July 1, 1930. J. JOHNSON 1,768,957

MIXING OR EMULSIFYING APPARATUS

Filed Jan. 7, 1929 2 Sheets-Sheet 1

Fig. 1.

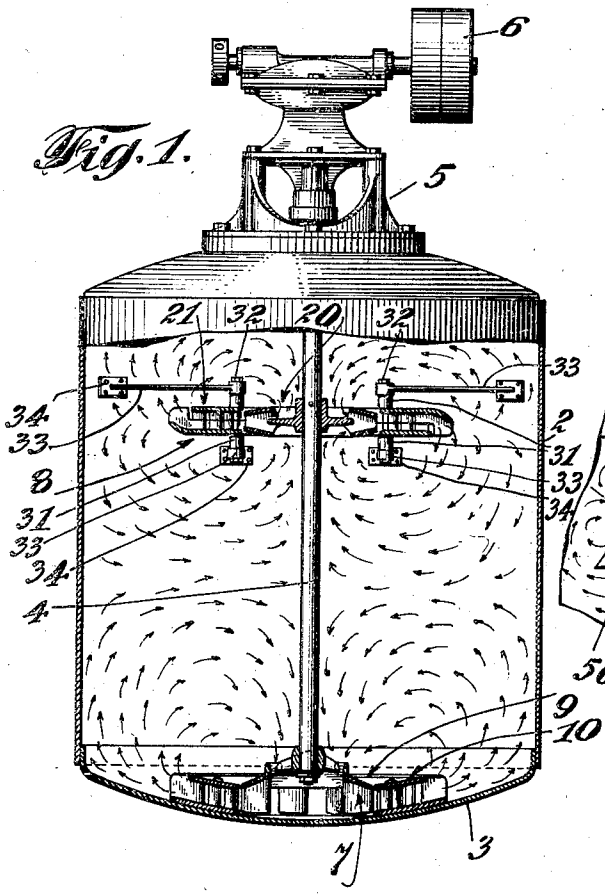


Fig. 5.

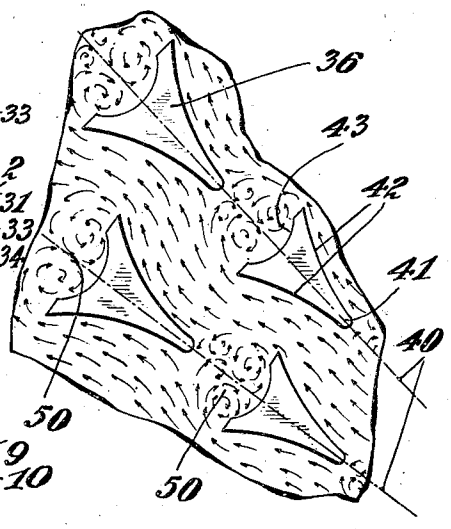
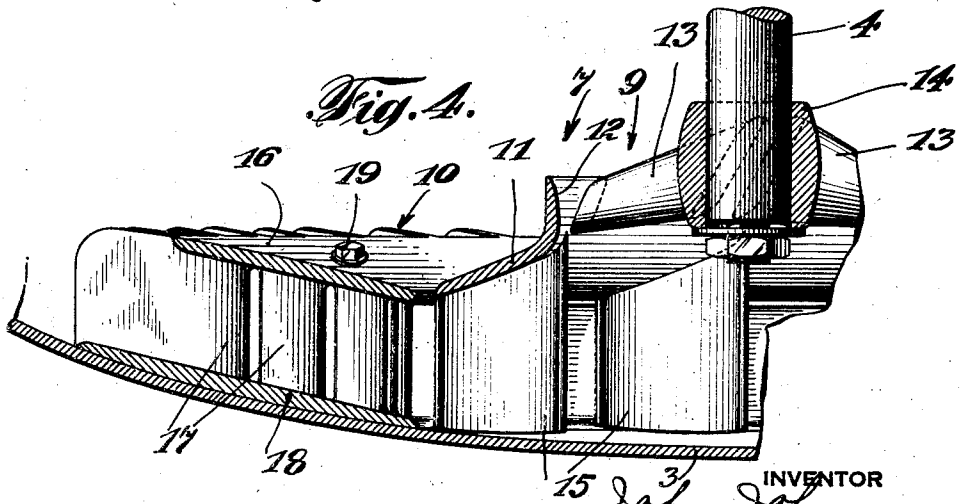


Fig. 4.



INVENTOR
John Johnson
BY
Frank Hall
ATTORNEY

July 1, 1930. J. JOHNSON 1,768,957

MIXING OR EMULSIFYING APPARATUS

Filed Jan. 7, 1929 2 Sheets-Sheet 2

Fig. 2.

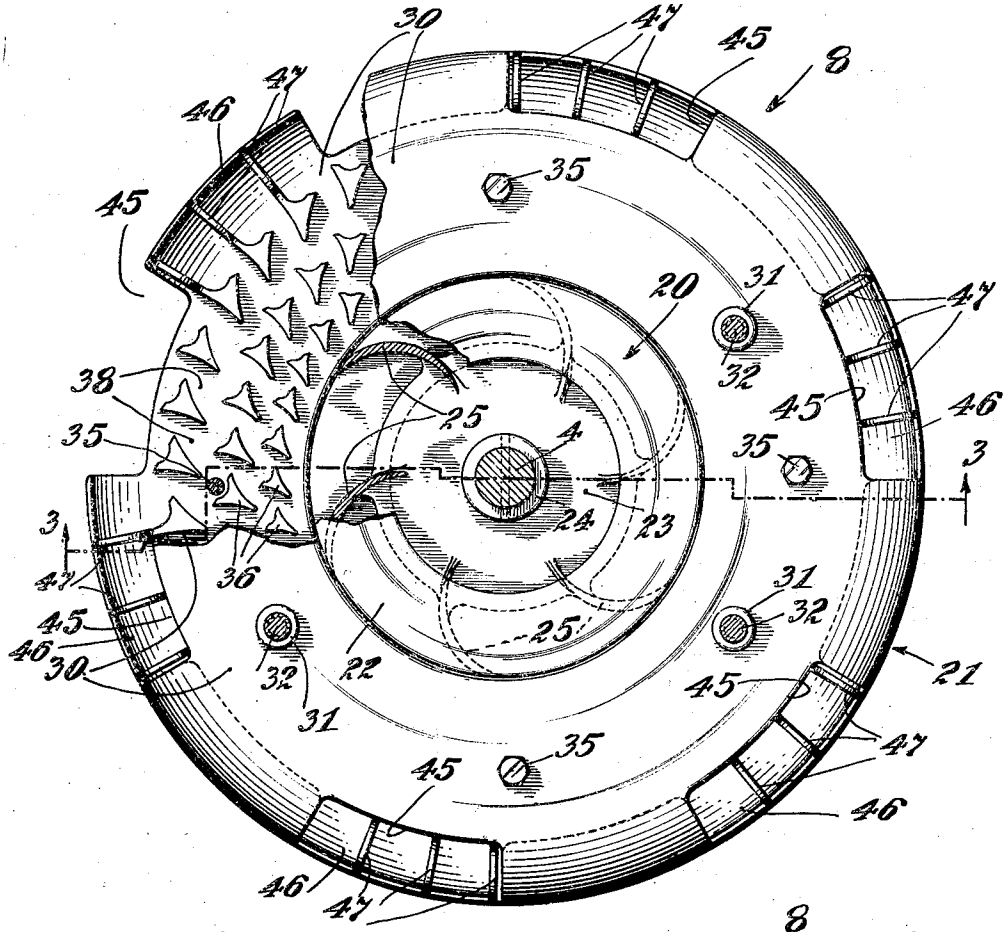
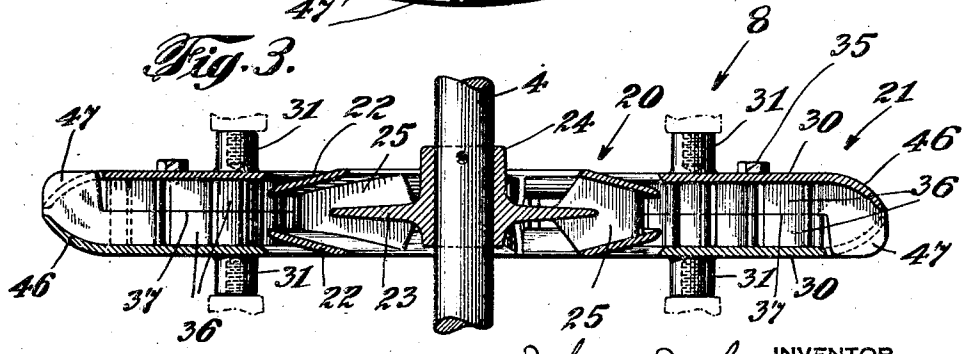


Fig. 3.



INVENTOR

BY

ATTORNEY

Patented July 1, 1930 1,768,957

UNITED STATES PATENT OFFICE

JOHN JOHNSON, OF MAPLEWOOD, NEW JERSEY, ASSIGNOR TO THE TURBO-MIXER CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

MIXING OR EMULSIFYING APPARATUS

Application filed January 7, 1929. Serial No. 330,708.

The invention relates to mixing apparatus of a character generally similar to that disclosed in various of my issued patents.

The principal object of the present case is to provide means for very vigorously or effectively circulating, agitating and intermixing liquids, or liquids carrying more or less solid materials. Especially, the apparatus is designed to accomplish the necessary intimate mixing of more or less diverse materials of which one example is water and oil, the intimate mixing of such diverse materials being called emulsifying, and the process involving such fine division of the particles of the different materials and uniform intermixing that they will remain in practically stable condition.

This emulsifying action is produced in the embodiment of the invention here shown, by providing in a stationary structure called a deflector, which acts upon liquid discharged by a propeller or impeller, a multiplicity of liquid flow controlling elements called baffles, so arranged as to provide tortuous passages for the liquid and to create eddy currents.

I also provide in one of the deflector structures new or improved means for effecting a desired upward and downward flow of the discharged liquid.

The characteristics and advantages of the invention are further sufficiently explained in connection with the following description of the accompanying drawings, which show one exemplifying embodiment. After considering this example, skilled persons will understand that many variations may be made without departing from the principles disclosed, and I contemplate the employment of any structures that are properly within the scope of the appended claims.

Fig. 1 is a view, partly in elevation and partly in axial section, of mixing or emulsifying apparatus embodying the invention in one form.

Fig. 2 is a top plan of the upper or intermediate mixing unit.

Fig. 3 is a section at 3—3, Fig. 2.

Fig. 4 is a section of the lower unit.

Fig. 5 is an enlarged detail, explanatory of the shape and arrangement of the baffles and liquid passages.

In Fig. 1, 1 is any suitable mixing tank which may have a cylindrical side wall 2 and a curved or part-spherical bottom 3. A shaft 4 is arranged vertically at the tank center and is supported at its upper end in suitable bearings in an upper structure 5 and driven in any convenient way, as by an electric motor, or pulleys 6. A lower mixing unit 7 is arranged at the tank bottom, and an intermediate or upper unit 8 is located at an upward position, in this instance relatively near the top of the tank. Each of the mixing or emulsifying units consists of an impeller and a stationary deflector structure.

Either mixing unit may be used by itself, or the two together, as shown.

As shown in Figs. 1 and 4, the lower unit consists of an impeller 9 and a deflector structure 10. The impeller comprises an annular plate 11 having an intake flange 12 and connected by spokes 13 to a hub 14 which is keyed on shaft 4. Suitably curved impeller blades 15 are cast integral with, or secured to, plate 11. The deflector 10 includes an annular upper plate 16 having blades 17 cast integral with, or secured thereto. A lower plate 18 may be provided or omitted. When included, this lower plate rests on the tank bottom 3; if omitted, the lower ends of the baffles will rest on the tank bottom. The deflector structure is secured in position in any suitable way, as by bolts 19. The nature and arrangement of the baffles and liquid passages in the deflector will be sufficiently understood from the following description of the upper or intermediate mixing unit.

This upper unit 8 consists of an impeller 20 and stationary deflector structure 21. The impeller includes upper and lower annular plates 22 having an outwardly converging, angular relation, a central plate or septum 23 having a hub 24 keyed or pinned on shaft 4, and suitably curved impeller blades 25 which connect plates 22 together and to plate 23.

The deflector structure in a preferred

form, as shown, includes upper and lower annular plates 30 arranged in the approximate planes of impeller plates 22, and surrounding the impeller, with suitable radial clearance. The upper and lower plates 30 may be of identical form except for the baffles, which are in relatively reversed positions on the two plates in order that the upper and lower members constituting one complete baffle, will properly match when the plates are put together. The deflector structure is supported by a suitable number of lugs 31 cast on the plates and bored and tapped to receive screws 32 passing through the ends of struts 33, secured to the tank wall as at 34; and the plates are secured together by bolts or screws 35.

Each plate has secured to, or cast integral on, its inner surface a multiplicity of lugs 36, each of these lugs constituting one-half of a complete baffle, the ends of the corresponding lugs abutting on the central line 37, Fig. 3. The form and arrangement of the baffles may vary greatly, the principal requirement being that they are of such number and arrangement as to provide a multiplicity of tortuous liquid passages 38, and also preferably to create eddy currents in the circulated medium, as here explained with reference to the particular form and arrangement of baffles chosen as an example. As here shown, the baffles are arranged in a plurality of annular rows, and desirably the cross sectional area of the baffles in the different rows, progressively outward from the center, increases, as sufficiently explained in Figs. 2 and 5, in general proportion to the increased circumference, and in order to provide a general outward increase in area of the liquid passages. The baffles in successive rows are also preferably in staggered relation with respect to a radial line, but their longer axes are aligned with respect to tangential lines, such as the line 40, Fig. 5, corresponding substantially to the tangential flow of material discharged from the rotary impeller blades 25, as well explained in Fig. 2. Desirably, the baffles are, as shown, of generally arrow-head form in cross section, including narrow, rounded, inward edges 41, curved side walls 42, and a rear wall 43 which is substantially at a right angle to the long axis of the baffle, and preferably includes a recessed central portion.

Means are provided at the periphery of the deflector, for diverting the general tangential flow to radial flow, in order to prevent undesired circular swirl of the liquid in the tank, and also for diverting portions of the liquid upward and downward to provide the desired circulation, as sufficiently indicated by arrows in Fig. 1. For these purposes peripheral segments of each of the plates 30 are cut away, as at 45, Fig. 2, and marginal portions 46 of each plate, corresponding to the gaps or cut-out portions 45 of the other plate, are curved upward or downward as shown at the left and right of Fig. 3, thus providing in effect a nozzle directed at an upward or downward angle to divert the liquid issuing therefrom in a corresponding direction, and thus to properly distribute the flow upwardly and downwardly in the tank. These plate portions are also provided with vertical radial blades 47 which may, as shown in Fig. 2, be formed as continuations of rear edge portions of outer baffles 36. These blades or flanges 47 serve to divert the tangential flow to radial, upward or downward directions.

In operation, liquid discharged tangentially by the rotor blades 25 flows through the deflector passages 38 in a generally tangential direction, as indicated by arrows in Figs. 2 and 5, but this flow is broken up by the production of vigorous eddy-whirls at the rear ends of the baffles, as sufficiently indicated by arrows at 50 in Fig. 5. The liquid is thus rapidly churned or whirled and intimately intermixed as it flows in a generally outward tangential direction, producing a vigorous emulsifying action; and finally is discharged radially upward and downward by blades 47 and plate edge formations 46, as above referred to.

In a broad aspect of the invention, upper and lower plates such as 30 are only one way of supporting baffles such as 36 in proper arrangement. A single supporting plate or ring may be used; with the baffles projecting from either or both sides thereof. The arrangements shown are preferred in some cases, since the plates confine the liquid flow in a generally tangential and radial direction, as well as supporting the baffles and directing the material through the baffle spaces, with emulsifying effect.

I claim:

1. In mixing apparatus of the class described, an emulsifier through which a liquid is circulated, and a multiplicity of baffles therein constructed and arranged to deflect the liquid flow and produce eddy currents, the baffles being in cross section of generally flaring form from their inward toward their outward ends.

2. In mixing apparatus of the class described, an emulsifier through which a liquid is circulated, and a multiplicity of baffles therein constructed and arranged to deflect the liquid flow and produce eddy currents, the baffles being in cross section of generally triangular form, with apices directed inwardly and with broad outward faces which produce eddy currents.

3. In mixing apparatus of the class described, an emulsifier through which a liquid is circulated, and a multiplicity of baffles therein constructed and arranged to deflect the liquid flow and produce eddy currents,

the baffles being in cross section of generally triangular form, with apices directed inwardly and with broad outward faces which produce eddy currents, and the side walls of the baffles being concavely curved.

4. In mixing apparatus of the class described, an emulsifier through which a liquid is circulated, comprising an annular supporting plate, and a multiplicity of baffles theron, constructed and arranged to deflect the liquid flow and produce eddy currents, the baffles being in cross section of generally flaring form from their inward toward their outward ends.

5. In mixing apparatus of the class described, an emulsifier through which a liquid is circulated, comprising an annular supporting plate, and a multiplicity of baffles thereon, constructed and arranged to deflect the liquid flow and produce eddy currents, the baffles being in cross section of generally triangular form, with apices directed inwardly and with broad outward faces which produce eddy currents.

6. In mixing apparatus of the class described, an emulsifier through which a liquid is circulated, comprising an annular supporting plate, and a multiplicity of baffles thereon, constructed and arranged to deflect the liquid flow and produce eddy currents, the baffles being in cross section of generally triangular form, with apices directed inwardly and with broad outward faces which produce eddy currents, and the side walls of the baffles being concavely curved.

7. In mixing apparatus of the class described, a stationary mixing or emulsifying structure comprising upper and lower annular plates, and baffles between the plates, in spaced relation and constructed and arranged to divert liquid flow between the plates and produce eddy currents with emulsifying effect, the baffles being of generally outwardly tapering form, with narrow leading edges and broad rear walls to create eddy currents.

8. In mixing apparatus of the class described, a stationary mixing or emulsifying structure comprising upper and lower annular plates, and baffles between the plates, in spaced relation and constructed and arranged to divert liquid flow between the plates and produce eddy currents with emulsifying effect, the baffles being of generally outwardly tapering form, with narrow leading edges and broad rear walls to create eddy currents, and the side walls being concavely curved.

9. In mixing and emulsifying apparatus, in combination with a rotary impeller discharging material peripherally in a cross axial plane, a stationary deflecting and emulsifying structure surrounding the impeller and comprising an annular flow-directing plate arranged substantially in a cross axial plane of the impeller, and a multiplicity of flow-directing and emulsifying baffle blades on the plate, arranged substantially in a plurality of annular series about the impeller and in spaced relation, providing a multiplicity of approximately radial, tortuous passages, through which material from the impeller moves outward with repeated diversion of direction by the baffles and with emulsifying effect.

10. In mixing and emulsifying apparatus, in combination with a rotary impeller discharging material peripherally in a cross axial plane, a stationary deflecting and emulsifying structure surrounding the impeller and comprising an annular flow-directing plate arranged substantially in a cross axial plane of the impeller, and a multiplicity of flow-directing and emulsifying baffle blades on said plate, the baffle blades being arranged substantially in a plurality of annular series about the impeller and in spaced relation, and at approximately tangential angles to the impeller, providing a multiplicity of generally tangential, tortuous passages through which material is moved by the impeller with emulsifying effect.

11. In mixing and emulsifying apparatus, in combination with a rotary impeller discharging material peripherally in a cross axial plane, a stationary deflecting and emulsifying structure surrounding the impeller and comprising an annular flow-directing plate arranged substantially in a cross axial plane of the impeller, and a multiplicity of flow-directing and emulsifying baffle blades on the plate, arranged substantially in a plurality of annular series about the impeller and in spaced relation, providing a multiplicity of approximately radial, tortuous passages, through which material from the impeller moves outward with repeated diversion of direction by the baffles and with emulsifying effect, and additional vertical and radial flow-directing blades at the outer periphery of said plate to direct the discharged material in radial, axial planes.

12. Mixing and emulsifying apparatus comprising a turbo-impeller discharging material tangentially in a cross axial plane, and a stationary deflecting and emulsifying structure surrounding the impeller, said structure including upper and lower annular flow confining and blade supporting plates, and a multiplicity of spaced emulsifying baffle blades between and supported by the plates, said blades being arranged substantially in a plurality of annular series surrounding the impeller and substantially at tangential angles, and providing a plurality of generally tangential, tortuous flow passages through which the material is

driven and repeatedly diverted, with emulsifying effect.

13. Mixing and emulsifying apparatus comprising a turbo-impeller discharging material tangentially in a cross axial plane, and a stationary deflecting and emulsifying structure surrounding the impeller, said structure including upper and lower annular flow confining and blade supporting plates, and a multiplicity of spaced emulsifying baffle blades between and supported by the plates, said blades being arranged substantially in a plurality of annular series surrounding the impeller and substantially at tangential angles, and providing a plurality of generally tangential, tortuous flow passages through which the material is driven and repeatedly diverted, with emulsifying effect, and additional substantially vertical, radial blades between the plates at their outer margins, to direct discharged material in radial, axial planes.

14. Mixing and emulsifying apparatus comprising a turbo-impeller discharging material tangentially in a cross axial plane, and a stationary deflecting and emulsifying structure surrounding the impeller, said structure including upper and lower annular flow confining and blade supporting plates, and a multiplicity of spaced emulsifying baffle blades between and supported by the plates, said blades being arranged substantially in a plurality of annular series surrounding the impeller and substantially at tangential angles, and providing a plurality of generally tangential, tortuous flow passages through which the material is driven and repeatedly diverted, with emulsifying effect, said annular plates being separate and said baffle blades being formed in halves, one-half of each blade being carried by each plate with the ends of the respective blade portions abutting, and means securing the plates together.

In testimony whereof I affix my signature.

JOHN JOHNSON.