

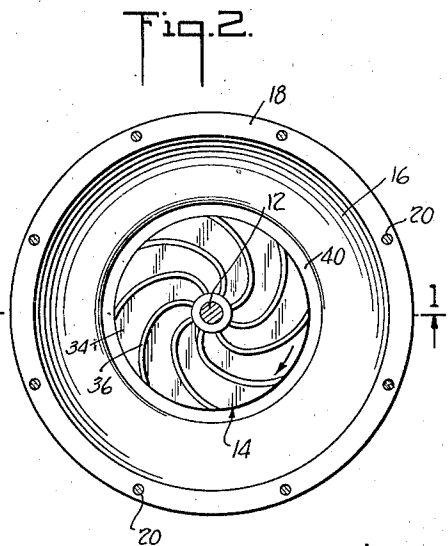
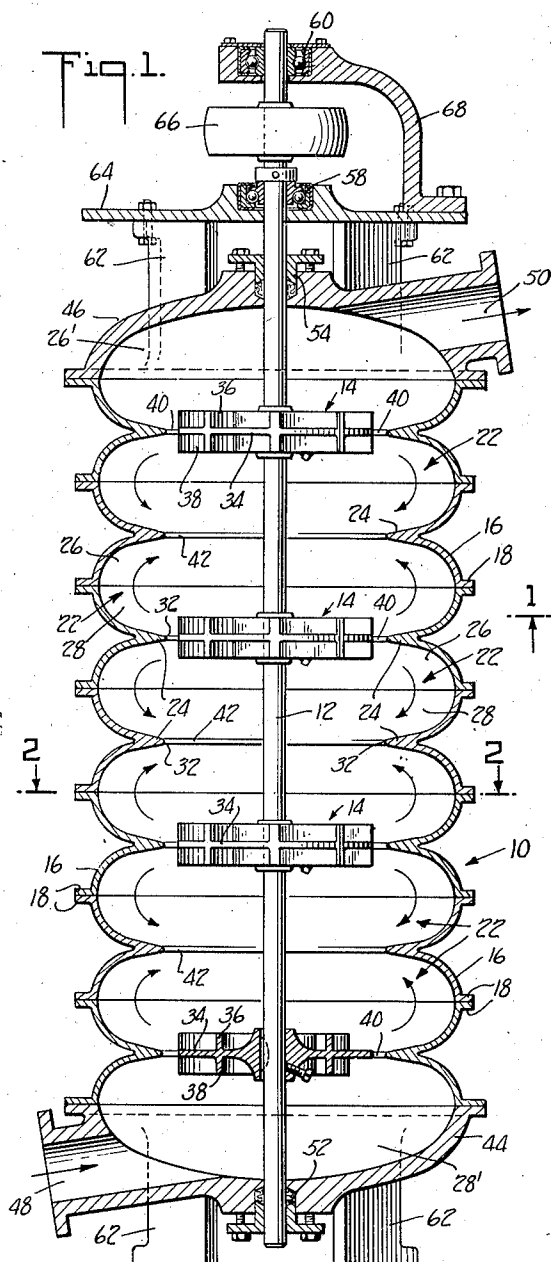
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CONTINUOUS MIXER

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CONTINUOUS MIXER

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My invention relates to a continuous mixer for the mixing of a liquid with another liquid or liquids, or the mixing of liquid material with solids and/or gases.

One purpose for which the invention is especially adapted, but however without limitation thereto, consists in producing a light foamy mix of distended fibrous material, which, upon being made into sheet form and dried, yields an extremely light sheet of distended fibrous material well adapted for sound and heat insulating purposes. Such illustrative mix can be made from components consisting of a watery pulp of fibrous material, preferably kraft pulp, air, a foaming agent or agents, such as saponin for example, for the production of strong air bubbles which can be extensively subdivided into bubbles very minute in size, and sizing materials such as wax or resin size. A foamy mix of such materials produced by the process of the present invention has excellent stability properties and stands up well in continuous formation into sheet form, and can be dried into a relatively strong, stable sheet without material collapse or densification.

One object of the invention consists in the provision of a mixer by which the materials to be mixed are passed through a series of aligned annular passages, and these materials as they pass through these annular passages are struck and crossed by outwardly directed streams consisting of other parts of the material to be mixed, and a very effective mixing action is secured by the crossing streams of material produced as described.

A further object of the invention consists in the provision of a mixer whereby the materials to be mixed are passed through a series of annular aligned passages, while other parts of the material are being thrown outward against and across such stream, and such thrown-out material or the principal part thereof is returned inwardly to be repeatedly thrown outward against and across to the streams of mix material passing through the annular passages.

In order to secure continuous operation, the mixer casing is preferably made in the shape of an elongated, generally cylindrical structure, and means are provided for supplying materials to be mixed at one end, preferably the lower end when the casing stands vertically, and discharged from the opposite end, preferably the upper end in case the arrangement is vertical. The passage of the materials to be mixed through the mixing apparatus may be effected in various ways, as by pumping for example, and the casing need not

be vertical but may be arranged horizontally or in other ways.

The aligned annular passages through which the material is passed in the course of the continuous mixing thereof are provided by making the casing of constricted form at a plurality of regions throughout the length thereof, and utilizing such constricted casing wall parts to define the outer walls of the annular passages. The inner walls of the annular passages are defined by impeller discs placed opposite certain of said casing constrictions, the diameter of the impeller discs being sufficiently less than the diameter of the constricted casing parts to leave narrow annular passages therebetween.

In the accompanying drawing forming a part of this specification,

Fig. 1 is a vertical sectional view on line 1—1 of Fig. 2 of a mixer in accordance with my invention; and

Fig. 2 is a transverse sectional view on line 2—2 of Fig. 1.

The mixer of the present invention, in its preferred form, comprises a casing 10, and an impeller shaft 12 extending axially through the casing 10 and provided with impellers 14.

The main part of the casing is preferably made up of a series of identical and reversible ring-like castings 16 provided with flanges 18 by which they may be secured together in any desired way, as for example with bolts, bolt holes 20 for such purpose being shown in Fig. 2. The casting members are of such formation as to provide the highly flattened spheroidal chambers 22 and the constricted casing wall parts 24 therebetween. A convenient way to produce the casing having such alternate chambers 22 and constricted regions 24 therebetween is to make these ring-like castings 16 of such formation that the walls of the upper half 26 of one of chambers 22 and the walls of the lower half 28 of the adjacent chamber 22 are comprised in a single casting 16, while providing therebetween the inwardly directed and interiorly constricted wall portions 24, terminating in the edges 32.

Each of the impellers 14, which are preferably made integral, as by casting, preferably comprises a centrally disposed circular disc portion 34 and upper vanes 36 and lower vanes 38 formed thereon. These vanes may be constructed in a variety of ways, but are preferably formed as indicated in Fig. 2 so as to be adapted for effective action in throwing the mix materials outwardly when the impellers are rotated in the direction of the arrow on Fig. 2. Set screws and "Woodruff"

keys can conveniently be used for holding the impellers 14 on shaft 12. By locating the impellers 14 on the shaft 12, opposite alternate ones of the constricted regions 24 of the casing 10, a series of narrow, aligned annular passages 40 is provided between the impeller discs 34 and such constricted portions 24 through which the materials of the mix are passed in streams in the course of their travel through the mixer. The remaining constricted regions 24 of casing 10 provide freely open passages 42 between chambers 22, so that substantially midway between the adjacent impellers and annular passages 40 formed therearound there is a pair of such chambers 22 in free communication with one another through a passage 42.

While the ring-shaped castings 12 can advantageously be made all alike so that they can be cast from a single or standard pattern, the end castings of the casing are preferably specially made from another pattern to take care of special requirements, as the inclusion of inlets and outlets and the provision for shaft mountings, etc. However, it is desirable to make these upper and lower castings alike to keep the structure as simple as possible and to reduce the number of patterns required. In the form shown, identical upper and lower castings 44, 46 are therefore provided, the same containing half spheroidal chambers 26', 28' and being provided with passages 48, 50 arranged for attachment of piping and adapted to serve respectively the purpose of inlet and outlet, and said end castings are further provided centrally with the stuffing boxes 52, 54 through which the axial shaft 12 passes.

The drive for the impeller shaft 12 in case of a vertically arranged mixer is preferably provided at the upper end of the mixer, and this can be accomplished by extending the shaft 12 and providing bearings 58, 60, preferably ball bearings, for such shaft.

A convenient way for supporting the first shaft bearing 58 is by providing the upper end casting 46 with leg portions 62 and mounting such bearing 58 in the preferably cast member 64 carried by the said legs 62 extending upwardly from the upper end casting 46. This end of the mixer can be fastened to a beam or other support as by attachment thereof to member 64. Beyond such member 64 the shaft 12 is provided with drive means for imparting rotation to the shaft and impellers, as for example provided with belt pulley 66. The bearing 60 provided for steadying the shaft 12 beyond the drive pulley 66 can be supported in any desired way, as for example by being mounted in a bracket 68 bolted to the member 64. The lower end casting identical with the upper end casting is also provided with legs 62 on which the mixer can stand.

In carrying out my improved mixing process, preferably making use of apparatus as above described, the material is travelled through the mixer, preferably by pumping in through the inlet passage 48, this pumping pressure serving also to travel the material through the mixer and to discharge the finished mix through the outlet passage 50, as for example for supplying same to a head box from which it can be continuously formed into a sheet. All the materials to be mixed can be supplied at 48 or the separate materials may have separate inlets if desired.

In their passage through the mixer the materials to be mixed are travelled serially through the annular passages 40 in the course of their passage from the inlet to the outlet.

As the materials being mixed pass through these annular passages 40, they encounter cross currents produced in the material being mixed by the rapid rotation of the impellers. These outward cross currents created by the rotation of the impellers and by the outward throwing action of the impeller vanes or blades 36, 38 on the upper and lower surfaces of the impeller discs are highly effective in producing agitation and mixing of the materials by engagement with portions thereof passing through the annular passages 40. As shown by arrows on Fig. 1, the circulation within the casing between any two of the impellers 14 is principally a vertical circulation, the material being thrown out by the impeller vanes, striking the material passing the annular passage 40, then encountering the spheroidal walls of the adjacent chamber 22 and being directed inwardly thereby to the axial region of the casing. The returning materials merge to some extent in the neighborhood of the open passages 42, and this merging contributes to the securing of a uniform final mix.

In the course of being so agitated and circulated, the material progresses upwardly against the action of gravity so that the casing is completely filled at all times, and thus through the several chambers 22 under the effect of the pumping action, being finally discharged as a homogeneous completed mix. There is also some horizontal rotation effected by the impellers but at a much slower rate than the vertical circulation above referred to, and indicated in Fig. 1.

In the use of my mixer and mixing process for producing a mix for the manufacture of distended fibrous sheets and wherein materials to be mixed consist principally of water and pulp, such as kraft pulp, a foaming agent such as saponin, sizing material, etc., and large quantities of air for effecting the fiber distention, the mixer and process of the present invention can be used to very great advantage. In the mixing of such materials, it is essential that the air bubbles in the finished mix be extremely small. Since it is impossible to introduce air into the mixer in bubbles all of small enough size, it is necessary that these bubbles be subdivided minutely during the mixing process, this being made possible by the use of saponin or equivalent as the foaming agent productive of strong bubble walls and making possible the minute subdivision of such bubbles. The mixer and process of this invention perform this function very effectively by reason of the vigorous motion imparted to the contents and because of the rapid and frequent change of direction of materials and portions thereof being mixed, and by the collisions between streams moving in diverse directions and with a great variety of speeds and speed changes taking place in the substantially incompressible liquid constituents of the mix.

The use of a continuous mixer is of great advantage in many operations, the particular use of such mixer for affording a mix for making a distended fibrous sheet being a good example of a condition where continuous mixing is desirable, it being essential in forming such a sheet to have a continuous source of supply of the mix so that it can be formed continuously into a sheet. As already indicated my improved mixer has many other applications as for mixing paints and a great variety of other mixes comprising liquid material and which may also comprise solids and/or gases.

It is to be understood that the illustrative showing made herein is only for illustration and affording an understanding of principles involved, and that the invention is not limited thereby, being of the full breadth defined by my claims.

I claim:

1. In a substantially vertically disposed mixer fed from the bottom and discharged from the top for materials comprising liquid material, a casing of generally cylindrical formation except that its interior is constricted at spaced-part zones, leaving parts of greater diameter between those zones, a series of rotary impellers comprising a central disc and upper and lower vanes, with such central disc opposite constructions in the casing to provide narrow but freely open annular passages therebetween, and means for travelling the materials to be mixed and including liquid material through said casing against the action of gravity, said lower vanes adapted to move portions of the liquid material generally outwardly across the path of the traveling materials and to be then deflected backwardly toward the zones of greater diameter.

2. A mixer for materials comprising liquid material comprising a generally cylindrical casing, a series of rotary impellers axially mounted in said casing, the casing bore containing pairs of substantially flat spheroidal chambers in free communication with one another between adjacent impellers and being constricted opposite each impeller so as to leave a narrow annular passage between impeller periphery and such constricted casing part, and means for traveling materials to be mixed including liquid material through the casing and against the action of gravity, said impellers adapted to move portions of the liquid material generally outwardly across the path of the traveling materials and to be then deflected along the walls of the spheroidal chambers.

3. A mixer for mixing materials comprising liquid material, comprising a casing having its interior made up of a series of flattened spheroidal chambers communicating through constricted openings, an axially arranged shaft in said casing and having a plurality of impellers located opposite alternate ones of said constricted openings and of diameter less than said openings to provide narrow annular passages within said casing about said impellers, and means for travelling the materials to be mixed and including liquid material through said chambers against the action of gravity and in the course of said travel through said annular passages, said impellers adapted to move portions of the liquid material generally outwardly across the path of the traveling materials and to be then deflected along the walls of the spheroidal chambers.

4. In a substantially vertically disposed mixer fed from the bottom and discharged from the top for mixing materials comprising liquid material, a generally cylindrical casing having its walls made up of a series of ring castings, each such casting containing separated halves of flattened spheroidal chambers and an intermediate constricted part, end castings for said casing, and having inlet and outlet passages, a shaft journaled in said end castings, said shaft being provided with a series of impellers, each impeller comprising a central disc and upper and lower impeller vanes, and said impeller discs being located opposite alternate ones of said constricted

wall portions to provide a narrow annular passage between the impeller disc and the constricted casing wall part, and the said chambers opening freely into one another at the remaining constricted wall portions, and means for traveling materials to be mixed including liquid material through the casing and against the action of gravity, said impeller vanes adapted to move portions of the liquid material generally outwardly across the path of the traveling materials and to be then deflected along the walls of the spheroidal chambers.

5. In a mixing apparatus, a casing formed to provide a series of two-part flattened substantially spheroidal chambers, said chambers communicating with one another through substantially circular openings, impellers revolvably mounted in the said openings, said impellers comprising a disklike part which closes the opening except for an annular passage therearound left open for the free flow of materials to be mixed, the said impellers having vane members at each face of the disklike part thereof, and means for traveling materials to be mixed including liquid material through the casing and against the action of gravity, said impeller vanes adapted to move portions of the liquid material generally outwardly across the path of the traveling materials and to be then deflected along the walls of the spheroidal chambers.

6. In a mixing apparatus, a casing formed to provide a series of chambers which are of least dimension at substantially the middle portions thereof and are of first increasing and then decreasing dimension toward each end, said chambers communicating with one another through substantially circular openings, and vane impellers revolvably mounted in said openings, said impellers comprising a central disk of form adapted to leave a substantially annular passage therearound for free flow through said passage of material being mixed, and means for traveling materials to be mixed including liquid material through the casing and against the action of gravity, said impeller vanes adapted to move portions of the liquid material generally outwardly across the path of the traveling materials and to be then deflected along the walls of the communicating chambers.

7. In a mixing apparatus, a casing formed with chambers constricted at substantially the middle and enlarged at each side of the constricted middle part and again constricted beyond such enlarged parts, said chambers communicating through substantially circular openings, and impellers rotatably mounted in such openings, said impellers comprising vane parts and a disk part which reduces said openings to an open annular passage about the disk part, and means for traveling materials to be mixed including liquid material through the casing and against the action of gravity, said impeller vanes adapted to move portions of the liquid material generally outwardly across the path of the traveling materials and to be then deflected along the walls of the communicating chambers.

8. In a mixing apparatus, a substantially upright casing providing chambers which are of least dimension at each end and also at substantially the middle and enlarged between the ends and the middle parts and communicate at their constricted ends through substantially circular openings, and disk and blade impellers revolvably mounted to close said openings except for an an-

nular passage therearound of width to permit free flow of materials being mixed, and means for traveling materials to be mixed including liquid material through the casing and against the action of gravity, said impeller blades adapted to move portions of the liquid material generally outwardly across the path of the traveling materials and to be then deflected along the walls and toward the enlarged parts of the chambers.

9. In a mixing apparatus, the combination with a generally cylindrical casing having spaced-apart regions of materially reduced diameter with interposed outwardly rounded regions of greater diameter, of axially mounted rotary impeller means at alternate ones of the regions of reduced diameter and means for traveling material to be mixed lengthwise through the casing against the action of gravity, whereby an outward current is created crossing the lengthwise current through the regions of reduced diameter where impellers are located together with a return current in the neighborhood of the intermediate regions of reduced diameter.

10. In a mixer having an intake opening at one end and a discharge opening at the other end for materials comprising liquid material, a casing of generally cylindrical formation except that its interior is constricted at spaced-apart zones, leaving parts of greater diameter between those zones, a series of rotary impellers comprising a central disc and vanes on opposite sides of the disc, the vanes on one side of said disc being positioned toward the intake opening and the vanes on the other side being positioned toward the discharge opening, with such central disc opposite constrictions in the casing to provide narrow but freely open annular passages therebetween, and means for traveling the materials to be mixed and including liquid material through said casing, said vanes facing each other on successive impellers tending to move portions of the liquid material outwardly and then deflected in substantially opposite directions.

WARREN A. CHILSON.

CERTIFICATE OF CORRECTION.

Patent No. 2,316,769.

April 20, 1943.

WARREN A. CHILSON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 26, for "mixed" read --mixer--; line 36, for "provisino" read --provision--; page 3, first column, line 16, claim 1, for "constructions" read --constrictions--; line 73, claim 4, for "dics" read --disc--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of May, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.