July 7, 1964 A. E. ELMORE 3,139,917

APPARATUS FOR REDUCING MATERIALS

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Fig. 1.

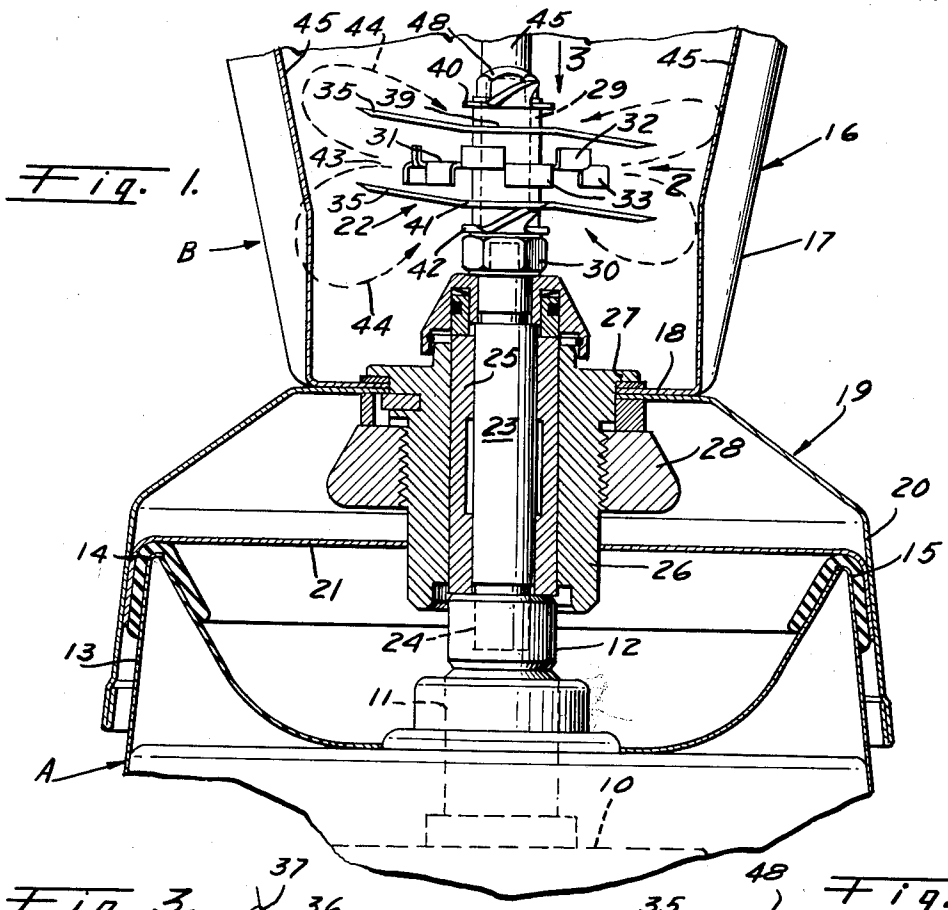

Fig. 3.

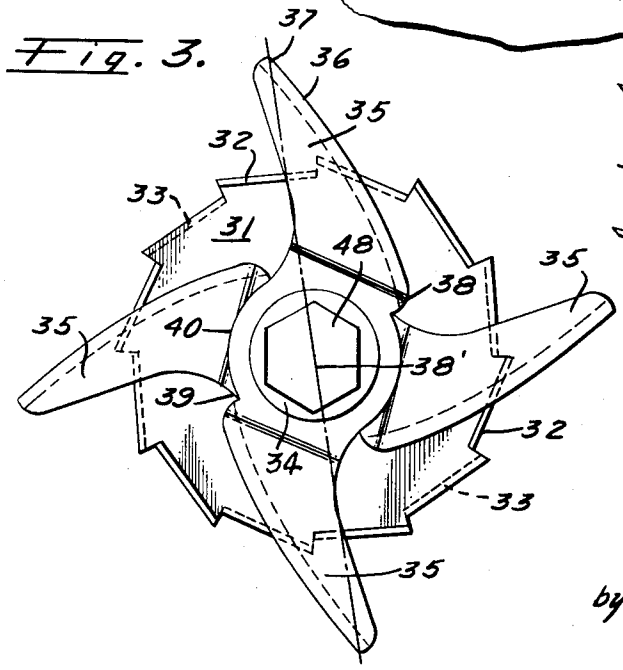

Fig. 2.

