June 19, 1945. R. J. S. CARTER 2,378,393

IMPACTING MACHINE

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Fig. 1

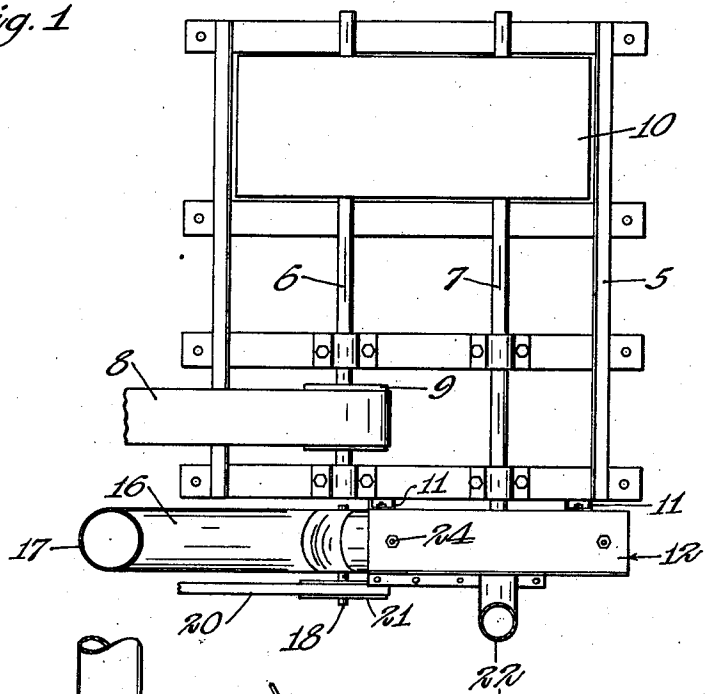
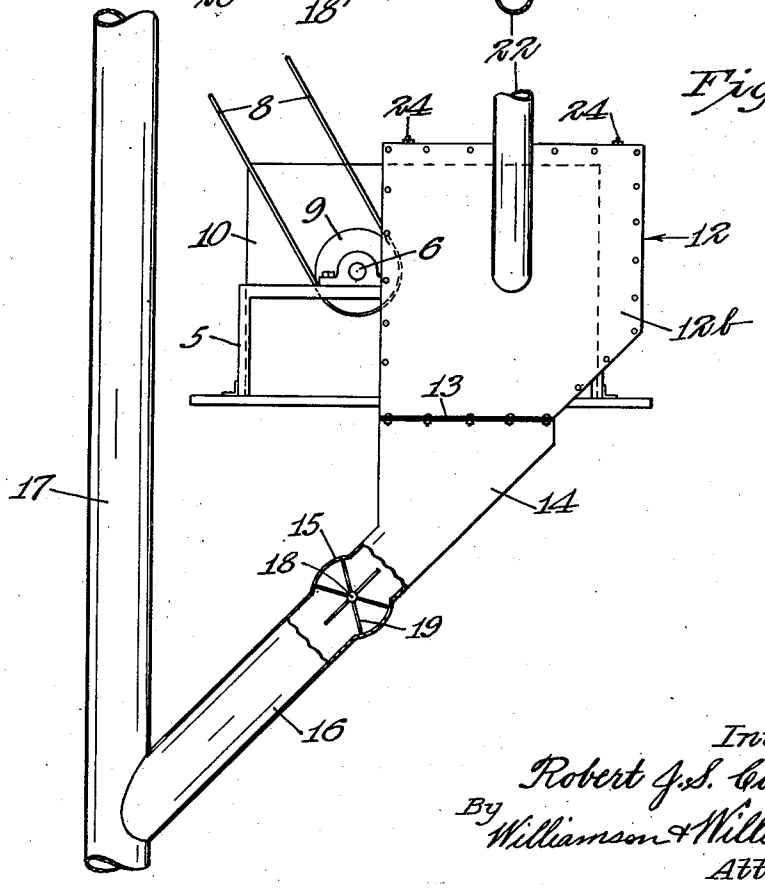


