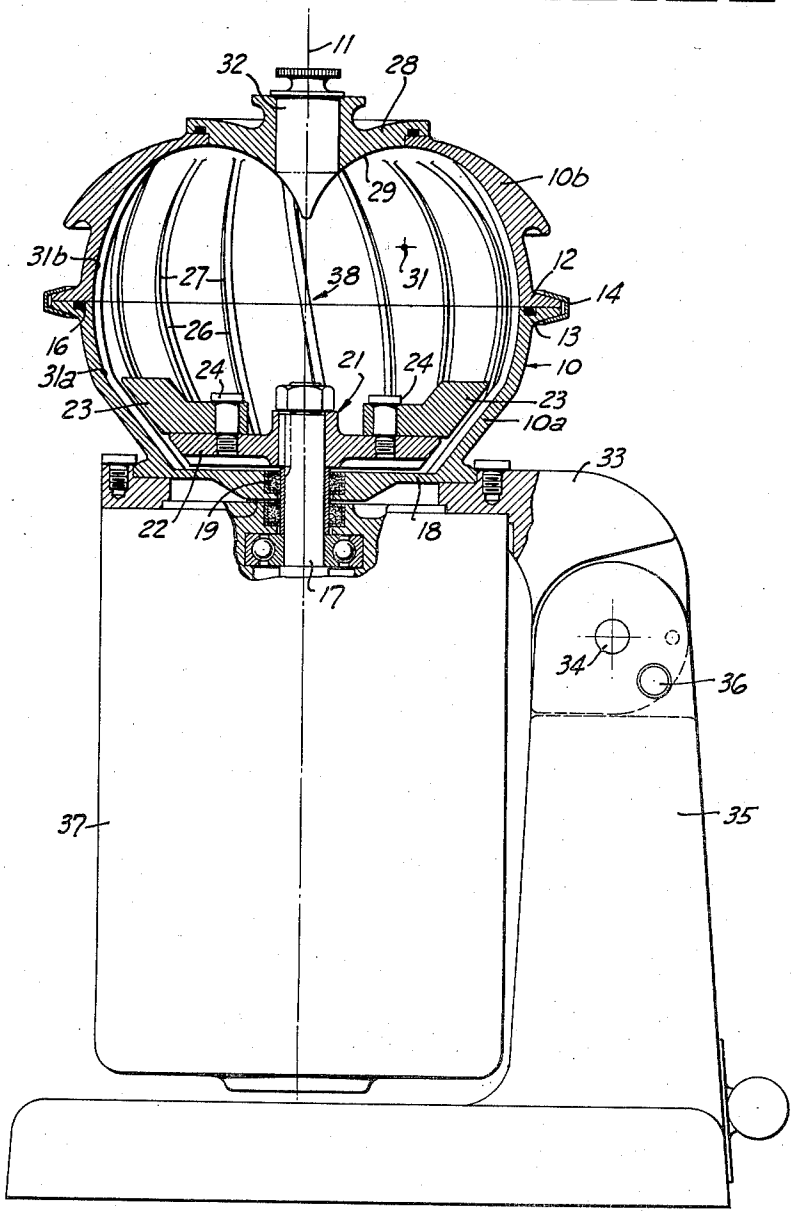
Sept. 6, 1960 C. A. RIETZ 2,951,649

DISINTEGRATING APPARATUS

Filed April 12, 1955 4 Sheets-Sheet 1

FIG_1_



INVENTOR.
Carl A. Rietz
BY
Fleher & Swain
