Dec. 4, 1951 J. H. POWERS 2,577,152

WASTE DISPOSAL APPARATUS

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Fig. 1.

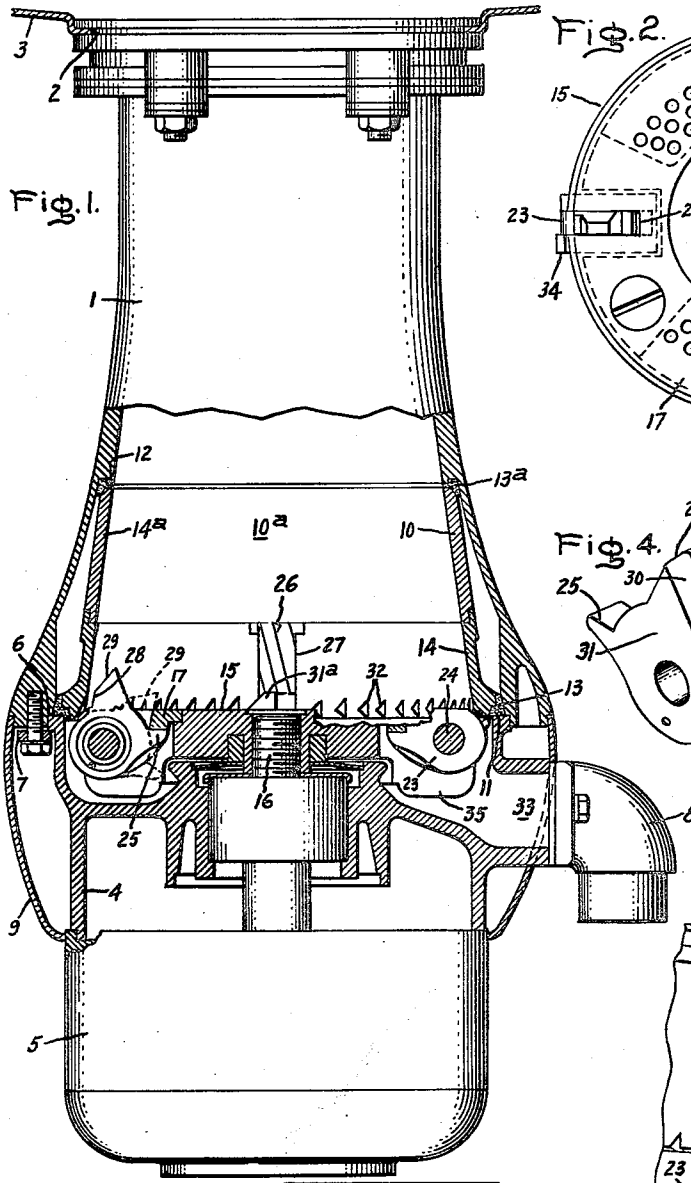


Fig. 2.

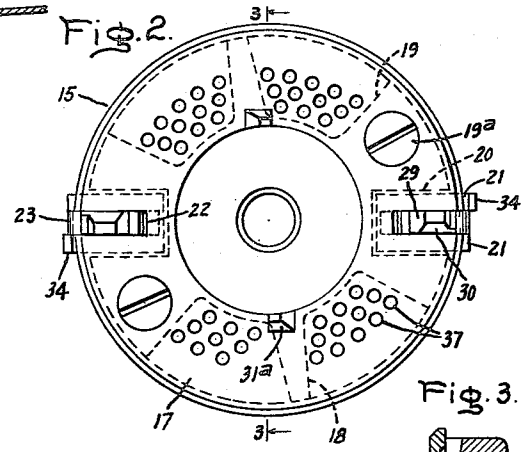


Fig. 3.

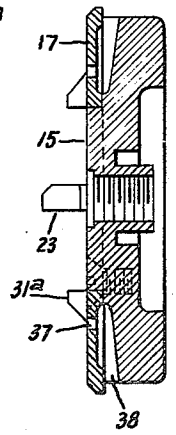


Fig. 4.

Fig. 5.

