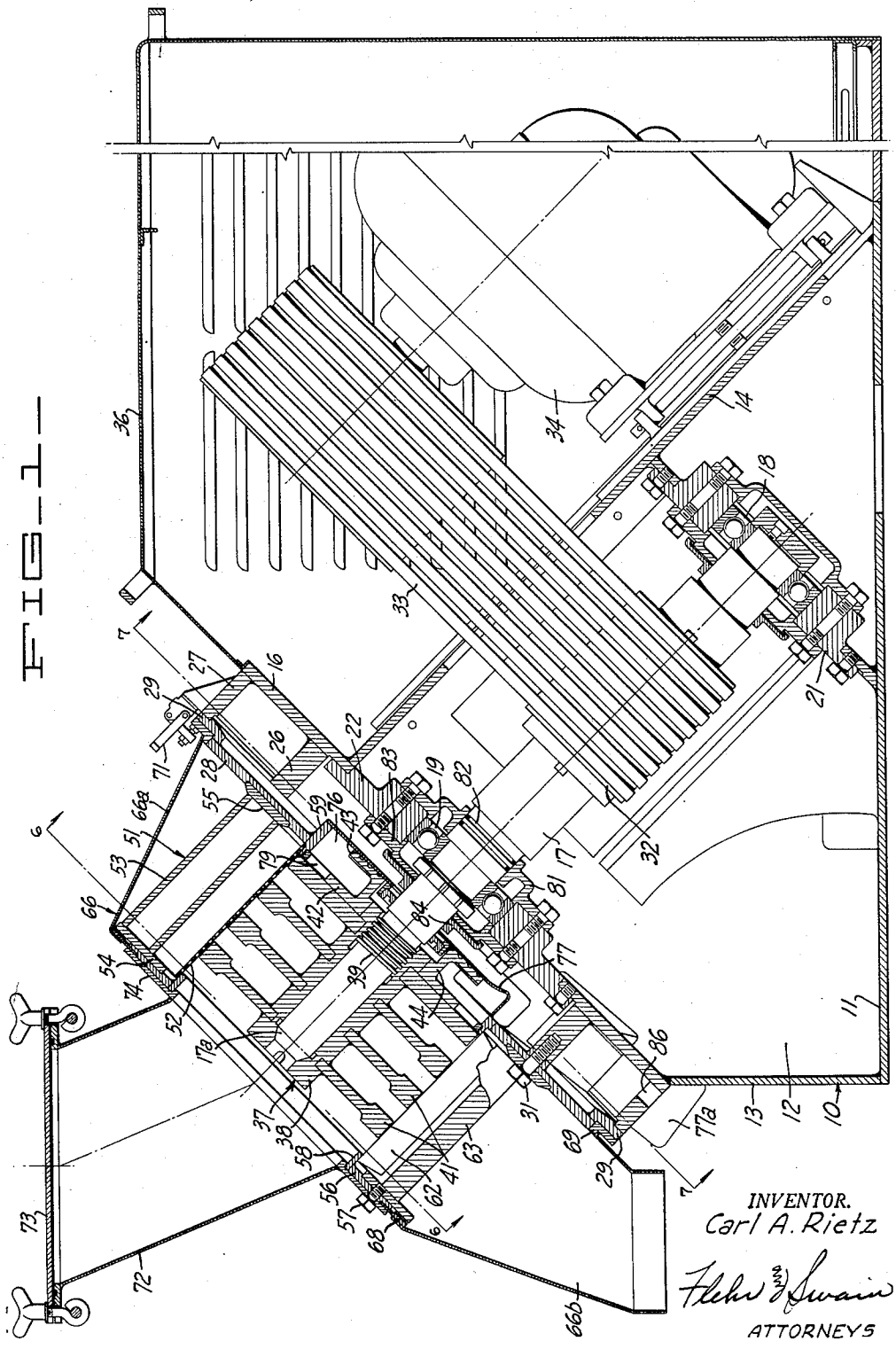
June 29, 1954 C. A. RIETZ 2,682,374

INCLINED AXIS ROTARY HAMMER AND SCREEN DISINTEGRATOR WITH PLURAL DISCHARGE STRUCTURES

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FIG. 1