Fig. 2



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Fig. 4

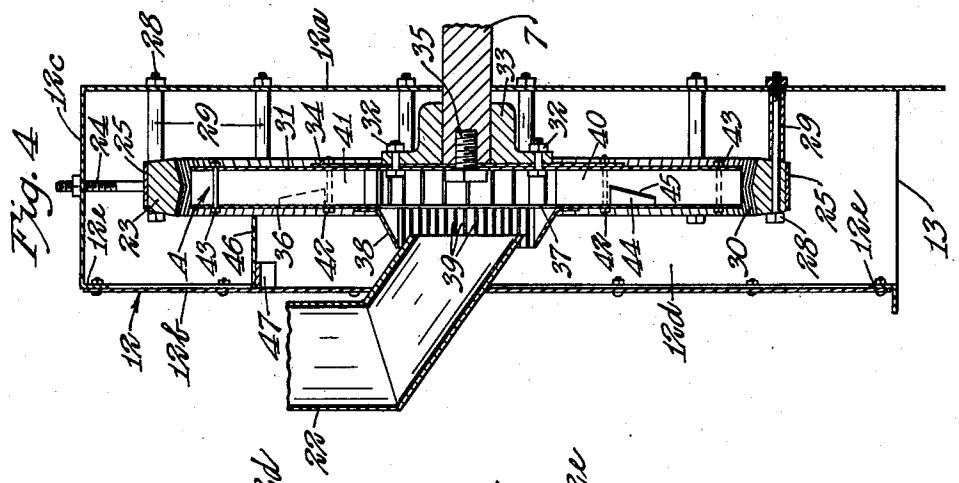
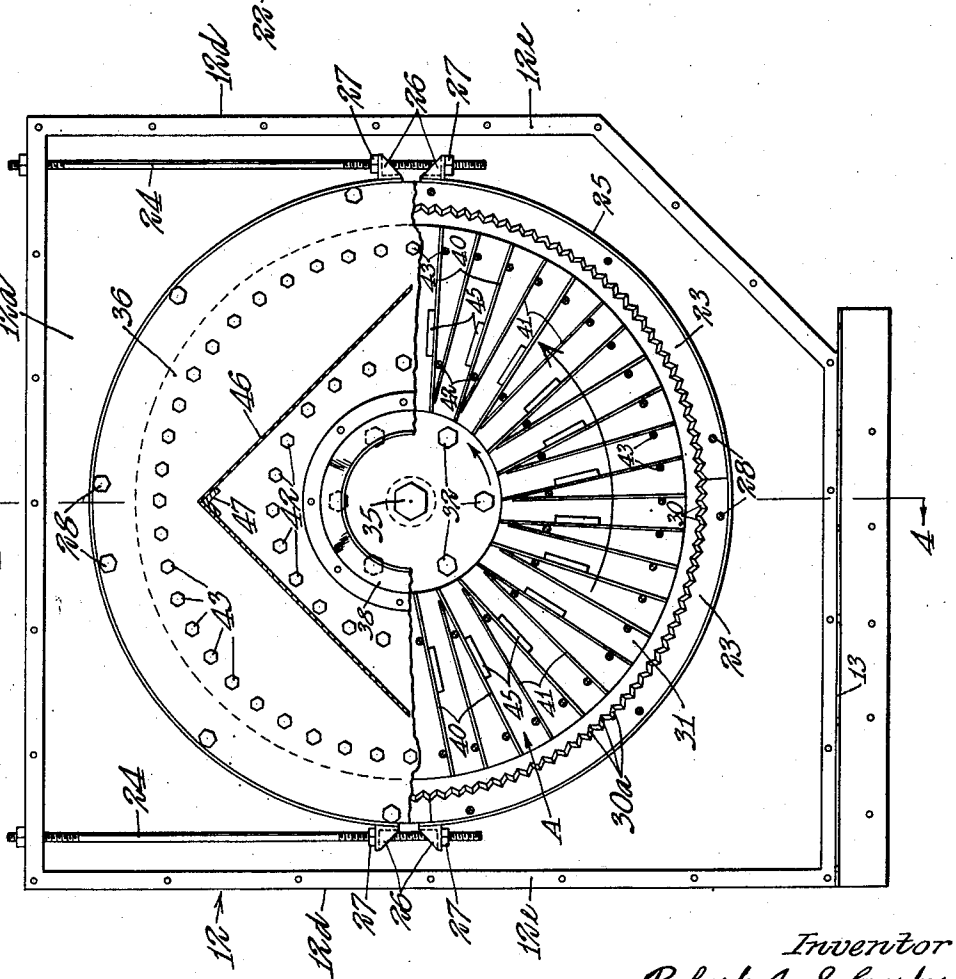


Fig. 3



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2,378,393

UNITED STATES PATENT OFFICE

2,378,393

IMPACTING MACHINE

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Application June 22, 1942, Serial No. 447,928

7 Claims. (Cl. 241—40)

This invention relates to impacting machines for shattering or breaking up granular material.

