Dec. 28, 1926. 1,612,281

J. F. GOETZ

MIXING APPARATUS

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Fig. 1.

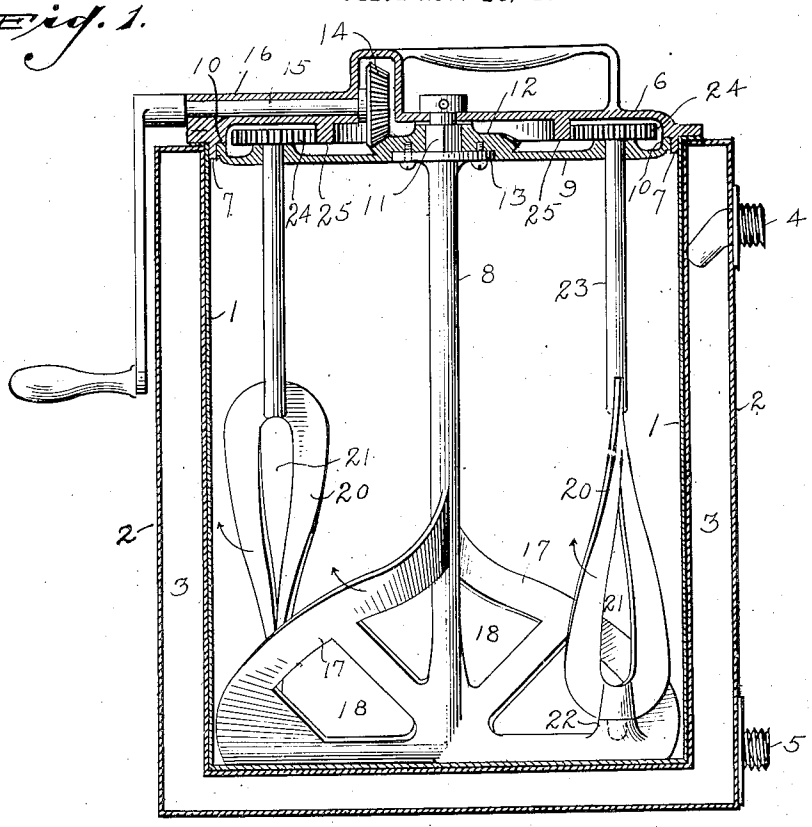
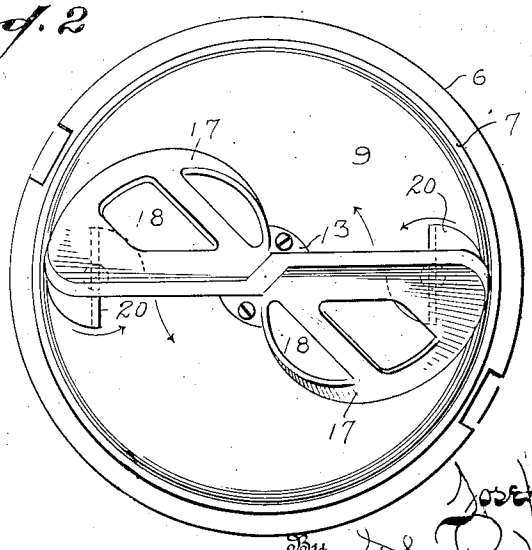



Fig. 2




Inventor

Joseph F. Goetz

By J. E. Walker

Attorney

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Fig. 3

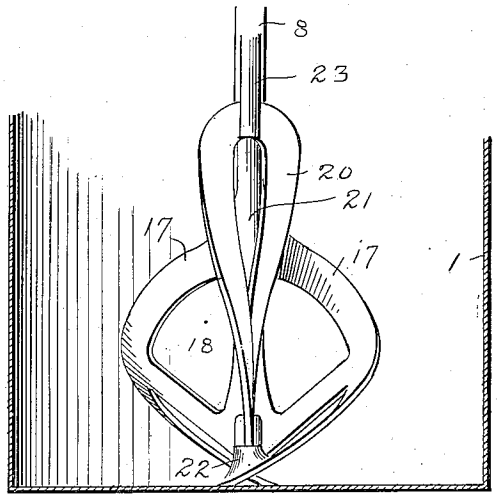



Fig. 6.

Fig. 4.

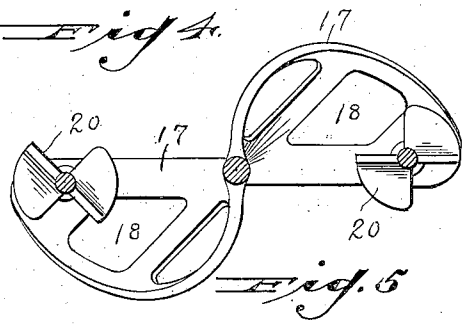



Fig. 5

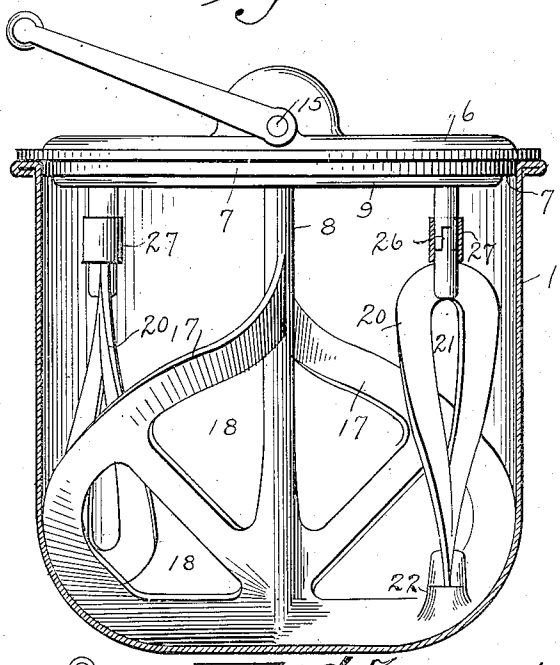
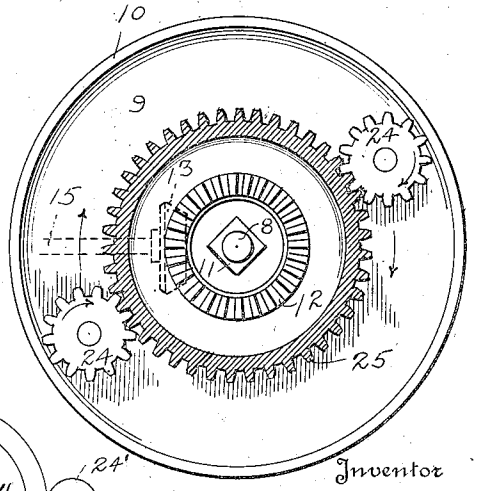
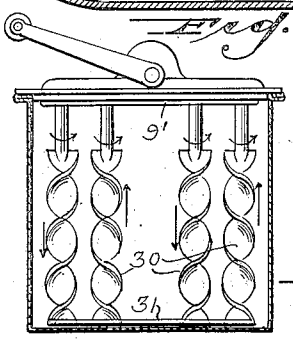



Fig. 7.



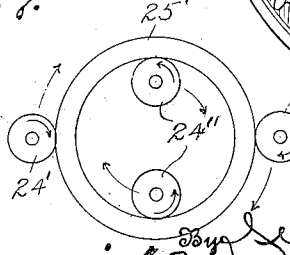




Fig. 8

Inventor

Joseph F. Goetz

By E. E. Walker

Attorney

Patented Dec. 28, 1926. 1,612,281

# UNITED STATES PATENT OFFICE.

JOSEPH F. GOETZ, OF DAYTON, OHIO, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE COLUMBIA METAL PRODUCTS COMPANY, OF DAYTON, OHIO, A CORPORATION OF OHIO.

## MIXING APPARATUS.

Application filed November 14, 1923. Serial No. 600,853.

My invention relates to mixers or agitators for mechanically stirring and intermixing materials in either a dry or liquid state and also materials of a semi-fluid or p'astic character.

The invention contemplates a plurality of rotary agitators of substantially helical form, a portion of which have translating motion in addition to their rotation, arranged to lift the material operated upon, or part of which may be directed downward while others produce ascending movement, the zones of operation being unseparated or unconfined whereby portions of material may freely pass from the area of operation of one agitator to that of the other. The illustrated translating motion is of planetary character wherein part of the helical agitators operate in a circular path in proximity to the wal's of the vessel and concentric with a double bladed central agitator, the blades of which are also of substantially helical form and perforated, but rotate about an eccentric axis common to both blades.

For intermixing materials of high specific gravity such as paints, co'or products and the like, wherein the pigments are held in a state of suspension with a tendency to settle to the bottom, the helical conveyors or agitators are all or nearly all arranged to produce ascending currents and lift the heavy and dense portions for distribution at higher leve's, the down currents being induced by gravity. For materials of other characteristics, as pastries, confections, certain chemical preparations and dry materials, one or more agitators are arranged in reverse relation to afford descending currents while other agitators exert elevating influence, thereby inducing reverse currents and causing complete circulation.

While the translating agitators beat the material whi'e moving to all parts of the body, the central agitator collects the deposited materials from the bottom of the vessel and directs it upwardly. It will be understood that the direction of operation of the central and planetary agitators may be reversed without departure from the invention.

The agitator or mixer forming the subject matter hereof may be applied to a wide variety of uses, as for instance, the mixing of paint and liquid color preparations wherein particles normally carried in a state of suspension tend to settle in the bottom of the vessel when undisturbed for long periods of time and frequently solidified or become quite dense and difficult to redistribute. The invention will also find a wide range of usefu'ness in candy making and other confectionery and culinary operations, as well as in the mixing of pastry and bakery products.

The object of the invention is to simplify the structure as well as the means and mode of operation of such mechanical agitators whereby they will not only be cheapened in construction, but will be more efficient in use, positive in operation, uniform in action, easily operated and unlikely to get out of repair.

A further object of the invention is to provide mechanical means for inducing a continuous circulation within a fluid or semi-fluid body, while at the same time, beating or vigorously stirring the body to cause intermingling of the portions thereof, and an interchange of material from one induced current to another.

A further object of the invention is to provide improved means for actuating such agitating or stirring mechanism and to provide improved form of stirrer blades, adapted to break up and diffuse induced currents of material, whereby the material will be uniformly intermixed and every portion of the body operated upon will be uniformly affected.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention consists of the features of construction, the parts and combinations thereof, and the mode of operation, or their equivalents as hereinafter described and set forth in the claims.

Referring to the drawings, Fig. 1 is a vertical sectional view of the assembled agitating mechanism, mounted within a double walled or water jacket vessel. Fig. 2 is a bottom plan view of the agitating mechanism removed from the vessel. Fig. 3 is a side elevation of the stirring e'ements or agitators viewed from the right in Figs. 1 and 2. Fig. 4 is a top plan view of the stirring elements or agitators. Fig. 5 is a top plan view of the driving or power transmission connection. Fig. 6 is a side elevation

similar to Fig. 1 showing the apparatus applied to a round bottomed vessel. Figs. 7 and 8 are detail side elevation and bottom plan view of a modification.

Like parts are indicated by similar characters of reference throughout the several views.

When many materials, such as paint and coloring mixtures as well as various chemical preparations of liquid or semi-liquid character are allowed to set for extended periods of time, the heavy and more dense ingredients, normally held in a state of suspension, have a tendency to settle to the bottom of the container, forming therein a semi-solid or plastic body, while the lighter or more fluid carrier medium will rise to the top of the vessel. When remixing such materials for use, a mere stirring of the liquid portion is not sufficient to thoroughly intermix the solid material. The mere agitation is not sufficient to break the heavier particles and cause their circulation throughout the entire body. The present apparatus is designed to collect and mechanically elevate such heavier portions of a mixture discharging the collected portions at elevated points in the body of material operated upon, and in proximity to agitators where it will be thoroughly stirred and intermixed to form a liquid or mixture of uniform density throughout. Likewise in confection making, it is necessary to continuously stir the product during the cooking operation, and to intermix the materials and prevent the material remaining long in contact with any one part of the side or bottom of the vessel. The apparatus is designed to carry out such confection making operation as well as the mixing of paints and coloring matter, or chemical preparations. It is also quite useful in the preparation of batters and various forms of light doughs and cake mixtures in the baking industry, and for agitating various culinary products and in canning and preserving such as apple butter making.

For some of these operations, double walled or water jacketed vessels, whereby the contents may be either heated or cooled during the agitating operation, will be found quite desirable, while in other operations single walled vessels will be amply sufficient. In the form of embodiment of the invention shown in Fig. 1 of the drawing, 1 is the vessel or container for the body of material to be operated upon, while 2 is an exterior shell or water jacket for the vessel, affording an intermediate water space 3 having an entrance orifice 4, and an outlet 5 for circulation of either hot or cold water about the vessel 1. The water inlet 4 is preferably in the form of a nozzle directed downwardly and laterally within the water space 3, whereby the incoming supply of water, whether hot or cold will be directed around the vessel 1, thereby insuring uniform temperature and complete change of water within the water bath. The agitating or mixing apparatus is mounted upon a closure plate or lid 6, resting upon the upper edges of the vessel. This lid or closure 6 is provided with a dependent annular flange 7, fitting within the mouth of the vessel, and serving to locate the lid and agitating apparatus concentrically in relation with the vessel 1. Suspended from the lid or closure 6 and mounted therein for revoluble movement is a central or main agitator shaft 8. This shaft may have any suitable form of bearing. In the drawings, it has been shown with a simple journal bearing in the lid. Fixedly supported upon this central or main agitator shaft 8 is a revoluble disc 9, having an upturned marginal flange 10, extending within the dependent flange 7 of the lid 6. The disc 9 is positively engaged with the shaft 8 for driving operation. To this end, shaft 8 has been shown provided with a square or polygonal head 11. Fitting within a similar socket or opening formed is a bevel gear 12, preferably formed integral with the revoluble disc 9. The disc with its integral bevel gear 12 is further connected by means of screw studs extending through a flange or collar 13 upon the shaft. These same screw studs may, however, be employed to connect a separately formed gear in lieu of the gear 12, with both the disc 9 and the collar of the shaft 8. The gear 12 intermeshes with a corresponding bevel gear pinion 14, carried upon a main drive shaft 15, journaled in suitable bearings 16 upon the lid or closure 6. This main drive shaft 16 may be operated from any suitable source of power, as by a motor, or by a crank, or other operating means. Upon rotation of the drive shaft 15, the gear 12 is rotated and with it, is carried the revolving flanged disc 9 and main drive shaft 8.

At its lower end the main agitator shaft 8 is provided with oppositely extending substantially helical agitator blades 17. These blades are of latticed construction, the upper edges of which are inclined or taper upward to their juncture with the main or central agitator shaft 8, and are curved in opposite directions to form a reverse or substantially ogee curve, while the lower terminal edges of the blades 17 extend in substantially straight radial relation with the shaft 8. The construction is such that each of the laterally disposed agitator blades 7 posses es a substantially helical form with the axis of such helix offset laterally in relation with the common shaft 8 and axis of rotation. That is to say, each of the laterally disposed blades 17 comprises in itself a short helix or spiral conveyor, which, however, does not rotate about the axis of such helix, but rotates about an eccentric axis, to wit: the axis of the main shaft 8, which is coincident with

the periphery of the respective helices, and common to both. Conjointly the agitator blades 17 form a double reverse curve at their upper extremities, and are substantially alined at their lower terminal edges to form oppositely disposed scoop-like collectors which conform to the bottom of the vessel, whether the latter be flat bottomed, as in Fig. 1, or round bottomed, as in Fig. 6. The openings 18, in these scoop like agitator blades, may be of any suitable size, according to the conditions of use and the character of the material operated upon. The perforations allow limited portions of the material collected by the scoop like blades to pass therethrough while other portions are raised to higher elevations in the body of material acted upon. This variable discharge of the collected materials insures a thorough and uniform displacement and interchange of portions of the material. It will be noted by comparison of figures of the drawings, that while the main agitator and elevator blades 17 extend into proximity to the walls of the vessel, in the direction of a maximum extent, they are comparatively narrow in a transverse direction, thus leaving ample space between the blades and the walls of the vessel, into which the disturbed and agitated material may pass. However, this material is again acted upon as the apparatus rotates. That is to say, there is always ample clearance space left in the rear of the agitator blades for the reception and intermingling of the disturbed material. As has been described and as shown in the drawing, the central or main agitator collects and directs the heavier particles of material upwardly, thus inducing an ascending current.

Co-acting with the main actuator are secondary agitators or beaters 20, also of helical form, which may act upwardly as in Fig. 1 or downwardly as in Fig. 6. These auxiliary agitators or beaters 20 travel in a circular path, in unison with the rotation of the primary agitator, and simultaneously with their rotation about their own axes. These auxiliary agitators are also of helical form, but as shown in Fig. 6, exert their influence in a direction reverse to that of the primary agitators; that is to say, in the present embodiment, these auxiliary agitators exert a downward influence, thus inducing in the body of material acted upon a descending current. The field of influence of the primary agitator and the auxiliary agitators or beaters 20 are unconfined or unseparated. In fact, the primary agitator as shown in the drawing extends beyond the zone of influence of the auxiliary agitator. Thus while the central agitator induces an ascending current of material, the auxiliary beaters or agitators induce a descending current, thus completing a circuitory movement. The auxiliary agitators are longitudinally slotted as at 21 to permit the escape of portions of the material acted upon, and thus increase the distribution. These auxiliary agitators or beaters 20 are journaled at their lower ends in bearing bosses 22, upon the main agitator or collector blade 17, and at their upper ends are journaled in the rotary disc 9. The drive shafts 23 of the beaters 20 carry at their upper end within the housing formed by the spaced discs 6 and 9, driving gear pinions 24, which intermesh with a gear ring 25, fixedly secured to the under side of the lid or closure disc 6. This gear ring 25 is stationary. The rotation of the disc 9 with the main shaft 8, to which it is connected carries the auxiliary agitators or beaters 20 around in unison with the shaft 8 and main agitator blade 17, during which movement, the gear pinion 24 intermeshing with the gear ring 25 transmit to the beaters or agitators 20 independent rotary movement about their own axes. There is thus transmitted the planetary movement by which the auxiliary beaters 20 are translated to every portion of the vessel. Inasmuch as for some conditions of use and for materials of certain characteristics, the main agitator blades 17 will be sufficient and the auxiliary beaters 20 either undesirable or unnecessary, these auxiliary beaters 20 are preferably though not necessarily detachably mounted. To this end, the drive shaft 23 of the auxiliary beaters have been shown provided with interlocking clutch joints 26, the parts being held in engaged relation by a sliding lock sleeve 27. By raising the lock 27, the overlapping lugs of the respective sections may be disengaged and the lower end of the beaters lifted out of their bearing within the bosses 22. Thus enabling the bodily removal of the beaters. It will be obvious that any other form of detachably driving connection may be employed in lieu of the sleeve locked clutch joint.

For the purpose of illustrating different embodiments of the invention, Fig. 1 shows a flat bottomed vessel with the main agitator conforming thereto and the auxiliary agitators arranged to exert their pressure upwardly. In Fig. 6, the vessel is shown as having a round bottom with which the main agitator conforms and the auxiliary agitators are arranged to act downwardly, or in opposition to the main agitator. This construction affords reverse currents which pass in close proximity one to another without being separated.

In lieu of the construction heretofore described and shown in the preceding figure, there is illustrated in Figs. 7 and 8, a modification wherein a plurality of planetary or translating helical beaters 30 are employed, and the main central agitator omitted. In such construction, part of the translating helical agitators exert their influence upwardly and part downwardly. Preferably

the upwardly and downwardly directed helical agitators are arranged in alternate relation. These beaters are mounted in a rotating disc 9′ as before described. Their lower end may be journalled in a suitable supporting spider 31. They are rotated as before described by the disc 9′, while the pinions carried by the respective agitators engage with the stationary gear ring 25′ upon the lid. In the event that a considerable number of such translating agitators are employed, the driving pinions of different agitators may be arranged to engage with interior and exterior teeth upon the gear ring as shown in Fig. 8.

Having thus described my invention, I claim:

1. A mixer of the character described comprising a vessel, a pair of substantially scoop-like helical agitator blades rotating about a common axis, and substantially conforming to the lower walls of the vessel and additional rotary helical agitators operating wholly within the circle of operation of said scoop-like blades and acting simultaneously upon unconfined portions of the same body within the vessel, the direction of the helices of said agitators being arranged in opposing relation, each tending to reverse the direction of movement of the material discharged from an adjacent agitator, said agitators being so relatively proportioned that the elevating influence of the scoop-like helical blades will dominate the influence of the second mentioned agitator, so that material is transferred from one to another at different points of elevation throughout the extent of the agitators.

2. In a mixing apparatus of the character described, two helical conveyors arranged in juxtaposition within a common container, the field of operation of one conveyor being wholly within that of the other conveyor, said conveyors being arranged to discharge in opposite directions in opposition one to the other the material acted upon being free to pass from the field of operation of one conveyor to that of the other at various points throughout their length, one of the conveyors being laterally movable through a circuitous path of travel simultaneously, with its rotation and means to actuate the conveyors.

3. In a mixing apparatus, a vessel, a rotary agitator helical therein, substantially conforming to the bottom and lower wall portions of the vessel and rotating in the direction to elevate the material within the vessel, and a second helical agitator exerting a depressing influence upon the material, and movable through a circuitous path simultaneously with its rotation about its axis and wholly within the circle of operation of the first agitator, and means for simultaneously actuating both agitators.

4. In a mixing apparatus, an ascending conveyor and a descending conveyor arranged in juxtaposition with the descending conveyor operating wholly within the field of operation of the ascending conveyor and acting simultaneously upon unseparated portions of a body of material to be mixed whereby the material may pass freely from the field of operation of one conveyor to that of the other, the influence of the ascending conveyor being greater than that of the descending conveyor, one of said conveyors being mounted for translating movement relative to the other simultaneously with its rotation and means for actuating the conveyors.

5. In a mixing apparatus of the character described, two rotary conveyors arranged in substantially parallel relation one acting wholly within the circle of operation of the other, and simultaneously acting upon unseparated portions of the body to be mixed to displace the portions acted upon in opposite directions, the material being free to pass from the field of operation of one conveyor to that of the other.

6. In a mixing apparatus, a helical agitator arranged to displace material upwardly, and a second helical agitator adapted to displace material downwardly, operative wholly within the circle of operation of the first agitator, one of the helical agitators being capable of translating movement in addition to its rotary movement, and means to actuate said agitators.

7. In a mixing apparatus, a perforated helical agitator adapted to elevate material to be mixed, portions of which are discharged through the perforations of the helical agitator while other portions are elevated above such discharge perforations for discharge from the edge of the agitator and a second agitator located eccentrically in relation with, but wholly within the circle of operation of the first agitator, and means to rotate the agitator.

8. In a mixing apparatus, a vessel, a substantially helical agitator of latticed construction substantially conforming to the bottom and lower side wall of the vessel, adapted to elevate material to be mixed and discharge same both over the edge and through the openings of the latticed structure, and means to rotate the agitator.

9. In a mixing apparatus of the character described, a rotary agitator having a substantially helical blade mounted for rotation about a signal axis of rotation eccentric with the axis of such helical blade, and means for rotating such agitator blade about said eccentric axis.

10. In a mixing apparatus of the character described, a rotary shaft, a rotary agitator comprising a wing carried thereby in radially disposed relation and having a scoop like shape of substantially helical for-

mation the axis of such helix being offset laterally in relation with the axis of rotation of such agitator and means for rotating the agitator.

11. In a mixing apparatus of the character described, a rotary agitator including a scoop like blade of substantially helical formation mounted for rotation about an axis eccentric in relation with the helical scoop formation, said blade being perforated and means for rotating the blade about such eccentric axis.

12. In a mixing apparatus of the character described, a vessel, a rotary agitator including a scoop like blade of substantially helical formation substantially conforming to the bottom and lower side walls of the vessel and thence tapered upwardly, said blade being of latticed construction whereby reduced portions of the material engaged may pass through the openings of the latticed blade, and means for rotating said agitator blade.

13. In a mixer of the character described, a rotary agitator including two oppositely disposed upwardly tapered substantially scoop like blades fixedly attached one to the other, and means for simultaneously rotating said blades about a common axis eccentric in relation with the axis of the helices of the blades.

14. In a mixer of the character described, a rotary agitator including a blade of double or reverse curvature extending on opposite sides of the axis of rotation, the lower edge of such reverse curved blade being deflected laterally with the oppositely disposed halves of the reverse curve blade terminating substantially in alignment one with the other, and means for rotating said reverse curve blade upon a medial axis.

15. In a mixer of the character described, a rotary agitator, including a rotary shaft, curved blades extending in opposite directions from said shaft and oppositely disposed forming conjointly a reversed or substantially ogee curve with the top edges of the blades inclined upwardly toward their connection with the shaft, the curvature of the blades decreasing in the axial direction of the shaft whereby the lower edge of each blade is substantially straight.

16. In a mixer of the character described, a rotary agitator including a pair of oppositely disposed warped blades, the terminal edges of which at one end are substantially straight, the terminal edges at the opposite ends being reversely curved, and means for rotating said blades about an intermediate axis.

In testimony whereof, I have hereunto set my hand this 30th day of October A. D. 1922.

JOSEPH F. GOETZ.