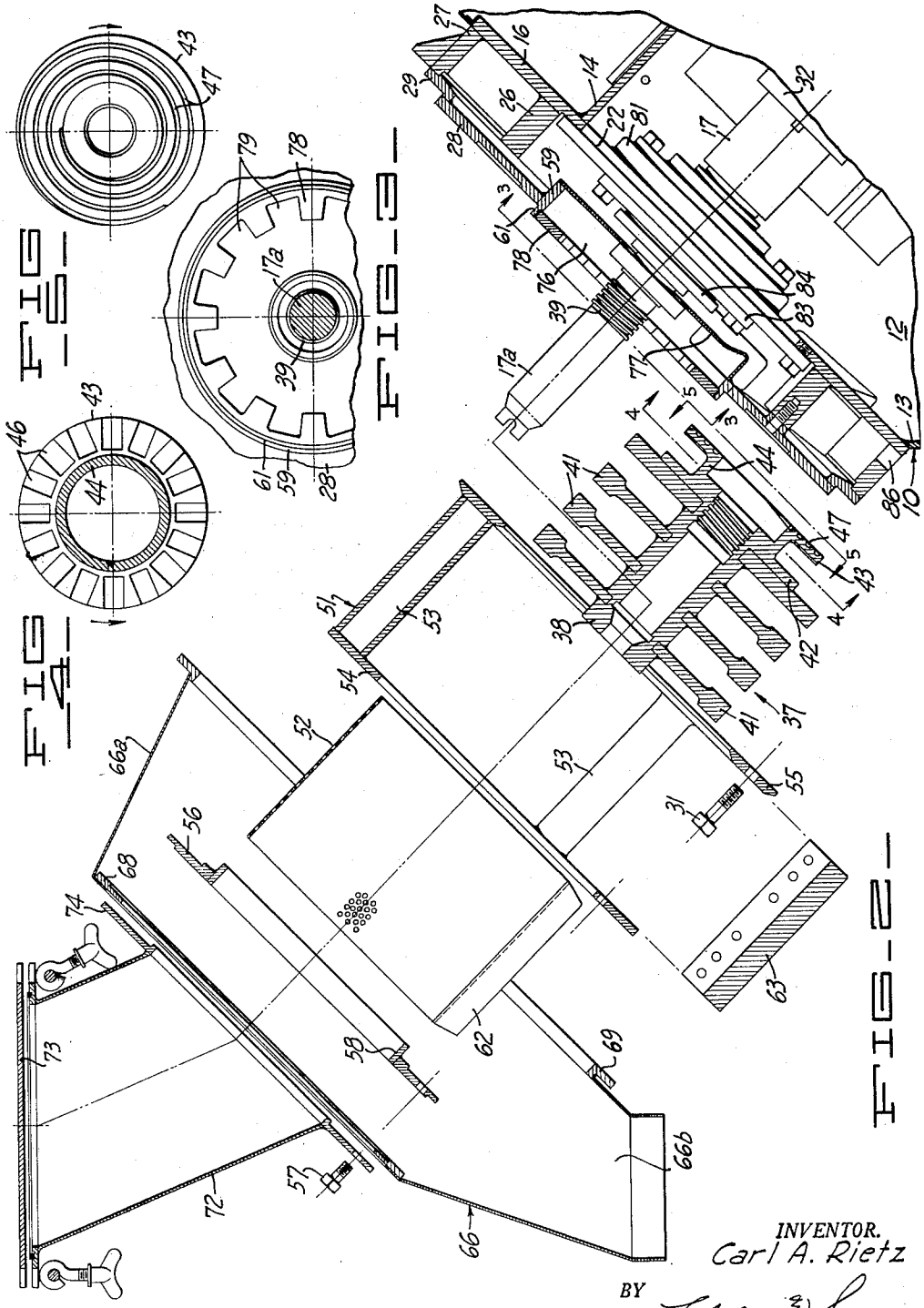


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INCLINED AXIS ROTARY HAMMER AND SCREEN DISINTEGRATOR WITH PLURAL DISCHARGE STRUCTURES