ATTORNEYS

Sept. 6, 1960 C. A. RIETZ 2,951,649

DISINTEGRATING APPARATUS

Filed April 12, 1955 4 Sheets-Sheet 2

FIG_2_

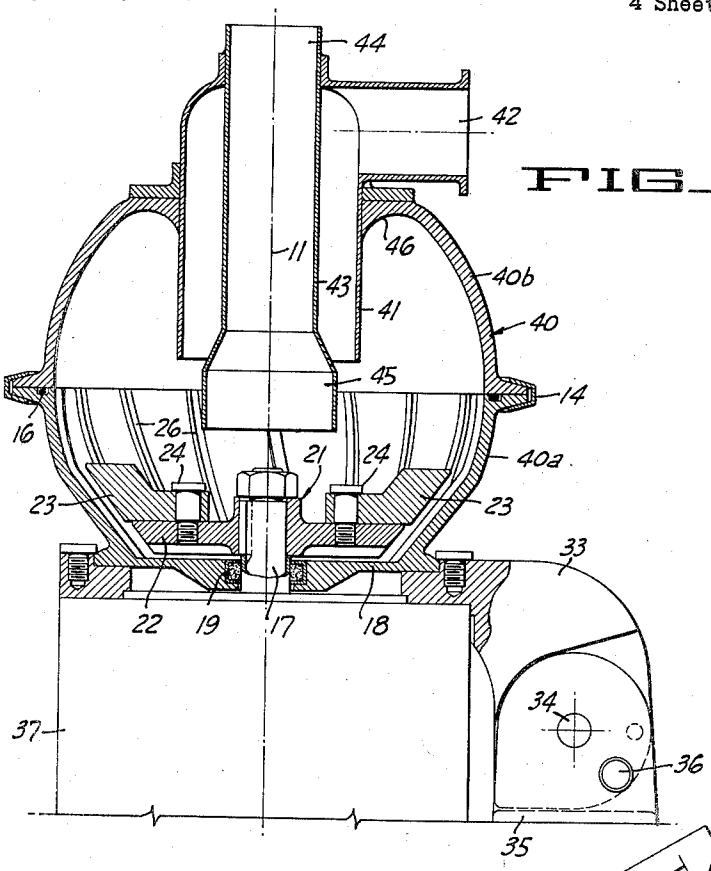
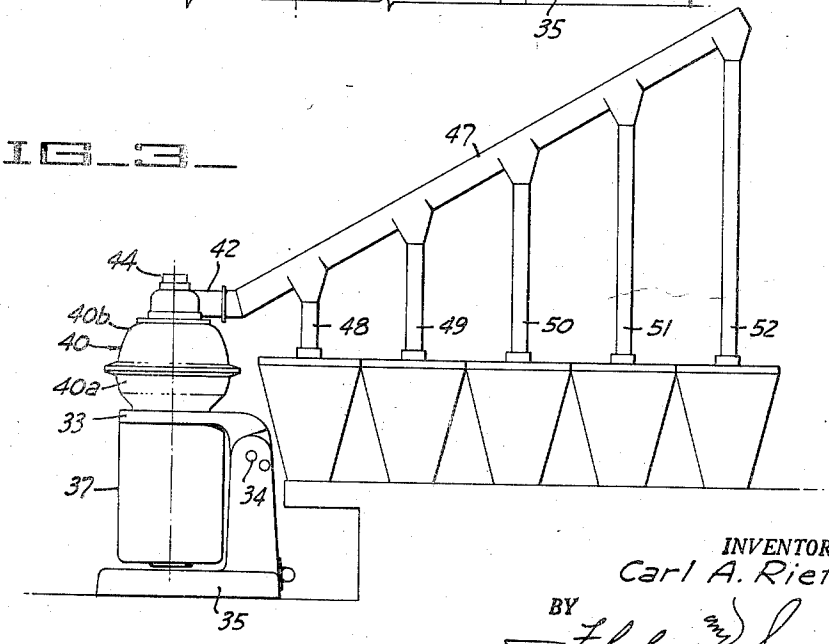