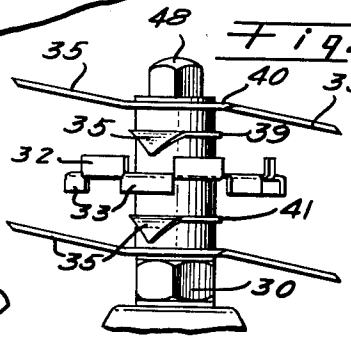

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Fig. 4.

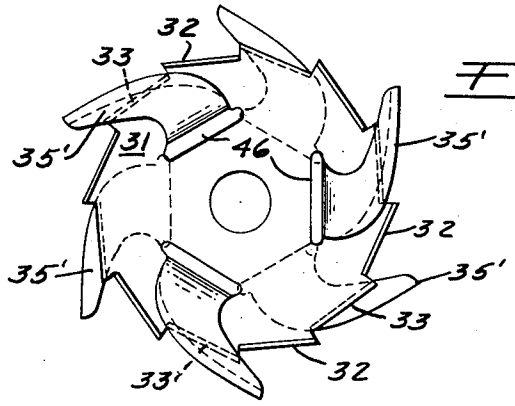


Fig. 5.

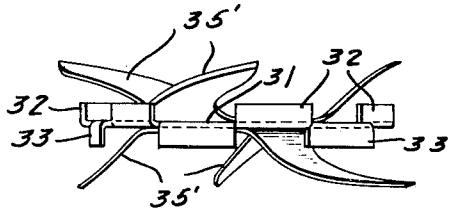


Fig. 6.

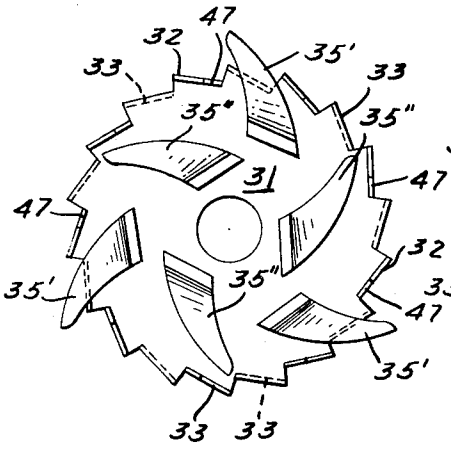
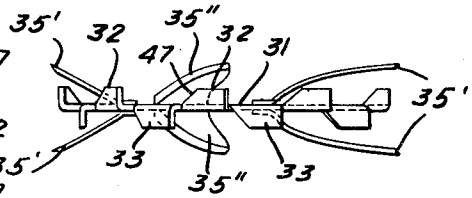


Fig. 7.



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APPARATUS FOR REDUCING MATERIALS

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Filed Aug. 8, 1961, Ser. No. 130,133
8 Claims. (Cl. 146—68)

The present invention relates generally to apparatus commonly referred to as mixers, blenders, liquifiers, and the like such as are conventionally utilized for the mixing and reduction of materials for industrial as well as domestic purposes; and is especially and more particularly concerned with improvements therein which will effectively and efficiently result in a reduction of foods such as meats, vegetables, fruits, and the like, to micro-fluid particles of such fineness that these particles may be readily passed through a small mesh screen without leaving a residue.

Conventional devices of this character have heretofore been constructed with cutters or knives with a view to cutting the material. However in the conventional devices, the knives have due to their inherent construction failed to produce the desired results for the reason that these knives have cutting edges which fail to produce a slicing action, and merely beat the material, thus leaving pulp fibers and the like in an unreduced condition.

Having the foregoing inherent disadvantages of conventional devices in mind, the present invention has for one object the provision of apparatus of the character described which includes an improved high speed impeller capable of operating at speeds of the order of 10,000–18,000 r.p.m., and which is so arranged that the material will be recirculated through paths containing a plurality of cutting blades or knives which will rapidly and efficiently reduce the material to micro-particles free of pulp, strings, and the like.

A further object is to provide as an article of manufacture, an improved high speed impeller construction embodying a unique combination of material circulating elements and material cutting elements in which the cutting elements are so arranged that the material will flow uniformly therebetween, and in which the cutting elements are staggered so as to not follow in the path of each other.

Another object is to provide as an article of manufacture, an impeller structure in which circulating vanes are positioned between upper and lower cutting blades having cutting edges which will function with a slicing effect, rather than a beating effect.