Certain features of the impacting machine forming the subject matter of this invention are illustrated and described but not claimed in my application for patent entitled "Milling process," filed May 11, 1942, Serial No. 442,439 and, therefore this application discloses improvements on the machine employed in the process of said prior application.

It is one of the objects of the invention to provide a novel and improved centrifugal impacting machine including an impact ring and an impeller which throws out granular material against the impact ring, the impact ring being so constructed that the grain thrown will strike surfaces on the impact ring substantially normal to the direction of movement of the thrown out grain.

Another object of the invention is to provide in such an impacting machine means for carrying the material laterally of the impact ring after the granular material has once struck the ring and been shattered or broken up.

A further object is to provide a centrifugal impacting machine including an impact ring, a centrally fed impeller working within the ring, and means for so delivering the granular material from the impeller that the granular material will move in thin streams against the ring and yet the machine will have high capacity.

One other object in such an impacting machine is to prevent back feed of impacted granular material through the machine a second time.

The objects and advantages of the present invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the various views, and in which—

Fig. 1 is a plan view of a machine embodying the invention;

Fig. 2 is a front elevation thereof;

Fig. 3 is a view on enlarged scale of the impactor showing the same partly in vertical section with the front plate of the machine removed; and

Fig. 4 is a vertical section taken on the line 4—4 of Fig. 3 as indicated by the arrows.

Referring to the drawings and first to Figs. 1 and 2 there is shown a typical installation of an impacting machine embodying the invention. There is provided a suitable frame work 5 within which a pair of shafts 6 and 7 are journaled. The shaft 6 may be driven in any suitable manner from a source of power as by means of a belt 8 working over a pulley 9 secured to the shaft 6. The shaft 7 is driven from the shaft 6 by means of a housed speed changing mechanism 10, the details of which are not shown, so as to allow the shaft 7 to be driven at any desired speed relative to the shaft 6. Secured to one end of the frame 5 as by means of channel bars 11 is the casing 12 of the impacting machine proper. This casing 12 has a discharge mouth 13 connected by a hopper 14 to a wing feeder 15 which discharges into a chute 16 running downwardly and connecting as to elevator chute 17. The wing feeder 15 has a substantially cylindrical portion through the center of which a shaft 18 extends and this shaft carries a series of radial vanes 19 working within the cylindrical part of the feeder. The shaft 18 may be driven from any suitable source of power as by means of a belt 20 working over a pulley 21 secured to the shaft 18.

Referring now particularly to Figs. 3 and 4, it will be seen that the casing 12 as there shown includes a rear wall 12*a*, a front wall 12*b*, a top wall 12*c* and side walls 12*d* and 12*e* respectively. In the particular casing shown the lower part of the side wall 12*e* is diagonally slanted to carry the material properly to the discharge mouth 13. The shaft 7 extends centrally through the rear wall 12*a* into the casing 12 while a feed chute 22 has an angular extension projecting through an opening in the front wall 12*b* into the interior of the casing 12.

Centrally disposed within the casing 12 is a heavy impactor ring 23 preferably made up of a number of arcuate sections as the four sections shown. This impactor ring is hung from the top wall 12*c* of the casing by means of a pair of bolts 24 which carry a pair of substantially semi-circular bands 25 which embrace the several sections of the impactor ring 23. The ends of the two bands 25 are equipped with lugs 26 through which the bolts 24 extend and jamb nuts 27 are employed drawing together on the bolts 24 the adjacent end portions of the two bands 25. While most of the weight of the impactor ring 23 is supported by the two bolts 24 from the top wall 12*c* of the casing 12, the impactor ring 23 is nicely positioned in vertical alignment and held in proper relation relative to the rear and front walls 12*a* and 12*b* of the casing by means of nutted bolts 28 which run through the impactor ring 23 and through the rear walls 12*a* and project through spacing thimbles 29 disposed between the rear side of the ring 23 and the rear wall 12*a*.