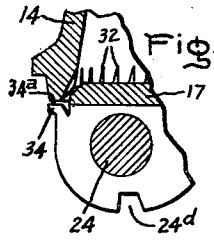


Fig. 7.

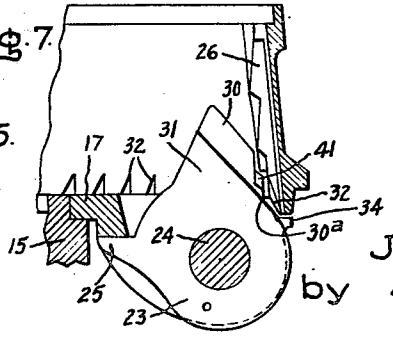
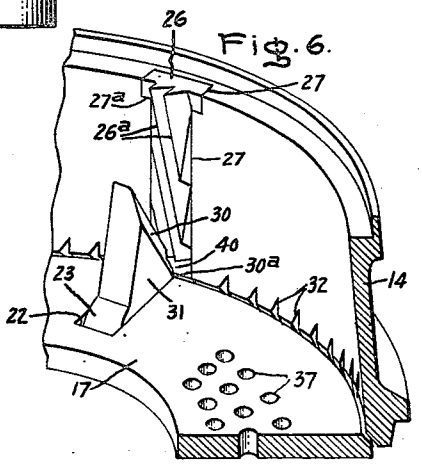


Fig. 6.



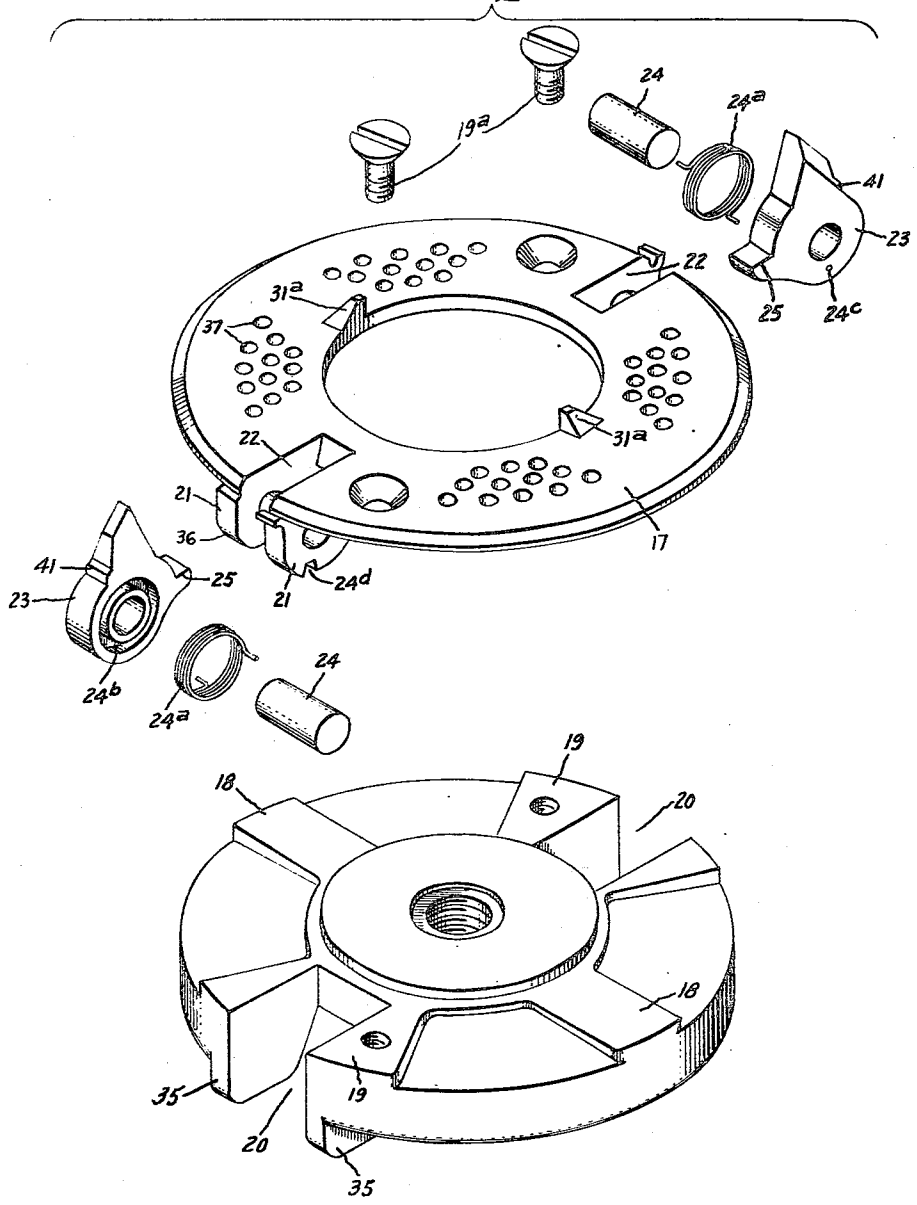
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WASTE DISPOSAL APPARATUS

