Aug. 11, 1959 W. K. WEYDANZ 2,899,181

APPARATUS FOR MIXING OR BLENDING LIQUID, PULPY, POWDERY, GRANULAR, OR FIBROUS MATERIALS

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Fig. 1

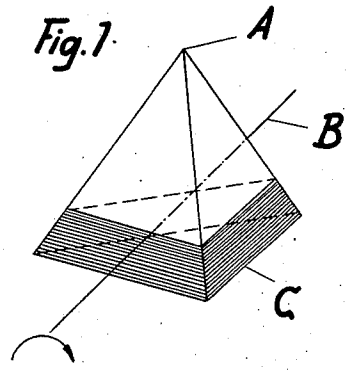


Fig. 2

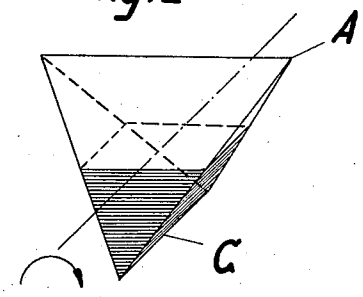


Fig. 3

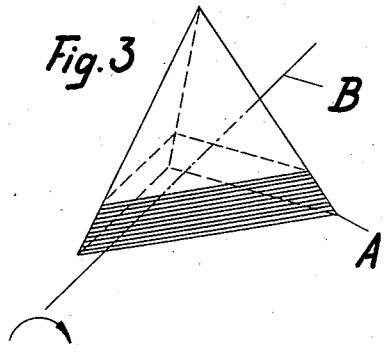


Fig. 4

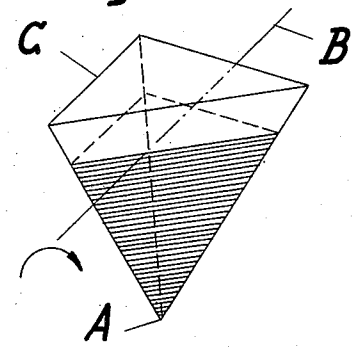


Fig. 5

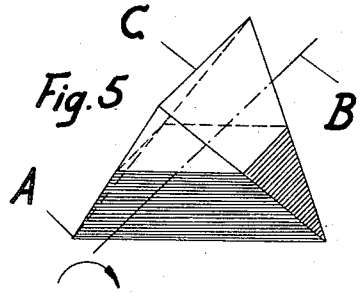
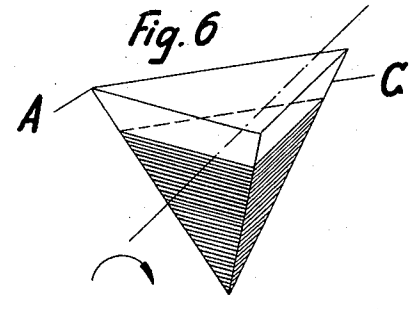