Still another object is to provide as an article of manufacture an improved double-ended integrally fabricated blade structure in which the blades are on opposite sides of an annular mounting portion, and having in each case an arcuate cutting edge which extends from a leading end adjacent the annular portion to a trailing end radially outwardly spaced from the annular portion.

Further objects of the invention will be brought out in the following part of the specification, wherein detailed description is for the purpose of fully disclosing several embodiments of the invention without placing limitations thereon.

Referring to the accompanying drawings, which are for illustrative purposes only:

FIG. 1 is a fragmentary elevational view of apparatus embodying the features of the present invention, a portion being shown in vertical axial section so as to disclose the operative relationship of certain elements thereof;

FIG. 2 is a side elevational fragmentary view of the impeller structure as it appears when viewed from the direction of the arrow 2 in FIG. 1;

FIG. 3 is a plan view of the impeller structure when viewed in the direction of the arrow 3 in FIG. 1;

FIG. 4 is a plan view of a modified impeller structure in which the impeller disc and cutting blades are incorporated in a single unit;

FIG. 5 is an elevational view of the structure of FIG. 4;

FIG. 6 is a plan view showing another modified impeller construction; and

FIG. 7 is an elevational view of the structure shown in FIG. 6.

Referring more specifically to the drawings, for illustrative purposes the invention is shown in FIG. 1 as being incorporated in mixing apparatus which comprises generally a base structure as generally indicated at A and a removable mixing container B.

The base structure is fabricated as a hollow casing which is adapted to house a driving electric motor **10** therein, this motor having a drive shaft **11** which terminates at its upper end in a recessed socket member **12**. The base structure is formed with an upper cap extension **13** which is centrally dished so as to provide an annular end flange **14** over which there is fitted a seat member **15** of resilient material. The socket member **12** is centrally positioned within the cap member, the socket member **12** being depressed below the annular flange or brim portion **14** of the cap.

The removable container B comprises a receptacle **16** having an outer wall **17** of generally tubular configuration, and which is open at its uppermost end, but closed at its lowermost end by a bottom wall **18**. Also extending below the wall **18** is a bottom base structure **19** which includes a flared skirt **20**, this base being adapted to normally support the container in an upright position, when detached from the base structure A, for filling the container with material or when cleaning it.

The skirt portion **20** is adapted to telescopically fit over the cap **13** and be positioned in a connected seated position in which a wall partition **21** in the base structure **19** is seated at its periphery on the seat member **15**.

The removable container B has mounted therein a rotatable impeller structure, as generally indicated by the numeral **22**, and which includes a rotatable shaft **23** which is supported in a suitable bearing support structure centrally of the bottom wall **18** with the uppermost end of the shaft **23** positioned within the receptacle **16**, and the lowermost end of the shaft **23** being formed with a multisided end projection **24** adapted to be removably seated in the socket member **12** so as to connect the drive shaft of the motor with the shaft **23** when the removable container B is associated with and seated on the base structure A.

The bearing structure for the shaft **23** may be of any desired conventional arrangement but is briefly shown as comprising a bearing sleeve **25** contained within a tubular bearing housing **26** which is secured in the bottom wall **18** by the cooperative clamping action of an end flange **27** on the bearing housing and a clamping nut **28** having threaded engagement with a portion of the bearing housing which is disposed below the bottom wall **18**. Suitable sealing gaskets are provided to prevent leakage.

As shown in FIG. 1, the rotatable impeller assembly **22** comprises a plurality of elements which will be described in detail, these elements being carried on a shaft extension **29** which terminates at its lowermost end in an internally threaded hexagonal connector portion **30** by which it may be secured to the uppermost end of the shaft **23**.

More specifically, the impeller structure comprises an impeller disc **31** having alternately upwardly projecting vanes **32** and downwardly projecting vanes **33** extending tangentially around the periphery of the impeller disc. Above and below the impeller disc, a set of cutting blades

15 are provided, the cutting blades being in spaced relation to each other and spaced from the impeller disc by suitable spacing washers.

As best shown in FIG. 3, the cutters are of double-ended construction and comprise in each case an annular portion 34 which defines a central opening for receiving the shaft extension 29 therethrough. The annular portion 34 has integrally formed on opposite sides thereof blade extensions 35—35, one of these extensions being upwardly and outwardly inclined, while the other is outwardly and downwardly inclined, as shown in FIGS. 1 and 2. Each of the blade extensions has a sharp bevelled and honed cutting edge 36, the bevel being on the underside of the blade in each case. This cutting edge, as shown in FIG. 3, extends from a tip point 37 which lies on a diametrically extending locus line 38' of the annular portion 34, and continues to an inner point as indicated at 38, this point being adjacent to the annular portion 34, but offset or spaced from the locus line 38'. With this construction, it will be observed that the point 38 of the cutting edge is the leading point of the edge, while the point 37 is the trailing point of the cutting edge. With this construction, rotation of the impeller assembly causes the cutting edges of the blades to operate with a slicing action rather than a hammering action with respect to the material in the container.

As shown in FIG. 1, the impeller assembly includes the impeller disc 31 with the vanes thereon, and an upper set of the double-blade structures composed of the blade elements 39 and 40, these elements being in spaced apart relation and in 90° angular disposition circumferentially of the extension shaft 29. The set of cutting blades below the impeller disc 31 consists of the blade elements 41 and 42, these elements being similarly disposed.

Considering now the operation of the impeller assembly as described above, when the impeller is rotated in a clockwise direction, as viewed in FIG. 3, the vanes 32 and 33 at the periphery of the impeller disc 31 will act to force the material in the receptacle outwardly in a flow path 43 between the upper and lower sets of cutting blades. When the outwardly moving material engages the outer wall 17 of the receptacle, the material will be separated into return flow paths 44—44 above and below the cutting blades, the cutting blades moving through the return flow paths as the material is returned to the central axis of the impeller and again recirculated by the vanes on the impeller disc. The material in the receptacle is prevented from general rotation with the impeller structure by providing inwardly projecting ribs 45 on the inner surface of the receptacle. By combined action of the vanes on the impeller disc in continuously recirculating the material through return paths having the cutting blades moving therein, the material will be rapidly and efficiently reduced to micro-particles which are devoid of fibers and strings, thus resulting in the production of a material which may be passed through a fine screen mesh without waste, and in the case of food materials, all the materials will be mixed and reduced to a micro-particle condition.

Instead of providing an impeller assembly in which the impeller disc and cutting blades are separate elements, it is within the concept of the present invention to provide impeller structures in which the blades and the impeller disc with its peripheral vanes are fabricated into a single unit of manufacture.

Referring now to FIGS. 4 and 5, there is disclosed a modified impeller structure in which the impeller disc 31 with peripheral vanes 32 and 33 has been constructed in the same manner as previously described. In this arrangement, however, the cutting blades are attached by welding or other conventional means at their innermost ends directly to the impeller disc 31, the point of attachment being indicated by the numeral 46. The blade 35' is in this case inclined outwardly and away from the disc 31, and the end portions of the blades extend beyond the peripheral vanes. In the arrangement disclosed, the blades secured to one surface of the disc 31 are in angularly spaced relation to the blades secured to the other surface of the impeller disc 31. The impeller assembly is thus simplified over that shown in FIG. 1, while the elements cooperate in the same efficient manner to reduce the material to micro-particles.

Referring now to FIGS. 6 and 7, a slightly modified structure incorporating the general features of the unitary arrangement shown in FIGS. 4 and 5 has been disclosed. In this further modified arrangement, the number of vanes has been increased over that shown in FIGS. 4 and 5, and the leading ends of the vanes have in this case been provided with an angularly inclined leading edge as indicated by the numeral 47. In addition to the blades 35' which extend beyond the periphery of the impeller disc, each set of blades on each side of the impeller disc 31 has additional blades 35'' which alternate with the blades 35'. The blades 35'', however, do not have their end portions extending beyond the periphery of the disc 31, but instead have their end portions inwardly spaced of the periphery.

By utilizing the modified structures shown in FIGS. 4 and 6, the cutting blades will be mounted as a unit with the impeller disc 31 as shown in FIG. 1, and it will be unnecessary to utilize the spacing washers since the unit assembly may be clamped as a single unit by providing short sleeves on either side of the impeller disc which are cooperable with the securing cap nut 48 which threadedly engages the uppermost end of the shaft extension 29 to mount the impeller assembly.

Various modifications may suggest themselves to those skilled in the art without departing from the spirit of my invention, and, hence, I do not wish to be restricted to the specific form or forms shown or uses mentioned, except to the extent indicated in the appended claims.