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Fig. 8.



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WASTE DISPOSAL APPARATUS

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Fig. 9.

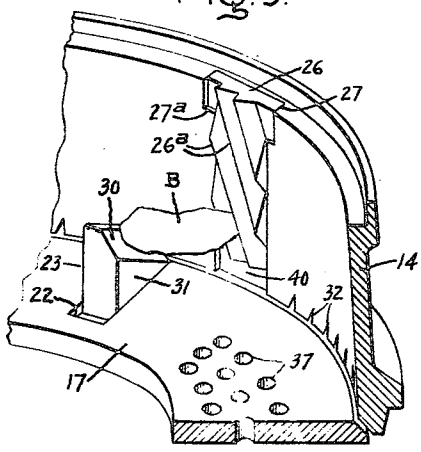


Fig. 10.

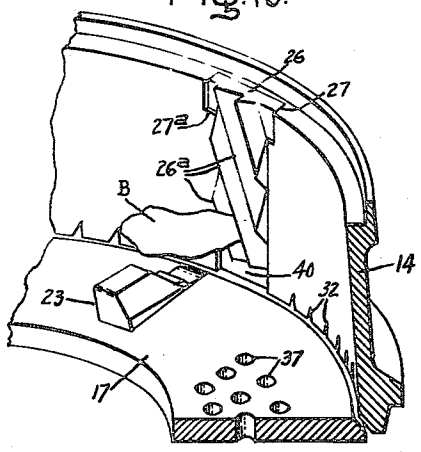


Fig. 11.

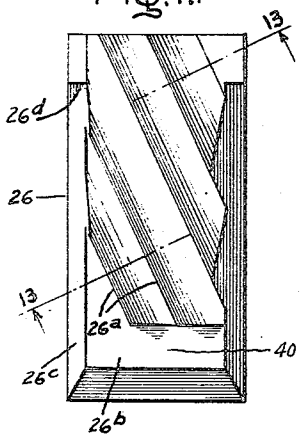


Fig. 13.

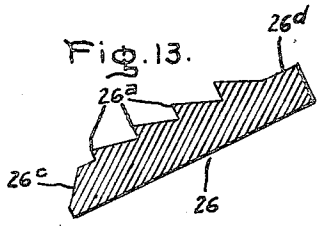
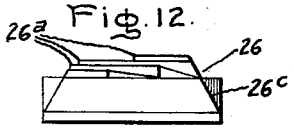


Fig. 12.



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UNITED STATES PATENT OFFICE

2,577,152

WASTE DISPOSAL APPARATUS

James H. Powers, Westport, Conn., assignor to General Electric Company, a corporation of New York

Application March 21, 1947, Serial No. 736,139

4 Claims. (Cl. 241—257)

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The invention relates to apparatus for the disposal of waste material, and particularly to apparatus for attachment to a sink drain for receiving a mixture of garbage and water, and provided with a flywheel with impeller blades and a coacting stationary shredding element for reducing or comminuting the solid particles to produce a flowable mixture suitable for discharge to the sink drain line.

