April 18, 1961 H. JORDAN 2,980,348

ROTARY GRIND TABLE WITH TRAILING IMPELLERS HAVING PLURAL CUTTING EDGES

Filed Aug. 22, 1957 3 Sheets-Sheet 1

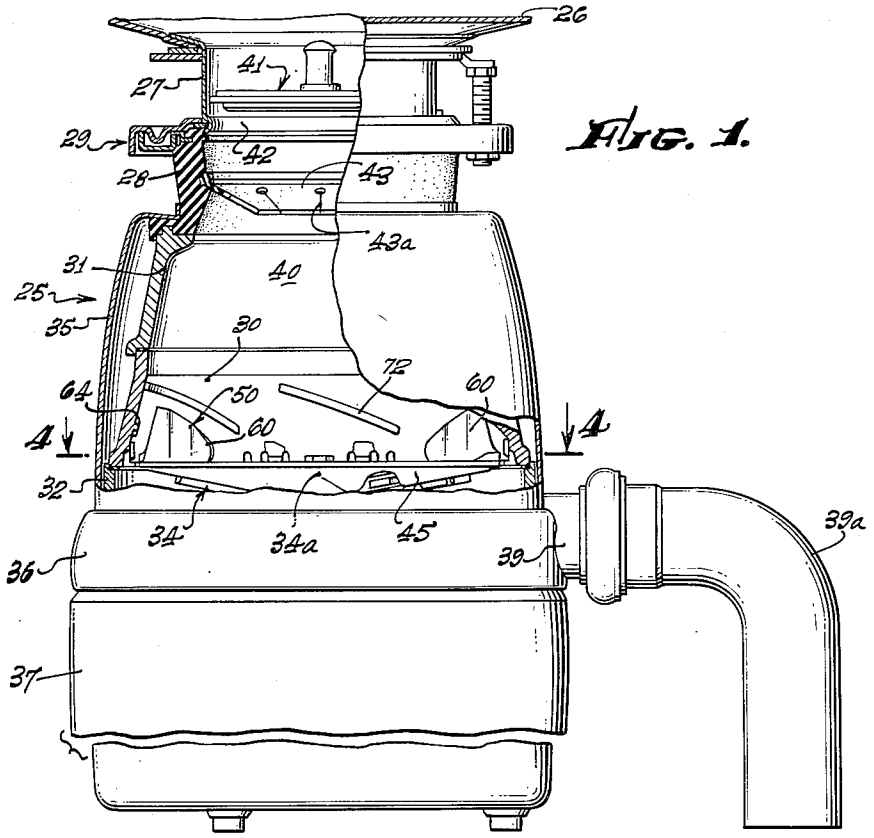


FIG. 1.

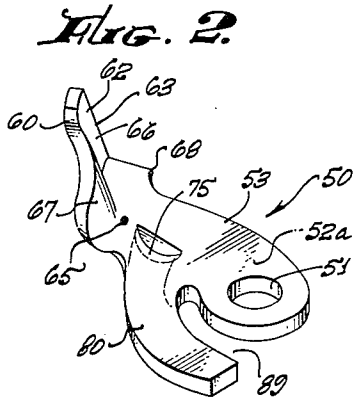


FIG. 2.

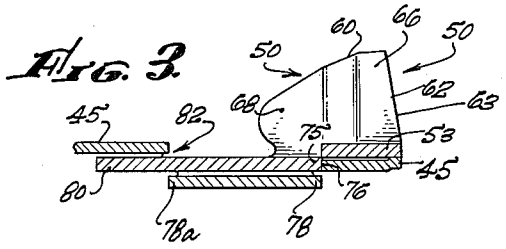


FIG. 3.

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FIG. 4.

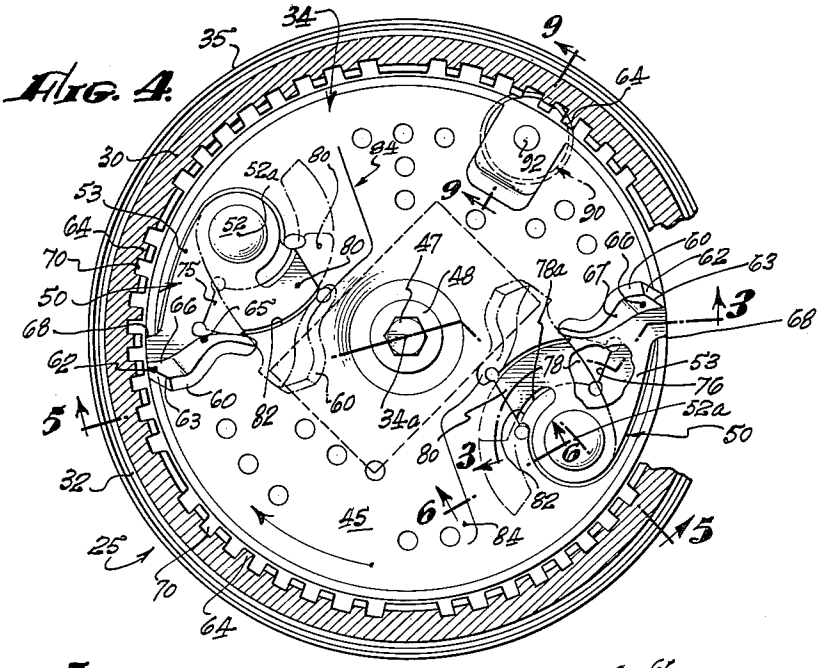


FIG. 5.

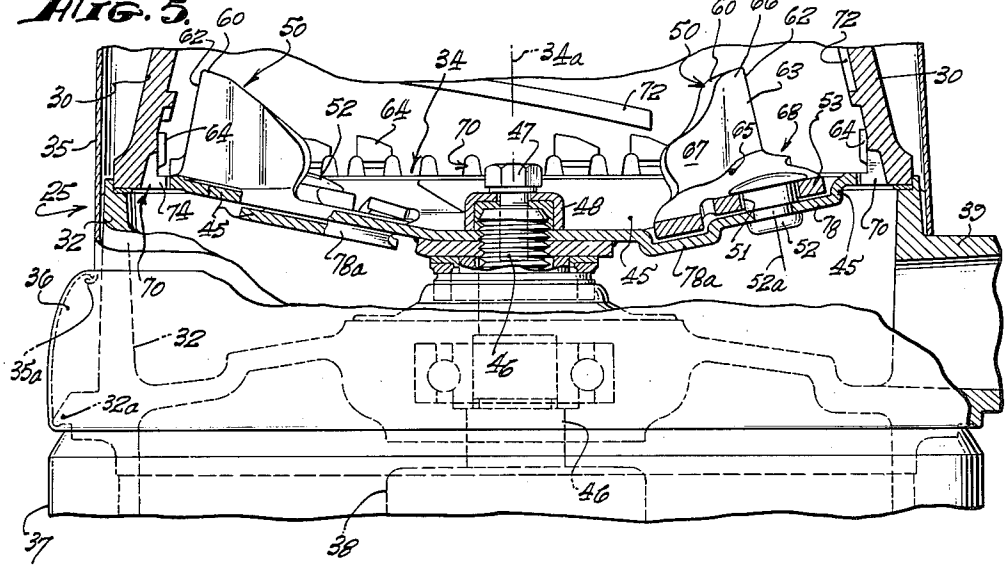
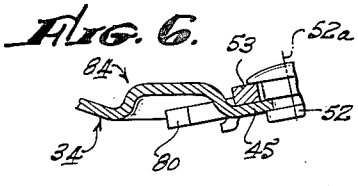


FIG. 6.



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FIG. 7.

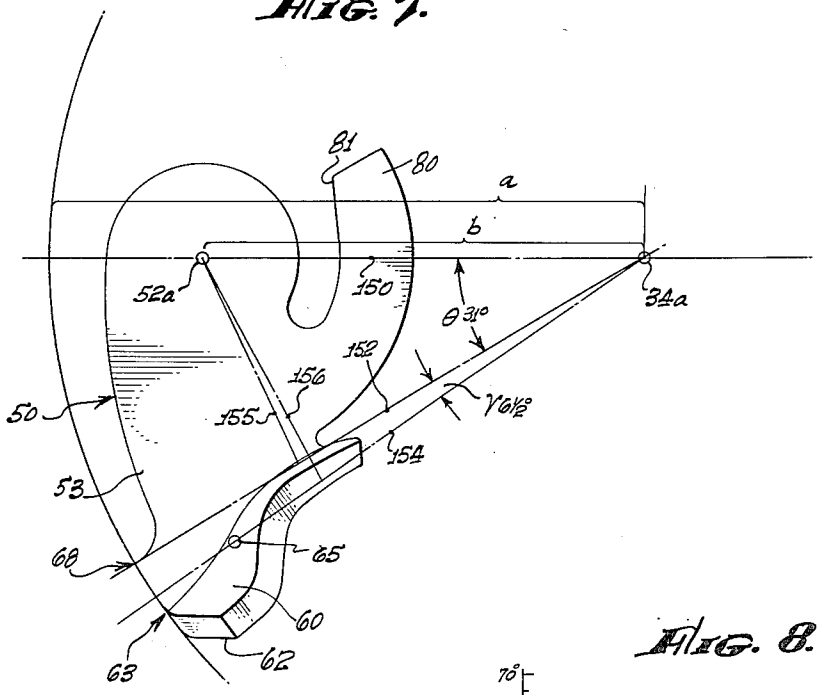


FIG. 8.

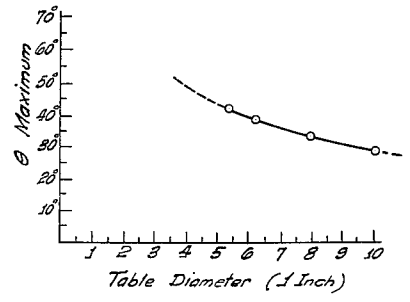
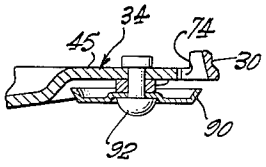


FIG. 9.



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Patented Apr. 18, 1961

2,980,348

ROTARY GRIND TABLE WITH TRAILING IMPELLERS HAVING PLURAL CUTTING EDGES

Hans Jordan, Los Angeles, Calif., assignor to Given Machinery Company, Los Angeles, Calif., a partnership

Filed Aug. 22, 1957, Ser. No. 679,626

9 Claims. (Cl. 241—46)

This invention relates generally to waste disposal devices for use in homes and in restaurants or other commercial establishments requiring ready disposition of food waste and other waste subject to rotary grinding.

More particularly this invention relates to rotary table structures employed in waste grinders of the indicated nature, having pivoted cutters or impellers carried by the table structures and co-operating with surrounding stationary grind rings carried by the housings of the disposal devices.

This application is related to the subject matter of my prior application Serial No. 576,410, filed April 5, 1956, now abandoned.

One particular object of the invention is to provide a rotary table structure for use with improved types of cutting impellers or "grinding flippers" pivoted upon the table and used to impel waste material against a surrounding grind ring. Another particular object of the invention is to provide improved impellers affording maximum efficiency for waste grinding.

With rotary table structures employing pivoted grinding impellers, the effective applied force exerted by the impellers in co-operation with the mentioned stationary grind rings is centrifugal force. Typically, such impellers assume positions when operating under the influence of the existant centrifugal forces wherein the main axis of each impeller as represented by its pivot center and its center of force or center of gravity lies relatively close to a corresponding radius of the rotary table through such pivot center (or within an angle of about 10° or less with respect to such radius), the grind point of the impeller (as later defined) lying substantially on such radius.

I have discovered that, by making a change in the position of the main or longitudinal axis of an impeller, a surprisingly large and unexpected increase in grinding efficiency of the impeller is accomplished.

It is therefore also an object of this invention greatly to improve the grinding efficiency of such pivoted impellers. A further object is to attain such efficiency by arranging and mounting impellers so that they are literally dragged behind their pivot centers with the center of force or the mass center of each impeller disposed approximately on the arc of a circle which is concentric with the rotation center of the table and passes through or near the pivot center of the respective pivoted impeller. The axes of these swinging impellers thus are relatively long with respect to prior impellers and also extend a considerable distance along the mentioned circle on or near which they are pivoted, having, for example, a length approximating from about one-seventh to one-twelfth or one-fifteenth of the circumference of the rotary table, depending upon table diameter.

A still further object of the invention is to provide a rotary table for waste disposal units which is provided with a pivoted impeller or grinding element having means attached thereto to guide the impeller in its inward and outward movements on the rotary table.

It is also an object to make it possible to employ a one-piece rotary table to carry impellers of the indicated nature.

A further object is to provide a table and an impeller structure such that they may be stamped from sheet steel.

One broad aspect in a preferred form of the invention resides in a rotary table carrying one or more (preferably two or three) pivoted trailing grinding impellers having swinging portions for co-operation with a surrounding grind ring, such trailing swinging portions, when operating, lying generally on a circle concentric with the table center and on which circle the pivot centers of the impellers are located. In this manner a heavy trailing body portion is provided at the swinging end of each impeller, such portion thus having a leverage substantially equal to the impeller length, which leverage, due to centrifugal action of the rotary table, causes unexpectedly high and efficient grinding action of radially directed cutting edge portions of the impeller in co-operation with or against the surrounding grind ring. In a particular form the table is concave, as a result of which the impellers tend to recede from their outward grinding positions upon cessation of rotation, although the table may be flat or it may be convex whereby to augment the working force of the impellers during table rotation. With the present form of impeller and its mounting, it is preferred to employ guide means which is carried by each impeller adjacent its swinging end and projects through the table, such guide means tending further to weight the outer end of the impeller.

Other objects and features of the invention will become apparent to those skilled in this art upon reference to the accompanying drawings and the following specification.

In the drawings:

Fig. 1 is a view partly in elevation and partly in vertical section showing an assembled and installed household garbage disposal device equipped with the rotary grinding table and impeller of the present invention;

Fig. 2 is a perspective view on an enlarged scale of one of the impellers illustrated in Fig. 1;

Fig. 3 is an enlarged sectional detail on the irregular line 3—3 of Fig. 4;

Fig. 4 is a view taken from the line 4—4 of Fig. 1 showing a rotary table and impellers of the form of Figs. 1 and 2 in plan view and the housing and grind ring in horizontal section;

Fig. 5 is principally a vertical section on an enlarged scale as indicated by the line 5—5 of Fig. 4;

Fig. 6 is a fragmentary sectional detail taken on the line 6—6 of Fig. 4;

Fig. 7 is a diagrammatic showing indicating angular relationships of the impeller and rotary table parts of this invention, and presented from the standpoint of developing a differential formula for deriving the optimum angular position of the grind point or contact point of an impeller or grinding flipper when co-operating with a grind ring surrounding the respective rotary table, this particular showing being exemplary of a rotary table having approximately a diameter of 10.0 inches;

Fig. 8 is a curve generally representative of maximum values for the angle theta of Fig. 7; and

Fig. 9 is a sectional detail taken on line 9—9 of Fig. 4.

Fig. 1 illustrates a household garbage disposal device 25 assembled and installed in suspended position from a kitchen sink bottom 26 as through the medium of a metallic suspending drainage sleeve 27 flanged at its upper end to be carried by the sink, and in turn supporting a resilient rubber suspending neck 28 through the medium of appropriate positioning and suspension means 29. The disposal device proper is shown as having an appropriate grind ring 30 upon which is supported an upper ring 31,

both of which rings may be of suitable cast or other appropriate construction, the grind ring **30** bearing upon the top of a housing **32** (best seen in Fig. 5) enclosing a rotary grinding table structure generally indicated at **34** and working about a center of rotation **34***a*. The upper end of the ring **31** is appropriately joined to the lower end of the rubber suspension neck **28**, such a joint including vulcanization, if desired, and in any event an outer shell **35** is employed with the illustrated structure which is flanged at its top to overhang a corresponding integral flange on the lower end of the rubber suspension neck **28**. A snap ring **36** (also seen in Fig. 5) is provided with an upper flange to overhang and clamp a lower flange **35***a* at the bottom of the shell and with a lower flange to snap under an annular flange **32***a* integrally provided at the lower end of the table housing **32**. Below the table housing **32** and its table structure **34** a motor housing **37** is carried, this housing enclosing an electric motor **38**. The table housing **32** is provided with any appropriate outlet connection **39** for attachment to any appropriate waste-gathering system **39***a* (Fig. 1).

The structure illustrated thus provieds for introduction of household waste, such as food trimmings, through the supporting sleeve **27** from the sink **26** and into a grinding chamber **40** within the cast rings **30** and **31** by way of a throat provided by the sleeve **27** and the resilient suspending neck **28**. A stopper **41** is conveniently employed to close the passage through the supporting sleeve **27** as required, the lower end of the sleeve **27** carrying an annular instruck seat **42** for the purpose. If desired, a yielding thin rubber diaphragm **43** is carried on an integral seat in the supporting neck **28**, this diaphragm serving as a splash guard but permitting the insertion of large pieces of waste to be ground through slits **43***a*.

The rotary grinding table structure **34**, as seen in Figs. 4 and 5, includes a stamped sheet steel table top or table **45** which is attached to the drive shaft **46** of the motor **38** as by threading of the shaft and by an anchor screw **47** on the top of the shaft bearing upon an anchor cap **48** whose lower edge in turn bears upon the table **45** around the screw threaded end of the shaft **46**. The table **45** is shown as carrying two of the previously mentioned pivoted flippers or cutting impellers which are indicated at **50**, and these impellers are disposed near the periphery of the table **45** to co-operate with the grind ring **30**.

Also, the pivoted impellers **50** are so mounted with respect to the periphery of the table **45** that, as the table is rotated in the direction from the impeller cutting edge toward the impeller pivoting point (clockwise or in the direction of the long arrow of Fig. 4), these impellers **50** drag directly behind their pivot centers on the table **45**, without being permitted to swing completely into an outwardly extended or radial position by reason of existing centrifugal force. Thus, the trailing or swinging end of each impeller exerts a maximum grinding action in co-operation with the grind ring **30**, as is subsequently to be developed. This arrangement of the impellers **50** on the rotary table **45** is best seen in Figs. 4 and 5.

One end of each impeller **50** is provided with a pivot opening **51** (Fig. 2) receiving a rivet type of pivot pin **52** mounted adjacent the periphery of the table **45** and providing a pivot center **52***a*. As illustrated, each impeller includes a main body portion or arm **53** extending longitudinally of the impeller from the pivot opening **51** to a free swinging end. Each impeller **50**, as shown, is stamped from heavy sheet steel of such hardness that, when stamped, it yields good cutting edges adequate for long life in shredding or comminuting garbage in extreme cases where the impeller tips may be appropriately hardened or coated with a suitable hard-facing material. The swinging end of such impeller is formed with an upstanding head **60** which produces a weighting end and provides a center of gravity or force center outward toward the swing terminus of the swinging flipper or impeller **50** during high speed rotation.

As seen in Figs. 3, 4 and 5, one side of the upstanding head **60** extends radially or laterally outward, with respect to the table **45**, as the flipper or impeller **50** and its head **60** trail behind the pivot center **52***a*, such laterally or radially disposed side portion of the head **60** providing a grind finger **62** having an outward upstanding grind edge **63** which directly co-operates with adjacent cutter lugs **64** integrally formed on the inner wall of the grind ring **30**. The mentioned force center of each impeller lies approximately at the point designated **65** in Figs. 2 and 5. The disposition of this point **65** with respect to the pivot center **52***a* of the pivot rivet **52** is what is considered a trailing position with respect to such pivot center (ignoring centrifugal force). In general the point **65** and the pivot center **52***a* may be considered as defining the longitudinal or main axis of the impeller, and such axis may be viewed as disposed approximately perpendicular to the table radius through the pivot center **52***a*, or as lying along an arc of the circle drawn about the center of rotation **34***a* of the table and passing through the pivot center **52***a*. The force center **65** and the main axis of the impeller **50** will in general lie within these indicated limits. Thus, more commonly the described main impeller axis tends to lie along the described arc, whereas the tip or grind edge **63** of the grind finger **62**, when in grinding position, tends to lie more directly behind the pivot center **52***a* and on a line substantially perpendicular to the table radius through the pivot center **52***a*.

With the described disposition of the impeller, substantially the entire impeller length constitutes a leverage working under centrifugal action to drive the grind edge **63** of the finger **62** into operative position adjacent the cutter lugs **64** of the grind ring **30**, such leverage or moment representing the maximum possible grinding force which the grinder finger **62** can produce or sustain. The described structure and arrangement have been found to possess a high efficiency factor (such as three to one or higher) as compared with impellers whose grinding point may lie only 10° or less behind a radial line drawn through the impeller pivot point.

Grinding action by each impeller **50** is facilitated by means of an upstanding advancing shoulder or wall **66** at the leading side of the grind finger **62**, this wall engageing and advancing waste to be ground, feeding of which waste to such advancing wall **66** and to the grind ring **30** being aided by centrifugal force. The upstanding wall **66** is in general directed perpendicularly toward the adjacent wall of the grind ring **30**, but may angle off a few degrees, for example 10° or 15° rearward or away from the direction of travel, whereby to facilitate somewhat the feeding of the waste to the grind ring **30**. Such feeding of the waste is however greatly further facilitated by an upstanding sloping wall **67** on the inward portion of the upstanding head **60**, such wall being, for example, inclined 45° or 50° to the previously mentioned main axis of the impeller arm **53**. This trailing inclination, augmented by centrifugal action, acts to crowd waste being fed into the space between the head **60** and the grind ring **30** and thus positively conducts the waste to the upstanding grind edge **63**, which in the form illustrated is actually an upstanding cutting edge **63** directly co-operating with the lugs **64** of the grind ring.

In addition to the upstanding walls **66** and **67** which provide for feeding action, and in addition to the grind edge **63**, there is provided a leading grind point **68** (see Fig. 2) which also is vertically directed but short or shallow, having a length equal to only the thickness of the steel sheet material from which the impeller is stamped. This relatively shallow grind point **68** is disposed considerably in advance of the upstanding wall **66** and its grind edge **63**, so that there is a relatively long trailing strip of metal behind the grind point **68** and permitting wear and gradual rearward recession of such short cutting edge or point **68**. This short cutting portion **68** commonly is subject to more wear than the up-

standing cutting edge 63 and it has therefore been found a very important factor to compensate for this greater wear of this particular edge or point 68 during grinding action by setting it forward as indicated. Since each impeller 50 may be stamped from tough long-wearing sheet steel, the described construction is produced without difficulty.

With the impeller structure described and illustrated, the mentioned force center 65 is in general at the point through which the centrifugal force during table rotation acts in effecting grinding by the finger 62, its upstanding grinding edge 63, and the forwardly disposed short grinding point 68 at the outer side of the flat impeller arm 53. Such force center 65 may thus be adjacent to or coincident with the center of mass of the impeller 50. A fuller description of the procedure for determining the positions of the impeller and its parts is given hereinafter in a discussion of Fig. 7.

Concerning the grind ring 30 with which the rotary table 45 and its cutting impellers 50 co-operate, the lower portion of this ring is disposed about the table top 48 and the grind fingers 62 so that there is slight cutting clearance between these parts and the mentioned cutting lugs 64. As indicated in Figs. 4 and 5, the cutting lugs 64 are spaced around the lower portion of the grind ring 30, and downwardly directed discharge passages or notches 70 are disposed between the lugs 64 for feeding ground material from the bottom of the ring 30 into the chamber surrounding and underlying the table 45 for flushing out through the discharge connection 39 by flushing water used in the grinding operation. Disposed above the cutting lugs 64 and the notches 70 there is preferably arranged a series of inclined integral ribs 72 which project inward to an extent approximating the extent of projection of the lugs 64, these ribs acting to feed waste material down to the cutting impellers 50. At the extreme lower end of the ring 30 on its inner side there are provided on the opposite sides of the notches 70 inwardly extending integral shelf-like projections 74 which lie below the positions of the grind fingers 62 so that, collectively, they form an annular waste-receiving shelf frequently interrupted by the notches 70. Such shelf assures better grinding of the waste and also discharge of the ground waste downward through the notches 70 for final disposition, and also avoids wedging of materials between the table and the grind ring 30.

Thus, when the rotary table 45 is rotated at relatively high speed, the impellers 50 pivoted thereon are thrown outward into the position illustrated in Figs. 4 and 5 whereby to co-operate (with very slight cutting clearance) with the cutter lugs 64 of the stationary grind ring 30.

Outward movement of each impeller 50 is limited by a downstruck stop 75 in a central portion of the flipper or impeller arm 53 (Figs. 2 and 3) which stop engages a co-operating stop edge 76 conveniently provided by offsetting downwardly a corresponding portion 78 of the steel disc from which the table 45 is formed.

It is desirable to provide appropriate means on each stamped impeller 50 for stabilizing the same on the table 45. Since the table 45 is also produced from stamped sheet steel, such stabilization is effectively obtained by means of offset portions of both the impeller and the table, and it is especially desirable that the principal operating portion of the impeller be disposed above the table and a guide portion be disposed below the table in an appropriate guideway. For this purpose, the downwardly offset portion 78 of the table 45 is continued to form a downwardly offset arcuate guide 78*a*, and this guide receives a correspondingly depressed arcuate guide tailpiece or finger 80 which was formed and offset by the same striking operation employed in producing the stop 75. Thus, as the table 45 rotates, the portion of the guide 78*a* opposite from the stop 75 leads, and the free end of the guide finger 80 also leads, with respect to the trailing head 60 of the impeller.

In order to dispose the advancing end of the arcuate guide 80 below the respective portion of the table 45 for stabilization purposes, the top of the table is sheared from the leading depressed end of the guide 78*a* so that an upper table portion lies above the arcuate guide 78*a* and produces a slot 82 (Fig. 3) in which the free end of the arcuate guide finger 80 works as it moves in its seat in the guide 78*a*. By these means the respective impeller 50 is adequately stabilized and guided. At the same time, the upper edge at the slot 82 acts as a stop for the inward edge of the upstanding head 60 to limit inward movement of the swinging end of the impeller 50 when such movement takes place. It will be noted that the slot 82 (including its stop portion for the impeller head 60) is in general on a radial line with the pivot rivet 52 and the motor shaft 46.

From the foregoing description, it is apparent that the rotary table 45 and its swinging impellers 50 are readily stamped from appropriately heavy sheet steel. For greater structural stability of the rotary table, it may be desirable, when stamping the table, to offset upwardly that radial portion of the table lying forward of each pivot 52 and overlying the swinging end of the guide finger 80 when the latter is in the retracted position indicated in broken lines in Fig. 4. Similarly it may be desirable to offset downwardly a portion of the table forward of such upstruck or upwardly offset table portion, approximately as indicated at 84 (Figs. 4 and 6).

Another feature involves the use of one or more circular knives 90, such as indicated in Fig. 9, secured at the under side of the table disc 45, in position to lie between the impellers 50 or otherwise as desired. Such a knife projects somewhat beyond the rotary table disc 45 in position closely underlying the shelf structure 74 previously described and at the bottoms of the discharge notches 70. Such a knife 90, thus lying close to the bottom of the grind ring 30, shears off string and other fibrous materials that may not have been adequately comminuted by the action of the impellers 50 and the lugs 64 of the grind ring. Here, the periphery of the table 45 rotates within the shelf structure 74 with only very slight clearance, as seen in both Figs. 5 and 9, so that the ground material for the most part leaves the grind chamber 40 through the notches 70. Each knife 90 is mounted adjacent the periphery of the table 45 as by means of a central pin or rivet 92. Such an undercutting knife, if it does not completely and adequately sever the stringy materials at least assists in drawing such waste through the discharge ports provided by the notches 70. As has been previously indicated, while the stamped sheet steel table 45 ordinarily will be concave, it might under some circumstances be flat or even convex.

In order better to explain the placing of the impellers or flippers in optimum grinding positions, reference is made to the diagrammatic showing in Fig. 7 of the angular relationship of the parts and to the accompanying differential equation for solving for the optimum angle θ (theta) of Fig. 7 which will yield the maximum grinding force which the grinding finger 62 and its grind point 68 can produce or sustain for any given table radius, radial position of the pivot 52*a* and effective impeller mass as represented by the position of the previously described force center 65. By "effective impeller mass" is meant the mass along the impeller body which is not counterbalanced on the opposite side of said pivot center.

The differential equation used is

$$\frac{d}{d\theta}\frac{(a-b\cos\theta)}{\sin(\theta+\gamma)}=0$$

with which the theoretical maxima for θ are derivable. Actual values for θ may vary from the theoretical maxima.

as dictated by design limitations, frictional forces, empirical tests, and the like.

The reference characters in Fig. 7 are conveniently those used for Figs. 1 to 6. Thus, there is indicated the pivot center **52***a* for the impeller **50**, the center of rotation **34***a* for the rotary table, the grind point **68**, and the center of force **65** of the impeller. Also, there is represented by a line **150** a table radius passing through the pivot center **52***a* and having the value *a* of the equation, the distance between the center of rotation **34***a* and the pivot center **52***a* being the pivot center radius and having the value *b* of the equation. A line **152** represents the radius through the grind point **68** and defines with the radius line **150** the angle theta (θ). A third radius line **154** passes through the force center **65** and defines with the radius line **152** through the grind point **68** the angle gamma (γ) of the equation. The angle gamma is usually small, e.g. around 5° to 10°, and is either readily determined or sufficiently well approximated. It may be positive or negative with respect to theta (θ), and is usually positive. By dropping perpendiculars **155** and **156** respectively to the radii **152** and **154** from the pivot center **52***a*, the equation is readily developed, and from it respective theta maxima are determined for known values of *a* and *b* and location of the impeller mass center establishing the force center **65**.

As examples of the determination of theta, in one table of about five inches radius (*a*) with the pivot point **52***a* on a four inch radius (*b*), and the angle gamma (γ) about 7°, the optimum angle theta (θ) was found to be about 28°.

In another table of 2.7 inches radius, with the pivot center **52***a* on a 1.7 inch radius, the angle gamma being about 10°, the optimum angle theta was found to be about 42°.

The angle theta thus becomes larger as the table diameter becomes smaller, and in tables of practical diameters between about ten or twelve inches and four or five inches, angle theta may vary from perhaps 20° or 25° up to perhaps 50°, representing from about one-fifteenth the table circumference to about one-seventh the table circumference. Fig. 8 is a curve plotted from the two angles 42° and 28° above, and from an angle of about 38° found to be the value of theta for a table having a 6.2 inch diameter (3.1 inch radius), and an angle of about 32° found to be the value of theta for a table having an 8 inch diameter (4 inch radius), *a*—*b* being 1 inch and thus locating the pivot centers **52***a* one inch from the circumference in all instances.

Whatever the angle theta, the position of the axis line of the flipper or impeller **50** (or other flipper or impeller of these disclosures) is roughly perpendicular to the radius **150** through the pivot center **52***a* and the force center **65**, as is the line connecting such pivot center **52***a* with the grind point **68**, one of such lines, however, lying usually a little on one side of such perpendicular and the other such line lying usually on the other side.

The invention claimed is:

1. In combination a waste disposal device: a substantially horizontal rotary table including a stamped sheet metal plate providing an axis and having mounting means for rotation about said axis; a grind ring disposed about said table and having cutting elements; and an elongated impeller formed of sheet metal of substantially uniform thickness and providing a longitudinal axis and mounted at one end upon said plate to swing thereon about a pivot center disposed adjacent the periphery of said plate and generally parallel to said axis of rotation, the combination including means to limit the swing of the free end of said impeller outward to an operative grinding position with respect to said cutting elements of said grind ring, the longitudinal axis of said impeller in such grinding position upon table rotation trailing behind said pivot center in position substantially perpendicular to the table radius through said pivot center to exert substantially maximum leverage, the swinging end of said impeller being turned upward at an angle to said longitudinal axis to form a head providing weighting means for enhancing grinding moment and providing grind means at a radially outward edge to co-operate with said cutting elements of said grind ring, said impeller including a grind point at the outer side of said impeller disposed forward in the direction of rotation from said head in position to co-operate with said cutting elements of said grind ring.

2. A combination as in claim 1 wherein said upstanding head slopes rearward with respect to the direction of rotation of said table and outward toward the periphery of the table to feed waste to said grind ring.

3. In combination a rotary grind table structure for waste disposal devices and the like: a rotary table of stamped sheet metal adapted to co-operate within a co-operating grind ring and having a center of rotation and provided with guide means; a stamped sheet metal grinding flipper pivoted on said table near its periphery at a pivot center defining a radius of the rotary table with the center for rotation of the table, said flipper being elongated and providing a longitudinal axis extending through said pivot center and having the force center lying on said longitudinal axis adjacent the swinging end of said flipper, said flipper having grind means adjacent its swinging end and lying adjacent the circumference of said table to co-operate with said grind ring when said table rotates during operation, said longitudinal axis of said flipper trailing behind said pivot center during such operation in position substantially perpendicular to said radius through said pivot center, said flipper having an elongated guide finger received in said guide means.

4. A combination as in claim 3 wherein said flipper has an arcuate guide finger and said table has a struck-out arcuate guide receiving and guiding said guide finger.

5. A combination as in claim 4 wherein said struck-out guide lies below the table level, the flipper body lying on top of the table, a slot being provided through said table at the end of said guide and passing said guide finger.

6. In combination in a rotary grind table structure for waste disposal devices and the like: a rotary table adapted to co-operate within a co-operating grind ring and having a center of rotation; a stamped sheet metal grinding flipper pivoted on said table near its periphery at a pivot center defining a radius of the rotary table with the center of rotation of the table, said flipper being elongated and providing a longitudinal axis extending through said pivot center and having the force center lying on said longitudinal axis adjacent the swinging end of said flipper, said flipper having grind means adjacent its swinging end and lying adjacent the circumference of said table to co-operate with said grind ring when said table rotates during operation, said longitudinal axis of said flipper trailing behind said pivot center during such operation in position substantially perpendicular to said radius through said pivot center, wherein stop means is provided to limit outward movement of said flipper in a cutting position and in which, when said flipper is in said cutting position, said grind means includes a grind point lying on a radius to the center of rotation of said table, such radius forming an angle theta (θ) with said radius through said pivot center and the maximum angle theta (θ) being determined by the differential equation

$$\frac{d}{d\theta}\frac{(a-b\cos\theta)}{\sin(\theta+\gamma)}=0$$

with *a* being the radius of the rotary table, *b* being the radius of said pivot center, and gamma (γ) being the angle between the radius through said grind point and the radius through said force center.

7. In combination in a waste disposal device: a sub-

stantially horizontal rotary table including a stamped sheet metal plate providing an axis and having mounting means for rotation about said axis; a grind ring disposed about said table and having cutting elements; and an elongated impeller formed of sheet metal of substantially uniform thickness and providing a longitudinal axis and mounted at one end upon said plate to swing thereon about a pivot center disposed adjacent the periphery of said plate and generally parallel to said axis of rotation, the combination including means to limit the swing of the free end of said impeller outward to an operative grinding position with respect to said cutting elements of said grind ring, the longitudinal axis of said impeller in such grinding position upon table rotation trailing behind said pivot center in position substantially perpendicular to the table radius through said pivot center to exert substantially maximum leverage, the swinging end of said impeller including weighting means enhancing grinding moment, and such swinging impeller end having grind means at a radially outward edge to co-operate with said cutting elements of said grind ring, wherein stop means is provided to limit outward movement of said flipper in a cutting position and in which, when said flipper is in said cutting position, said grnd means includes a grind point which lies approximately on a radius through the center of rotation of said table and such radius forms an angle theta (θ) with said radius through said pivot center and the maximum angle theta (θ) is determined by the differential equation

$$\frac{d}{d\theta}\frac{(a-b\cos\theta)}{\sin(\theta+\gamma)}=0$$

with a being the radius of the rotary table, b being the radius of said pivot center, and gamma (γ) being the angle between the radius through said grind point and the radius through the force center of said grind means located on said longitudinal axis.

8. In combination a waste disposal device: a substantially horizontal rotary table including a stamped sheet metal plate providing an axis and having mounting means for rotation about said axis; a grind ring disposed about said table and having cutting elements; and an elongated impeller formed of sheet metal of substantially uniform thickness and providing a longitudinal axis and mounted at one end upon said plate to swing thereon about a pivot center disposed adjacent the periphery of said plate and generally parallel to said axis of rotation, the combination including means to limit the swing of the free end of said impeller outward to an operative grinding position with respect to said cutting elements of said grind ring, the longitudinal axis of said impeller in such grinding position upon table rotation trailing behind said pivot center in position substantially perpendicular to the table radius through said pivot center to exert substantially maximum leverage, the swinging end of said impeller including weighting means enhancing grinding moment, and such swinging impeller end having grind means at a radially outward edge to co-operate with said cutting elements of said grind ring, wherein said impeller has its swinging end turned upward to form a head providing a substantially L-shaped cutting edge with a substantially vertical leg formed by said swinging end and a substantially horizontal leg formed by the body of the impeller and having a grind point at its forward end, said legs being adapted to co-operate with said cutting elements of said grind ring.

9. In combination in a rotary grind table structure for waste disposal devices and the like: a rotary table adapted to cooperate within a cooperating grind ring, said table being formed of metal of substantially uniform thickness, said table having a downwardly recessed seating portion providing a seat, and having an upwardly deformed portion forming a substantially radial hump in advance of said seat in the direction of intended rotation of said table; and a stamped sheet metal grinding flipper pivoted to said table on said seating portion, said flipper being elongated and having a substantially flat major portion substantially parallel to the upper surface of the table and having an upturned outer end providing grinding means adapted to cooperate with such grind ring, said hump extending above said major portion of the flipper adjacent thereto.

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