FIG_3_



INVENTOR.
Carl A. Rietz
BY
Fishburn & Swain
ATTORNEYS

Sept. 6, 1960 C. A. RIETZ 2,951,649

DISINTEGRATING APPARATUS

Filed April 12, 1955 4 Sheets-Sheet 3

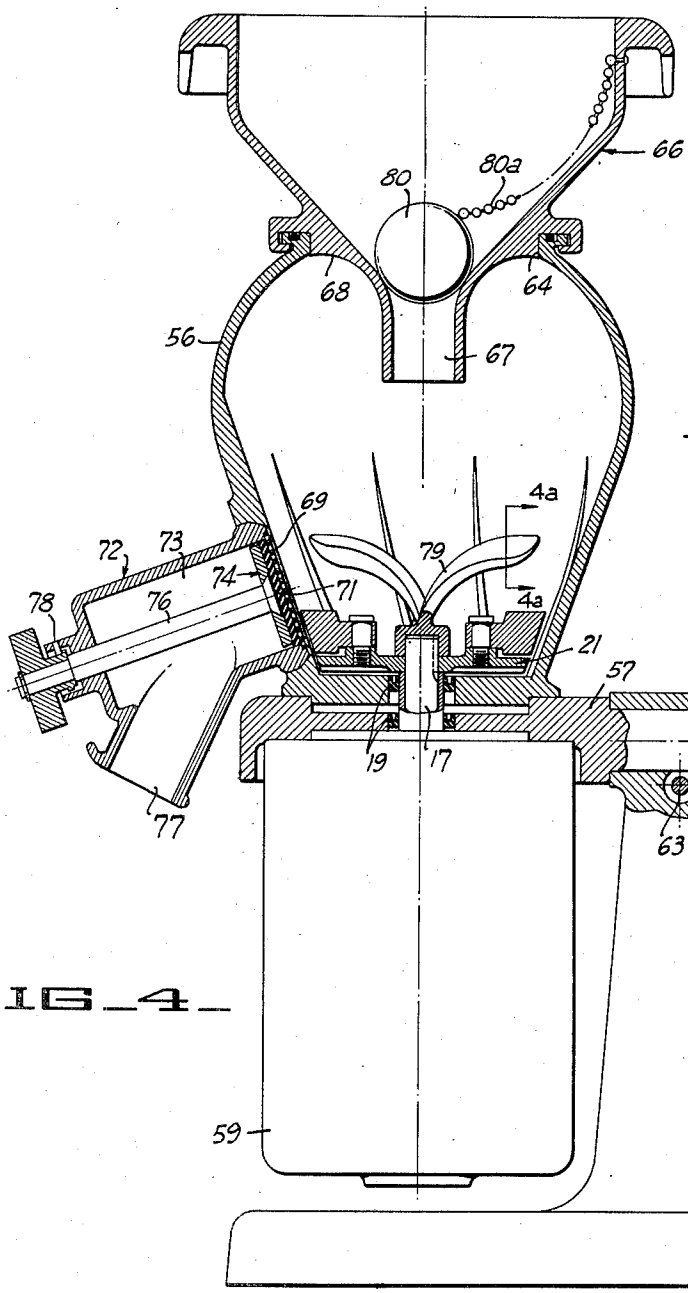


FIG 4



FIG 4A

INVENTOR.
Carl A. Rietz
BY Fuller and Fuller
ATTORNEYS

Sept. 6, 1960 C. A. RIETZ 2,951,649

DISINTEGRATING APPARATUS

Filed April 12, 1955 4 Sheets-Sheet 4

FIG_5_

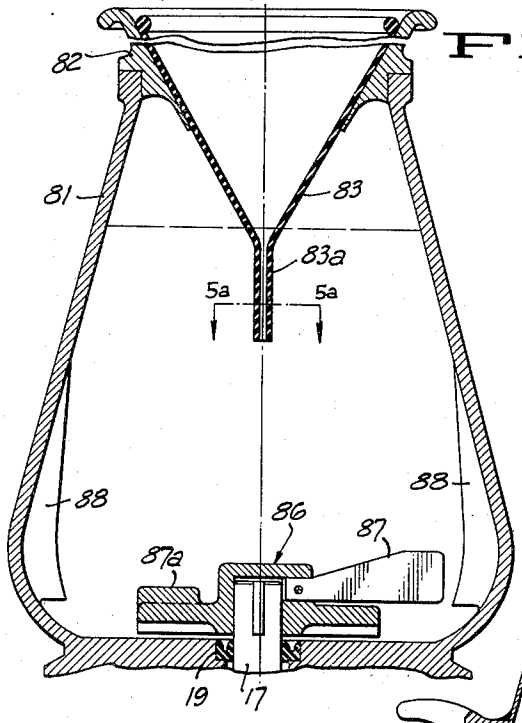
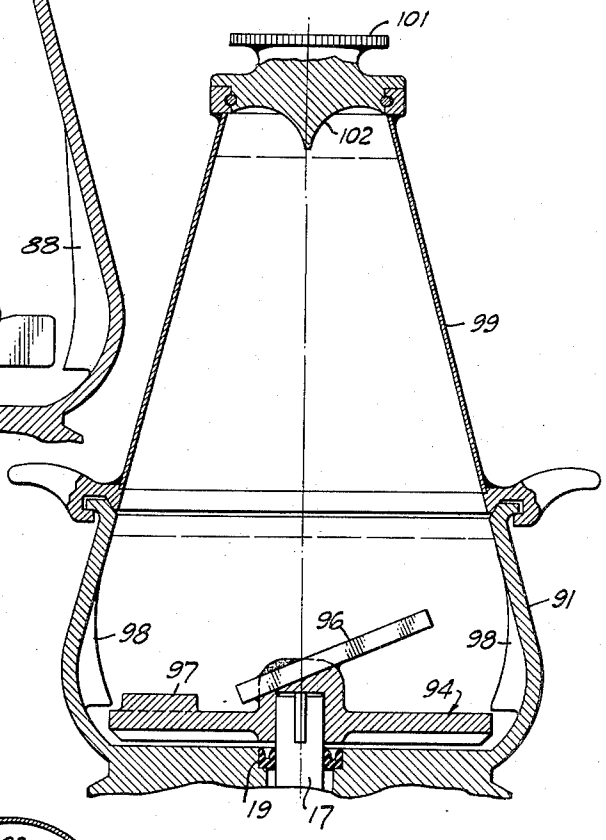