The object of my invention is to provide certain improvements in an apparatus of this type, and in particular to provide an improved flywheel and shredder construction which functions more effectively to reduce or comminute solid particles.

In the accompanying drawings Fig. 1 is an elevation mainly in section of a waste disposal device embodying my invention; Fig. 2 is a top plan view of a flywheel used in the device of Fig. 1; Fig. 3 is a section on line 3—3 of Fig. 2 looking in the direction of the arrows; Fig. 4 is a perspective view of one of the impeller blades; Fig. 5 is an enlarged sectional view of a detail; Fig. 6 is an enlarged detail perspective view, and Fig. 7 an enlarged sectional view showing a part of the flywheel, and the associated stationary shredding element; Fig. 8 is an exploded perspective view of the flywheel shown in Fig. 2; Figs. 9 and 10 are detail perspective views of a part of the flywheel and coacting stationary shredding elements illustrating the manner of their coaction in reducing a hard solid particle; Fig. 11 is an enlarged front elevation of the stationary shredding element; Fig. 12 is a bottom plan view of the element of Fig. 11; and Fig. 13 is a sectional view taken through the line 13—13 of Fig. 11 looking in the direction of the arrows.

Referring to the drawings, there is shown a waste disposal device having a frusto-conical casing or chamber 1 fixed to and depending from the drain opening 2 of a sink 3. At the lower end of the casing in a bottom flange 4 carrying an electric motor 5 clamped against a shoulder 6 in the casing by a clamping ring 7. The bottom flange is provided with an outlet 8 for connection with the sink drain line. The bottom flange is enclosed by a removable shield 9 depending from the casing and blending into the motor.

In the lower end of the casing 1 is a frusto-conical wall 10 which defines a shredding chamber 10a clamped between a shoulder 11 on the bottom flange and a shoulder 12 on the casing. Rubber rings 13 and 13a arranged between the shredding chamber wall and the shoulders prevent the transmission of vibrations. Wall 10 may be divided in two parts; a lower part 14

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formed from a hard wear-resisting metal, and an upper part 14a formed from some suitable material lower in cost than that from which part 14 is formed.

At the lower end of the shredding chamber is a flywheel 15 threaded on the motor shaft 16. The lower part of the walls of chamber 10a surround the flywheel, as shown, and while, as stated, the walls of the chamber are frusto-conical, they are almost vertical, having an angle of about 7° with the true vertical. On the upper side of the flywheel is a replaceable disk 17 of wear-resisting material clamped against circumferentially spaced radially extending ribs 18 and 19 on the upper surface of the flywheel by suitable bolts 19a. The ribs 19, which are much wider than the ribs 18, are provided with radial recesses 20 for receiving pairs of ears 21 depending from the lower side of the disk 17. Each pair of ears 21 defines a slot 22 for receiving an impeller blade 23 pivoted on a pin 24 extending between ears 21. The ends of pins 24 are positioned in holes in ears 21. The impeller blades are biased by gravity and by springs 24a toward the dotted line position in Fig. 1 and are moved outward by centrifugal force to the full-line position thereof when the flywheel is rotated. Springs 24a are located in annular recesses 24b in the blades and have out-turned ends located in openings 24c in the blades and notches 24d in ears 21. The outward movement of the impeller blades is limited by stop lugs 25 on the blades which engage the under side of the disk 17 as shown in Fig. 1. In the outer position the impeller blades run close to and in shearing cooperation with stationary shredding members 26 fastened in recesses 27 in the lower end of the shredding chamber wall 10. Three shredding members are provided uniformly spaced around the shredding chamber which otherwise has a smooth inner surface. Referring to Fig. 2, it will be seen that the impeller blades 23 are positioned on radii of the flywheel so that they are at right angles to walls 10 and pass the shredding members 26 at right angles thereto. The shredding members 26 are identical, each having a plurality of parallel ribs defining a series of parallel cutting edges 26a set at an angle to the horizontal, as shown: this angle is not critical but in the embodiment illustrated is about 65°. The ribs are mounted on a base 26b which has sloping sides 26c which are dovetailed into the recesses 27, the sides of which are shaped in complementary fashion to them. At the top these sides 26c have projections 26d which rest upon shoulders 27a provided for them in the recesses and whereby the shredding mem-

ber is supported. As shown most clearly in Figs. 12 and 13, the cutting edges gradually increase in height from the left side, which first intercepts the waste, to the right side.

In operation, the impeller blades **23** cause a mixture of water and garbage to be whirled around the shredding chamber at a speed such that the solid particles are moved outward by centrifugal force and reduced or comminuted by being tumbled against the cutting edges **26***a* of the shredding members **26**. There is also a further comminuting action resulting from the shearing action between the impeller blades and the shredding members. Since the impeller blades are freely pivoted, the possibility of jamming is reduced. Due to centrifugal action the whirling mixture of garbage and water is in the form of an annulus adjacent the side walls of the shredding chamber and having its upper end extending into the upper part of the casing. Water and garbage falling on the center of the fly-wheel are quickly moved outward by centrifugal force, and the movement across the upper surface of the disk has a scouring action which keeps this surface clean. The outer surfaces **28** of the impeller blades located at their outer radial edges, rise substantially straight up from the fly-wheel when the blades are in their outermost extended position, as shown in Fig. 1; and to prevent jamming of said material between the blades and shredding projections, the blade tip surface **29** flares inwardly away from the shredding elements at an angle to the outer surfaces, as shown. When solid material is caught between the shredding elements and the surfaces **29**, a force is developed tending to pivot the impeller blades inward and relieve the forces which might otherwise cause jamming. The top surfaces **29** are almost horizontal—inclined upwardly at but a very slight angle—when the blades are retracted, as shown in Figs. 1 and 10.

An important feature of this invention is the provision of a broad beveled surface **30** on the forward face **31** of each impeller blade as regards the direction of rotation of fly-wheel **15**, that is, the face which engages directly the material being comminuted. This surface is provided for the purpose of preventing jamming of the fly-wheel when the apparatus is started up due to the presence of very hard waste material, such as partially broken-up bone pieces left from a previous incomplete operation; and also to prevent jamming while the machine is running. The surface **30** slopes from the top surface **29** downwardly and forwardly as regards the direction of rotation of the fly-wheel; moreover, it extends radially inwardly from the surface **28** at the blade's front radial edge back to the inner radial edge **28***a* of the blade. And, as shown, it follows the angle of the beveled top surface **29**. Moreover, the outer radial end of its lower edge intersects the rounded portion of the blade at point **30***a*, which also is the point of intersection of the front wall **28** with the rounded portion, and this point, it will be observed, lies substantially in the upper surface of the plate **17**. From this point, the lower edge of the surface **30** inclines upwardly at a small angle to the plate **17** since, preferably, it is parallel to the upper edge of the surface which edge follows the inclination of top surface **29**. Because of this arrangement, the surface **30** takes in substantially the whole front part of the blade which projects above the top surface of plate **17** when the blade is retracted, as shown in Fig. 10; and the lower part of the outer radial end always is substantially in the surface of the flywheel, irrespective of the angular position of the blade.

When the machine is operating, the blades **23** tend to move to their outer extended positions (Figs. 1 and 9) due to centrifugal force, and when so positioned to propel waste around the chamber **10***a*, as fully described heretofore. Now, if a bone B (Figs. 9 and 10) or some other relatively hard piece of waste is present, it will be propelled forwardly by one of the blades and will engage one of the shredding elements **26**, as shown in Fig. 9. The bone, by exerting a force on the bevelled surface **30**, pushes the blade back toward its retracted position. As the blade moves back, not only is the clearance between the blade and the adjacent stationary shredding element **26** increased, but the bevel approaches its retracted horizontal position of Fig. 10. Because of the increased clearance and the lowered position of the bevel, the bone passes freely over the blade, and eventually is struck and tumbled by the next blade coming along. The bone, instead of being whirled around with the blade without being reduced to any substantial degree, is forced to have a periodic whirling motion. This causes the bone to be tumbled about by the blades as its velocity is periodically reduced. It is this tumbling that exposes the bone to the successive smashing action of the blades. The small and relatively light pieces of bone resulting from this action are then easily reduced to fine particles by the rubbing action of the stationary elements **26**.

Thus, jamming is eliminated while the machine is operating. Likewise, it is eliminated at the start of the operation for, at this time, since the blade is in its retracted position of Fig. 10, it is not possible for a hard unreduced bone particle to find a purchase on any part of the blade whereby it may jam between the blade and one of the stationary shredding elements.

Moreover, the bevelled surfaces **30** assist in returning the blades to their retracted positions by the force of any water and waste material remaining in the machine and acting on them to force them down as the flywheel slows down to a stop.

The arrangement of the plurality of cutting edges **26***a* in an inclined position, and their gradual increase in height from the entering to the leaving end of the element are important features. Waste engages the cutting edges with low impact because where it enters the shredding element the edges are relatively low. The waste rides across the cutting edges as up an inclined plane. This results in smoother and quieter operation. Moreover, the efficiency of operation is increased because it is possible to have a large number of cutting edges due to the inclined arrangement. The inclined arrangement, although more effective, is less harsh and imposes less duty on the motor **5** than in the case where there is a single relatively high shredding element. Tough vegetable fibers in being forced over the plurality of cutting edges are either cut or broken into small particles. The shredder performs an extremely satisfactory reducing operation on tough pieces of meat gristle. Furthermore, the inclined arrangement of the cutting edges reduces the possibility of jamming of the mechanism by large pieces of bone. Such a piece, engaging the lower cutting edge at the left is gradually lifted from one edge to the other and, therefore, is not directly exposed to a single high cutting edge, as in previous mechanisms.

To insure that the material being comminuted rotates with the flywheel, I provide in the vicinity of the central portion of the flywheel a plurality of projections or lugs 31*a* (two being shown in the present instance) which engage such material and help to carry it along with the flywheel. These projections are described in and form the subject matter of claims in my copending application, Serial No. 640,913, filed January 12, 1946, and which became Patent No. 2,482,125 on September 20, 1949, and which is assigned to the assignee of the instant application.

In the side wall 10 of the shredding chamber at its lower end are a series of straining grooves 32, the upper ends of which communicate with the shredding chamber and the lower ends of which discharge into an annular receiving chamber 33 connected to the outlet 8. Referring particularly to Fig. 7, it will be noted that the grooves 32 are downwardly directed to discharge comminuted material downwardly past the peripheral edge of the flywheel to the receiving chamber. The grooves 32 limit the cross section of the particles discharged from the shredding chamber into the receiving chamber. To prevent the discharge of long stringy material to the drain line which might pass lengthwise through the straining grooves, the ears 21 are provided with projections 34 having shearing surfaces 34*a* which are in shearing cooperation with the lower ends of the straining grooves 32. See Fig. 5. These shearing surfaces clip the long stringy material, reducing it to lengths suitable for discharge to the drain line. It will be noted that the shearing projections 34 are formed on the flywheel so they rotate therewith and always are positioned to cooperate with the grooves 32. Thus, they may be accurately positioned with respect to the lower ends of the grooves 32 and arranged to have a fixed close clearance with the adjacent surface of the flywheel which close clearance will be maintained at all times. The drain grooves 32 and associated cutting projections 34 also are described and claimed in my aforementioned copending application, Serial No. 640,913.

The inclination of the parallel ribs defining the cutting edges 26*a* of the stationary shredding elements 26 have the added function of guiding shredded waste material downwardly toward the strain grooves 32, and thereby clean out the spaces between the cutting edges.

Below the shearing surfaces 34*a*, are impeller elements 35 which are formed integral with and project downwardly below the flywheel (see Figs. 1 and 8) and which act as a centrifugal pump to force the flowable mixture of comminuted garbage and water from the receiving chamber 33 to the outlet 8. Also, the radially outer portions of ears 21 project beyond the periphery of flywheel 15 to provide additional fluid-impelling surfaces 36 which increase the pumping action.

Since, during operation, the mixture of garbage and water is in the form of an annulus adjacent the side walls of the shredding chamber, any solid material remaining in the shredding chamber when the motor is stopped will settle onto the flywheel adjacent the straining grooves and may sufficiently block the grooves 32 so that the normal sink drainage will not flow through the shredding chamber to the drain line. While the normal sink drainage might seep through in time, this is objectionable since the fluid capacity of the casing is much less than the capacity of the sink. In the present construction, this disadvantage is overcome by straining openings 37 in

the disk 17 intermediate the ribs 18 and 19 on the flywheel. The straining openings are radially inward of the whirling annulus of water and garbage during the use of the apparatus and accordingly are not blocked by solid material remaining in the shredding chamber when the motor is stopped. Since the space between the outer ends of the ribs 18 and 19 is open, passages 38 leading through the straining openings 37 to the receiving chamber 33 are provided which by-pass the straining grooves 32 and conduct normal sink drainage to the outlet 8. This by-pass structure also is described and claimed in my above-mentioned copending application, Serial No. 640,913.

In order to reduce wear in the plate 17 and for other reasons, I prefer to terminate the lower ends of the cutting edges 26*a* short of the top surface of the flywheel to provide spaces 40 between these lower ends and the flywheel; and to provide on the impeller blades projecting lugs 41, which, when the impeller blades are in their extended position (Figs. 1, 7 and 9), sweep through spaces 40 to dislodge any material which may tend to gather in front of the lower edges of the shredding members or lodge under said edges. This structure is described and claimed in my copending application, Serial No. 638,383, filed December 29, 1941, now Patent No. 2,482,124, September 20, 1949, and which is assigned to the assignee of the instant application.

Where this arrangement is used the bevel surface 30 may have its lower edge run back from the upper edge of the lug 41 parallel with the upper edge of this surface, that is, parallel with the plane of top surface 29. This reduces the area of the bevel surface and it permits a more rapid operation of the machine.

And here it should be noted that the speed of operation of the machine is controllable by varying the angle of the surface 30 and its area, or its angle alone or the area alone. In the specific embodiment illustrated, the surface 30 makes an angle of 45° with the plane of the forward face 31 of the blade. But it may have other values, such as 30°.

While I have shown and described a particular embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention in its broader aspects and I therefore aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an apparatus for comminuting material, of the type having a rotary flywheel, with a horizontal face for receiving material to be comminuted, a shredding chamber having walls above and surrounding said flywheel face, a material impelling blade in the edge of said flywheel pivoted to move in a plane normal to said flywheel face and radially thereof between an active position in which said blade extends above said flywheel face into said chamber adjacent the wall thereof and an inactive position in which said blade is retracted away from said chamber wall and a stationary shredding element on said chamber wall projecting into said chamber adjacent the path of movement of said blade when in active position, for cooperation with said blade, that improvement which comprises an inner edge on said blade close to said flywheel face extending upwardly substantially normal to said face and

passing close to and substantially parallel to a portion of said shredding element and chamber wall when said blade is in active position, an outer edge on said blade extending upwardly from said inner edge in the same plane normal to said flywheel face but slanting at an acute angle away from said shredding element and chamber wall when in active position, a single continuous beveled face on the forward side of said blade as regards the direction of rotation of said flywheel, said beveled face slanting at an acute angle to said chamber wall downwardly and forwardly toward said flywheel face from both said outer and inner edges.

2. In an apparatus for comminuting material, of the type having a flywheel rotated in a given direction, an upper horizontal planar face on said wheel for receiving material to be comminuted, a shredding chamber having a wall above and surrounding said flywheel face, a material impelling blade in the edge of said flywheel pivoted therein to move in a plane normal to said flywheel face and radially thereof between an active position in which said blade extends above said flywheel face into said chamber adjacent said wall and an inactive position in which said blade is retracted radially inwardly and downwardly toward said flywheel face, means biasing said blade toward said retracted position, the blade being urged toward said extended active position by centrifugal force when said flywheel is rotated, and a stationary shredding element on said chamber wall projecting into said chamber adjacent the face of the flywheel and the rotary path of movement of said blade when in extended position, that improvement which comprises an inner edge on said blade above and close to said flywheel face extending upwardly substantially normal to said face and passing close to and substantially parallel to said shredding element when said blade is in active position, an outer edge on said blade extending upwardly from said inner edge in the same radial plane from said flywheel face but slanting at an acute angle away from said shredding element when the blade is in active position, said outer edge being substantially parallel to the plane of said flywheel face when the blade is in said retracted position, a single continuous beveled face on the forward side of said blade as regards the said given direction of rotation of said flywheel, said beveled face slanting at an acute angle to said chamber wall and shredding element downwardly and forwardly substantially to the periphery of said flywheel face from both said outer and inner edges, and said beveled face extending above said flywheel face in all positions of said blade, whereby material being comminuted tends in all positions of said blade to move it to said retracted position by acting on said beveled face.

3. In an apparatus for comminuting material, of the type having a horizontal rotary flywheel, with a face for receiving material to be comminuted, a shredding chamber having walls surrounding said flywheel face, a material impelling blade in the edge of said flywheel pivoted to move in a plane normal to said flywheel face and radially thereof between an active position in which said blade extends above said flywheel face into said chamber adjacent the walls thereof and a retracted position in which said blade is positioned away from said chamber walls, and a stationary shredding element on said chamber wall projecting into said chamber adjacent the face of the path of movement of said blade when in active position for cooperation with said blade, that improvement which comprises an inner edge on said blade close to said flywheel face extending substantially normal to said face and passing close to and substantially parallel to said shredding element when said blade is in active position, an outer edge on said blade extending upwardly from said inner edge in the same plane normal to said flywheel face but slanting at an acute angle away from said shredding element when said blade is in active position, a single continuous beveled face on the forward side of said blade as regards the direction of rotation of said flywheel, said face slanting at an actue angle to said chamber walls downwardly and forwardly toward said flywheel face from both said outer and inner edges, and said stationary shredding element comprising a group of continuous straight ridges defining parallel cutting edges projecting from said chamber wall and extending longitudinally upwardly of the wall generally vertical to the plane of said flywheel face from close to said face and slanted slightly angularly from the vertical with respect to said face in a direction opposite the direction of rotation of said flywheel.

4. In an apparatus for comminuting material, of the type having a rotary flywheel, with a horizontal face for receiving material to be comminuted, a shredding chamber having walls above and surrounding said flywheel face, a material impelling blade in the edge of said flywheel pivoted to move in a plane normal to said flywheel face and radially thereof between an extended active position in which said blade extends above said flywheel face into said chamber adjacent the walls thereof and another position in which said blade is retracted away from said chamber wall, and a stationary shredding element on said chamber wall projecting into said chamber adjacent the face of the flywheel and the path of movement of said blade when in extended position for cooperation with said blade, that improvement which comprises an inner edge on said blade close to said flywheel face extending substantially normal to said face and passing close to and substantially parallel to said shredding element and chamber wall when said blade is in extended position, an outer edge on said blade extending upwardly from said inner edge in the same plane normal to said flywheel face but slanting at an acute angle away from said shredding element and chamber wall when said blade is in extended position, a single continuous beveled face on the forward side of said blade as regards the direction of rotation of said flywheel, said face slanting at an acute angle to said chamber walls downwardly and forwardly toward said flywheel face from both said outer and inner edges, and said stationary shredding element comprising a series of continuous straight, parallel, sharp ridges projecting from said chamber wall and extending longitudinally upwardly of the wall generally vertical to the plane of said flywheel face from close to said face and slanted slightly angularly from the vertical with respect to said face in a direction opposite the direction of rotation of said flywheel, each ridge in said series projecting progressively further into said chamber than the preceding ridge as regards the direction of rotation of the flywheel, whereby particles of material are deflected angularly upward by said bevel and said

outer blade edge against said shredding element cutting edges upon rotation of said flywheel.

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