The impactor ring 23 is of peculiar formation

in that it is provided at its inner periphery with a multiplicity of corrugations which extend generally transversely of the ring to provide a multiplicity of teeth 30 on the internal periphery of the ring. These teeth as best shown in Figs. 4 and 5 are slightly peaked at their central portions for a purpose presently to appear.

Disposed to work concentrically within the ring 23 in the casing 12 is an impeller designated as an entirety by the letter A. This impeller includes an inner circular disc 31 secured as by nutted bolts 32 to a hub 33 carried by the shaft 7 within the casing 12. To strengthen the central part of the inner disc 31 a circular sheet 34 may be provided which is also fastened by the bolts 22 to the hub 33. Preferably the central parts of the disc 31 and the sheet 34 are further secured to the shaft 7 by a heavy bolt 35 centrally mounted in the outer end of the shaft 7. Spaced from the disc 31 and also forming part of the impeller is an annular disc 36 having a central feed opening 37 therein. Attached to the annular disc 36 adjacent the edges of the feed opening 37 is a truncated conical feed mouth 38 equipped with a multiplicity of radially disposed triangular shaped distributing fins 39. Extending between the two discs 31 and 36 and running from adjacent the feed opening 37 to the outer peripheries of the two discs are a multiplicity of primary vanes or fling arms 40. Secured adjacent the inner end of each of the primary fling arms 40 in slightly outwardly spaced relation from its inner end is a secondary vane or fling arm 41. The primary and secondary fling arms 40 and 41 are preferably attached together as by welding and the inner portions of each pair of primary and secondary fling arms are secured to the discs 31 and 36 and the discs are secured together by means of nutted bolts 42 which are received between the inner angular portions of the joined pair of fling arms. Outer nutted bolts 43 also extend between and interconnect the two discs 31 and 36 and each primary and secondary fling arm 40 and 41 is anchored to one of these outer bolts 43 as by welding thereto. With this arrangement a strong rigid impeller structure A is provided.

Each of the primary fling arms 40 in spaced relation from its inner end is provided with an opening 44 for a purpose presently to appear. This opening at its inner end is approximately equal, in the illustrated embodiment, to one-half the width of the primary fling arm 40 and the opening at one side of the same, as at the inner side, gradually diminishes in width. Secured to each primary fling arm 40 as along the inner side of the opening 44 and at the opposite side of the primary fling arm 40 from that side to which its companion fling arm 41 is attached, is a guard flange 45.

It will be noted that the inner ends of the primary fling arms 40 are regularly circumferentially spaced and that the outer ends of the primary fling arms are also regularly circumferentially spaced at the peripheries of the two discs 31 and 36. The outer ends of the secondary fling arms 41 are intermediately spaced between the outer ends of the adjacent primary fling arms 40 and as a result there is a regular circumferential spacing between the outer ends of all the various fling arms.

The angularly extending portion of the feed chute 22 extends to a point within the feed mouth 38, there being free clearance for rotation of the feed mouth 38 relative to the chute 22. To prevent impacted grain thrown out from upper portions of the impactor ring 23 from working into the impeller A between the feed mouth 38 and the adjacent portion of the feed chute 22, there is provided an angular roof 46 which is secured to the front wall 12b of the casing as by suitable supporting bracket 47.

In operation the shaft 6 is driven as by the belt 8 running over the pulley 9. The speed changing mechanism 10 is so regulated that the shaft 7 will be turned at a desired speed relative to the shaft 6. Inasmuch as any suitable speed changing mechanism may be employed for the purpose of driving the shaft 7 from the shaft 6 and varying the speed of rotation of the shaft 7 as desired, it is thought unnecessary to describe or illustrate the speed changing mechanism in detail. The shaft 7 will be driven so as to rotate the impeller A at high speed in the direction indicated by the arrow in Fig. 3. The grain to be impacted is fed in a continuous stream through the feed chute 22 into the feed mouth 38. The triangular fins 39 distribute the fed grain to the passages of the impactor formed between the inner ends of the adjacent primary fling arms 40. The primary fling arms 40 catch this grain and the grain bearing against the advancing sides of the primary fling arms 40 is slid outwardly on the primary fling arms 40 through centrifugal action. As the grain works outwardly to the openings 44 in the primary fling arms, half of the grain drops through these openings on to the secondary fling arms 41, the remaining half of the grain being still carried by the primary fling arms 40. After half of the grain is slid outwardly on the primary fling arms 40 past the inner ends of the openings 44, this grain tends to fan out to the full width of the primary fling arms 40 and to prevent more than half of the grain from working through the openings 44, flanges 45 are provided which guard against such action. The grain after being divided in the manner specified between the primary fling arms 40 and the secondary fling arms 41 is carried on outwardly through centrifugal force to be thrown from the ends of the primary and secondary fling arms against the teeth 30 of the corrugated impactor ring 23.

Assuming that the impeller is rotating in a counterclockwise direction as indicated by the arrow in Fig. 3 the grain discharged from the ends of the primary and secondary fling arms 40 and 41 will strike the surfaces of the teeth 30 which are designated 30*a*. The corrugations which form the teeth 30 are so made that the surfaces 30*a* are disposed substantially normal to the general direction of movement of the grain as it is flung off from the impeller A against the impacting ring 23. The grain as it works off the outer ends of the fling arms 40 and 41 has a radial component of force due to the centrifugal action imparted thereto by the impeller and the grain also has another component of force substantially tangential to the various ends of the respective fling arms. The resultant line of movement of the grain as it is ejected from the impeller causes the grain to strike the surfaces 30*a* of the teeth almost squarely with great violence thereby shattering the grain. By reason of the fact that the teeth 30 are slightly peaked, the grain after striking the surfaces 30*a* of the teeth 30 glances off to the two sides of the impactor ring 23 so that the once impacted grain will not stand in the way of the succeed-

ing grain thrown out by the impeller and interfere with proper impacting action.

The shattered grain that has been impacted drops through the discharge mouth 13 of the casing into the hopper 14 and then runs down into the wing feeder 15, the vanes 19 of which feed the material into the chute 16 and thence into the chute 17. The impeller A in addition to throwing the grain out violently against the impactor ring 23 has a centrifugal fan action and the wing feeder 15 prevents air from being forced violently into the chute 16 past the feeder. The roof 46 prevents to a large extent the carrying back of the impacted grain into the feed mouth 38, whereby double impaction of the grain is prevented. Of course, a certain amount of air thrown out by the fan action of the impeller will work back to the space between the feed mouth 38 and the end of the feed chute 22 into the central part of the impeller. It should be noted that the end of the feed chute 22 disposed within the feed mouth 38 is located close to the upper part of the mouth but spaced from the lower part of the mouth. This is done deliberately so that back feed of air into the mouth will be largely at the lower portion thereof whereby the entering air will rise against the stream of grain discharged from the feed chute to lift this discharged grain and counteract to some extent the force of gravity whereby more even distribution to all the passages formed between the inner ends of the primary fling arms 40 is obtained.

The purpose of employing the secondary fling arms 41 in conjunction with the primary fling arms 40 is to secure high capacity of the impactor while still permitting the grain to be discharged from the various fling arms in thin streams or sheets. By reason of the fact that the grain is fed centrally to the rotary impeller, the circle about which the inner ends of the primary fling arm 40 is arranged is quite small and the passages between the inner ends of the primary fling arms are of limited size. By employing the secondary fling arms 41 and equipping the primary arms 40 with the openings 44 and the flanges 45 the capacity of the machine may be greatly increased over what it would be if merely the primary fling arms 40 were used with no openings through these fling arms. It will, of course, be appreciated that the capacity of the machine could be still again increased in impellers of sufficient diameter by again subdividing the streams moving outwardly on the fling arms under centrifugal force and employing additional auxiliary fling arms with appropriate openings through the existing fling arms.

With the corrugated impactor ring 23 it is found that a much better impacting effect is secured on the grain than when a smooth impactor ring is employed. This is undoubtedly due to the fact that with the tooth construction the grain hits the surface against which it is impacted much more squarely than is the case when a smooth faced impactor ring is employed.

The shattering action secured is controlled very largely by the speed of rotation of the impeller A and by varying this speed the granulation obtained may be regulated. The impactor is particularly effective for use in connection with the impacting of such cereal grains as wheat, rye, etc., although it will be understood that it may be used for breaking up and sub-dividing any type of granular material. An impactor can be used effectively as disclosed in my pending application for patent Serial No. 442,439 heretofore fully identified, to break out the germ of such cereal grains as wheat and rye in substantially whole form from the remainder of the grain berries. This is, of course, only one use to which the impactor may be put.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departure from the scope of the present invention which, generally stated, consists in the matter shown and described and set forth in the appended claims.