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FIG-6

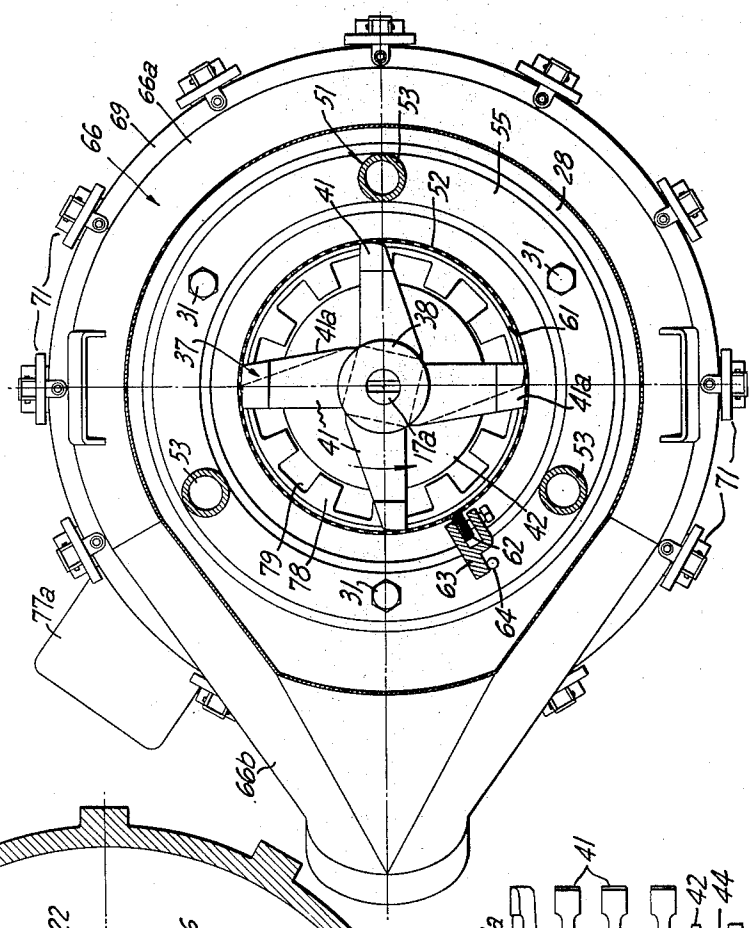


FIG-7

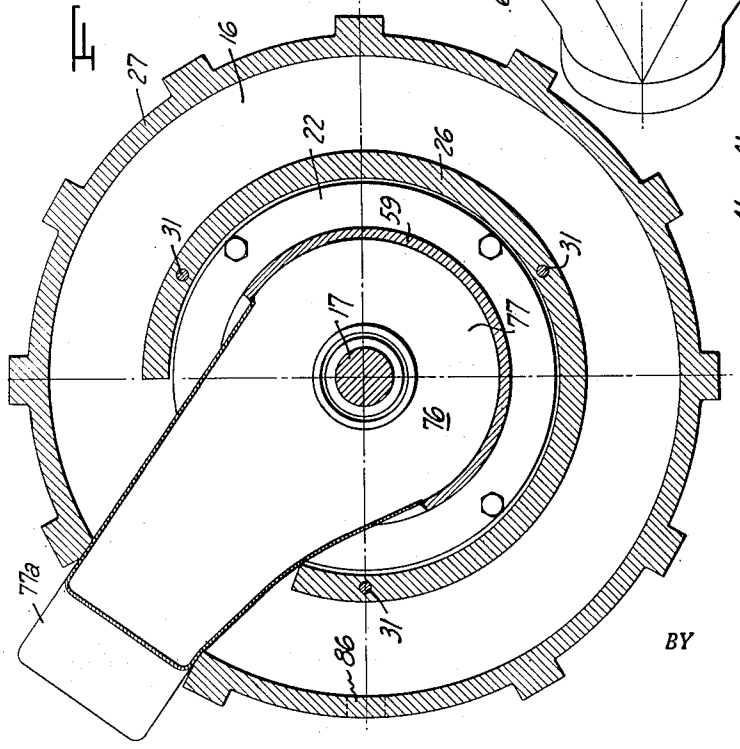
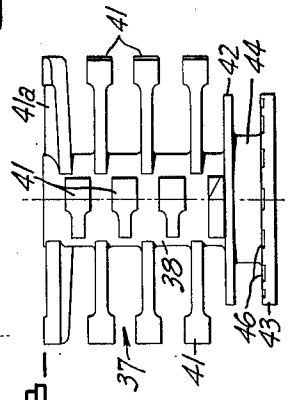


FIG-8



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UNITED STATES PATENT OFFICE

2,682,374

INCLINED AXIS ROTARY HAMMER AND SCREEN DISINTEGRATOR WITH PLURAL DISCHARGE STRUCTURES

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6 Claims. (Cl. 241—86)

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This invention relates generally to disintegrating apparatus of the rotary hammer mill type, and particularly to machines of this character such as are suitable for use in the food processing industry.

Disintegrating apparatus of the rotary hammer mill type have been widely used for disintegrating or reducing the particle fineness of various products, including for example vegetables and other food materials. Conventional hammer mills fall into two general types, namely horizontal and vertical, depending upon whether the axis of the rotor is disposed horizontally or vertically. In both conventional types the product undergoing treatment must pass over surface areas which are either flat or inclined upwardly in the general direction of movement of the material. Thus there is no gravity flow through the machine, and one must depend upon the centrifugal effect of the rotating hammers or the crowding effect of the material to cause continued progression of material from the feed to the point of discharge. In addition the machines are constructed in such a manner as to form pockets or relatively dead spaces in which the material may accumulate and remain for a considerable period of time, thus raising the risk of possible bacterial contamination or spoilage. In addition to the foregoing such conventional machines are difficult to maintain in a clean and sanitary condition. Upon terminating a run it is difficult to remove all of the remaining material, and to clean and sterilize all of the working parts of the machine as required by sanitation regulations.

It is an object of the present invention to provide a new type of disintegrating apparatus which will be characterized by gravity flow of material through all the parts of the same.

Another object of the invention is to provide a novel form of disintegrator particularly adapted for use in the food industry, and which will facilitate maintaining the working parts in clean and sanitary condition.

Another object of the invention is to provide a machine of the above character which is well adapted for high speed operation to produce a fine particle size.

Additional objects 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 in section illustrating a disintegrating machine incorporating the present invention.

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Figure 2 is an exploded view illustrating how the principal working parts of the machine are removed and reassembled.

Figure 3 is a cross-sectional detail taken along the line 3—3 of Figure 2.

Figure 4 is a cross-sectional detail taken along the line 4—4 of Figure 2.

Figure 5 is a cross-sectional detail taken along the line 5—5 of Figure 2.

Figure 6 is a cross-sectional view taken along the line 6—6 of Figure 1.

Figure 7 is a cross-sectional view taken along the line 7—7 of Figure 1.

Figure 8 is an elevational view illustrating the disintegrating rotor.

The machine illustrated in the drawing consists generally of a base support 10, which can be formed largely of fabricated metal plate, and which includes in this instance the bottom wall 11, the vertical side walls 12, the forward end wall 13, and the upper inclined wall 14. The walls 12, 13 and 14 serve to mount the casting 16, which is annularly contoured and which forms a mounting plate for other working parts of the machine.

A shaft 17 is disposed within the base support 10, and is carried by the ball bearing assemblies 18 and 19. Assembly 18 is carried by the journal mounting 21, which in turn is secured to the adjacent parts of the base support. Ball bearing assembly 19 is carried by the journal mounting ring 22, which is secured to the plate 16. The axis of shaft 17 is at an angle of substantially 45° to the horizontal, as shown in Figure 1.

Arcuate ribs 26, 27 (Figure 7) are formed upon the outer (i. e. upper) face of the plate 16, and serve to mount another annularly contoured plate 28. This plate has an outer margin 29 adapted to seat upon the arcuate rib 27, and it is secured to the rib 26 as by means of the screws 31.

The shaft 17 carries a multigroove pulley 32 which engages the V-belts 33. The belts are driven by the electric motor 34. This motor and the exterior part of the belt drive can be enclosed by the removable hood 36.

The shaft portion 17*a* which extends beyond the plate 16 is adapted to mount the disintegrating rotor 37. This rotor consists of a hub 38, which is machined to fit the shaft portion 17*a*, and which is threaded internally to engage the threaded portion 39 of the shaft. Disintegrating hammers 41 extend radially from the hub 38, and are preferably staggered along the length of the rotor as illustrated in Figure 8. The uppermost hammers 41*a* can have beveled faces to urge material

fed to the same into the zone of operation of the rotor, as will be presently described. At the lower end of the rotor the hub serves to mount a pair of spaced discs 42 and 43, which are joined by the hub portion 44. It is preferable to form the upper face of disc 43 with the radially extending grooves 46 (Figure 4) and it is also desirable to form the lower face of this disc with a spiral groove 47 (Figure 5). As will be presently explained the grooves 46 aid in securing proper discharge of secondary material, while the spiral groove 47 tends to prevent material from finding its way into the upper one of the shaft bearings.

Carried by the plate 28 there is a frame unit designated generally at 51, and which serves to mount a cylindrically shaped screen 52. The frame consists of the tubular standards 53, which are spaced circumferentially about the zone of operation of the rotor, and which are secured at their ends to the rings 54, 55. The lower ring 55 is clamped to the plate 28 by the screws 31. Another annular member 56 is removably secured to ring 54 by screws 57, and serves to mount the screen supporting rim 58. The plate 28 serves to mount the collar or annular member 59, which forms an upwardly extending flange 61. The lower edge of the cylindrical screen engages about the flange 51, and the upper end engages about the flange 58.

The screen is generally formed of a single strip (or two superposed strips) of perforated material bent cylindrical shape. The longitudinal edges of the strip are bent outwardly to form the portions 62, which are adapted to be held together by the C clamp 63 (Figure 6). The C clamp can engage the stationary pin 64, to prevent its rotation.

The frame unit 51 is generally embraced by the collecting and discharge shrouding 66. This shrouding can be formed of suitable sheet metal, and includes the portion 66*a* which is annularly contoured and which surrounds the main part of the frame, and the lower convergent portion 66*b* on the underside of the frame (Figure 1) and which provides a downwardly extending discharge spout. The upper annular portion of the shrouding is reinforced by the stiffening ring 68, and is adapted to seat upon the annular member 56. Similarly the lower face of the shrouding is reinforced by the annular ring 69, and is adapted to be removably secured by quick detachable clamping means 71, to the peripheral margin 29 of the plate 28.

A feed hopper 72 serves to supply feed material to the upper end of the rotor. When the machine is not in use this hopper can be closed by cover 73. Its lower end carries a stiffening flange 74, which is adapted to be secured to the frame 51 by the screws 57.

The majority of material supplied to the machine is disintegrated by the action of the hammers, forced outwardly through the screen 52, and then delivered through the discharge spout 66*b*. A smaller amount of material finds its way into a so-called secondary chamber 76 which is located at the lower end of the rotor. This chamber is defined in part by the annular member 59, and in part by the member 77, which is fitted against the lower edge of member 59, and in substantially face to face contact with the lower face of the disc 43. Member 77 is contoured substantially as shown in Figure 7 to provide a conduit portion 77*a* extending downwardly from the same for discharge of so-called secondary material. In other words the conduit portion 77*a* communicates with the secondary chamber space 76, and conveys the material outwardly and downwardly with respect to the rotor, to a point of discharge. It will be noted that the conduit portion 77*a* is positioned between the spaced plates 16 and 28, and is accommodated by gaps or breaks in the ribs 26, 27 and in member 59. Material passing downwardly into the secondary chamber must pass through the annular orifice plate 78, which is removable and which is provided with spaced slots 79 which are disposed about the periphery of disc 42.

It is desirable to provide an adequate seal to prevent the material being disintegrated from being contaminated with oil supplied to the ball bearing assembly 19. Thus the lower side of the ball bearing assembly is enclosed by the plate 81, which in turn is sealed with respect to the shaft by the resilient O ring type of seal 82. The upper side of the ball bearing assembly is enclosed by plate 83, which has a relatively close fit about the shaft. Immediately overlying the plate 83 there is a slinger disc 84, which is mounted upon the shaft and rotates therewith. Any oil which finds its way to the lower side of the slinger disc 84 is discharged outwardly from the same, and eventually drains through the opening 86.

Figure 2 illustrates how the principal working parts can be readily disassembled for cleaning or sterilizing. Thus to disassemble the machine after a run, the parts are removed in the order in which they appear in Figure 2, commencing with the feed hopper 72, and continuing until one has removed the rotor 37. The rotor is removed by use of a suitable tool which serves to hold the shaft 17 against rotation, while a torque is applied to the rotor to unscrew the same from the shaft. When the threads have been disengaged the rotor is slid off the inclined shaft by hand. After the parts have been disassembled as shown in Figure 2, they can be readily cleaned and sterilized, and one can then readily clean the secondary chamber 76, and the secondary discharge conduit 77*a*. After all of the parts have been cleaned, they can be readily reassembled in inverse order.

The feature referred to above is particularly desirable in the food industry, where it is necessary to frequently clean and sterilize the working parts of the machine. It will be noted that this feature is made possible by the fact that the rotor shaft is driven from its lower end, thus leaving the upper side of the machine completely accessible for removing the various parts. In addition the inclined positioning of the shaft greatly facilitates the labor involved in removing and applying the rotor and other parts.

Another feature of the machine which is of particular importance in the food industry, is the fact that all of the parts through which the material passes are arranged whereby there is a natural gravity flow from the point of introduction of the material to be disintegrated, to the point of final discharge of the disintegrated material. All of the surfaces upon which the material undergoing treatment may be temporarily supported are inclined to the horizontal, whereby wet or slurry-like materials flow by gravity over the same to the point of final discharge. In addition there are no pockets or dead spaces in which material may accumulate, and which may encourage bacterial contamination.

In the handling of many products, such as fresh green vegetables being disintegrated to the form

of a puree, a coarse fibrous material tends to accumulate in the secondary chamber 76 and discharges from the same through the conduit 77a. The disc 43 acts in effect as a slinger and impeller to force such secondary material in a general outward direction for discharge through the portion 77a. The plate 78 and the slots 79 in the same serve in effect to control delivery of such secondary material into the chamber 76. To accommodate various materials plates 78 of various sizes and types can be provided for use with the machine. Thus the plates may vary with respect to the size of the openings 79, thereby more or less controlling the amount and character of the secondary material.

My construction is well adapted for operation at relatively high rotative speeds. Thus it is possible to operate the machine at speeds ranging from say 6,000 to 9,000 R. P. M. or higher, such as are desired for relatively fine particle size.

The machine is adapted for use in a closed system for the processing of various materials. For example pressure feed means can continuously supply treated material such as hot cooked vegetables to the feed hopper 72 and the material then caused to pass through the machine without exposure to the air, to be delivered as a puree from spout 66b.

I claim:

1. In disintegrating apparatus of the rotary hammer type, a supporting base, a shaft journaled to said base and disposed substantially on an angle of about 45° to the horizontal, drive means carried by the base and applied to the lower portion of the shaft, a rotor provided with a plurality of disintegrating hammers and removably attached to the upper portion of said shaft, a frame removably secured to said base and including upper and lower annular members adjacent the upper and lower ends of the rotor, a substantially cylindrically shaped screen carried by said frame and surrounding the zone of operation of the rotor, the frame providing a space about said screen for receiving material passing therethrough, a feed hopper communicating through the upper one of said annular members for supplying feed material to the upper end of the rotor, and a discharge shroud removably carried by the frame, said shroud including an annular portion surrounding the screen and a portion forming a discharge conduit extending downwardly from the lower side of the screen.

2. In disintegrating apparatus of the rotary hammer type, a supporting base, a shaft journaled to said base and disposed on an axis of substantially 45° to the horizontal, means for applying driving torque to the lower portion of the shaft, a disintegrating rotor having a plurality of hammers and removably secured to the upper portion of the shaft, a frame removably secured to the base, a hopper removably secured to the frame and serving to supply feed material to the upper end of the rotor, a screen surrounding the rotor and carried by the frame, the frame providing a space about the screen for receiving material passing therethrough, a discharge shroud removably carried by the frame and including an annular portion surrounding the screen and a conduit portion forming a discharge spout extending downwardly from the lower side of the screen, means forming a secondary chamber adjacent the lower end of the rotor and below said screen, and a downwardly directed discharge spout communicating with the lower side of said secondary chamber for discharge of material accumulating therein.

3. In disintegrating apparatus of the rotary hammer type, a supporting base, a shaft journaled to said base and disposed on an axis of substantially 45° to the horizontal, means for applying driving torque to the lower portion of the shaft, a disintegrating rotor including a plurality of hammers and removably secured to the upper portion of the shaft, a frame unit removably secured to the base, said frame unit including upper and lower annular members adjacent the upper and lower ends of the rotor, an annular plate carried by the base and forming means for mounting said frame, a hopper removably secured to the frame and serving to supply feed material to one end of the rotor, a screen surrounding the rotor and carried by the frame, the frame providing a space about the screen for receiving the material passing therethrough, a discharge shroud removably carried by the frame and including an annular portion surrounding the screen and a conduit portion forming a discharge spout extending downwardly from the lower side of the screen, means forming a secondary chamber adjacent the lower end of the rotor and below said screen, said secondary chamber being adapted to accumulate material delivered downwardly from the zone of operation of the rotor, and a downwardy directed discharge spout communicating with the lower side of said secondary chamber for discharge of material accumulating therein, said spout being located below said annular plate.

4. In disintegrating apparatus of the rotary hammer type, a base, a pair of spaced parallel plates carried by the base and inclined at an angle of substantially 45° to the horizontal, a shaft journaled to said base and disposed on an angle of substantially 45° to the horizontal and substantially 90° to the planes of said plates, the upper portion of said shaft projecting from said plates and the lower portion of said shaft being within said base, means for applying driving torque to the lower portion of the shaft, a disintegrating rotor having a plurality of hammers and removably secured to the projecting portion of the shaft, a frame unit removably mounted upon the upper one of said plates, a hopper removably secured to the frame unit and serving to supply feed material to the upper end of the rotor, a screen carried by the frame unit and surrounding the zone of operation of the rotor, a discharge shroud removably carried by the frame and including an annular portion surrounding the screen and a conduit portion forming a discharge spout extending downwardly from the lower side of the screen, means forming a secondary chamber adjacent the lower side of the rotor and intermediate said plates, and a downwardly directed discharge spout located between said plates and communicating with the lower side of said secondary chamber, said spout serving to discharge secondary material accumulating in said secondary chamber.

5. In disintegrating apparatus of the rotary hammer type, a supporting base, a shaft journaled to said base and disposed on an axis of substantially 45° to the horizontal, the lower portion of said shaft extending into said base and the upper portion projecting from the base, means for applying driving torque to the lower portion of the shaft, a disintegrating rotor having a plurality of hammers and removably secured to the upper portion of the shaft, a frame

unit carried by the base, a screen surrounding the zone of operation of the rotor and carried by the frame unit, means forming a secondary chamber adjacent the lower end of the rotor and below said screen, and a flinger disc carried by said rotor below the hammers of the same and disposed in said secondary chamber, said finger disc serving to propel material outwardly from said shaft.

6. In disintegrating apparatus of the rotary hammer type, a supporting base, a shaft journaled to said base and disposed substantially on an angle of about 45° to the horizontal, drive means carried by the base and applied to the lower portion of the shaft, the upper portion of the shaft forming a stud portion for mounting a rotor, a rotor provided with a plurality of disintegrating hammers and removably attached to the upper stud portion of the shaft, a frame removably secured to said base and including upper and lower annular members adjacent the upper and lower ends of the rotor, the lower annular member being removably secured to the base, a substantially cylindrically-shaped screen carried by said frame and surrounding the zone of operation of the rotor,

the frame providing a space about said screen for receiving material passing therethrough, a feed hopper communicating with the upper one of said annular members for supplying feed material to the upper end of the rotor, and a discharge shroud removably carried by the frame, said shroud including an annular portion surrounding the screen and a portion forming a discharge spout extending downwardly from the lower side of the screen for gravity discharge of disintegrated material.

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