July 1, 1930. J. JOHNSON 1,768,955

MIXER

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Fig. 1.

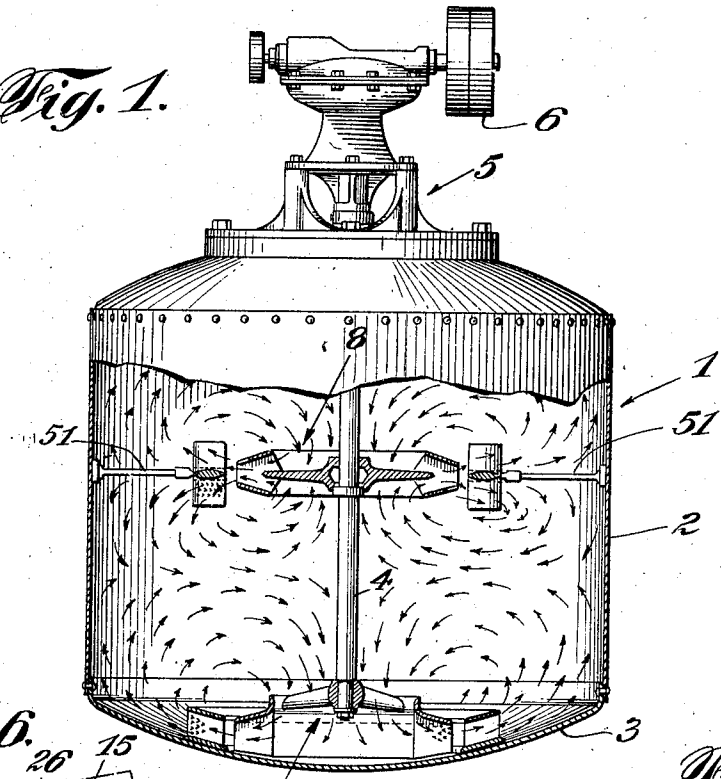


Fig. 6.

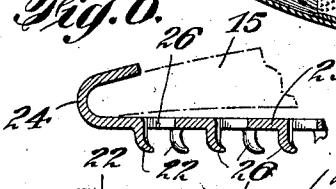


Fig. 7.

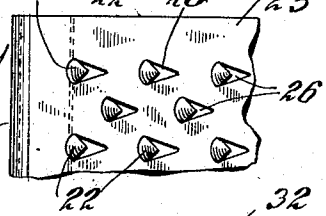


Fig. 9.

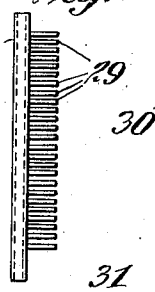


Fig. 8.

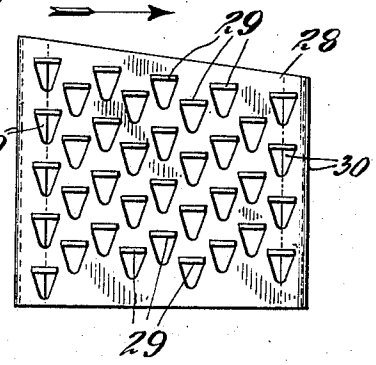
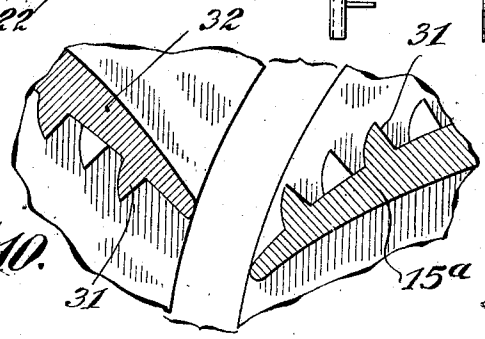


Fig. 10.



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Fig. 2.

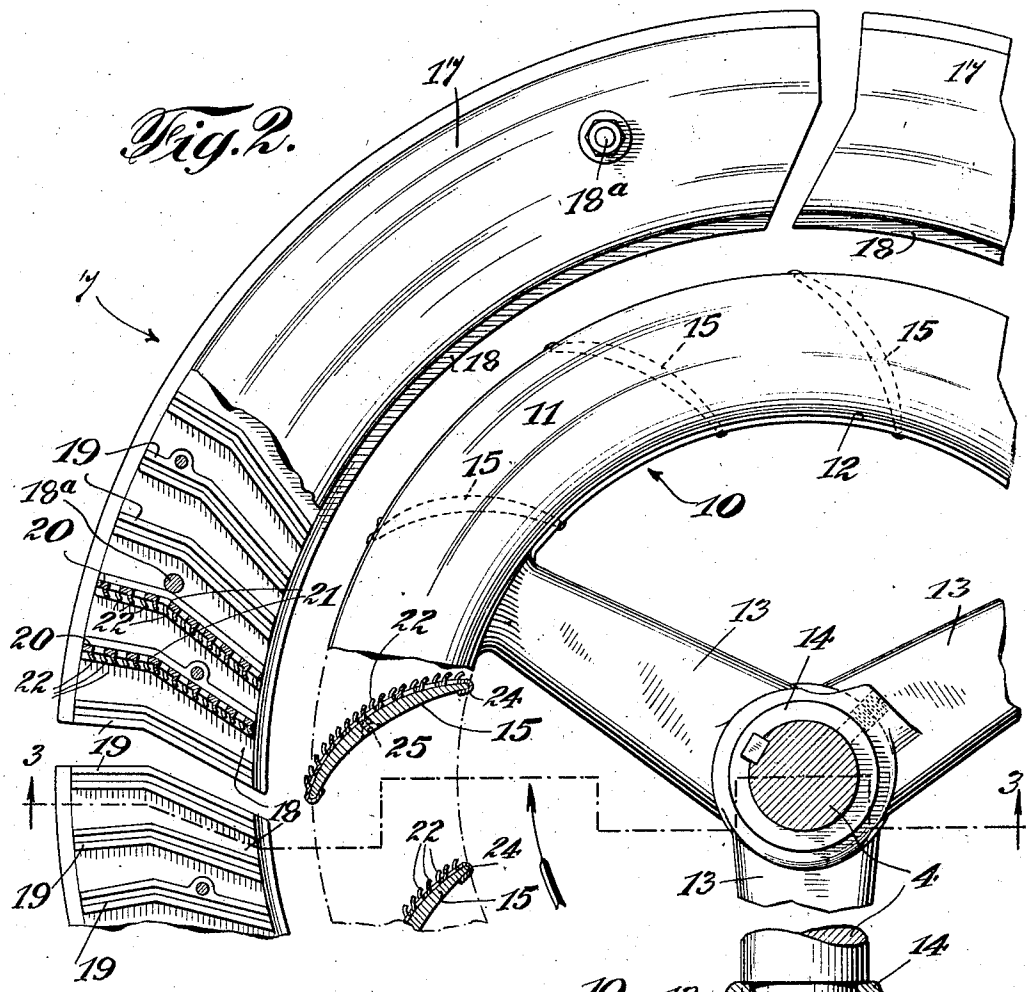
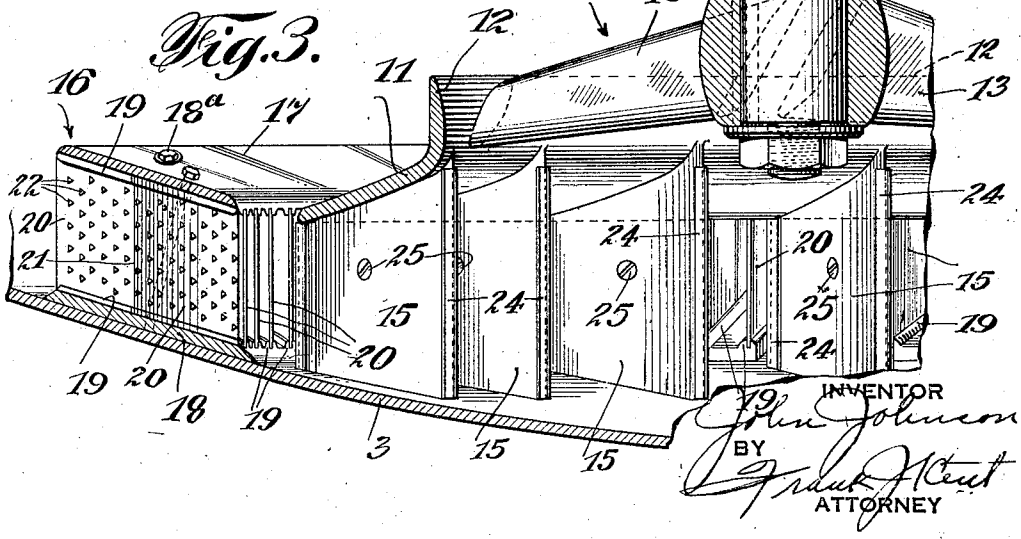


Fig. 3.



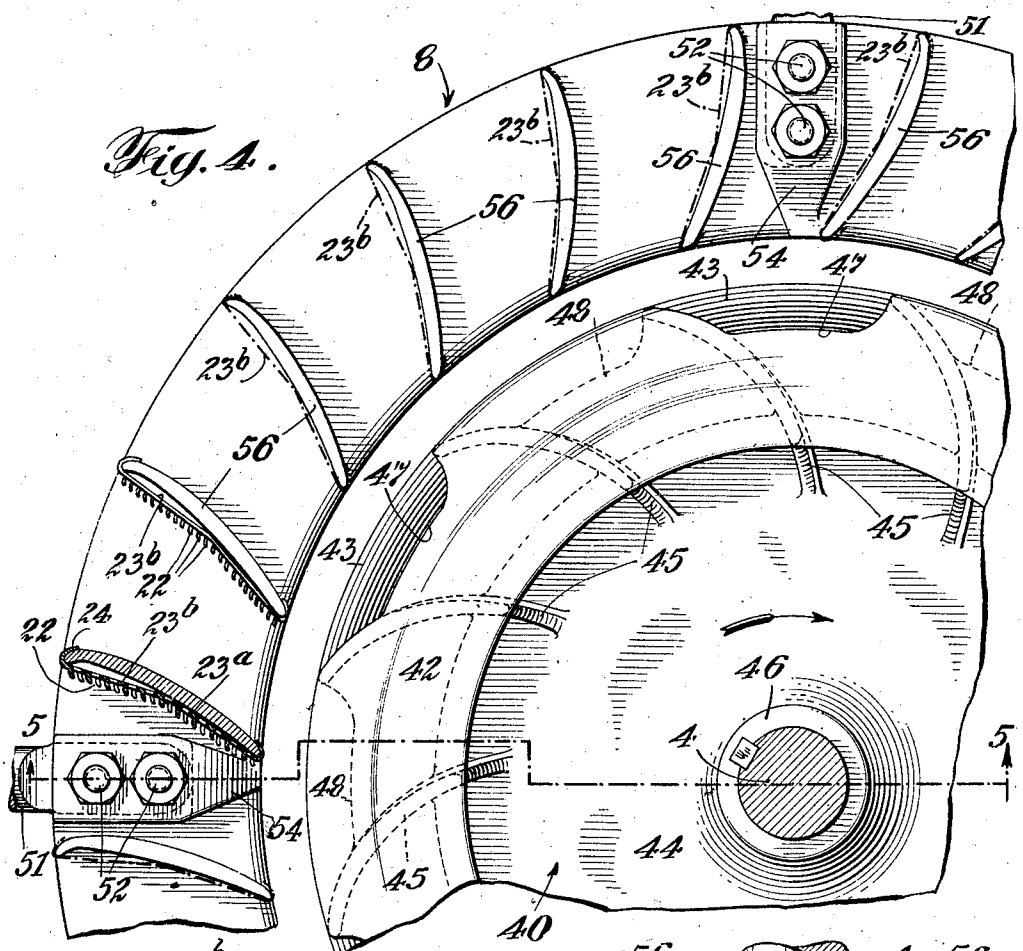
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MIXER

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Fig. 4.



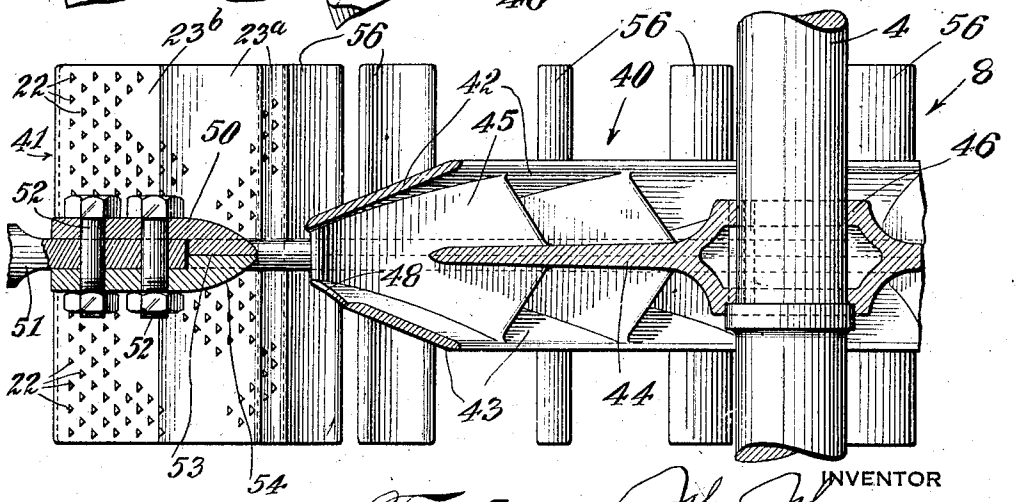


Fig. 5.

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Patented July 1, 1930 1,768,955

UNITED STATES PATENT OFFICE

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MIXER

Application filed November 14, 1928. Serial No. 319,200.

My invention relates to mixing mechanism of the general character disclosed in various of my prior patents, for efficiently mixing gases, liquids or solids with liquid.

The principal object of the present invention is to provide new and improved means for more effectively breaking up or comminuting solid or semi-solid substances, in the process of circulating and mixing, so that such solid bodies, of whatever size, are more rapidly broken up or disintegrated and mixed with the liquid.

This is accomplished by providing on either or both the impeller and stationary deflector blades, teeth, blades or analogous protuberances, properly arranged to engage the solid bodies, which are forcibly brought in contact with them by the rapidly circulating liquid, so that the disintegration or comminution of such solids is expedited and the mixing completed in much shorter time than would be possible without the provision of such blades or teeth.

The characteristics and advantages of the invention are further sufficiently explained in connection with the following detail description of the accompanying drawings, which show certain 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 side elevation, and partly in axial section, of a mixer embodying the invention in one form.

Fig. 2 is a horizontal section, enlarged, of the lower mixing unit.

Fig. 3 is a section at 3—3 of Fig. 2.

Fig. 4 is a horizontal section of the upper or intermediate mixer.

Fig. 5 is a section at 5—5 of Fig. 4.

Fig. 6 is a detail section of one blade structure.

Fig. 7 is an elevation thereof.

Fig. 8 is an elevation or face view of another blade structure.

Fig. 9 is a left side elevation thereof.

Fig. 10 is an enlarged fragmentary section of other blade structures.

In Fig. 1, 1 is any suitable mixing tank, usually having a cylindrical side wall 2, and a dished or part-spherical bottom 3. A vertical impeller shaft 4 is located centrally in the tank and is supported in suitable bearings in the top structure 5 and driven in any suitable way, as by an electric motor mounted thereon, or by pulleys 6, shaft mounting and driving means being sufficiently shown in my prior patents above referred to.

A lower mixing unit 7 is arranged at the bottom of the tank and an upper or intermediate unit 8 is arranged at an intermediate vertical position, usually near the vertical center of the tank. Each of these units includes a rotary impeller mounted on the shaft, and a stationary deflector structure.

Details of the lower mixing unit are shown in Figs. 2 and 3. This unit is generally similar to lower mixing units shown in the prior patents above mentioned. The impeller 10 includes an annular plate 11 having an intake flange 12. This is supported by spokes 13 having a hub 14 keyed on shaft 4, and when desired the spokes may be of relatively thin section and angularly arranged as sufficiently shown in dotted lines in Fig. 3, to provide a centripetal effect and amplify the inflow of liquid. Impeller blades 15 of suitable curvature are secured to, or as shown, cast integral with plate 11. The stationary deflector 16 includes a top plate 17 and bottom plate 18 secured to the tank bottom 3, the blades being secured together by bolts 18^a. The plates have on their lower and upper faces, respectively, channeled ribs 19 to receive and hold the stationary deflector plates 20 which, as shown in Fig. 2, are bent angularly at 21 to properly receive the liquid discharged tangentially by the rotary blades 15, and properly divert it to a substantially radial flow and upward and inward circulation, as shown by arrows in Fig. 1. Otherwise, the blades may be curved, substantially as shown in the stationary structure of Figs. 4 and 5.

Either the rotary or stationary blades, or both, may be provided with teeth, corrugations, or analogous formations, for mechan-

ically grating or disintegrating solids brought in contact with them by the liquid flow. These teeth may be formed integral with the blades or attached thereto in various ways. In Figs. 2, 3, 6 and 7, curved or hooked teeth 22 are formed as integral parts of plates 23, which are curved to fit the leading faces of rotor blades 15 and secured by end portions 24 of the plates, bent around the vertical edges of the blades and also, if desired, by screws 25. The teeth are conveniently formed by punching the plates, leaving apertures 26 therein. The stationary blades 20 of Figs. 2 and 3 are analogous to plates 23 just described, and in this instance themselves form the deflector blades provided with teeth 22 of the same character as described in connection with the rotor blades. Figs. 8 and 9 show a modification in which plates 28 may be either rotor or stator plates or blades or arranged for attachment to rotor or stator blades. Teeth 29 are in this case thin and flat, being produced by punching them from the integral metal of the plate and bending them at right angles thereto, the plane of the blade being in the direction of the current flow, as indicated by the arrow, Fig. 8, and the blades in successive rows are properly arranged, or staggered, to insure effective disintegrating contact with a multiplicity of the blades by solids passing over the plate surfaces. These plates have their edges bent as at 30 for engagement with edges of rotor or stator blades, after the fashion of Figs. 6 and 7.

Fig. 10 shows another modification, in which lugs or teeth 31 are formed integral, as by casting, on rotor blades 15^a and stator blades 32, respectively.

Figs. 4 and 5 show the upper or intermediate mixing unit 8 which includes the rotor or impeller 40 and stationary deflector, or stator 41. The impeller includes upper and lower annular plates 42 and 43, respectively, and a central plate or septum 44, the plates being connected by blades 45, of suitable curvature. Plate 44 has a hub 46 keyed on shaft 4. The outer margins of plates 42 and 43 are incurved or cut back as at 47 and 48, the cut back portions for each plate being between alternate pairs of blades, and also with relation to the upper and lower plates being in staggered or interspaced relation to each other, thus providing for upward and downward deflection of the liquid flow, as sufficiently indicated by arrows in Fig. 1. The blades 45 may be provided with teeth, blades or corrugations, in any of the ways previously mentioned.

The stationary deflector, or stator, structure 41 includes horizontal plates, or annular flat supporting rings 50, secured together, and to supporting struts 51 by bolts 52. The supporting plates or rings 50 may be continuous, as shown, or made in segments. The struts 51, are connected at their outer ends to the tank wall 2. The inward edges of plates 50 meet at 53 and their upper and lower faces are curved as at 54 to present a smooth, rounded surface to liquid flow. The stationary blades 56 are connected to, or cast integral with, the supporting plates or rings 50, and project above and below the rings; otherwise, a single supporting ring may be provided, with the upper and lower blade portions secured to or cast on its upper and lower surfaces.

Tooth-plates 23^a, generally similar to plates 23 of Figs. 6 and 7, are secured to blades 56. Fig. 4 shows that these plates need not conform exactly to the curvature of the active blade surface. For example, portions 23^b of plates 23^a may form a tangent to the blade surface; otherwise, the plate 23^a may be pressed to closely conform to the blade surface at all points.

The described structure provides for efficient liquid flow and mixing in the manner sufficiently set forth in prior patents above referred to and as indicated by arrows in Fig. 1; and, in addition, the blades or teeth on the rotor or stator blades or both, are engaged by any solid or semi-solid material in the liquid, and such material is rapidly and effectively shredded, broken up or comminuted by blade or tooth action, thus greatly reducing the time required for mixing when solid materials are included.

I claim:—

1. Mixing mechanism comprising a tank, and a rotary, bladed impeller therein, the active surfaces of the blades being provided with teeth for disintegration of solids contained in a circulated liquid.

2. Mixing mechanism comprising a tank, and a rotary, bladed impeller therein, the active surfaces of the blades being provided with teeth for disintegration of solids contained in a circulated liquid, and a stationary bladed deflector surrounding the impeller.

3. Mixing mechanism comprising a tank, and a rotary, bladed impeller therein, the active surfaces of the blades being provided with teeth for disintegration of solids contained in a circulated liquid, and a stationary bladed deflector surrounding the impeller, the active surfaces of the deflector blades being provided with teeth for disintegration of solids contained in a circulated liquid.

4. In mixing apparatus, in combination with a liquid flow controlling blade, a plate having means for connection to the blade and provided with a multiplicity of teeth.

5. In mixing apparatus, in combination with a liquid flow controlling blade, a plate having means for connection to the blade and provided with a multiplicity of teeth

consisting of integral parts of the plate punched and bent up therefrom.

6. Mixing mechanism of the character described, comprising a rotary impeller and a stationary deflector surrounding the impeller, both the impeller and deflector having blades acting on circulated liquid, certain of said blades having on their active faces a multiplicity of teeth to engage and disintegrate solids carried by the liquid.

7. Mixing mechanism of the character described, comprising a rotary impeller and a stationary deflector surrounding the impeller, both the impeller and deflector having blades acting on circulated liquid, the impeller blades having on their active faces a multiplicity of teeth to engage and disintegrate solids carried by the liquid.

8. Mixing mechanism of the character described, comprising a rotary impeller and a stationary deflector surrounding the impeller, both the impeller and deflector having blades acting on circulated liquid, the deflector blades having on their active faces a multiplicity of teeth to engage and disintegrate solids carried by the liquid.

9. Mixing mechanism of the character described, comprising a rotary impeller and a stationary deflector surrounding the impeller, both the impeller and deflector having blades acting on circulated liquid, the blades having on their active faces a multiplicity of teeth to engage and disintegrate solids carried by the liquid.

10. In mixing apparatus, a tank, and a rotary, bladed, fluid actuating device therein, the active faces of the blades being provided with teeth for disintegration or comminution of solids contained in the circulated medium.

11. Mixing apparatus comprising a tank, a rotary liquid circulating element, and a stationary deflector in the tank, the liquid circulating element and the deflector being provided with blades, and a multiplicity of teeth projecting from the active surfaces of the blades to disintegrate solids carried by the circulated medium.

12. Mixing mechanism comprising a tank, and a rotary, bladed impeller therein, certain surfaces of the blades being provided with teeth for disintegration of solids contained in a circulated liquid.

13. Mixing mechanism comprising a tank, a rotary, bladed impeller therein, and a stationary bladed deflector surrounding the impeller, surfaces of certain of the blades being provided with teeth for disintegration of solids contained in a circulated liquid.

14. In mixing apparatus, a tank, and a rotary, bladed, fluid actuating device therein, certain faces of the blades being provided with a multiplicity of teeth for disintegration or comminution of solids contained in the circulated medium.

15. Mixing apparatus comprising a tank, a rotary liquid circulating element, and a stationary deflector in the tank, the liquid circulating element and the deflector being provided with blades, and a multiplicity of teeth projecting from certain surfaces of the blades to disintegrate solids carried by the circulated medium.

16. In mixing and disintegrating apparatus, in combination with a tank and a rotary impeller therein, a deflecting structure surrounding the impeller and comprising upper and lower plates, and spaced deflecting blades secured between the plates in perpendicular relation thereto, the blades being perforated for passage of material therethrough and having on their active faces a multiplicity of disintegrating teeth.

In testimony whereof I affix my signature.

JOHN JOHNSON.