Oct. 13, 1936. E. COWLES 2,057,478

APPARATUS FOR DISINTEGRATING, DISSOLVING, AND MIXING SOLIDS IN LIQUIDS

Filed May 18, 1934 2 Sheets-Sheet 1

Fig. 1.

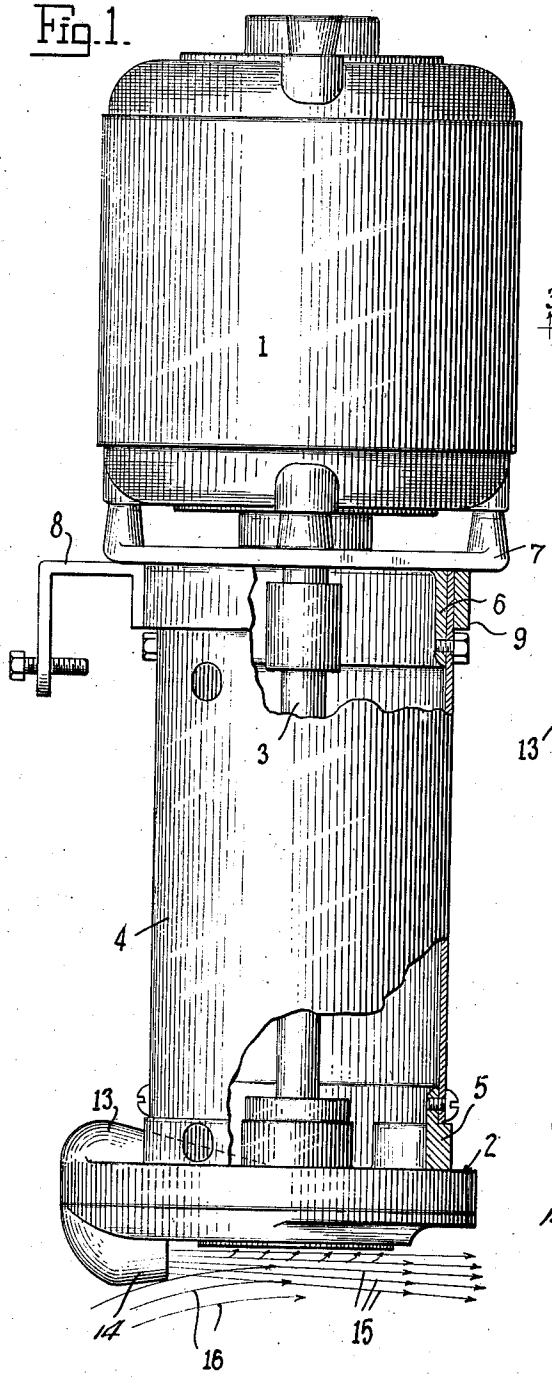


Fig. 2.

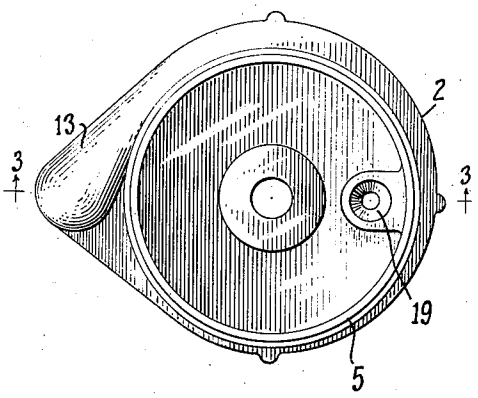


Fig. 3.