I claim:

1. Apparatus of the character described, comprising: a container having a bottom wall and a side wall; a rotatable shaft in said container extending above said bottom wall; an impeller disc spaced above said bottom wall carried by said shaft, said impeller disc having alternately upwardly and downwardly extending peripheral tangential vanes coacting with said side wall for circulating a material in the container in a substantially radial outward path from said shaft towards said side wall, said side wall deflecting the material from the outward flow path into return paths toward said shaft positioned above and below said outward path; and a plurality of cutting blades carried by and rotatable with said shaft, said blades extending above and below said impeller disc into the respective return paths of movement of said material.

2. Apparatus of the character described, comprising: a container having a bottom wall and a side wall; a rotatable shaft in said container extending above said bottom wall; an impeller disc spaced above said bottom wall carried by said shaft, said impeller disc at its periphery having vanes for circulating material centrally above and below the disc in the container in an outward path generally radially from said shaft towards said side wall, said side wall deflecting the material from the outward flow path into return paths towards said shaft respectively positioned above and below said outward path; and a plurality of cutting blades rotatable with said shaft, said blades extending above and other of said blades extending below said impeller disc and having inner end portions extending over the disc into the return paths of movement of said material, and outer end portions extending beyond the periphery of said impeller disc.

3. Apparatus of the character described, comprising: a container having a bottom wall and a side wall; a rotatable shaft in said container extending above said bottom wall; an impeller disc spaced above said bottom wall carried by said shaft, said impeller disc having upwardly and downwardly projecting peripheral vanes for circulating a material on the opposite sides of the disc in the con-

tainer in an outward path from said shaft towards said side wall and deflected return paths generally radially towards said shaft respectively positioned above and below said outward path; and a plurality of cutting blades carried by said impeller disc, certain of said blades extending above said impeller disc and other of said blades extending below said impeller disc into the return paths of movement of said material, and having end portions positioned adjacent said peripheral vanes.

4. Apparatus of the character described, comprising: a container having a bottom wall and a side wall; a rotatable shaft in said container extending above said bottom wall; an impeller disc spaced above said bottom wall carried by said shaft, said impeller disc having peripheral vanes coacting with said side wall for circulating a material in the container in an outward path from said shaft towards said side wall and return paths towards said shaft positioned above and below said outward path; and a plurality of cutting blades carried by said impeller disc, said blades extending above and below said impeller disc into the return paths of movement of said material, certain of said blades having end portions positioned inwardly of said peripheral vanes, and other of said blades having end portions extending beyond said peripheral vanes.

5. Apparatus of the character described, comprising: a container having a bottom wall and a side wall with inwardly projecting circumferentially spaced apart ribs, a rotatable shaft in said container extending above said bottom wall, and impeller means carried by said shaft including a plurality of vanes for moving material in the container in a circulatory path in the space between the shaft and container side wall, and a plurality of radially extending cutting blades extending into and movable through said circulatory path, said blades each having a curved cutting edge extending from an inwardly leading end to a trailing radial outer end.

6. As an article of manufacture, rotatable impeller means for material mixing and reducing apparatus, comprising: a disc member, a plurality of upwardly and downwardly projecting vanes carried by said disc for circulating a material over the disc surfaces, a plurality of cutter blades on the opposite sides of said disc, each of said blades being secured at its innermost end to said disc and being outwardly inclined away from the disc so as to position its outer end in spaced relation to said vanes.

7. As an article of manufacture, rotatable impeller means for material mixing and reducing apparatus, comprising: a disc member, a plurality of upwardly and downwardly projecting vanes carried by said disc for circulating a material over the disc surfaces, a plurality of cutter blades on the opposite sides of said disc, each of said blades being secured at its innermost end to said disc and being outwardly inclined away from the disc so as to position its outer end in spaced relation to said vanes, the cutter blades on one side of said disc being staggered with respect to the cutter blades on the other side of the disc.

8. As an article of manufacture, rotatable impeller means for material mixing and reducing apparatus, comprising: a disc member, a plurality of upwardly and downwardly projecting vanes carried by said disc at its periphery for circulating a material over the disc surfaces, a plurality of cutter blades on the opposite sides of said disc, each of said blades being secured at its innermost end to said disc and being outwardly inclined away from the disc so as to position its outer end in spaced relation to said vanes, and the cutter blades on each side of said disc having their ends alternately extending beyond and inwardly of the disc periphery.

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CERTIFICATE OF CORRECTION

Patent No. 3,139,917

July 7, 1964

Austin E. Elmore

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, lines 58 and 59, strike out "generally radially"; line 61, strike out "respectively"; same column 4, line 64, strike out "other of said blades extending".

Signed and sealed this 24th day of November 1964.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents