May 6, 1930. J. JOHNSON 1,757,197

MIXER

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Fig. 1.

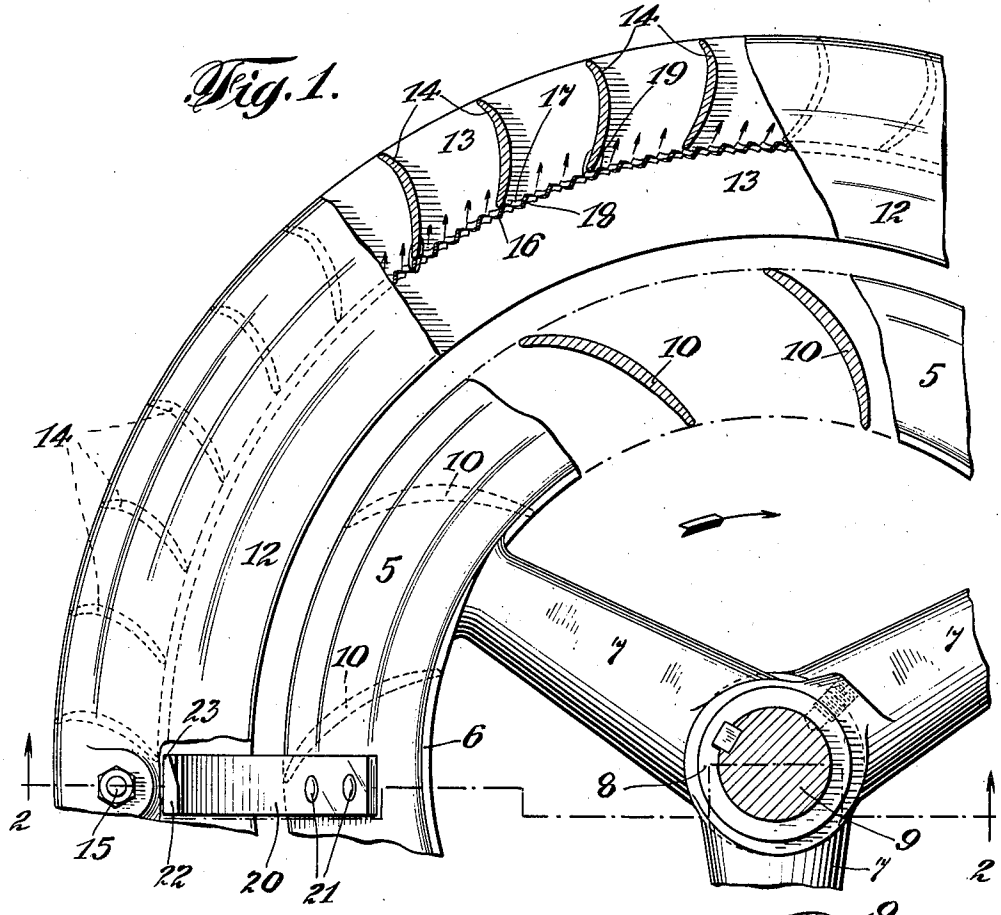
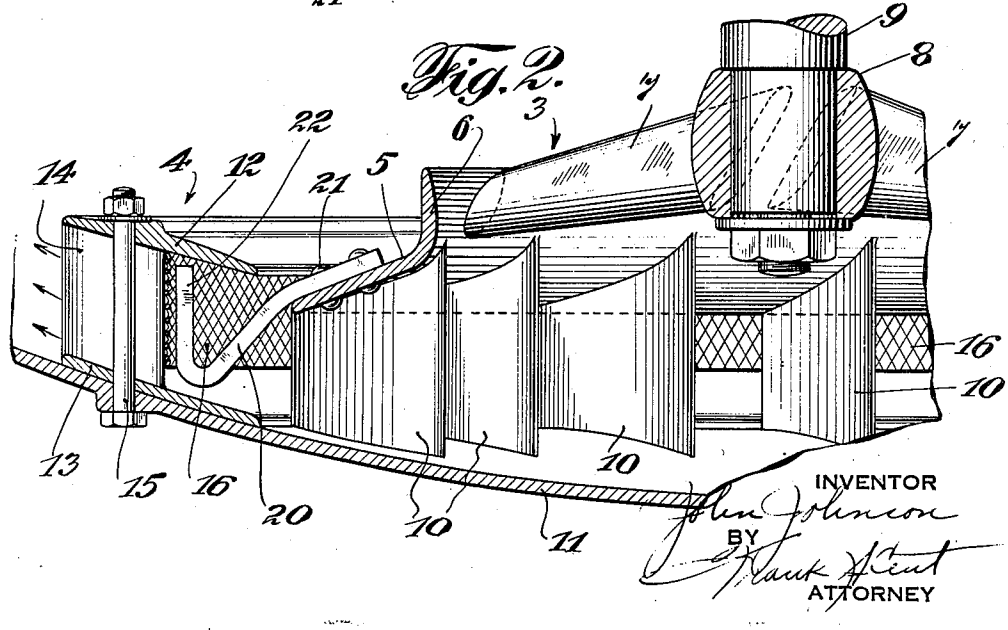



Fig. 2.




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Fig. 6.

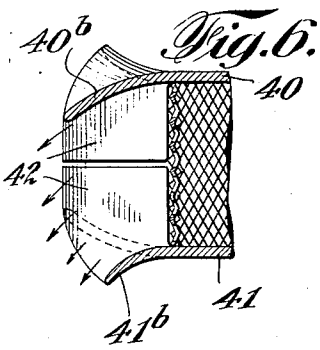



Fig. 5.

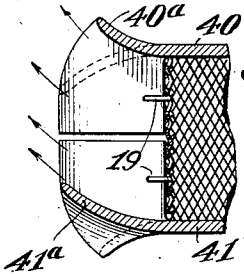
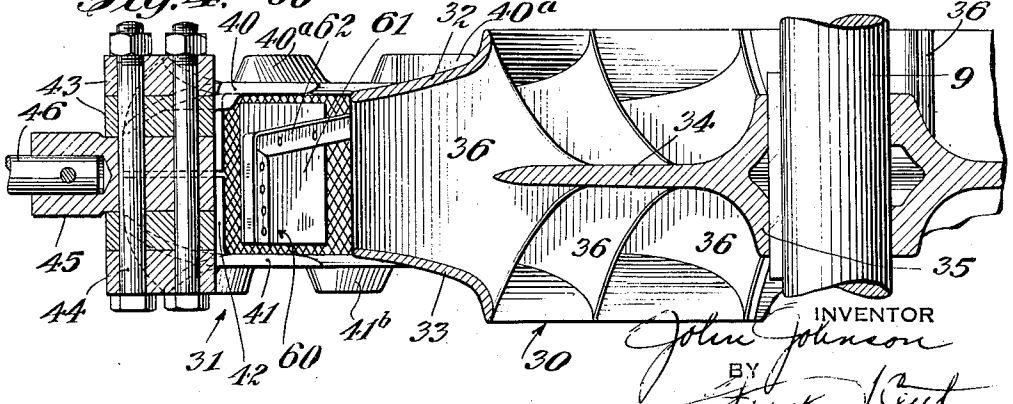



Fig. 3.




Fig. 4.




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# UNITED STATES PATENT OFFICE

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## MIXER

Application filed November 14, 1928. Serial No. 319,201.

My invention relates to mixing apparatus of the general character disclosed in various of my prior patents.

The principal object of the present invention is to provide new and improved means for rapidly and efficiently disintegrating, breaking up, or comminuting solid or semi-solid material in the circulated liquid. This is accomplished by providing a suitable disintegrator or screen associated with the stationary deflector or stator of a mixing unit.

The characteristics and advantages of the invention are further sufficiently explained in connection with the following detail description of the accompanying drawing, which shows representative embodiments. After considering these examples, 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 top plan, and partly in horizontal section, of a lower mixing unit.

Fig. 2 is a section at 2—2, Fig. 1.

Fig. 3 is a view, similar to Fig. 1, of an upper or intermediate mixing unit.

Fig. 4 is a section at 4—4, Fig. 3.

Fig. 5 is a section at 5—5, Fig. 4.

Fig. 6 is a section at 6—6, Fig. 4.

Each of the mixing units includes a rotary impeller, and a stationary deflector or stator, and the units are arranged, and the impellers are driven, to produce liquid circulation, in the manner set forth in my prior patents above mentioned and in a companion application executed of even date herewith.

The lower mixing unit as shown in Figs. 1 and 2 includes an impeller 3 and a stationary deflector or stator 4. The impeller may be of the type shown in the above mentioned companion application, including a plate 5 having an intake flange 6, spokes 7 connecting the plate to a hub 8 which is keyed in the vertical shaft 9, and suitably curved impeller blades 10, the lower edges of which run close to the curved or part-spherical tank bottom 11. The stationary deflector includes an upper, annular plate 12 and a lower plate 13, and suitably curved deflector blades 14. For the sake of simplicity the plates and blades are shown as integrally formed, although they may be separate and connected together in various ways. The deflector structure is secured to the tank bottom by bolts 15.

A disintegrating screen 16 is secured to the inner vertical edges of blades 14, between upper and lower plates 12 and 13. The structure of the screen may vary greatly.

In a preferred form, as shown, it is formed of expanded metal (produced in general conformity with metal lathing of the expanded sheet type); that is, it consists of a sheet of metal cut and expanded to provide openings 17 separated by strips 18 which are arranged angularly (at about 45°) to the general plane of the screen. The screen may be practically continuous around the inner periphery of the deflector, or may be in sections, and may be secured in any suitable way, as by wires or other suitable fastenings 18 passed through holes in the margins of blades 14.

To cooperate with the disintegrator or screen, a scraper 20 is desirably secured to the impeller. This in the form shown in Figs. 1 and 2, consists of a strip of metal of moderate width connected at 21 to rotor plate 5 and having an upwardly bent portion 22 located close to the screen surface and having a leading edge 23 of reduced thickness, or beveled, as shown in Fig. 1.

Figs. 3 and 4 show an upper or intermediate mixing unit including an impeller 30 substantially similar to that shown in the above mentioned companion application, and a stationary deflector or stator 31. The impeller includes upper and lower annular blades 32 and 33 respectively, a central plate or septum 34 having a hub 35 keyed to shaft 9, and suitably curved impeller blades 36.

The stationary deflector comprises upper and lower plates 40 and 41 respectively. Each of these plates may be a complete annulus or may consist of segments or quadrants as shown. The upper and lower plates or plate sections are connected by the suitably curved deflector blades 42. The ends of the plate sections are provided with ears or lugs 43 secured by bolts 44 to heads 45 on struts 46,

which are connected to the tank wall (not shown) to support the stator in proper relation to the impeller. A disintegrator or screen 50 which may be substantially similar to that described in connection with the lower mixing unit, is secured in a similar way to the inner edges of blades 42, bridging the space between the upper and lower plates 40 and 41.

A scraper or pusher 60 is connected to the impeller to cooperate with screen 50. This includes a vertical plate or blade 61 arranged at an angle to a radial, axial plane of the rotor, that is to say, it slants outward and rearward in respect to the direction of rotation, as clearly shown in Fig. 3. The outer edge of the scraper runs close to the inner surface of the screen. It is supported by an arm 62 connected to the impeller, specifically, to the upper plate 32 thereof, at 63.

The stationary deflector in this example has means for deflecting liquid issuing at its periphery, upward and downward, to provide the desired circulation, as set forth in my previous patents above mentioned. Thus marginal portions of the upper and lower plates 40 and 41 are curvedly bent downward and upward, as best explained in Figs. 5 and 6, in connection with Figs. 3 and 4. Thus between any two of the blades 42, the margin of the upper plate 40 is bent upward as at $40^a$, Fig. 5, and the margin of the lower plate 41 is also bent upward as at $41^a$, thus providing in effect between the stated blades, an upwardly directed nozzle to direct liquid upward as indicated by arrows. Between the next pair of blades, in either direction, as shown in Fig. 6, the upper plate margin $40^b$ is bent curvedly downward, and the lower plate margin $41^b$ is similarly bent downward, forming a downwardly directed discharge orifice or nozzle, to deflect liquid downward as shown by arrows, thus providing a desired downward and upward circulation of the liquid adjacent the tank wall for reasons explained in the above mentioned prior patents, and as sufficiently indicated in Fig. 1 of my companion application above mentioned.

In operation, liquid containing solids in larger or smaller lumps or masses, is circulated by the mixing units in the manner set forth in the patents referred to. The solid material may vary greatly in character. It may be in the form of relatively large or small masses or lumps of solid or semi-solid, more or less fibrous, gelatinous or other character. In any case the disintegrators or screens provide for rapid and efficient separation of the masses into smaller strands or fragments which are thereafter quickly and effectively further broken up by the liquid circulation produced by the impeller action. At the same time the pushing or scraping elements such as 22, Figs. 1 and 2, or 61, Figs. 3 and 4, serve to propel the solid material in close contact with the screens and also to scrape or clear the inner surface of the screen. The solid material, to give only one example, may be in the form of lumps such as 70, Fig. 3, of considerable size, and may be more or less gelatinous or plastic. When such solid material is contained in the liquid, in the absence of screening or disintegrating means, the lumps are broken up relatively slowly and a long time is required for their reduction and proper mixing. When screens are provided as shown, the solid lumps are brought by the liquid flow in forcible contact with the screen surface, and the screen by attrition quickly wears down the lumps into small particles which pass through the screen. Particularly with material such as referred to, and when scrapers such as 22 and 61 are provided, a solid lump such as 70, Fig. 3, is carried by the scraper in contact with the inner face of the screen and with the inner edges of the screen strips 18, which are inclined at an angle as above described. These edges are also sharp on account of the manner of screen formation, and act practically as knives, so that by the combined action of the scraper or pusher and the screen strips, the solid material is pushed through the screen in the form of divided strands or strips of small cross-section, and these are quickly further broken down or separated into particles of required fineness by repeated screening actions, and the effect of the vigorous liquid circulation.

I claim:

1. In mixing apparatus of the class described, a rotary bladed impeller and a stationary deflector about the impeller, the deflector having blades for discharging material radially, and a disintegrator associated with the deflector for disintegrating or dividing solid materials in a liquid circulated by the impeller and passing through the deflector.

2. In mixing apparatus of the class described, comprising a rotary impeller and a stationary deflector provided with blades, a circumferential disintegrating screen in the deflector.

3. In mixing apparatus of the class described, comprising a rotary impeller and a stationary deflector provided with blades, a circumferential disintegrating screen in the deflector, and a scraper carried by the impeller and moving close to the screen surface.

4. In mixing apparatus of the class described, comprising a rotary impeller and a stationary deflector provided with blades, a circumferential disintegrating screen in the deflector, and a scraper carried by the impeller and moving close to the screen surface, the scraper being positioned to urge solid material through the screen and to clear the screen surface.

5. The structure set forth in claim 1 with

the addition that the disintegrator includes spaced strips angularly arranged and presenting edges for contact with and separation of solid masses.

6. The structure set forth in claim 2 with the addition that the screen is of expanded metal structure including spaced strips presenting substantially sharp edges for contact with and disintegration of solid materials.

7. Mixing apparatus comprising a rotary bladed impeller, a stationary deflector surrounding the impeller and including upper and lower plates and deflector blades between the plates, and a circumferential disintegrating screen secured in the deflector between its plates.

8. Mixing apparatus comprising a rotary bladed impeller, a stationary deflector surrounding the impeller and including upper and lower plates and deflector blades between the plates, and a circumferential disintegrating screen secured in the deflector between its plates and against the inner edges of the blades.

9. The structure defined in claim 7 with the addition of: a scraper carried by the impeller and moving close to the screen surface to effect contact of solid material with the screen.

10. The structure defined in claim 7 with the addition that the screen is of expanded metal including spaced strips having edges for separating-contact with solid material.

In testimony whereof I affix my signature.

JOHN JOHNSON.