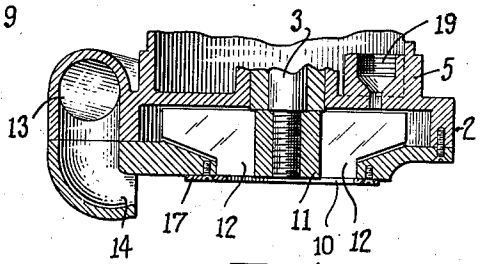
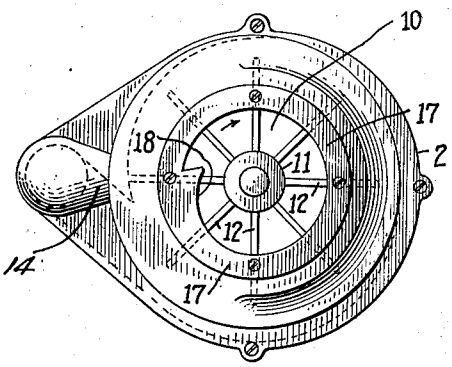


Fig. 4.



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Filed May 18, 1934 2 Sheets-Sheet 2

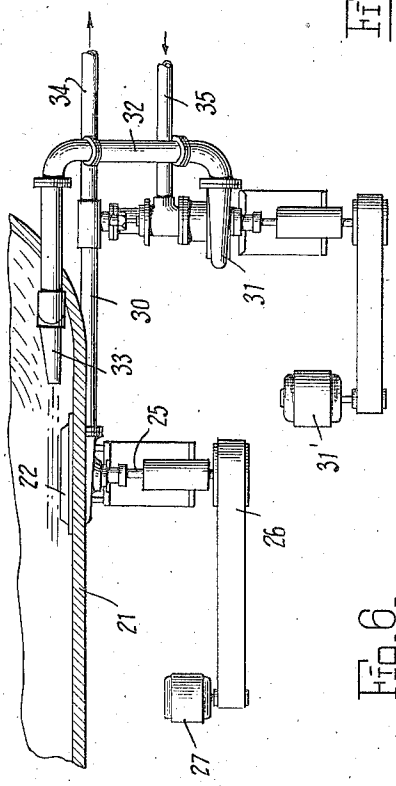


Fig. 5.

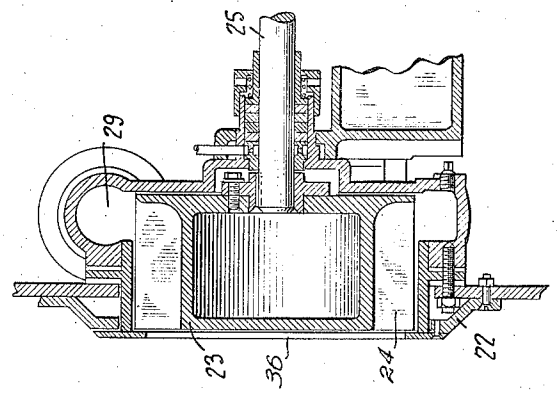


Fig. 7.

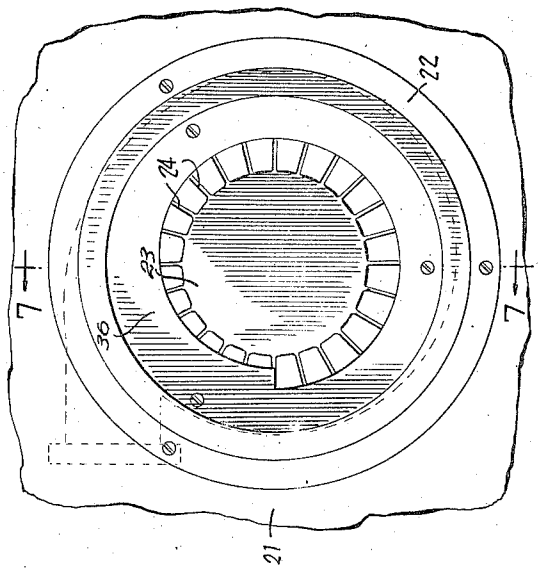


Fig. 6.

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2,057,478

APPARATUS FOR DISINTEGRATING, DISSOLVING, AND MIXING SOLIDS IN LIQUIDS

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Application May 18, 1934, Serial No. 726,302

13 Claims. (Cl. 259—95)

This invention relates to improvements in apparatus for disintegrating, dissolving, and mixing solids in liquids.

In many industries there are problems of disintegrating, dissolving, and mixing solids in liquids. For example, in the paper industry there is the problem of disintegrating fibrous material in water in order to prepare the stock from which the paper is formed. In the manufacture of paint, there is the problem of mixing pigments with the liquid carrier. In the manufacture of varnish and lacquer there are problems of dissolving solids in liquid solvents, which problems are particularly difficult in some cases.

It is an object of this invention to provide a simple, inexpensive apparatus which will be suitable for use for such purposes.

Other objects and advantages of the invention will appear hereinafter.

A preferred embodiment of the invention selected for purposes of illustration is shown in the accompanying drawings, in which,

Figure 1 is a side elevation of the device partly broken away.

Figure 2 is a top plan view of the pump unit.

Figure 3 is a section on the line 3—3 of Figure 2, and

Figure 4 is a bottom plan view.

Figure 5 is a top plan view, partly broken away, of a different form of apparatus embodying my invention.

Figure 6 is an enlarged front elevation of the screen housing.

Figure 7 is a section on the line 7—7 of Figure 6.

In my prior Patent No. 1,883,597 I have disclosed a method and apparatus for disseminating solids in liquids in which a high speed jet of liquid is used as the primary disseminating or disintegrating force. The liquid from which the jet is formed is withdrawn from the container in which the disseminating action taken place through a stationary perforated screen, and in order to prevent the screen openings from being clogged by solid material, the jet is so directed as to sweep across the screen, thus tending to keep the screen clear at all times.

According to the present invention I propose to replace the stationary screen described in my prior patent by a device which may be called, for convenience, a rotating or spinning screen, and comprising a rotating element located at the mouth of the intake opening, and having vanes or other means which subdivide the intake opening into a plurality of smaller openings. The size of these openings may be adjusted as desired to control the size of pieces of solid material which may be permitted to pass through the screen.

Such a rotating screen not only serves to control the size of pieces of solid material which pass through but also tends to clear itself so as to prevent clogging by solid material. It also serves to provide an efficient mechanical disintegrating action as the advancing edges of the vanes strike pieces of solid material as they enter the intake opening with the rapidly moving liquid current. These latter functions are served independently of the action of the jet of liquid sweeping the intake opening, and in certain applications of the invention, using the spinning screen, an efficient disintegrating action may be secured, and the intake opening may be kept clear even though the jet is not directed across the intake opening.

Because of the fact that the said screen is rotated and is provided with vanes, it is possible to use it not only as a screen but also as an impeller to induce circulation of the liquid, and in one embodiment of my inventon I propose to use the rotating screen both as a screen and as the impeller in the system. In other embodiments of my invention I propose to use the rotating screen in systems having a separate impeller, in which case, the rotating screen may serve as an auxiliary impeller, or may serve only its screening function and not act as an impeller at all.

Referring to Figures 1 to 4 of the drawings, the invention has been illustrated in a form in which the rotating screen serves both as a screen and as an impeller, and because this form is generally better adapted for small installations or units, I have shown it as embodied in what may be called a portable apparatus in the sense that it is embodied in a self-contained unit which may be partially immersed in a tank or other container containing the liquid and solid to be treated. As thus embodied, the apparatus comprises a motor 1, a pump unit 2 and a suitable driving connection between the motor and pump, as for example, the drive shaft 3.

Since the pump is intended to be immersed in the liquid to be treated, the pump unit and motor are preferably spaced from one another in order to avoid the necessity of providing a water-proof cover for the motor, and this spacing may be accomplished by the provision of the cylindrical tube 4 which may be connected at its lower end to the upstanding flange 5 of

the pump housing, and which may be connected at its upper end to the depending flange 6 of the plate 7 to which the motor is secured.

In order to support the machine in a tank which contains the material to be treated, a bracket 8 may be provided to fit over the upper edge of the tank and the said bracket may be secured to a ring 9 which surrounds the tube 4, the tube being adjustable therein in order that the jet hereinafter referred to may be directed as desired.

Secured to the lower end of the drive shaft 3 and enclosed within the pump housing closely adjacent the intake opening 10 is a rotating member 11 having vanes 12, the leading edges of which subdivide the intake opening into a plurality of smaller openings thus providing a rotating screen. At the same time, rear ends of the vanes of the rotating member serve as an impeller to circulate the liquid as hereinafter described. The rotating member illustrated in the drawings is provided with flat vanes, but it will be understood that any suitable form of vanes may be substituted for the simple form illustrated.

The pump housing is formed to provide an outlet or discharge conduit 13 which is connected to the nozzle 14, also conveniently formed as part of the pump housing, the nozzle being preferably mounted in such manner as to direct the liquid discharged from the pump directly across the intake opening 10.

Thus, when the pump housing is immersed in a liquid containing solid material which is to be disintegrated, mixed or dissolved, and the motor is operated to drive the impeller of the pump, liquid will be drawn in through the intake opening 10 and will be forced out through the outlet 13 and the nozzle 14 in the form of a jet which sweeps across the intake opening as indicated by the arrows 15 shown in Figure 1. The contents of the tank will be circulated by the jet thus formed and will move across the intake opening in the manner illustrated generally by the arrows 16 so that a circulating movement is set up which exposes the contents to the disintegrating, mixing or dissolving action of the jet.

Certain portions of the solid material will be drawn toward the intake opening by the inflowing liquid current, but any tendency to clog the intake opening is avoided by the presence of the rotating screen at the mouth of the intake opening. In cases where the nozzle is so located as to cause the jet of liquid to constantly sweep the intake opening, the jet, being of higher velocity than the intake current, also tends to drive solid material away from the intake opening. At the same time, any solid material which reaches the intake opening is immediately subjected to the mechanical disintegrating action of the rotating screen, thus causing a rapid and efficient disintegrating action by the motion of the screen itself, in addition to the disintegrating action of the jet.

In some cases, as for example, where the machine is used for disintegrating waste paper stock in which pieces of string or twine are apt to be found, it has been found desirable to provide means to clear the impeller vanes which might otherwise become entangled with such material, and for this purpose a ring 17 may be attached to the bottom of the pump housing, the said ring being provided with a shearing edge 18 extending partially across the bottom of the rotating screen, which said edge tends to clear the screen of any material which may become entangled therein.

In case it is desired to remove material continuously from the tank while mixing proceeds, an opening 19 is provided in the pump housing which may have connected thereto a suitable tube or pipe (not shown) to conduct the liquid to any desired point. It will be observed that this opening will be constantly kept clear by the vanes of the impeller.

In large installations, it has been found that the efficiency of the pump is reduced if the impeller of the pump is utilized not only as an impeller, but also as a rotating screen member at the pump intake. Accordingly, in such larger installations it has been found advisable to provide a separate pump and a separate rotating screen. Thus, referring to Figures 5, 6 and 7, the tank 21 is provided having mounted therein a housing 22. Inside the housing is mounted a rotatable member 23 having a plurality of relatively closely spaced vanes 24 around its outer periphery which subdivide the intake opening into a plurality of smaller openings for reasons previously described. The said rotatable member may be driven in any suitable manner as by the shaft 25 and the belt 26 connected to the electric motor 27. The housing 22 has a relatively large intake opening, and the liquid entering the said opening and passing between the vanes 24 is passed through the opening 29 which is connected by means of the conduit 30 with the intake side of the pump 31 which may be driven in any suitable manner as by motor 31'. The discharge side of the pump 31 is connected by means of a conduit 32 with a nozzle 33 which is preferably so located as to direct a jet of liquid across the intake opening. In this apparatus the rotating screen serves the same functions in the same manner as previously described in connection with the apparatus illustrated in Figures 1 to 4, and it is necessary to repeat the description of the operation.

As in the case of the machine previously described, it may be desirable to remove material continuously from the tank, and the pipe 34 is provided for such withdrawal leading to any suitable container. If this is done it may also be desirable to add liquid continuously in order to keep the system in balance and accordingly a pipe 35 may be provided through which such make-up liquid may be introduced.

In apparatus such as illustrated in Figures 5, 6 and 7, the rotating screen may operate as an auxiliary impeller or it may be operated in such manner that its impelling action is negligible. In fact, it is possible, by suitable modification of the vanes, to cause the screen to be rotated by the flow of liquid through the housing 22, in which case it is unnecessary to provide separate drive means for the screen.

In the machine illustrated in Figures 5, 6 and 7, a shearing ring 36 may be provided, if desired, to perform the functions of the ring 17 previously described.

It will be understood that the invention may be variously modified and embodied within the scope of the subjoined claims.

I claim as my invention:

1. Apparatus of the character described, comprising, in combination, a pump having an intake opening through which liquid may be drawn into said pump and an outlet opening through which liquid may be discharged from said pump,

said outlet opening being arranged to discharge a jet of liquid across said inlet opening, and means to subdivide the intake opening into a plurality of smaller openings, said means being rotatable so as to provide a spinning screen for said intake opening, said intake opening being unscreened, except by said rotatable means.

2. Apparatus of the character described, comprising, in combination, a pump having an intake opening through which liquid may be drawn into said pump and an outlet opening through which liquid may be discharged from said pump, said outlet opening being arranged to discharge a jet of liquid across said inlet opening, and a rotatable member mounted in said intake opening having a plurality of vanes which subdivide the intake opening into a plurality of smaller openings, said intake opening being unscreened, except by said rotatable member.

3. Apparatus of the character described, comprising, in combination, a vessel containing liquid and solid material, an opening in said vessel, a nozzle located to direct a jet of liquid across said opening, and means subdividing said opening into a plurality of smaller openings, said means being rotatable so as to provide a spinning screen for said opening, said opening being unscreened, except by said rotatable means.

4. Apparatus of the character described comprising, in combination, a vessel containing liquid and solid material, an opening in said vessel, a nozzle located to direct a jet of liquid across said opening, and a rotatable member mounted in said opening having a plurality of vanes which subdivide said opening into a plurality of smaller openings, said opening being unscreened, except by said rotatable member.

5. Apparatus of the character described, comprising, in combination, a vessel containing liquid and solid material, a pump, an opening in said vessel having connections to the intake side of said pump, a nozzle in said vessel having connections to the discharge side of said pump, said nozzle being located to direct a jet of liquid across said opening, and means subdividing said opening into a plurality of smaller openings, said means being rotatable so as to provide a spinning screen for said opening, said opening being unscreened, except by said rotatable means.

6. Apparatus of the character described, comprising, in combination, a vessel containing liquid and solid material, a pump, an opening in said vessel having connections to the intake side of said pump, a nozzle in said vessel having connections to the discharge side of said pump, said nozzle being located to direct a jet of liquid across said opening, rotatable means subdividing said opening into a plurality of smaller openings, and means to rotate said means so as to provide a spinning screen for said opening, said opening being unscreened, except by said rotatable means.

7. Apparatus of the character described, comprising, in combination, a pump having an impeller therein, said pump having an intake opening immediately adjacent said impeller and subdivided by the vanes of said impeller, said intake opening being unscreened, except by the vanes of said impeller and a nozzle connected to the discharge side of said pump, said nozzle being arranged to direct the liquid discharged from said pump across said intake opening.

8. Apparatus of the character described, comprising, in combination, a pump having an impeller therein, said pump having an intake opening immediately adjacent said impeller and subdivided by the vanes of said impeller, said intake opening being unscreened, except by the vanes of said impeller, a nozzle connected to the discharge side of said pump, said nozzle being arranged to direct the liquid discharged from said pump across said intake opening, and a second outlet opening through which material may be removed from further treatment, said opening being unscreened but swept by the vanes of said impeller.

9. