June 16, 1964 C. R. STEELE 3,137,334

DISINTEGRATOR HAVING DOWNWARDLY INCLINED BAFFLES

Filed Nov. 17, 1960 2 Sheets-Sheet 1

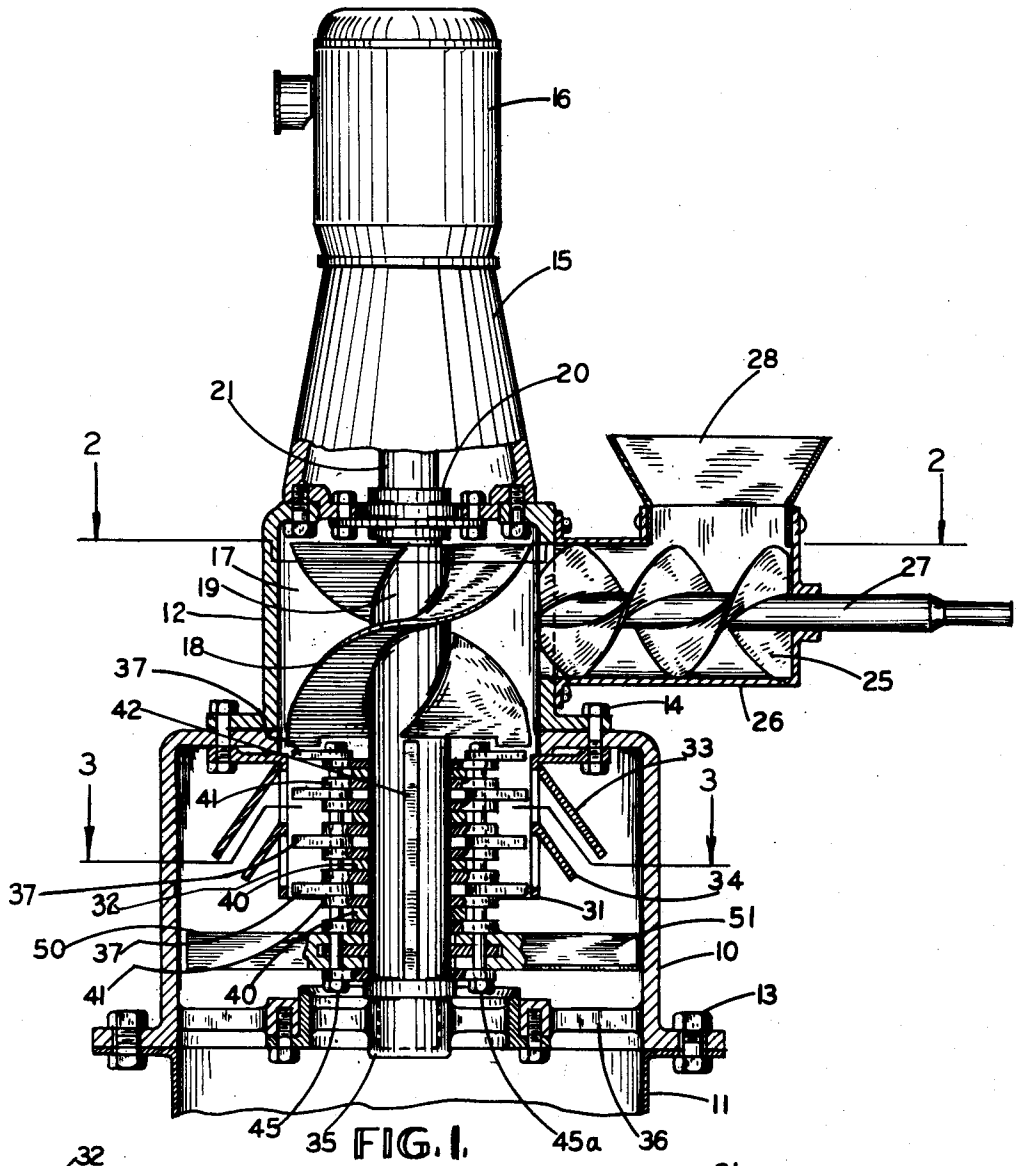

FIG. 1.

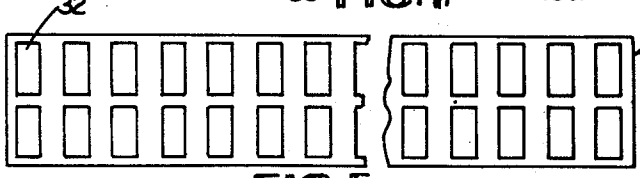

FIG. 5.

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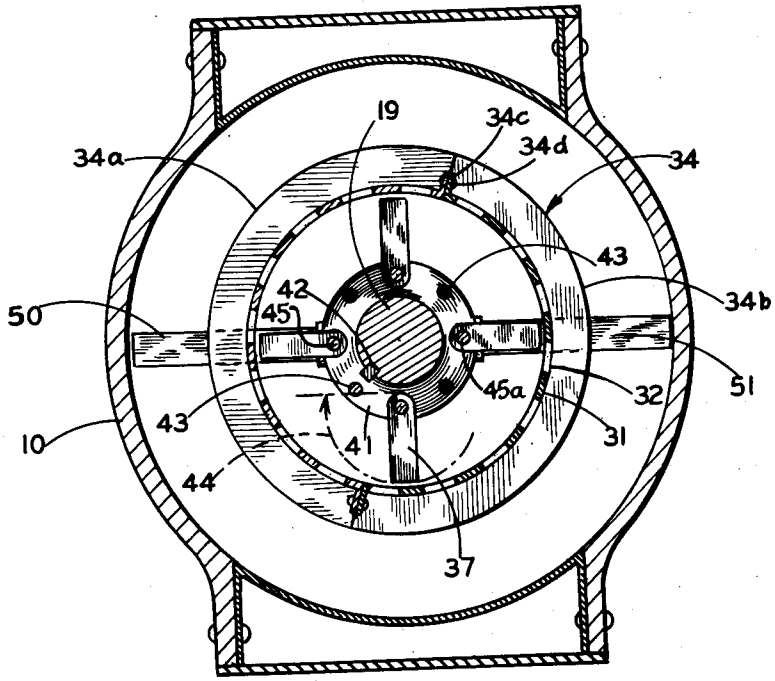

FIG. 3.

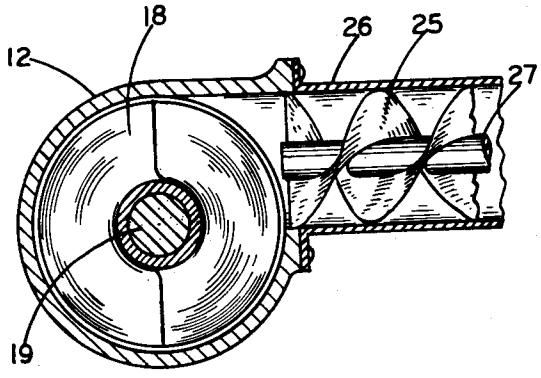

FIG. 2.

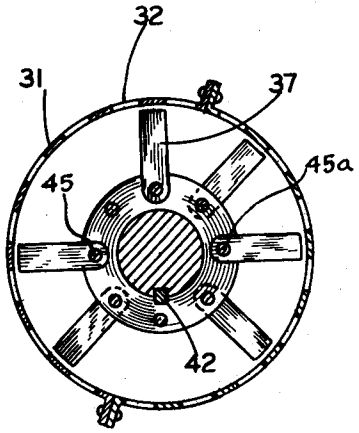

FIG. 4.

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3,137,334

DISINTEGRATOR HAVING DOWNWARDLY INCLINED BAFFLES

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16 Claims. (Cl. 146—192)

This invention is directed to a comminutor or disintegrator and more particularly to method and means for disintegration and size reduction of vegetal materials.

In the comminution and size reduction of vegetal materials, and particularly fibrous vegetal materials such as sugar cane, special designs, construction, and method of operation are required because available apparatus used in treatment of other material of similar size is not suited for treating certain of these vegetal materials, such as sugar cane, having intrinsic moisture or natural sap content which tends to cause lumping, agglomerating build up or packing of material in the apparatus. I have found it desirable that the material treated be forced into and through the zone of disintegration and maintained under pressure during its passage therethrough. Further, my invention takes advantage of this same tendency of such vegetal materials to agglomerate by providing a novel internal screening closure and deflecting structure at a subsequent stage. The disintegrating zone includes novel hammer members, which reduce the vegetal material to a finely divided mass, and are designed to overcome the deleterious effects of tramp iron, stones and the like in the feed.

Briefly, my invention is comprised, essentially, of a housing having an inlet at one end and an outlet at the opposite end into which cut or chopped materials are force-fed through a restricted feed conduit at the top. The upper zone of the housing has additional force feeding mechanism which continually pushes or forces the material into and through the disintegrating zone in contact with a plurality of vertically spaced groups or sets of hingedly mounted hammer members so as to reduce the feed mass to a finely divided, substantially homogeneous mass and extrude or force it as substantially contiguous rod-like mass through a plurality of large, generally rectangular, apertures in an internal screening closure. The material forced through the apertures, is deflected downwardly by a plurality of vanes or baffles, which tend to choke the discharge from the apertures and aid the extruding process. The downwardly and outwardly positioning of the vanes or baffles directs the rod-like masses into contact with impellers which break up the rods and lumps of material and eject it for final movement through the outlet.

Because of the novel hinged or pivotal mounting arrangements for the hammers, tramp iron, rocks, and similar foreign materials do not damage the hammers with which they may come in contact. The same hammer mounting arrangement and construction also provides multiple selective arrangements of hammers at various positions in the disintegrating zone.

It is an object of my invention to provide a simple, efficient and economical method of disintegrating vegetal materials which is adapted to accommodate variations in properties and characteristics of such material by simple adjustments of component parts of the mechanism used in performing such methods.

Another object of this invention is to provide simple, durable and efficient apparatus for disintegrating vegetal materials which employs a force feeding action into, through and out of the disintegrating zone so as to maintain full capacity operation over extended periods of treatment.

Still another object is to provide a novel hammer arrangement which not only accomplishes the desired function of disintegration, but also employs a novel mounting to prevent damage to the hammers by foreign materials passing in contact therewith.

It is a further object of my invention to provide a novel closure and aperture arrangement enclosing the disintegrating zone which takes advantage of inherent characteristics of material being processed to obtain a superior disintegration.

Other features and advantages of my invention, including novel details of construction and combinations and arrangements of parts, will become obvious to those skilled in the art from the following description in which reference is made to the appended exemplary drawings.

In these drawings:

FIG. 1 is a partially broken side elevation of disintegrating apparatus embodying features of my inventive concept;

FIG. 2 is a section along the line 2—2 of FIG. 1;

FIG. 3 is a partial section taken along the line 3—3 of FIG. 1;

FIG. 4 is an alternative arrangement of hammer elements of a device such as shown in FIG. 1; and

FIG. 5 is a developed elevation of a portion of the enclosure for the disintegration zone in the apparatus of FIG. 1.

Before describing the drawings in detail, it should be understood that I do not wish to be limited thereby, but rather by the spirit and a scope of my invention as defined in the hereafter appended claims.

A disintegrator according to my inventive concepts is shown in FIG. 1 as including a generally tubular central housing section **10** connected between a discharge casing **11** and an upper housing **12** by means such as bolts **13** and **14**, respectively. Mounted on the top of the housing **12** is a housing **15** for supporting a power source **16** such as an electric motor.

The disintegrator preferably has an upper feed distributing zone **17** with a positive feed mechanism therein comprised of a plurality of vertically spaced impellers preferably in the form of the vertically mounted double screw conveyor **18**. The conveyor **18** is mounted on a central shaft **19** which is suitably supported by the bearing arrangement **20** and forms an extension of the power take off shaft **21** of the motor **16**. A second positive feed mechanism, also preferably a screw conveyor, and shown as double screw conveyor **25**, extends through a housing **26** adjoining a side of housing **12** at the top of distributing zone **17** to provide a force feed to said zone and a hopper **28** delivers the feed into housing **26**. The shaft portion **27** of the conveyor **25** extends outwardly for interconnection with a power source (not shown).

A disintegrating zone is disposed below the upper feed distributing zone **17** and receives the vegetal material force fed by conveyor **18**. A housing or closure **31** forms an annular extension of housing **12** and has a plurality of parallel rows of enlarged apertures **32** (see FIG. 5) which in commercial devices may be of the approximate dimensions of two and one-half inches wide by four inches high. The height of the closure member **31** is a substantial portion of the length of the central housing or casing **10** and preferably is about one-half the height thereof.

As shown in FIG. 5, the apertures **32** are arranged in upper and lower rows, and baffles such as baffles **33** and **34**, extend at a downward inclination from the top of each row in substantially parallel relationship. Baffles **33** extend outwardly beyond baffles **34** in spaced relation to housing **10** and define passages of substantially uni-

form size from top to bottom. As shown in FIG. 3, baffle 34 is formed in two sections 34*a* and 34*b* having end flanges 34*c* secured by bolts 34*d*. Baffle 33 may be assembled in the same way.

The lower end of the shaft 19 is maintained in a thrust-bearing relationship with a lower housing 35 by a supporting spider assembly 36. A plurality of vertically spaced hammer members 37 are supported on the shaft 19 for conjoint rotation therewith in substantially horizontal paths. The preferred manner of mounting these hammers is to sandwich them between a spacer 40 and a collar 41 disposed directly above and below each hammer 37. This arrangement is repeated and continued along the shaft from the top to bottom of the disintegrating zone. The collars and hammers are held together in the sandwich by elongated bolt and nut arrangements such as 45 and 45*a*.

In FIG. 3, it will be seen that the collar members 41 are keyed to the shaft 19 by an elongated key 42 fitting in opposed complementary slots in the collars and shaft. With this arrangement, each of the hammers 37 is adapted for limited horizontal pivotal movement, between pins 43, normal to the shaft. These pins are spaced at regular intervals around the collars, and will be referred to in more detail hereinafter. The dotted line 44 in FIG. 3 is indicative of the range or magnitude of pivotal movement of the hammers 37.

One or a plurality of impellers are mounted on shaft 19 below the hammers 37 for conjoint rotation therewith to intercept falling material discharged through openings 32. In the drawings, I have shown a pair of hinged impellers 50 and 51 spaced 180° relative to each other and mounted in the same horizontal plane. The outer ends of the impellers are disposed in closely spaced relation to housing 10 so as to contact falling material throughout the entire area of housing 10.

The pins 43 are arranged for selective interchangeable and staggered arrangements for mounting the hammers 37, such as the arrangement shown in FIG. 4, wherein the uppermost collar shown has three hammers mounted thereon. The collar below the uppermost, also has three hammers but they are staggered in non-equiangular relation to the uppermost hammers.

In assembling the hammers for a given operation, the spacing positions are selected and elongated bolts such as 45 or 45*a* are passed through aligned openings in the collars 41 and hammers 37. After securing the hammer spacing in this manner, pins 43 are inserted into the remaining openings so as to act as stops for limiting pivotal movement of the hammers.

In operation, a disintegrator such as shown in the drawings may be placed in a conventional material treatment circuit such as a sugar cane refinery. The material which is fed to the disintegrator will have been previously reduced to about three or four inch lengths and is fed into the feed hopper 28 and thence into contact with the positive feed means, or double screw conveyor 25. The rotating conveyor 25 in housing 26 forces the confined material into the upper feed zone 17. The double screw conveyor or positive feed means 18 rotating therein on the shaft 19, forces the material down into and through the intermediate disintegrating zone into contact with a plurality of vertically spaced sets or groups of hammers 37. The hammers also are moving in conjoint rotation with the shaft and they hammer and break up the material fed in contact therewith. The comminuted material is forced through the apertures 32 and because of the close spacing between the closure and the ends of the hammers and the inherent tendency of the material, such as vegetal materials to lump and agglomerate, such material is discharged through openings 32 as a rod-like extrusion. The rod-like masses of material passing through the apertures are subjected to the choking influence of the outwardly and downwardly extending baffle members 33 and 34. The deflected material then passes into contact with the impellers 50 and 51 which are also moving in conjoint rotation with the shaft 19. These impellers break up the rods and lumps of material which then fall through the casing 11 in a loosened or fluffy condition for disposition at any stage of the refinery operation.

Any tramp iron, rocks, and other relatively hard foreign material which is included in the feed material will not damage the hammers or impellers because of their pivotal hinged arrangement wherein upon contacting such hard materials, they pivot or move out of contact therewith, without damage to the hammers.

When different consistencies or toughness of feed materials are encountered, selective arrangement of the hammers between their respective collars may be made to provide increased efficiency. For instance, if a relatively tough material is being encountered, the uppermost collars may have only two or three hammers therebetween. The number of hammers in progressively lower series can then be increased and/or staggered with relation to the uppermost, to thereby obtain the desired consistency in the disintegrated product.

A distinctive feature of the structural arrangement previously described is the provision of a space of substantial vertical extent between the lowermost hammer member and the impellers 50 and 51 which permits passage of material outwardly into impact relationship with said impellers and discharge in a fluffy consistency distant from the shaft rather than packing around said shaft as otherwise might occur.

Another distinctive feature of the arrangement is the choking effect on the intermediate zone deriving from the position of baffles 33 and 34, which cause material in the intermediate zone to be delayed inwardly of the periphery of the enclosure before discharge through the apertures 32. Most of the hammer action is directed against material alined with said openings rather than material located between the walls of closure 31 and the outer ends of hammers 37, thereby preventing an accelerated passage of material through the intermediate zone and assuring adequate hammer impact to attain the desired reduction before such material passes out of the discharge apertures 32.

Having thus described my invention, what I desire to have protected by Letters Patent is set forth in the following claims.

I claim:

1. A disintegrator comprising a hollow housing having an upper feed distributing zone, an intermediate comminuting zone and a lower product removal zone inclusive of a bottom discharge outlet, a rotary shaft extending downwardly through said upper and intermediate zones, a plurality of vertically spaced hammer members hingedly supported from said shaft for conjoint rotation therewith within said intermediate zone, a stationary closure beyond the ends of said members having upper and lower rows of discharge openings of substantial vertical extent, a downwardly inclining baffle mounted on the exterior of said closure at the top of each row, at least one impeller supported for rotation by said shaft below said inclining baffles, a positive-feed mechanism for moving material to be disintegrated into said upper zone, a plurality of vertically-spaced impellers mounted on said shaft above said hammers for rotation in the said upper zone and arranged to direct incoming material downwardly into said intermediate zone, and means for rotating said shaft.

2. A disintegrator comprising a hollow housing having an inlet and an upper feed distributing zone, an intermediate comminuting zone and a lower product removal zone, inclusive of a bottom discharge outlet, a rotary shaft extending downwardly through said upper zone and into said intermediate zone, a plurality of vertically spaced hammer members hingedly supported from said

shaft for conjoint rotation therewith within said intermediate zone, a stationary closure beyond the ends of said members having upper and lower rows of discharge openings of substantial vertical extent, a downwardly inclining baffle mounted on the exterior of said closure at the top of each row, at least one impeller supported for rotation by said shaft below said inclining baffles, a positive-feed mechanism for moving a material to be disintegrated into said upper zone, said vertically-spaced hammer members being arranged to direct incoming material through said intermediate zone and out said openings, and means for rotating said shaft.

3. A disintegrator comprising a hollow housing having an inlet and an upper feed distributing zone, an intermediate comminuting zone and a lower product removal zone inclusive of a bottom discharge outlet, a rotary shaft extending downwardly through said upper zone and into said intermediate zone, a plurality of vertically spaced hammer members supported from said shaft for conjoint rotation therewith within said intermediate zone and hinged for pivotal movement normal to said shaft, a stationary closure beyond the ends of said members having upper and lower rows of discharge openings of substantial vertical extent, a downwardly inclining baffle mounted on the exterior of said closure at the top of each row, at least one impeller supported for rotation by said shaft beneath said inclining baffles, a positive-feed mechanism for moving material to be disintegrated into said upper zone, positive-feed means for moving material through said upper zone to said intermediate zone, said vertically-spaced hammer members and said impeller cooperating to direct incoming material downwardly through said intermediate zone and from said lower zone, and means for rotating said shaft.

4. A disintegrator comprising a hollow housing having an inlet and an upper feed distributing zone, an intermediate comminuting zone and a lower product removal zone inclusive of a bottom discharge outlet, a rotary shaft extending downwardly through said upper zone and into said intermediate zone, a plurality of vertically spaced hammer members hingedly supported from said shaft for conjoint rotation therewith within said intermediate zone, a stationary annular closure beyond the ends of said members having upper and lower rows of discharge openings of substantial vertical extent, a downwardly inclining baffle mounted on the exterior of said closure at the top of each row, at least one impeller supported for rotation by said shaft beneath said inclining baffles, a positive-feed mechanism for moving material to be disintegrated into said upper zone, said vertically spaced hammer members and said impeller cooperating to direct incoming material downwardly through said intermediate zone and from said lower zone, and means for rotating said shaft.

5. A disintegrator comprising a hollow housing having an inlet and an upper feed distributing zone, an intermediate comminuting zone and a lower product removal zone inclusive of a bottom discharge outlet, a rotary shaft extending downwardly through said upper zone and into said intermediate zone, a plurality of vertically spaced hammer members hingedly supported from said shaft for conjoint rotation therewith within said intermediate zone, a stationary annular closure beyond the ends of said members having upper and lower rows of discharge openings of substantial vertical extent around the closure, a downwardly inclining baffle mounted on the exterior of said closure at the top of each row, at least one impeller supported for rotation by said shaft beneath said inclining baffles, a positive-feed mechanism for moving material to be disintegrated into said upper zone through said inlet, positive-feed means for moving material through said upper zone to said intermediate zone, a plurality of said vertically-spaced impellers arranged to direct incoming material downwardly through said intermediate zone and through said openings, and means for rotating said shaft mounted on said housing.

6. A disintegrator comprising a hollow housing having an inlet and an upper feed distributing zone, an intermediate comminuting zone and a lower product removal zone inclusive of a bottom discharge outlet, a rotary shaft extending downwardly through at least said upper zone and into said intermediate zone, a plurality of vertically spaced hammer members hingedly supported from said shaft for conjoint rotation therewith within said intermediate zone, a stationary tubular closure surrounding the ends of said members having a plurality of vertically spaced rows of discharge openings of substantial vertical extent around said closure, a baffle member mounted on the exterior of said closure and having a planar bottom surface downwardly inclining from the top of each row, a pair of impellers supported in 180° relation to each other and in substantially the same horizontal plane by said shaft beneath said inclining baffles, a positive-feed mechansim for moving material to be disintegrated into said upper zone, said vertically-spaced hammer members arranged to direct incoming material downwardly through said intermediate zone and extrude it through said openings, and means for rotating said shaft.

7. A disintegrator comprising a hollow housing having an inlet and an upper feed distributing zone, an intermediate comminuting zone and a lower product removal zone inclusive of a bottom discharge outlet, a rotary shaft extending downwardly through at least said upper zone and into said intermediate zone, a plurality of vertically spaced hammer members hingedly supported from said shaft for conjoint rotation therewith within said intermediate zone, a stationary tubular closure surrounding the ends of said members having a plurality of vertically spaced rows of discharge openings of substantial vertical extent around said closure, a baffle member mounted on the exterior of said closure and having a planar bottom surface downwardly inclining from the top of each row, at least one impeller supported for rotation by said shaft beneath said inclining baffles, a positive-feed mechanism for moving material to be disintegrated into said upper zone, said vertically-spaced hammer members arranged to direct incoming material downwardly through said intermediate zone and extrude it through said openings, and means for rotating said shaft.

8. A distintegrator comprising a hollow housing having an inlet and an outlet, a second hollow housing mounted internally of said first housing and extending throughout a major portion of the length thereof, an upper feed distributing zone in said first housing including positive feed means, an intermediate comminuting zone in said second housing including a plurality of vertically spaced hammer members supported from a rotary shaft, a plurality of rows of discharge openings of substantial vertical extent in the said second housing member, baffle means having downwardly inclined bottom surface portions extending from the top of each of said openings, and at least one impeller supported on said shaft for rotation below said intermediate comminuting zone and said baffle means for impacting material descending from said baffle means.

9. A distintegrator comprising a hollow housing having an inlet and an outlet, a second hollow housing concentrically mounted internally of said first housing and extending throughout a major portion of the length thereof, an upper feed distributing zone in said first housing including positive feed means, an intermediate comminuting zone in said second housing including a plurality of vertically spaced hammer members supported from a rotary shaft, a plurality of rows of discharge openings of substantial vertical extent in the said second housing member, baffle means having downwardly inclined bottom surface portions extending from the top of each of said openings, and at least one impeller supported on said shaft for rotation below said intermediate comminuting zone and said

baffle means for impacting material descending from said baffle means.

10. A distintegrator comprising a hollow housing having an inlet and an outlet, a second hollow housing mounted internally of said first housing and extending throughout a major portion of the length thereof, an upper feed distributing zone in said first housing including positive feed means, an intermediate comminuting zone in said second housing including a plurality of vertically spaced hammer members supported at angles relative to each other from a rotary shaft, a plurality of rows of discharge openings of substantial vertical extent in the said second housing member, baffle means having downwardly inclined bottom surface portions extending from the top of each of said openings, and at least one impeller supported on said shaft for rotation below said intermediate comminuting zone and said baffle means for impacting material descending from said baffle means.

11. A disintegrator comprising a tubular housing having an inlet and an outlet, a tubular closure concentrically mounted internally of said housing and extending a major portion of the length thereof, positive feed means to feed material to the inlet, said inlet opening from an upper feed distributing zone in which is mounted second positive feed means, an intermediate comminuting zone in said tubular closure including a plurality of vertically spaced hammer members hingedly supported from a rotary shaft and arranged for limited pivotal movement in a horizontal plane normal to said shaft, a plurality of rows of discharge openings of substantial vertical extent in said tubular closure, baffle means having a downwardly extending bottom surface extending from the top of each of said openings, at least one impeller supported on said shaft for rotation below said intermediate comminuting zone and said baffle means for impacting material descending from said baffle means.

12. A disintegrator comprising a tubular housing having an inlet and an outlet, a tubular closure concentrically mounted internally of said housing and extending a major portion of the length thereof, positive feed means to feed material to the inlet, said inlet opening from an upper feed distributing zone in which is mounted second positive feed means, an intermediate comminuting zone in said tubular closure including a plurality of vertically spaced hammer members hingedly supported from a rotary shaft and arranged for limited pivotal movement in a horizontal plane normal to said shaft, upper and lower substantially horizontal and parallel rows of discharge openings of substantial vertical extent in said tubular closure, baffle means having a downwardly extending bottom surface extending from the top of each of said openings, at least one impeller supported on said shaft for rotation below said intermediate comminuting zone and said baffle means for impacting material descending from said baffle means.

13. A disintegrator comprising a first hollow housing having an inlet and an outlet, a second hollow housing concentrically mounted internally of said housing extending throughout a major portion of the length of the first housing, said inlet opening from first positive feed means into an upper feed distributing zone in said first housing which is inclusive of second positive feed means, an intermediate comminuting zone in said second housing including a plurality of vertically spaced hammer members supported in parallel horizontal planes by a rotary shaft extending through the first and second housings, upper and lower rows of discharge openings of substantial vertical extent around the said second housing, downwardly inclined baffle means depending from the top of each opening, a pair of impeller members supported for rotation by said shaft below said intermediate comminuting zone and said baffle means, and said impeller members being mounted about 180° relative to each other in substantially the same horizontal plane.

14. A disintegrator comprising a hollow housing having an upper feed distributing zone, an intermediate comminuting zone and a lower product removal zone inclusive of a bottom discharge outlet, a rotary shaft extending downwardly through said upper and intermediate zones, a plurality of staggered groups of vertically spaced hammer members hingedly supported from said shaft for conjoint rotation therewith within said intermediate zone, a stationary closure beyond but substantially adjacent the ends of said members having upper and lower rows of discharge openings of substantial vertical extent, a downwardly inclining baffle mounted on the exterior of said closure at the top of each row, at least one impeller supported for rotation by said shaft below said inclining baffles, a positive-feed mechanism for moving material to be disintegrated into said upper zone, positive-feed means mounted on said shaft above said hammers for rotation in the said upper zone and arranged to direct incoming material downwardly into said intermediate zone, and means for rotating said shaft.

15. A disintegrator comprising a hollow housing having an upper feed distributing zone, an intermediate comminuting zone and a lower product removal zone inclusive of a bottom discharge outlet, a rotary shaft extending downwardly through said upper and intermediate zones, a plurality of sets of vertically spaced hammer members hingedly supported from said shaft for conjoint rotation therewith within said intermediate zone, a stationary closure beyond the ends of said members having upper and lower rows of discharge openings of substantial vertical extent, a downwardly inclining baffle mounted on the exterior of said closure at the top of each row, at least one impeller supported for rotation by said shaft below said inclining baffles, a positive-feed mechanism for moving material to be disintegrated into said upper zone, positive-feed means mounted on said shaft above said hammers for rotation in the said upper zone and arranged to direct incoming material downwardly into said intermediate zone, and means for rotating said shaft.

16. A disintegrator comprising a hollow housing having an upper feed distributing zone, an intermediate comminuting zone and a lower product removal zone inclusive of a bottom discharge outlet, a rotary shaft extending downwardly through said upper and intermediate zones, a plurality of sets of hammer members hingedly supported from said shaft in a plurality of vertically spaced substantially parallel horizontal planes for conjoint rotation with said shaft within said intermediate zone, a stationary closure mounted in said intermediate zone beyond the ends of said hammer members and having upper and lower rows of discharge openings of substantial vertical extent, a downwardly inclining baffle mounted on the exterior of said closure at the top of each row, at least one impeller supported for rotation by said shaft below said inclining baffles, a positive-feed mechanism for moving material to be disintegrated into said upper zone, positive-feed means mounted on said shaft above said hammers for rotation in the said upper zone and arranged to direct incoming material downwardly into said intermediate zone, and means for rotating said shaft.

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