Fig. 6



INVENTOR
WILHELM KARL WEYDANZ

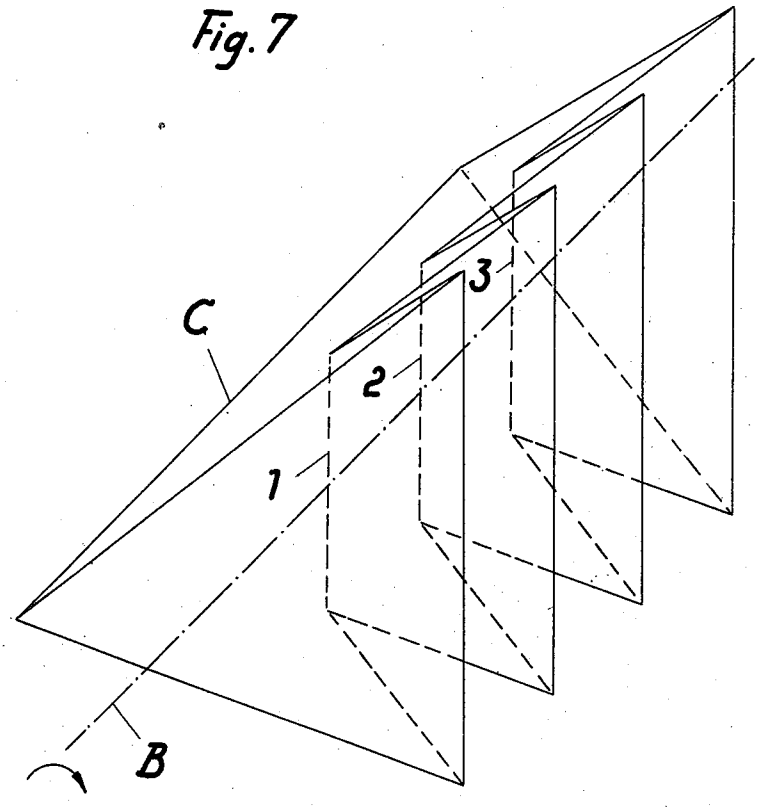
By Linton and Linton
ATTORNEYS

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Fig. 7



INVENTOR
WILHELM KARL WEYDANZ

By Linton and Linton
ATTORNEYS

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Fig. 8

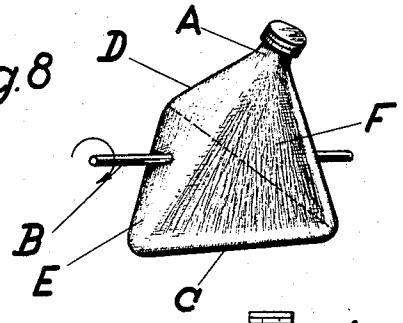


Fig. 10

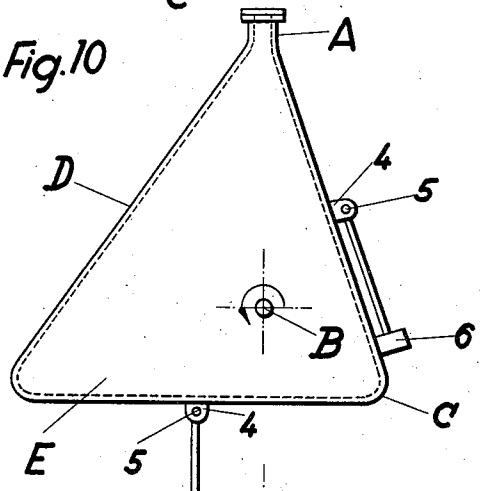
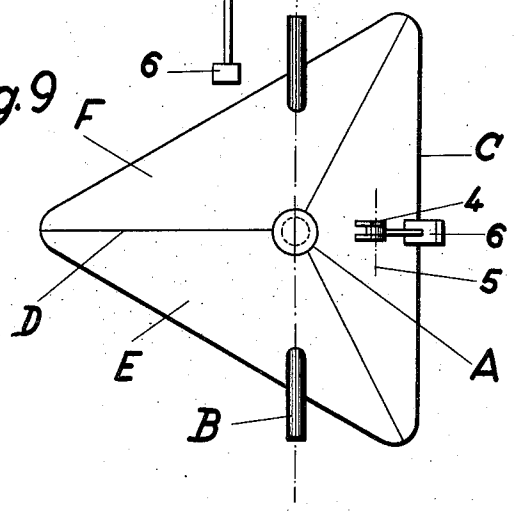


Fig. 9



INVENTOR

WILHELM KARL WEYDANZ,

By Linton & Linton

ATTORNEYS

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Fig. 11

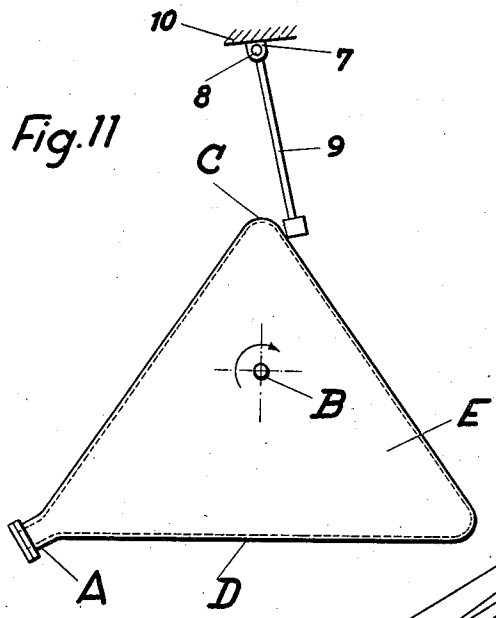
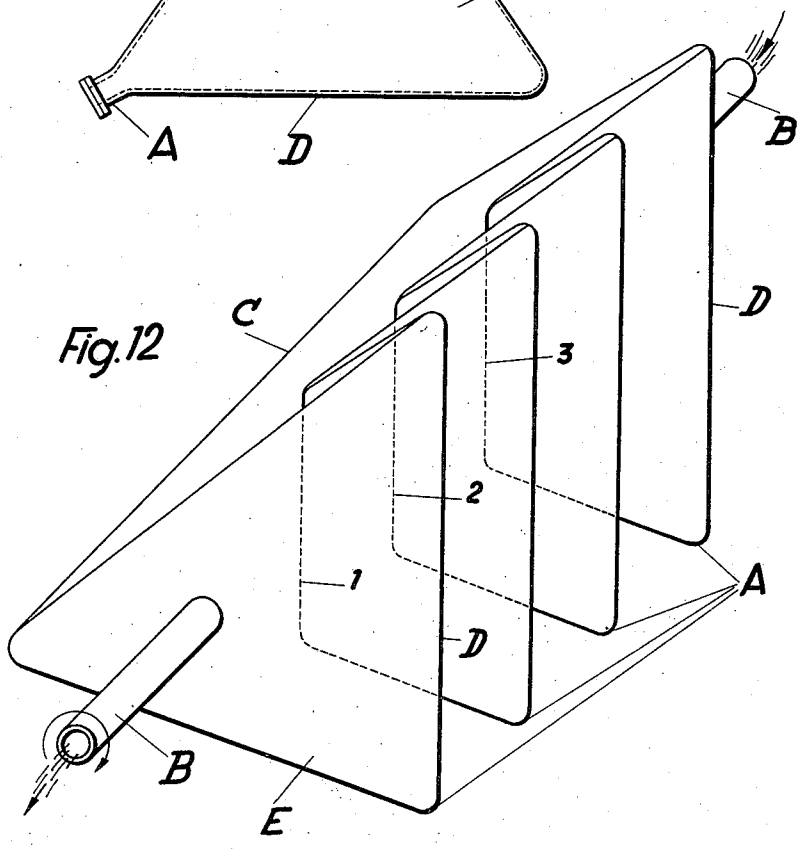


Fig. 12



INVENTOR

WILHELM KARL WEYDANZ,

By Linton + Linton

ATTORNEYS

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APPARATUS FOR MIXING OR BLENDING LIQUID, PULPY, POWDERY, GRANULAR, OR FIBROUS MATERIALS

Wilhelm Karl Weydanz, Gottingen, Germany, assignor to Fa. Penicillin-Gesellschaft Dauelsberg & Co., Gottingen, Germany

Application May 9, 1955, Serial No. 507,085

7 Claims. (Cl. 259—57)

The present invention relates to an apparatus for mixing or blending liquid, pulpy, powdery, granular, or fibrous materials.

For mixing such materials rotary containers are in general use. Inside such containers, which are not completely fully loaded, the materials are mixed due to the continuous tumbling motion. For this purpose tumbler and rotary devices have been developed, the inclined baffles of which give the materials an axial and radial motion, and the apex or vortex of which force varying amounts of differently composed materials from different places of the container to move and admix due to the continuously repeated change of position of the apex. There has also been developed a V-shaped mixing apparatus, the walls of which are oblique relative to the trunnion axis and ending in an apex.

It has been found that a very large number of changes in the shape of the materials to blend and best mixing efficiency in the direction from the surface to the center of the materials as well as in the axial direction is achieved when the rotary container essentially forms a triangular pyramid, and more particularly a tetrahedron.

The present invention relates to such rotary mixing apparatus of a shape substantially similar to a triangular pyramid, and more particularly to a tetrahedron. Common features of the devices as described above and the one in accordance with this invention are: simplicity of the structure, and thus simple and economical manufacture. The mixing apparatus in accordance with this present invention, however, provides improved efficiency in material mixing operations.

As in other differently shaped containers, milling means may be added to the materials to blend when a mixing and milling effect is required at the same time, or when the materials tend to compact and the conglomerate, the center of which being not subjected to the mixing operation, does not disperse during the tumbling action.

Sometimes materials have to be dealt with which do not flow freely, and which tend to collect in the corners and edges of the container, thus excluding the so collected portions from the mixing process. To eliminate this deficiency it is proposed to slant or round all or part of the corners and edges of the container which itself retains its basic shape. This can be done also to facilitate cleansing of the container.

As in other mixing containers it is advantageous also in the embodiment in accordance with this present invention to have the axis of rotation pass through the center of gravity of the container or in its proximity. The axis of rotation may also be disposed in various planes relative to the triangular pyramid. Not all of these possible arrangements, however, render a satisfactory mixing effect. It has been found that the mixing operation is highly efficient when the axis of rotation is in parallel with one of the sides of the triangular pyramid, or when it passes through the centers of two sides which do not meet in an apex.

If materials have to be admixed which tend to adhere to the walls of the container the adhering portions of the material would not partake in the mixing process. To prevent this adhesion the present invention therefore proposes to employ means which knock against the container. This can be done by arranging elastic or spring-suspended hammers or the like within the path of movement of the mixing container, or by providing the container itself with means which knock against the walls during the rotary motion of the container. In some cases adhesion can also be prevented by having the interior of the container covered with a protective coating which keeps the materials from sticking to the walls.

Besides at least one opening for loading and unloading the container, further openings for cleansing the container may be provided at suitable places on the walls. All openings can be provided with means so that they can be closed.

The highly efficient mixing operation of the container is also maintained if, in accordance with this present invention, several triangular pyramids or tetrahedrons are arranged one after the other on a common shaft, adjacent containers being interconnected so as to form a single, long mixing apparatus. The common container so constituted may be continuously loaded at its one end and continuously unloaded at its other end.

Two embodiments in accordance with this present invention are described in the following and illustrated in the accompanying drawings, of which

Figs. 1 to 6 are diagrammatic illustrations of one embodiment showing different phases of the tumbling action,

Fig. 1 shows a thin layer of material over all the surface of a tetrahedron.

Fig. 2 shows the tetrahedron rotated into the next position with some material piled up.

Fig. 3 shows the tetrahedron rotated into a next position with material again spread in a thin layer.

Fig. 4 shows the next position with the material piled deep in a vertex.

Fig. 5 shows the next position with the materials fallen into a trough between sides of the tetrahedron; and

Fig. 6 shows the next position with material again piled deep in a vertex.

Fig. 7 is a diagrammatic illustration of a second embodiment in which four tetrahedrons are combined to form a single mixing unit.

Fig. 8 is a perspective view of a device according to the present invention.

Fig. 9 is a plan view thereof.

Fig. 10 is a front view taken looking in the direction of the axis of rotation B of Fig. 9.

Fig. 11 is a modified form of an embodiment with knocker means outside of the container; and

Fig. 12 is a perspective view of a common container which is constituted of a plurality of assembled single tetrahedron containers of the kind shown in Fig. 8, and shows the continuous inflow and outflow of material.

Example I

25 kg. of a certain substance with a weight of 0.5 gr./cc. for the production of, for instance, medical tablets, are to be admixed with a small amount of 50 gr. of a valuable essence so that each tablet produced from the mixture contains equal amounts of the essence. Mixing is done in a rotary container substantially shaped like a tetrahedron with 1000 mm. long sides which is mounted on shaft means. The axis of rotation of the shaft means passes through the center of gravity of the tetrahedron. The lateral surfaces have 70 mm. wide bevelled sections. Three of the four apexes of the tetrahedron are bevelled by equilateral tri-

angles with 70 mm. long sides. One apex in the symmetry plane is bevelled by an equilateral hexagon with 70 mm. long sides. In its center this apex is provided with a loading and unloading opening of 100 mm. diameter. The opening can be closed. In the center of the opposite tetrahedron surface, an additional opening of 100 mm. diameter is provided to facilitate cleansing of the container.

The rotary shaft in a first embodiment extends through the container and is flanged to the walls. It is journalled in ball bearings and driven by a motor through means of a coupling. The driving shaft of the motor rotates at a speed of 36 r.p.m. which speed is imparted to the container.

After weighing and filling-in the basic substance and the essence the mixing container is rotated, and after a short time of operation the mixing operation has been thoroughly completed and the mixed material can be unloaded through the inlet and discharge opening.

Figs. 1 to 6 diagrammatically show the tetrahedron-shaped mixing container during different phases of the tumbling operation.

To simplify the drawings, the bevel form of the edges and apexes, and the inlet and cleaning openings, are not shown. Letter "A" designates the place where the inlet opening is arranged. "B" is the axis of rotation of the shaft which in this embodiment is in parallel with a side "C" of the container. The content of the container is shown by shade lines to illustrate the mixing operation. In this example the materials occupy approximately half of the volume of the container. The surface of the materials is shown as being horizontal, as will be the case in a position of rest. During operation the surface of the materials is sloping due to the centrifugal force and the pouring quality of the materials.

In Fig. 1 a thin layer of materials covers all of one tetrahedron surface. When turning the container into a position according to Fig. 2 the material flows into the space defined between two walls and the side C parallel to the axis of rotation, and forms a layer of medium height. Upon further rotation according to Fig. 3 the materials again spread on one tetrahedron surface in a thin layer. As rotation continues into a position according to Fig. 4 the materials flow from the wide area into the apex A where they form a deep layer. When rotating the container into a position as shown in Fig. 5 the materials side into a ridge portion defined by two surfaces and one side, perpendicular to the axis of rotation. When rotating the container into a position according to Fig. 6, the materials tumble into an apex and form a deep layer. Further rotation to the initial position according to Fig. 1 causes the materials accumulated in an apex to spread again in one thin layer, and the rotary operation cycle starts again.

Such a variety of different alterations in the shape of the mass of material results in a highly efficient mixing operation which is achieved with a container in accordance with this present invention. The materials are spread twice on one of the tetrahedron surfaces, they accumulate twice in an apex of the tetrahedron, and they are received twice inside a ridge portion, one of which being in parallel with the axis of rotation, the other one being perpendicular relative to the axis of rotation. This process is repeated during each revolution of the container.

It is also possible in a second embodiment to connect the rotary shaft whose axis is the axis of rotation and the container in another way. It is not necessary for the shaft to extend through the container. Two trunnions may be journalled in flanges on two sides of the tetrahedron. Furthermore, the container may be enclosed by a square flat iron clamp disposed within the plane of the surface of the materials shown in Fig. 2 or 5. A trunnion each is then fixed to the flat iron on both sides in the axial direction.

In Figs. 8–12, E and F are the two sides of the containers through which the axis of rotation B passes. Since the axis of rotation B is to pass through the center of gravity of the container and further is to pass parallel to an edge such as C, the location of the axis of rotation B is uniquely determined. It passes through the two walls E and F which meet in the edge B.

In Figs. 9 and 10, there is shown in addition the knocker **6** which swings on pivot **5** carried on lug or ear **4** mounted on the side of the tetrahedron, and impacts against the outer surface of the tetrahedron.

In the embodiment shown in Fig. 11, the knocker lies outside of the space which is traversed by the container. In this embodiment, the lug **7** and its pivot pin **8** and the knocker **9** are rotatably mounted on a fixed frame point **10**.

In Fig. 12, the four individual tetrahedrons intercommunicate by passages connecting adjacent tetrahedrons to form an array which is a common container.

Example II

Two or more different fertilizers, the quantity of which being predetermined in special devices, have to be processed continuously to render a uniform fertilizer mixture. The mixing container, the shape of which is diagrammatically shown in Fig. 7 is a common container which, is a combination of four individual containers of tetrahedron shape in accordance with this present invention. The sides of the tetrahedron are 2 metres long. The axis of rotation B of the common drive shaft passes through the centers of gravity of the four containers. Sides of the four tetrahedrons are in the parallel with the axis of rotation and form a side "C." The four tetrahedrons are arranged close to each other so that the three edges **1**, **2**, and **3** are level with the axis "B." The mixing container as a whole is carried in two rings, each of which runs on two rollers.

The rollers are driven by a motor so that the mixing container revolves 25 times per minute. The rings, the motors, and the rollers are not shown in Fig. 7.

The fertilizers are loaded into the mixing container at one of its ends by means of a worm-type elevator level with the axis, while at the other end a second conveyor means level with the axis receives the processed fertilizer mixture for transport so that the mixing container is always filled for approximately half its volume. The materials pass through all four of the tetrahedron containers. In each of the containers the materials are subjected to the tumbling operation as described in the above Example I. The ingredients are uniformly distributed in the processed fertilizer mixture transported by the conveyor means.

It will be apparent to those skilled in the art that this present invention is susceptible of various modifications to adapte it to particular applications, and all such modifications which are within the scope of the appended claims are considered to be within the spirit of this present invention.

I claim:

1. In apparatus for mixing comminuted materials, shaft means, support means comprising bearings in which said shaft means is rotatably journaled, a container substantially in the shape of a tetrahedron and having four substantially flat walls meeting to form edges and vertices, said container being rotatably so mounted on said shaft means that the axis of said shaft means passes the center of gravity of said container and parallel to one of said edges.

2. In apparatus for mixing comminuted materials, shaft means, support means comprising bearings in which said shaft means is rotatably journaled, a container substantially in the shape of a tetrahedron and having four substantially flat walls meeting to form edges and

vertices, said container being rotatably so mounted on said shaft means that the axis of said shaft means passes through the center of gravity of said container and parallel to one of said edges, said edges and said vertices being rounded.

3. In apparatus for mixing comminuted materials, shaft means, support means comprising bearings in which said shaft means is rotatably journaled, a container substantially in the shape of a tetrahedron and having four substantially flat walls meeting to form edges and vertices, said container being rotatably so mounted on said shaft means that the axis of said shaft means passes through the center of gravity of said container and parallel to one of said edges, and knocking means mounted externally of said container and adapted to knock against outer faces of walls of said container as the same rotates.

4. In apparatus for mixing comminuted materials, shaft means, support means comprising bearings in which said shaft means is rotatably journaled, a container substantially in the form of a tetrahedron and having four substantially flat walls meeting to form edges and vertices, said container being rotatably so mounted on said shaft means that the axis of said shaft means passes through the center of gravity of said container and parallel to one of said edges, and knocking means mounted externally of said container, and supporting means separate from said container and supporting said knocking means displaceably in the path of and engageable with external faces of walls of said container as the same rotates.

5. A container according to claim 1, the internal surfaces of said walls being provided wtih a protective coating which prevents the enclosed materials from sticking to said walls.

6. An apparatus for mixing comminuted materials characterized by a common container array constituted of a plurality of single individual containers, each in the shape of a tetrahedron and having four substantially flat walls meeting to form edges and vertices, the said single containers being arranged close to each other and intercommunicating to form the said common container, the said single containers having one common edge shaft support means comprising bearings in which said shaft means is rotatably mounted, the said single containers being mounted to have a common axis of rotation, said common container being rotatably so mounted on said shaft means for rotation about said common axis of rotation, that the axis of said shaft means passes through the centers of gravity of all said single containers and extends parallel to said common edge of said single containers.

7. Apparatus according to claim 6, said common container having openings at its ends near the axis of rotation for continually filling with unmixed materials and emptying the mixed materials.

References Cited in the file of this patent

UNITED STATES PATENTS

405,973	Welch	June 25, 1889
2,267,898	Cornell	Dec. 30, 1941
2,514,126	Fischer	July 4, 1950

FOREIGN PATENTS

375,755	Great Britain	Dec. 22, 1930