 47, is hingedly mounted to swing about a hinge point 51 so that materials fed between the rollers causes the roller 47 to be swung upwardly in an arc about the pivot 51 against the weight of the roller which always tends to bear against the materials, thus maintaining the weight on the materials fed to the idler roller so that they are pressed against the driving roller to facilitate their being fed to the shredding chamber 19. The roller 47 is suspended from the pivot mounting 51 by arms 52 between which the roller is rotatably mounted on an axle 53 rigid with the arms 52. Whereas the roller 46 is provided with a rubber frictional surface, the idler roller 47 includes a cylindrical steel surface 54, but this surface also is modified by the provision of projecting elements on the surface to increase the operating performance of the multiple roller unit. This has been accomplished by the depositing of beads 55 of weld material at spaced intervals around the cylindrical steel surface of the roller.

THIRD EMBODIMENT

The shredding machine illustrated in FIGS. 13, 14 and 15 also is generally similar to the machines previously described in the provision of a wheel supported structure including an engine driven shredding mechanism in an enclosed housing having an associated feeding mechanism and a loading chute which may be disposed in either a lowered position or an upper raised position for directing materials to be shredded into the shredding chamber. Similar parts in this version have been identified by like reference characters. The feeding mechanism in this machine is driven by the belt 42 from pulley 41 on the end of cam shaft extension 40 having its outer end supported in bearing 43 on the shredding chamber housing 19 as in the machine and driving arrangement just described.

In this shredding machine the feeding mechanism is mounted in a housing 60 having a sloping bottom wall 61 leading into the shredding chamber 19 and outwardly extending spaced side walls 62 between which the loading chute 44 is pivotally mounted as at 63 for movement between its lower ground engaging position and the raised position thereof, as shown, where it is secured by the releasable latching device 64. The feeding device shaft 65 is also rotatably mounted in suitable bearings in the side walls of the housing 60 and a pulley 66 is fixed on a projecting outer end of this shaft for driving engagement by the belt 42 which thereby drives the feeder device shaft 65. A belt tensioning device 67 adjustably mounted on the side wall of the housing 60 maintains the driving belt 42 in most effective driving relationship with the driven pulley 66.

The feeding device shaft 65 includes a series of paddles or blades 68 which are mounted on the shaft, as best shown in FIG. 13, and rotate therewith to move materials on the sloping floor 61 of the feeder housing

60 into the shredder chamber 19 for shredding by the rotating knives 12. The blades 68, as shown, comprise three in number but may be provided in any suitable number, as preferred, and are shaped and arranged to wipe the floor 61 as they rotate and thereby effectively move all materials deposited on this floor from the loading chute into the shredding chamber. The feeder elements 68 are rigidly mounted on the driving shaft 65 but this mounting is such that the blades may be removed individually or in their entirety merely by removing the fastenings 69 whereby to release the clamping elements 70 fixing the paddle blades on the shaft.

BAGGING ATTACHMENT

The bagging attachment illustrated in FIGS. 16, 17 and 18 is adapted also to be removably mounted on the discharge outlet from the shredding chamber 19 and includes a discharge opening for materials passing from the shredding chamber into a receptacle such as a plastic bag removably fastened on the bagging attachment, and a vent opening for escaping air flowing out of the receptacle. The bagging attachment comprises a frame structure 75 having a continuous groove 76 extending entirely around the four sides of the frame and this groove is adapted to receive the open end of a plastic bag 77 slipped over the edges of the frame and removably secured therein by means of an elastic band or O-ring 78 which is snapped in place over the mount of the bag to tightly engage the open bag in the groove 76 at all four sides of the frame 75.

The frame structure 75 is adapted to be removably mounted on the discharge outlet from the shredding chamber 19. Outstanding flange 79, located at the top of opening 80 through the frame structure, is provided with spaced openings 81 which fit over upstanding pins 82 on the top of the discharge outlet 83 with opening 80 fitting around the discharge outlet so that shredded material from the chamber 19 will pass through the opening 80 directly into the plastic bag mounted on the frame. It will be noted that the bottom side of the discharge outlet 83 is open to admit air for mixing with the shredded materials to facilitate flow of the materials into the bag.

The frame structure 75 also includes a particularly efficient series of vent openings 84 with associated louvers 85, disposed above the opening 80, for venting the air escaping from the bag 77 while maintaining materials escaping at a minimum and substantially avoiding the buildup of such materials in the openings and thus block the escape of air from the bag. The louvered openings are disposed and arranged to direct the escaping air and any materials discharged, away from the machine 10, but a more important function of this outlet arrangement is to cause the laterally directed air discharged through the openings 84 to effect a wiping action on the inside faces of the louvers 85 and the outside faces of the adjacent areas of the frame structure 75, whereby to maintain these surfaces free of any accumulations of the shredded materials that may be carried in the air stream passing from the bag 77. This is accomplished by the particular structure of the openings 84 and the related louvers 85. The openings 84 extend through the wall of the frame structure 75 and are disposed in the plane of that wall. The louvers 85 overlie the openings 84 and are disposed at an angle to the plane of this wall such that the air venting through the openings 84 impinges against the inside faces of the

louvers 85, disposed at the angle indicated and extending from one side of each opening partially over the opening, so that the air and any materials carried thereby are deflected laterally and creating a wiping action across the inner faces of the louvers and the outside face of the wall of the frame structure 75 whereby to prevent clogging of the openings.

From the foregoing it will be seen that there has been provided a shredding machine having novel material feeding devices at the inlet to a shredding chamber as well as a bagging attachment for the shredded material with novel venting means and including driving means for the feeder mechanism of equally novel design.

I claim:

1. A shredding machine having a housing including a compartment defining a shredding space having an inlet, a material loading chute discharging material to said inlet, one or more rotary knives in the shredding compartment, a rotary feeder mechanism located adjacent to said inlet for mechanically feeding material from said chute through said inlet, the axis of said rotary knives and the axis of said rotary feeder mechanism being disposed at an angle to each other and said feeder mechanism being located tangentially in relation to said rotary knives, power means for driving said rotary knives and said rotary feeder, said shredding compartment having a discharge outlet, and a discharge unit removably mounted in operative relation to said outlet, said discharge unit having means for attaching a receptacle thereto for receiving material discharged from said outlet, said discharge unit having a material inlet opening to said receptacle and an air outlet opening from the receptacle.

2. A shredding machine having a housing including a compartment defining a shredding space having an inlet, a material loading chute discharging material to said inlet, one or more rotary knives in the shredding compartment, a rotary feeder mechanism located adjacent to said inlet for mechanically feeding material from said chute through said inlet, power means for driving said rotary knives and said rotary feeder, said shredding compartment having a discharge outlet, a discharge unit removably mounted in operative relation to said outlet, said discharge unit having means for attaching a receptacle thereto for receiving material discharged from said outlet, said discharge unit having a material inlet opening to said receptacle and an air outlet opening from the receptacle, said power means for driving the rotary knives and rotary feeder mechanism including a vertical drive shaft for the knives extending through the shredding compartment and a drive pulley mounted on the shaft below said compartment, said feeder mechanism including a feeder housing enclosing the mechanism and a horizontal drive shaft extending through the feeder housing with a driven pulley mounted on the horizontal drive shaft outwardly of the feeder housing, a drive belt operatively connecting said drive pulley and said driven pulley, and a pair of spaced idlers engaged by said belt to change the plane of operation of the belt and thereby provide a right angle drive.

3. A shredding machine as set forth in claim 1 wherein said rotary feeder mechanism is mounted in a feeder housing and includes a drive shaft supported in the housing, and a plurality of radially disposed feeder elements mounted on the drive shaft.

4. A shredding machine having a housing including a compartment defining a shredding space having an inlet, a material loading chute discharging material to said inlet, one or more rotary knives in the shredding compartment, power means for driving said rotary knives, said shredding compartment having a discharge outlet, and a discharge housing mounted in operative relation to said outlet, said discharge housing having means for attaching a receptacle thereto for receiving material discharged from said outlet, said discharge housing having a material inlet opening to said receptacle and an air outlet opening from the receptacle, a dividing wall in the housing separating said openings, one side of the housing being open to atmosphere, and a perforate screen covering the side open to atmosphere.

5. A shredding machine having a housing including a compartment defining a shredding space having an inlet, a material loading chute discharging material to said inlet, one or more rotary knives in the shredding compartment, a rotary feeder mechanism located adjacent to said inlet mechanically feeding material from said chute through said inlet, power means for driving said rotary knives and said rotary feeder mechanism, said rotary feeder mechanism including a friction roller belt driven from said power means, and an idler roller swingingly mounted relative to the friction roller and disposed on an axis offset inwardly of the machine from the friction roller.

6. A shredding machine as set forth in claim 5 wherein said friction roller has a nonmetallic surface of rubber or the like, and said idler roller has a plurality of surface projections at spaced intervals thereon.

7. A shredding machine as set forth in claim 6 wherein the idler roller is driven by the operation of the friction roller.

8. A shredding machine having a housing including a compartment defining a shredding space having an inlet, a material loading chute discharging material to said inlet, one or more rotary knives in the shredding compartment, a rotary feeder mechanism located adjacent to said inlet mechanically feeding material from said chute through said inlet, the axis of said rotary knives and the axis of said rotary feeder mechanism being disposed at an angle to each other and said feeder mechanism being located tangentially in relation to said rotary knives, power means for driving said rotary knives and said rotary feeder mechanism, said rotary feeder mechanism including a housing mounted adjacent to said compartment defining the shredding space, a pulley driven shaft in the housing rotated by means of a belt driven from said power means, and a plurality of radially disposed blades mounted on said shaft and rotating therewith to feed material through said housing to the shredding space, said housing having a sloping floor wiped by said blades as they rotate to feed the material thereon into the shredding space.

9. A shredding machine having a housing including a shredding space, said shredding space including a discharge outlet having a discharge opening and an air inlet opening, a bagging attachment comprising a frame structure, means for removably attaching a bag on the frame structure, said frame structure being removably mounted on said discharge outlet, said frame structure having an opening therethrough in communication with said discharge opening for passage of shredded materials into said bag, and an opening through the frame structure for escape of air entering from said air

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inlet opening, said opening for escape of air comprising a plurality of openings in the plane of said frame structure, each having a louver disposed at an angle to said plane directing escaping air across surfaces of the frame structure and the louvers whereby to avoid clog-
5 ging of the openings by shredded materials carried in the escaping air.

10. A shredding machine having a housing including a compartment defining a shredding space having an inlet, a material loading chute discharging material to
10 said inlet, one or more rotary knives in the shredding compartment, a rotary feeder mechanism located adjacent to said inlet mechanically feeding material from

said chute through said inlet, power means for driving said rotary knives and said rotary feeder mechanism, said rotary feeder mechanism including an upper roller in said inlet, and a lower roller located adjacent to a
5 side wall of said shredding space defining one side of said inlet, the axis of the upper roller being located above and inwardly of the axis of the lower roller and the upper roller overlying at least a portion of said shredding space.

11. A shredding machine as set forth in claim 10 wherein said lower roller is driven from said power
10 means and the upper roller is driven by the lower roller.

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