Dec. 23, 1941. E. SCHMIDT 2,267,341

MIXER

Filed Nov. 1, 1940 2 Sheets-Sheet 1

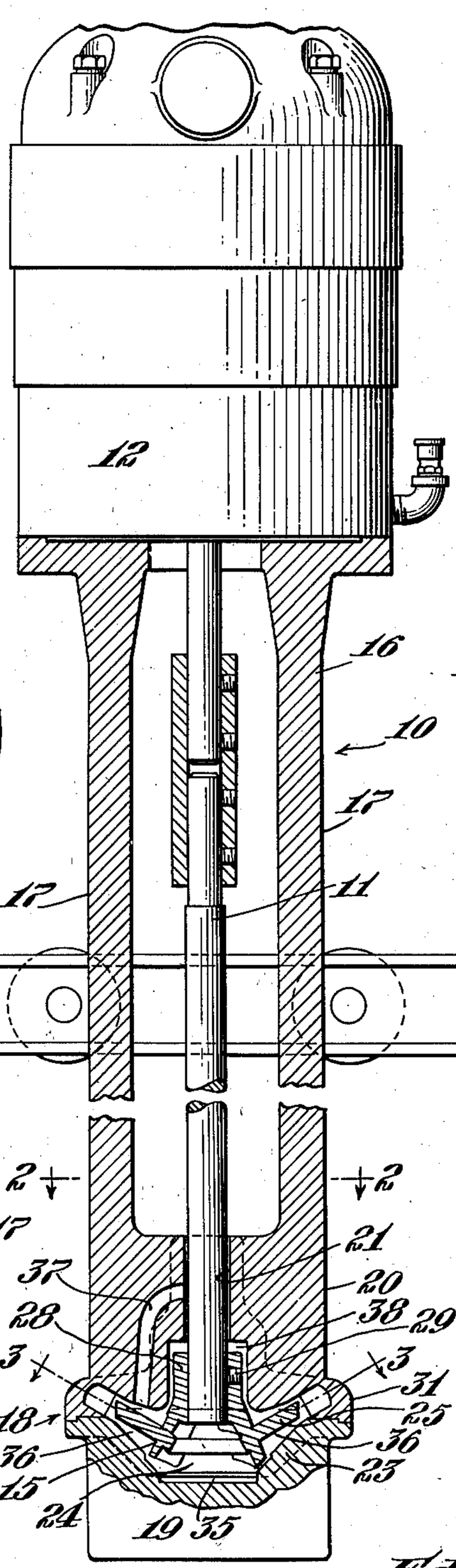

Fig. 1

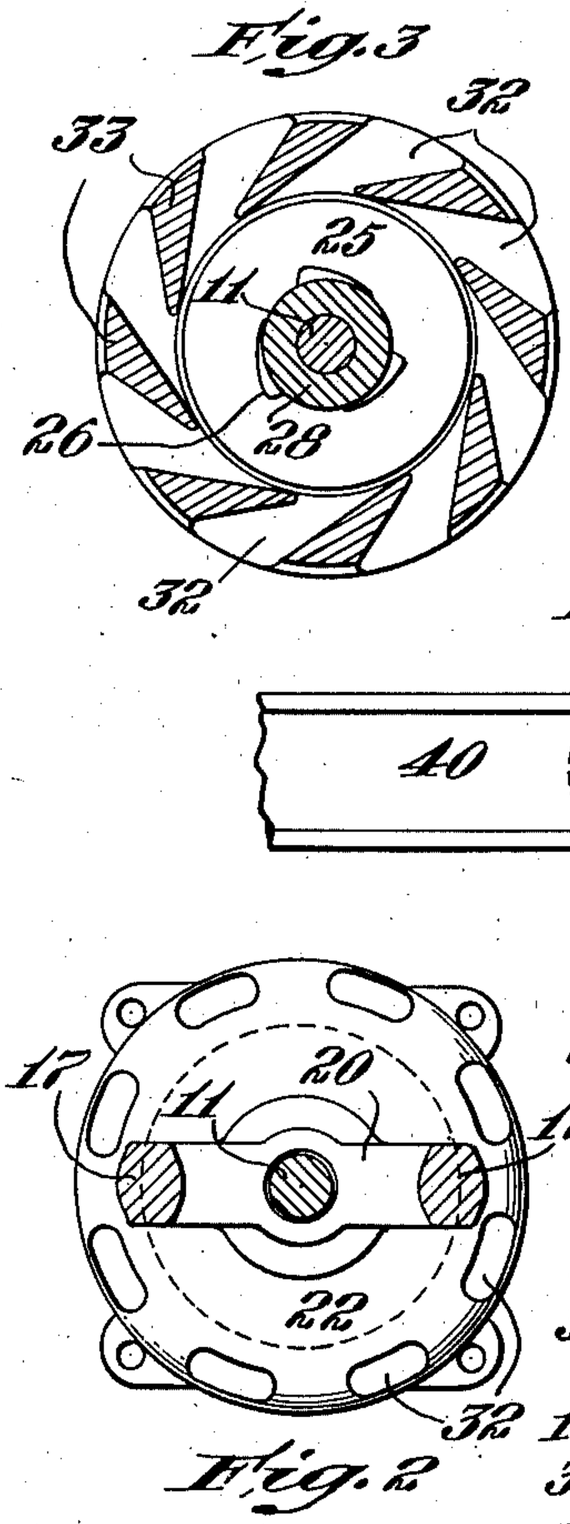

Fig. 3

Fig. 2

Inventor
Edward Schmidt
by Pobelt, Buchman & Woodbury
Att'ys.

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MIXER

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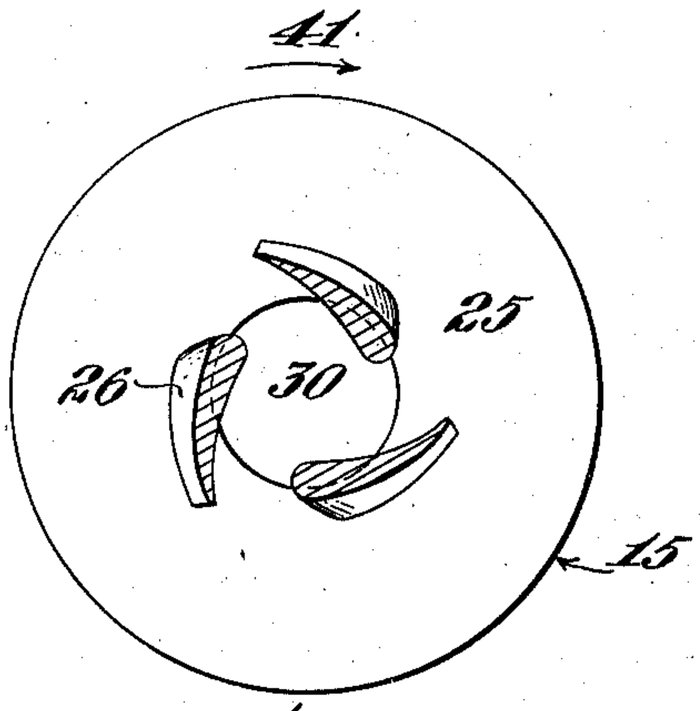

Fig. 4

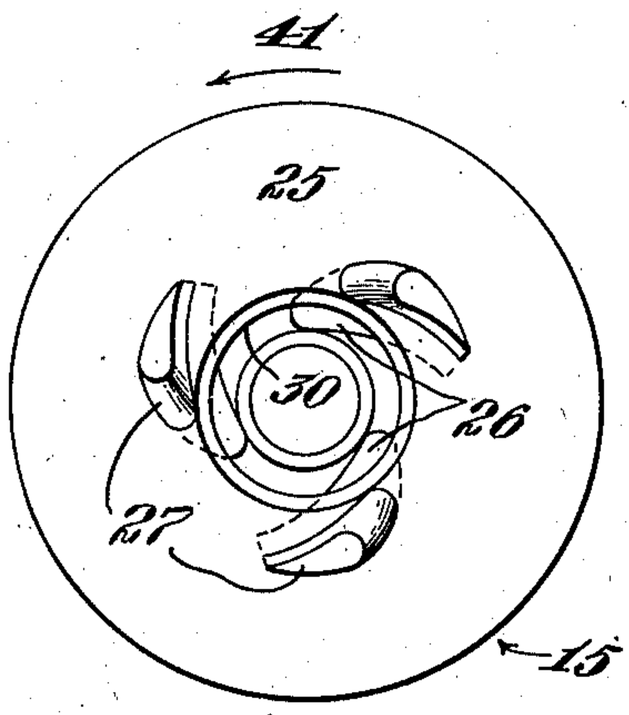

Fig. 5

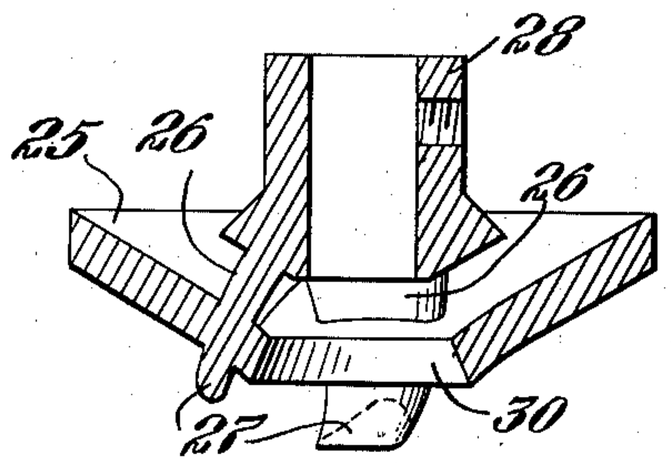

Fig. 6

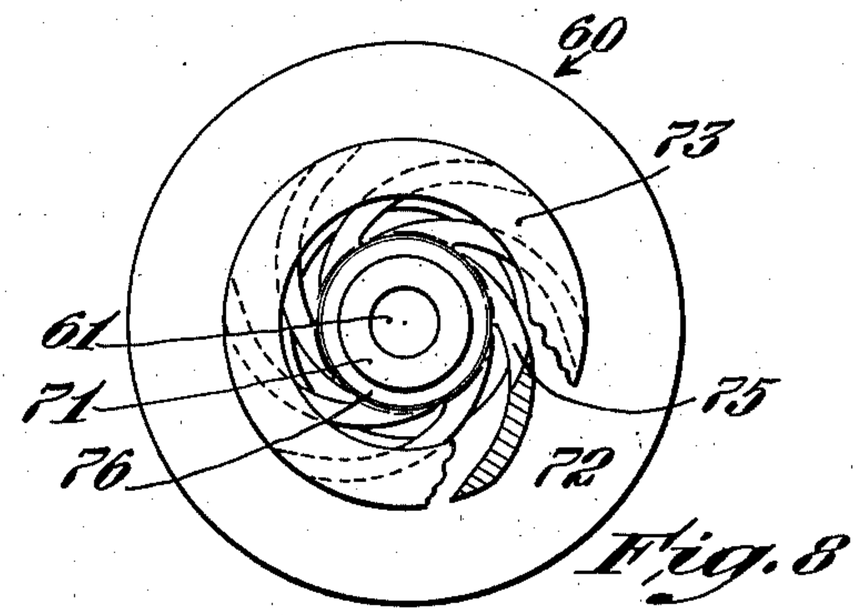

Fig. 8

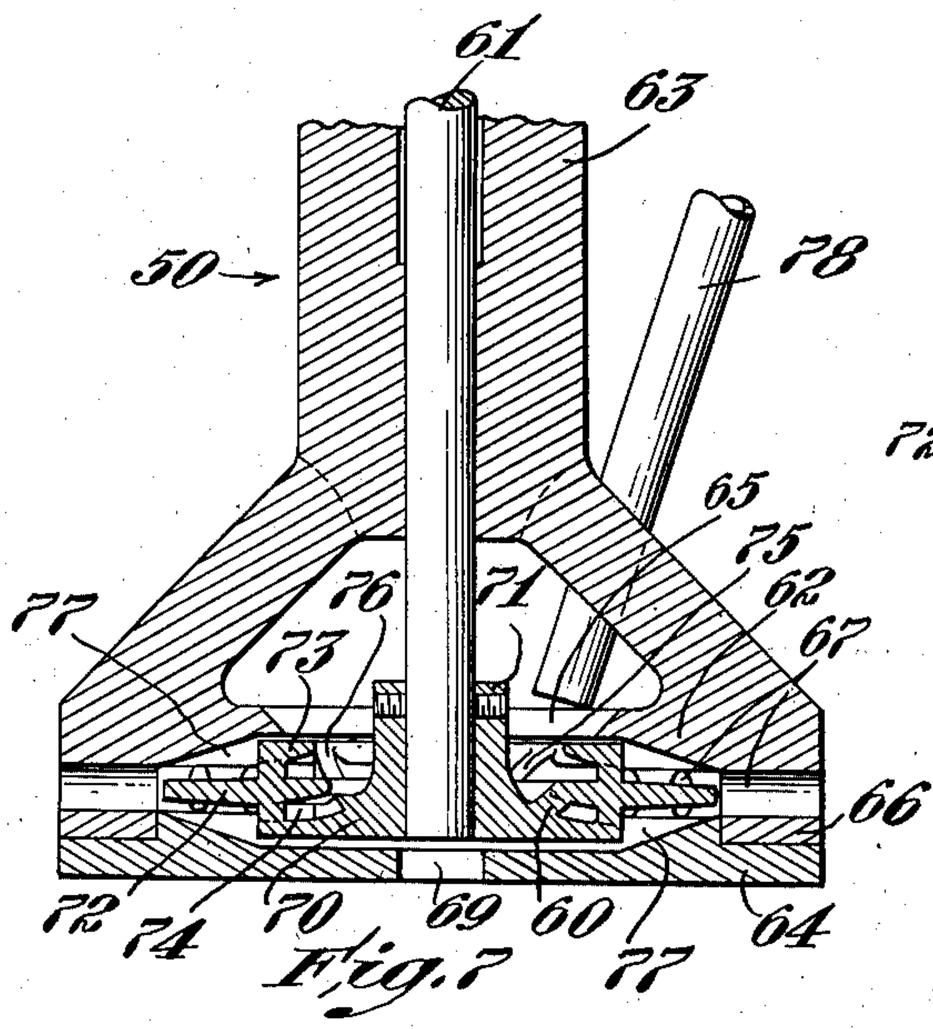

Fig. 7

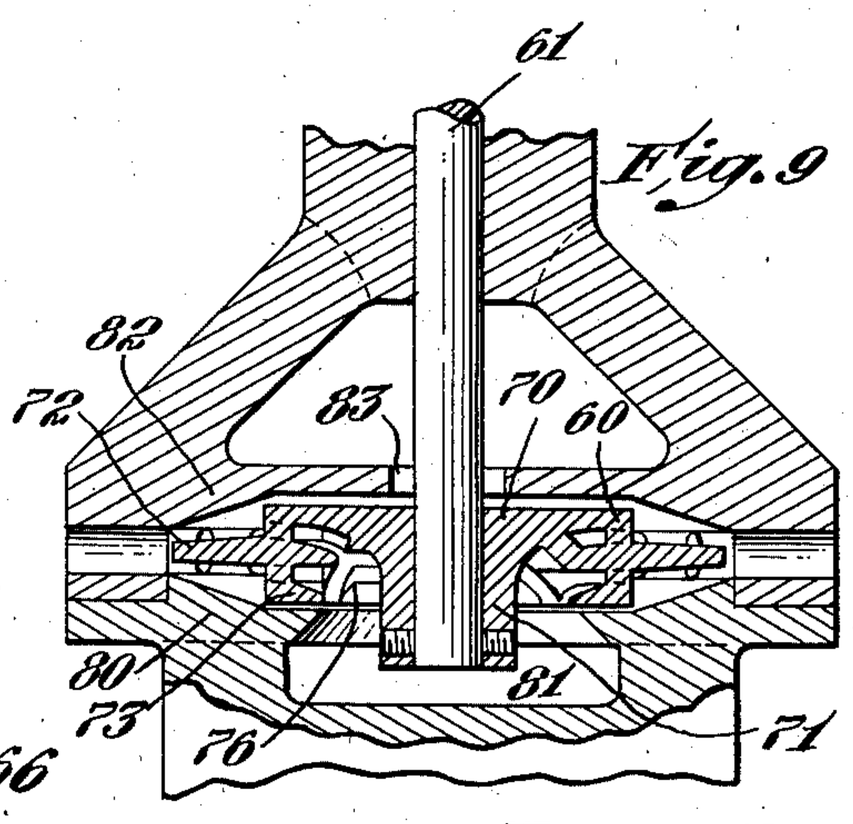

Fig. 9

Inventor
Edward Schmidt
by Roberts, Cushman & Woodberry
Att'ys.

Patented Dec. 23, 1941 2,267,341

UNITED STATES PATENT OFFICE

2,267,341

MIXER

Edward Schmidt, Methuen, Mass., assignor to Lawrence Pump and Engine Co., Lawrence, Mass., a corporation of Massachusetts

Application November 1, 1940, Serial No. 363,828

5 Claims. (Cl. 259—96)

This invention relates to an improvement in a mixer and more particularly in a mixer of the type shown in my Patent No. 2,206,266, dated July 2, 1940.

Such mixers have many uses as to blend, dilute, disperse, dissolve or emulsify liquids or other fluid material whereby complete homogeneity is obtained. For convenience in description the term "mixing" is used in the general sense to denote any such function of a machine of this type.

The primary object of this invention is to provide a mixer wherein a shearing action is set up to reduce any lumps in the treated material to a minimum and thereby promote a fine degree of emulsification.

Another object of this invention is to provide a mixer having an impeller which comprises an annular disk having vanes on opposite surfaces and a casing which encloses said impeller and has a plurality of ports which coact with the impeller in the treatment of liquids or fluids.

A further object of this invention resides in the formation of such casing with an annular passage having converging walls in which passage the disk rotates and through which passage the liquid or fluid travels under the urge of the impeller toward the ports of the casing, the walls of such passage coacting with the disk to set up a shearing action by which any lumps or coarse particles in the liquid are reduced to a minimum.

These and other objects of the invention will appear from a consideration of the following description and of the accompanying drawings in which

Fig. 1 is a view largely in longitudinal section of a mixer embodying this invention;

Figs. 2 and 3 are cross-sectional views taken along the section lines 2—2 and 3—3 respectively in Fig. 1;

Figs. 4 and 5 illustrate the top and bottom respectively of the impeller which forms one element of the mixer shown in Fig. 1;

Fig. 6 is a cross-sectional view of such impeller;

Fig. 7 is a sectional view of the lower end of another type of mixer embodying this invention;

Fig. 8 is a top plan view of the impeller shown in Fig. 7, with a portion broken away; and

Fig. 9 is a view similar to Fig. 7 of a third type of mixer.

The mixer 10 includes a spindle 11 rotated by a motor 12 and carrying at its lower end an impeller 15. The spindle 11 is supported in a frame 16 on the top of which rests the motor 12. The frame 16 includes a pair of posts 17, a casing 18 which encloses the impeller and a plate 19 projecting from the casing 18. The posts 17 are connected at the lower ends by an integral cross strap 20 having a bearing 21 for the spindle 11. The casing 18 comprises a cover 22, integral with the cross strap 20, and a base 23, integral with the plate 19, which cover and base coact to form a chamber 24 for the impeller 15.

The impeller 15 comprises an annular disk 25 which is conical in cross section and upon the faces of which are mounted vanes 26 and 27. A collar 28 supported by the vanes 26 receives the lower end of the spindle 11 to which it is secured by a set screw 29. As shown in the drawings, the disk 25, the vanes 26 and 27, and the collar 28 are integral and formed as a unit. It will be understood, however, that if desired the various parts may be separately formed and thereafter assembled to form the impeller. As shown particularly in Figs. 4 and 5 the vanes 26 and 27 are arcuate having heads at the central opening 30 in the disk 25 and converging side walls.

The cover 22 of the casing 18 includes an annular wall 31 which surrounds the disk 25 of the impeller. Through the wall 31 extend a plurality of ports 32 separated by partitions 33. The walls of the partitions diverge outwardly as shown in Fig. 3 so that the ports extend tangentially with respect to the inner face of the wall 31. The liquid enters the chamber 24 through openings 35 formed in the base 23 at each side of the plate 19.

The chamber 24 includes an annular passage 36 which receives the disk 25 beyond the vanes 26 and 27. The passage 36 is outwardly tapered and terminates at the wall 31 of the cover 22. A conduit 37 leads from the passage 36 to the spindle bearing 21 in the cross strap 20. The chamber 24 also includes a pocket 38 which receives the collar 28 of the impeller.

The mixer when in use is inserted into a receptacle or other container (not shown) for the liquid or fluid to be treated, and is usually supported at the desired location upon a crossbar 40 secured to the frame 16 in any suitable manner. When the impeller is rotated in the direction indicated by the arrows 41 (Figs. 4 and 5) the liquid is drawn into the chamber 24 through the openings 34 and 35 and expelled therefrom through the ports 32. The vanes 26 and 27 act to force the liquid into the converging passage 36.

The layers of liquid closely adjacent the casing walls have obviously a much lower circumferential speed of travel than have the layers of liquid closely adjacent the faces of the disk and

as a result a shearing action is set up between the layers which reaches the greatest intensity at the periphery of the disk just before the liquid enters the ports. The liquid discharged from the mixer consequently contains only very small particles, all the large particles having been disintegrated. The impeller not only acts to disintegrate the particles but also acts through the vanes and ports to distribute the particles uniformly. The streams of liquid emerging from the ports **32** are distributed throughout the container, traveling at such speed that they leave the vicinity of the mixer and insure the entry of untreated liquid into the mixer. After a short period the entire body of liquid in the receptacle has been treated by the mixer and brought into a homogeneous and uniform condition.

The openings **35** in the base of the casing are of advantage in that the suction exerted therethrough draws into the impeller the heavier elements of the liquid which would otherwise tend to remain at the bottom of the container. The plate **19** eliminates any possibility that the openings **35** should be closed by resting directly upon the bottom of the container.

The mixer **50** illustrated in Figs. 7 and 8, has an impeller of the enclosed type wherein liquid enters at both sides of the impeller. The impeller **60** is mounted upon the lower end of the spindle **61** which is driven by any suitable means (not shown) such as an electric motor. The casing enclosing the impeller comprises a cover **62**, integral with the post **63**, which supports the spindle **61**, and a base **64**. The cover **62** has a central opening **65** and at its periphery an annular wall **66** provided with a plurality of ports **67** similar in construction and arrangement to the ports **32** of the mixer **10**. A second opening **69** is provided in the base **64**.

The impeller **60** comprises a base **70**, a collar **71**, an annular disk **72**, a ring **73**, vanes **74** between the base **70** and the disk **72**, and vanes **75** between the disk **72** and the ring **73**. Preferably, as here shown, these various elements are integrally connected but could, if desired, be separately formed and thereafter united. The ring **73** is spaced from the collar **71** and defines therewith an opening **76** in register with the opening **65** and through which liquid flows to the central opening in the disk. The vanes **74** and **75** while greater in number than the vanes **26**, **27** in the impeller **15**, are similar in construction and arrangement and hence detailed description and showing thereof are considered unnecessary and will be omitted. The inner faces of the cover **62** and base **64** which define the annular passage **77** in which the disk **72** travels and into which the liquid is drawn by the vanes, are inclined toward the wall **66**.

The mixer **50** is operated in substantially the same manner as the mixer **10**. The liquid under treatment enters through the opening **65**, is forced by the vanes **74** and **75** into the passage **77**, and thence through the ports **67** returned to the container and mingled therewith. The disk **72** acts with the walls of the passage **77** to shear the particles of the liquid in the manner described in detail with respect to the mixer **10**. Under some conditions, as where a blending of two or more liquids is desired, it has been found advantageous to introduce one or more of the liquids directly to the impeller through a pipe **78**.

The impeller **60** is reversible and may be used in a mixer, as shown in Fig. 9, with the base **70** uppermost and the opening **76** at the bottom. The casing for the impeller in this position comprises a base **80** having a central opening **81** and a cover **82** having an annular opening **83** which surrounds the spindle **61**. That the impeller **15** is also reversible is obvious from a consideration of Fig. 1.

While certain embodiments of this invention have been described herein and illustrated in the accompanying drawings, it will be understood that the invention is not limited thereto and that other embodiments thereof may be made without departing from the spirit and scope of this invention as set forth in the following claims.

I claim:

1. A mixer comprising an impeller, a casing therefor, said impeller comprising a base, an annular disk and a ring, and vanes mounted on both faces of the disk adjacent the central opening therein by which vanes the base and ring are connected to the disk, and means for rotating said impeller.

2. A mixer comprising an impeller, a casing therefor, said impeller comprising a base, an annular disk and a ring, and vanes mounted on both faces of the disk adjacent the central opening therein by which vanes the base and ring are connected to the disk, said casing including an annular passage in which said disk travels when the impeller is rotated, and a peripheral wall having ports therein toward which said passage leads, and means for rotating said impeller.

3. A mixer comprising an impeller, a casing therefor, said impeller comprising a base, an annular disk and a ring, and vanes mounted on both faces of the disk adjacent the central opening therein by which vanes the base and ring are connected to the disk, said casing including an annular passage in which said disk travels when the impeller is rotated, and a peripheral wall having ports therein toward which said passage leads, the walls of the passage being inclined toward said peripheral wall, and means for rotating said impeller.

4. An impeller for a mixer comprising a base, an annular disk and a ring and vanes mounted on both faces of said disk adjacent the central opening therein, by which vanes the base and ring are connected to the disk.

5. A mixer for liquids comprising a rotatable impeller consisting of a base, an annular disk, a ring and vanes mounted on both faces of the disk adjacent the central opening therein by which vanes the base and ring are connected to the disk, the outer portion of the disk extending beyond the peripheries of the base and ring, a casing for the impeller including an annular passage in which the outer portion of the disk travels when the impeller is rotated to coact with the walls of the passage and shear the particles of the liquid treated by the mixer, and a peripheral wall having ports therein toward which said passage leads, and means for rotating said impeller.

EDWARD SCHMIDT.