What is claimed is:

1. An impacting machine comprising an impact ring having a multiplicity of internal substantially transverse teeth, a horizontal shaft centrally disposed relative to said ring, an impeller including two spaced discs one of which has a central feed opening therein and a multiplicity of fling arms projecting from adjacent said opening to the outer peripheries of said discs, said impeller being secured to said shaft, a feed chute having a discharge portion extending into said feed opening of the disc provided therewith and a pitched roof overlying the discharge portion of said feed chute and disposed intermediately between the upper portion of said impact ring and said feed opening.

2. An impacting machine comprising an impact ring, a pair of spaced discs rotatably mounted within said ring, one of said discs being provided with a central opening, means for feeding granular material to said central opening to the space between said discs and a plurality of primary and secondary fling arms disposed between said discs, the primary arms extending from adjacent said opening to the peripheries of said discs and having passages therein intermediate the ends of the primary arms of less width than the width of the arms and said secondary arms being located between primary arms and running from points outwardly of the inner ends of said primary arms but inwardly from said passages to the outer peripheries of the discs, said discs and said primary and second fling arms forming an impeller and means for rapidly rotating said impeller.

3. The structure defined in claim 2, said primary fling arms having at their advancing sides upstanding flanges each disposed at the inner side of one of said passages for preventing lateral movement of a portion of the granular material moving outwardly along the associated fling arm.

4. An impacting machine comprising an impact ring, a shaft centrally disposed relative to said ring, means for rotating said shaft and an impeller secured to said shaft, said impeller comprising a pair of spaced discs, one of which has a central feed opening therein and a multiplicity of primary and secondary fling arms disposed between said discs, the primary arms extending from points adjacent said feed opening to the outer peripheries of said discs and having intermediate therein passages therethrough of less width than the full width of said primary arms and said secondary arms being connected to said primary arms outwardly from the inner ends of said primary arms and between the inner ends of said primary arms and said passages and projecting to the outer peripheries of said discs, whereby the material received between the inner ends of said primary arms is caused during rotation of said impeller to be divided and thrown

against said ring some by said primary arms and some by said secondary arms.

5. An impacting machine comprising an impeller mounted for rotation upon a horizontal axis, said impeller having a plurality of fling arms unobstructed at their outer ends, an impact ring mounted concentrically of said impeller and having a centrally peaked impact area forming outwardly and uniformly sloping surfaces from each side of the central peak whereby material impacted will be caused to discharge rapidly and laterally from both sides of said impact ring, a casing surrounding said impeller and said impact ring and having side walls spaced substantially from the sides of said ring for defining vertical passages for receiving laterally discharged impacted material from both sides of said ring and for permitting the same to freely drop downwardly by gravity for removal and means for feeding granular material to the center of said impeller to be acted upon by said fling arms.

6. An impacting machine comprising an impact ring, a pair of spaced discs rotatably mounted within said ring, one of said discs being provided with a central opening, means for feeding granular material to said central opening to the space between said discs and a plurality of primary and secondary fling arms disposed between said discs, the primary arms extending from adjacent said opening to the peripheries of said discs and having narrow passages therein intermediate the ends of the primary arms and said secondary arms being located between the primary arms and diverging outwardly from points adjacent the inner ends of said primary arms to the periphery of said disc, said disc and said primary and secondary fling arms forming an impeller and means for rapidly rotating said impeller.

7. An impacting machine comprising, a casing having a bottom discharge outlet, an impact ring mounted within said casing and having substantially transversely extending centrally peaked teeth on its inner periphery, a central horizontal shaft extending within said casing, means for rapidly rotating said shaft, and an impeller secured to said shaft, said impeller comprising a pair of spaced discs one of which has a central feed opening therein and a multiplicity of fling arms diverging from adjacent said feed openings to the peripheries of said discs, said impeller being disposed within said casing to work within said ring, said centrally peaked teeth providing oppositely disposed slopes merging into a central ridge for causing material impacted to discharge laterally at both sides of said ring and said teeth each having a substantial plane surface so related to said ring and the speed of rotation of the impeller as to lie substantially normal to the fling movement of the material processed, said casing having side walls spaced from the side of said ring and said impeller to provide passages for receiving impacted material discharged laterally from said sides of said ring and for permitting such material to drop by gravity downwardly to said discharge outlet.

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