FIG_7_



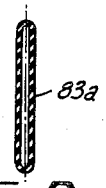


FIG_5A_

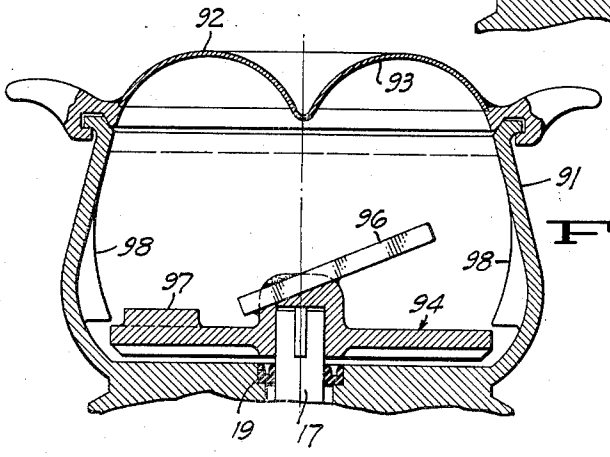


FIG_6_

INVENTOR.
Carl A. Rietz
BY Fleit & Swain
ATTORNEYS

United States Patent Office 2,951,649
Patented Sept. 6, 1960

2,951,649

DISINTEGRATING APPARATUS

Carl A. Rietz, San Francisco, Calif., assignor to Rietz Manufacturing Company, Santa Rosa, Calif., a corporation of California

Filed Apr. 12, 1955, Ser. No. 500,808

9 Claims. (Cl. 241—185)

This invention relates generally to apparatus and methods for reducing the particle size of various materials, and is applicable to both wet and dry disintegrating and grinding operations.

A wide variety of commercial equipment is available for various disintegrating and grinding operations. Particularly in the food processing and baking industries, it is common to use so-called blendors for such operations as, for example, to disintegrate and inter-mix various ingredients to form a homogenous slurry or paste. Conventional blendors of this type employ a high-speed rotor provided with cutting blades and disposed at the lower end of a container. Succulent materials such as vegetables, meats or the like introduced into the container are progressively reduced to a desired particle fineness and inter-mixed to form a slurry or paste. The rotor may or may not be disposed eccentric with the vertical axis of the vessel. One of the principal difficulties with such apparatus is that unless the mixture is quite fluid, it will not circulate within the container to subject all portions of the solids to the disintegrating action of the rotor. In other words channeling or pocketing occurs, thus requiring the contents to be scraped from the sides of the container and to be returned to a position where they are acted upon by the rotor. In addition to such difficulty, conventional blendors are not well adapted to a wide variety of materials, including dry or semi-dry materials such as bone, etc.

In general it is an object of the present invention to provide an improved apparatus and method which can be used to advantage in place of conventional disintegrators of the blendor type and which greatly facilitates disintegrating and mixing operations.

Another object of the invention is to provide apparatus of the above character which has provision to facilitate charging and discharging operations.

Another object of the invention is to provide apparatus of the above character having novel provision for carrying out classifying and separating operations in conjunction with disintegration.

Additional objects and features of the invention will appear from the following description in which the preferred embodiments have been set forth in detail in conjunction with the accompanying drawing.

Referring to the drawing:

Figure 1 is a side elevational view partly in section illustrating apparatus incorporating the present invention.

Figure 2 is a side elevational view partly in section illustrating another embodiment of the invention.

Figure 3 is a view like Figure 2 but illustrating the apparatus utilized in conjunction with means for carrying out a pneumatic separating and classifying operation.

Figure 4 is a side elevational view in section illustrating another embodiment of the invention, in which material is discharged through valve means.

Figure 4–A is a detail in section showing one of the cutting blades for the auxiliary rotor.

Figure 5 is a side elevational view in section illustrating another embodiment of the invention.

Figure 5–A is a cross sectional view taken along the line 5—5 of Figure 5.

Figure 6 is a side elevational view illustrating another embodiment of the invention in which the container can be altered with respect to its capacity.

Figure 7 is a side elevational view in section showing the embodiment of Figure 6 incorporated in a two part receptacle device.

The invention as illustrated in Figure 1 consists of a container **10** forming a chamber that is symmetrical about the normal vertical operating axis **11**. In horizontal section the chamber is circular. In this instance the chamber is formed in two sections **10***a* and **10***b* having cooperating flanges **12** and **13**, and clamped together by means of the clamping ring **14**. Suitable sealing means is provided between the sections, such as a resilient ring **16** of the O-ring type.

An operating shaft **17** is concentric with the axis **11** and extends upwardly through the bottom wall **18**. Suitable sealing means **19** prevents leakage between these parts. A rotor **21** is fixed to the shaft **17** and disposed in the lower portion of the container. This rotor consists of a wheel-like member **22**, together with hammers **23** pivotally carried by the pins **24**.

The shaping of the container is such that the material acted upon by the rotor **21** tends to be impelled upwardly along the side walls. Note that the container extends to a larger diameter for a substantial distance above the rotor, and then decreases in diameter toward the upper end of the container. In this particular embodiment the greatest diameter is along the parting plane between the sections **10***a* and **10***b*. It is desirable to provide the interior of section **10***a* with the vertically extending and circumferentially spaced ribs **26**, which act upon the material, and tend to convert its rotary movement into a vertical velocity component. The upper section **10***b* can have similar spaced ribs **27**, which in effect form continuations of the ribs **26**. Both sets of ribs are inclined at a small angle to the vertical. In the upper part of the container means is provided for directing the material inwardly toward the axis **11**, and then downwardly toward the rotor. Thus the cover **28** for the container is formed to provide an inner surface **29** which is a surface of revolution, concentric with the operating axis **11**. In vertical section the surfaces **29** are contoured to correspond with the arc of a circle drawn from the center **31**. The inner surfaces of sections **31***a* and **31***b* (as viewed in vertical section) likewise are curved, and the curvature of the surfaces for section **31***b* merge with the surfaces **29**. Surfaces **29** are formed in part by the inner end surface of a plug **32**, which is removably fitted in the cover **28**. This plug can be removed for inspection or for adding materials while the apparatus is in operation.

It is desirable to mount the container in such a manner as to permit the apparatus to be tilted from its normal vertical position. Thus in the embodiment of Figure 1 the bottom wall **18** is mounted upon the arm **33** and this arm in turn is pivotally carried by the horizontal shaft **34** of the supporting standard **35**. By means of removable dock-pin **36**, the arm **33** can be either fixed in horizontal position as illustrated, or swung to a generally upright position with the axis **11** extending horizontally. An electric driving motor **37** can likewise be mounted upon the arm **33** with its shaft directly coupled to the shaft **17**.

The apparatus described above operates as follows: With the rotor stationary the cover **28** is removed and a quantity of material placed in the container **10**. The cover **28** is then replaced, and may be attached by suit-

able locking means. The rotor **21** is started in operation by energizing the electric motor **37**. Contrary to the manner in which conventional blendors are operated, the driving speed for the rotor need not be excessive. For example the rotors about 5 inches in diameter the speed can be of the order of from 2500 to 4000 r.p.m. Material acted upon by the rotor is disintegrated by the impact action of the hammers **23** and is propelled outwardly and upwardly along the lower expanding sides of the container. The reaction of the rotating material on the ribs **26**, **27** creates vertical velocity components whereby the material is delivered upwardly to be directed by the surface **29** inwardly and downwardly. In the region **38** below the surface **29** and in the region of the axis **11**, the material commingles and interacts with extreme violence and turbulence, and then is delivered back to the rotor. In explanation of what occurs in the region **38**, it can be pointed out that the material enters this zone with relatively high velocity, and that the velocity components are in a rotary direction, in a direction inwardly toward the axis **11**, and in a downward direction toward the rotor. The inter-mingling of materials having such velocity components necessarily causes intense turbulence together with a distintegrating action upon solids present. In addition thorough inter-mixing occurs in this area.

The length of time required for an operating cycle will be dependent upon the type of materials being treated, and the fineness desired. After treatment has been carried out to the extent desired, the motor is stopped, and then the arm **33** swung upwardly to bring the axis **11** horizontal. In this position all of the disintegrated material can be discharged from the container, after which the apparatus is returned to its normal position for a new charge.

My apparatus has a number of advantageous features. Even though the mixture resulting from the disintegrating operation is relatively thick or pasty in consistency, it will continue to function to disintegrate the material, instead of the effective action being interrupted or impaired by the formation of channels or pockets. The apparatus has relatively high capacity for a given size of equipment, thus enhancing its usefulness where comparatively high capacity is desirable. Its distintegrating action is relatively intense compared to conventional blendors, and the apparatus can be used to advantage on relatively hard materials, as for example, meat bone such as is desired in the manufacture of animal feeds, or the preparation of soup stocks. The progressive subdivision of solids which takes place is due to several actions, including impacting of the hammers with the material, discharge of the material from the rotor against the ribs **26**, and the attrition effect of the intense turbulence taking place in the zone **38**. Thus a relatively hard material can be disintegrated as well as soft materials such as fresh or cooked succulent vegetables. Although in the food industry the materials being disintegrated will generally contain a certain amount of moisture resulting in a paste or slurry, the material being treated may be dry or have a negligible moisture content, whereby a powdered product or meal results, rather than the formation of a paste or slurry. Thus the apparatus does not depend for its action upon the formation of a fluid-like material which may flow back into the zone of operation of the rotor.

Figure 2 shows apparatus which in some respects is similar to that of Figure 1, but which is intended for the disintegration of substantially dry materials. The container **40** in this instance corresponds to container **10**, and its lower portion **40***a* is provided with parts corresponding to Figure 1, including the rotor **21**, the rotor hammers **23**, and the ribs **26**. The upper container part **40***b* is provided with concentric inlet and outlet passages. Thus a conduit **41** is disposed concentric with the operating axis **11**, and extends downwardly through the container section **40***b*. Exterior of the container the conduit **41** connects with the outlet conduit **42**. A smaller conduit **43** extends concentrically through the conduit **41**, and its exterior end **44** forms an inlet. The inner end of conduit **43** is shown provided with the enlarged portion **45**, which generally overlies the rotor **21**. Curve portion **46** serves to direct the material downwardly about conduit **41**, and is a surface of revolution having its axis coincident with axis **11**.

Operation of the embodiment shown in Figure 2 is as follows: A dry product, which may be crushed in a preliminary operation, is supplied through the inlet **44**, together with a current of air. Assuming that the rotor is being driven at a suitable speed, the material is rapidly disintegrated in the manner previously described, and the finer components are carried with the air current upwardly through the conduit **41** to be discharged through the outlet **42**. It is an inherent feature that suction is developed to draw air downwardly through conduit **43**, while a pressure is developed to discharge air through conduit **41**. Assuming continuous flow of an air stream through the apparatus, with continual feeding of material, the dry divided material may be continuously discharged through the outlet **42**. When operated in this manner some classification takes place automatically within the apparatus, with conveyance and discharge of the finer material as the desired degree of fineness is obtained. The classifying action can be adjusted by vertical adjustments of conduit **43**. With the construction of the apparatus illustrated in Figure 2, the material is discharged upwardly along the sides of the container, and then is deflected by the curved surfaces **46** back upon the rotor. Thus there is a continual movement of material undergoing disintegration downwardly past the lower end of conduit **41**, and across the air flow occurring into this conduit. Instead of feeding the device of Figure 2 continuously, it will be evident that it can be batch fed, and the finer material discharged over an operating period while continuously supplying a stream of air through the inlet **44** and out of the outlet conduit **42**. At the end of such an operation any remaining undisintegrated material can be discharged from the apparatus.

Figure 3 illustrates how the apparatus in Figure 2 can be incorporated with novel pneumatic separating means. Thus in this instance an inclined conduit **47** is connected with the outlet conduit **42**, and the lower side of conduit **47** is provided with a plurality of spaced and downwardly extending outlet openings **48**, **49**, **50**, **51** and **52**. Assuming that the material being delivered through the outlet conduit **42** varies somewhat as to size, the coarser fraction will be delivered through opening **48**, and the finer through the uppermost opening **52**. Intermediate fractions are delivered through openings **49**, **50** and **51**.

The apparatus shown in Figure 3 can be used where it is desirable to provide a plurality of classified fractions of finely divided material. Here again the apparatus can be operated continuously, or a batch of material can be introduced into the apparatus and the disintegration and the discharge of classified fractions carried out over an operating cycle. With such apparatus it will be evident that a continuous stream of air or other gas must be supplied to the apparatus by way of the inlet **44**, thus providing a continuous pneumatic discharge. In some instances the gas may be an inert medium, such as nitrogen or may be a treatment medium having one or more active components.

The embodiment illustrated in Figure 4 is provided with side means for the discharge of material. In this instance the container **56** is somewhat modified as to shaping, and is mounted upon the arm **57**. The rotor **58** is attached to a shaft driven by the motor **59**. Arm **57** is carried by the journal **61** on a supporting standard **62**. Suitable means such as a lock pin **63** can be employed to retain the arm **57** in a desired position. The upper end of the container **56** is provided with an opening **64** in

which the device **66** is fitted. A device **66** forms a hopper for receiving feed material, and for delivering such material into the interior container **56** through the opening **67**. The lower face of the device **66** provides a curved surface **68**, corresponding to the surface **46** of Figure 2. One side wall of the container **56** is interrupted by the opening **69**, normally covered by the screen **71**. A fitting **72** is attached to the container and forms a cylinder **73** extending outwardly from the screen **71**. A piston or plunger **74** is fitted in cylinder **73**, and attached to the operating rod **76**. A discharge opening **77** communicates with the lower side of cylinder **73**. By retracting rod **76** and piston **74**, the piston can be made to clear the opening **77**, thus permitting material from the container to pass through the screen **71** and out through the passage **77**. Assuming that the piston **74** is in open position, and that the rotor is being driven, air is drawn in through the passage **67**, and discharged through the screen **71**. Thus at the end of an operating cycle, the opening of piston **74** results in rapid discharge of material. Suitable means such as a bayonet lock pin **78**, can be provided for retaining the rod **76** in the normal closed position shown in Figure 4.

Figure 4 also incorporates supplemental rotor means in the form of blades **79** which are mounted on the hub of the rotor. These blades serve to chop and cut material and may be inclined as shown in Figure 4–A, to urge material toward the main rotor. They also tend to prevent material from bridging or riding on top of the rotor.

The opening **67** in Figure 4 can be provided with suitable sealing or closure means to seal the interior of the container. A simple device for this purpose is a ball **80** which may be attached to device **66** by a cord or chain **80***a*. When liquid is introduced into device **66** ball **80** can be readily lifted to permit the liquid to flow through the opening **67**. When the apparatus is operating, the pressure below the ball may be subatmospheric, in which event the ball is urged and held in closed position. Should a pressure above atmospheric be developed, the ball is forced from its seat to provide a safety vent.

Under certain operating conditions it is desirable to tilt the apparatus of Figure 4. When there is a relatively small charge of liquid or fluid material in container **56**, the action desired may not take place. If under such circumstances the apparatus is tilted to an angle of say 45°, the rotor operates more effectively and the disintegrating action proceeds as desired.

The embodiment of Figure 5 is suitable for use in restaurants and small food processing establishments. The container **81** in this instance is again somewhat modified in shaping, particularly in that it has been extended vertically. The upper opening of the container is normally covered by a closure consisting of a conical shaped ring **82** which serves to seat a conical member **83** formed of resilient material like synthetic rubber. The lower portion **83***a* is flattened to form an approximate seal. This ring **82** has an inner curved surface **84**, corresponding generally to the curved surface **29** (and adjacent curved surfaces) of Figure 1. The rotor **86** in this instance is provided with a single blade **87**, together with one or more radial ribs **87***a*, and the side walls of the container are provided with vertically extending ribs or vanes **88**. The blade **87** in this instance is formed as a flexible spring strip attached to the hub of the rotor and capable of flexing somewhat during operation.

In general the embodiment of Figure 5 operates in the same general manner as Figure 1. During operation material can be introduced through the member **83**, including objects or fragments of substantial size.

Figures 6 and 7 show another embodiment somewhat similar to Figure 5, but with means to facilitate a change in capacity. Referring first to Figure 6 the container **91** has its upper end fitted with the closure **92**. The inner surface **93** of this closure is curved to correspond generally to the curved surface **84** of Figure 5. The rotor **94** is provided with the single flexible blade **96**, and with one or more ribs **97**. The side walls of the container are provided with the vanes or ribs **98**. Figure 7 shows the device of Figure 6 modified for greater capacity. The cover **92** has been removed and an extension **99** applied to the container **91**. The extension **99** is in turn covered by closure **101** which is formed similar to the closure **83** of Figure 5, and which has a lower curved surface **102**. The flexible blade (as distinguished from a rigid hammer) is particularly desirable when operating upon the softer materials, such as succulent vegetables.

It will be evident that the apparatus of Figures 6 and 7 is adjustable with respect to capacity, and therefore is suitable for domestic use or small processing establishments. For example, if the capacity of Figure 6 is one pint, that for Figure 7 can be one quart.

I claim:

1. In apparatus for reducing the particle size of material, a container formed symmetrical about an operating axis and circular in section, a disintegrating rotor disposed concentric with the said axis and adjacent one end of the container, said rotor serving to act upon a quantity of material and to propel the same with rotary motion along the surfaces defining the sides of the container and towards the other end of the same, directing means at the other end of the container for directing material from the side surfaces toward the axis of the container and then back toward the rotor with predominant directional components that are rotary and parallel to the axis of the rotor, and valve means in the lower portion of the container for the discharge of the material, said valve means including a cylindrical member having one end of the same communicating through an opening in one wall of the container near the lower portion thereof, a screen covering said opening and conforming to the inner surface of the container, a discharge opening on one side of said member, and a piston movable from a closed position adjacent the screen to an open position beyond the discharge opening.

2. In apparatus for reducing the particle size of material, a container symmetrical about an operating axis and circular in horizontal section, a disintegrating rotor disposed adjacent a lower end of the container so as to provide a free space thereabove, said rotor being provided with hammer means including a free end adjacent inner wall surfaces of the container and extending a substantial distance above peripheral portions of the rotor, said rotor and hammer means serving to act upon material and propel the same with rotary motion along the surfaces defining the sides of the container and toward the other end of the same, and material deflecting means adjacent the upper end of the container for directing material from the side surfaces toward thte axis of the container and downwardly toward the free space above said rotor, said material deflecting means defining a surface of revolution having a common point on the axis of said rotor and adjacent an upper region of said free space, said common point being spaced a substantial distance above said rotor, said other end of the container being provided with a closure including a member of resilient material having a normally closed opening, whereby upon operation of the apparatus the material being treated is directed along rotary paths in a zone of intense turbulence created in the free space region below said normally closed opening.

3. Apparatus for reducing the particle size of solids, comprising: means defining a chamber having a circular bottom wall lying perpendicular to a centrally disposed vertical operating axis; rotary disintegrating hammer means located in the lowermost portion of said chamber and being mounted immediately above said bottom wall on a drive shaft lying on said axis and extending downwardly through said wall, said drive shaft being connected to a source of power for imparting rotary motion

to said disintegrating means and causing a zone of turbulence immediately thereabove; annular chamber side wall means inclined outwardly to lie in upwardly diverging relation for a substantial distance above the level of said bottom wall and above the level of said zone; a plurality of ribs formed on the inner surface of said side wall means with the inner surfaces of each rib lying in substantially parallel relation with the adjacent side wall portion, said hammer means terminating in outer surfaces lying closely adjacent the inner surfaces of said ribs and substantially parallel thereto, said side wall means also including upper wall portions converging upwardly and inwardly toward said axis of rotation at the top of said chamber and terminating in centrally disposed downwardly converging flow-guiding means lying in the area of said axis of rotation at a substantial height above said disintegrating means and above said zone, whereby material acted upon by said disintegrating means is forced outwardly against said side wall means and moves upwardly therealong to a level above said zone and passes to said flow-guiding means where it is turned downwardly directly into the center of said zone along said axis.

4. The apparatus of claim 3, wherein said bottom and side wall means serve to define a chamber which is of inverted pear shape.

5. The apparatus of claim 3, including flexible blade means mounted on said drive shaft and extending outwardly therefrom above said hammer means.

6. The apparatus of claim 3, wherein said ribs are arranged in spiral relation along said inner surface of said side wall means.

7. The apparatus of claim 3, wherein the inner extremities of said flow-guiding means define an axially disposed opening.

8. The apparatus of claim 3, wherein said chamber is mounted for pivotal movement to permit said chamber to be pivoted from a vertical to an inclined position.

9. In apparatus for reducing the particle size of material, a container symmetrical about an operating axis and circular in horizontal section, a disintegrating rotor disposed adjacent a lower end of the container so as to provide a free space thereabove, said rotor being provided with hammer means including a free end adjacent inner wall surfaces of the container and extending a substantial distance above peripheral portions of the rotor, said rotor and hammer means serving to act upon material and propel the same with rotary motion along the surfaces defining the sides of the container and toward the other end of the same, and material deflecting means adjacent the upper end of the container for directing material from the side surfaces toward thet axis of the container and downwardly toward the free space above said rotor, said material deflecting means defining a surface of revolution having a common point on the axis of said rotor and adjacent an upper region of said free space, said common point being spaced a substantial distance above said rotor, the upper portion of the container also forming a hopper end and having a feed passage in alignment with the axis of the rotor, and in the vicinity of said common point, and a ball disposed in said hopper and adapted to serve as valve means for closing said passage, whereby upon operation of the apparatus the material being treated is directed along rotary paths into a zone of intense turbulence created in the free space region below said feed passage.

References Cited in the file of this patent

UNITED STATES PATENTS

433,163	Crawford	July 29, 1890
1,135,795	Hiller	Apr. 13, 1915
1,230,395	Fornander	June 19, 1917
1,426,080	Holt	Aug. 15, 1922
1,637,678	Camilla et al.	Aug. 2, 1927
1,697,704	Wood	June 1, 1929
1,874,079	Black	Aug. 30, 1932
1,875,817	London	Sept. 6, 1932
1,984,619	Wright	Dec. 18, 1934
2,428,420	Green	Oct. 7, 1947
2,434,449	Wells	Jan. 13, 1948
2,436,767	Gerlicher	Feb. 24, 1948
2,496,017	Newell et al.	Jan. 31, 1950
2,511,357	Marty	June 13, 1950
2,594,250	Tranberger	Apr. 22, 1952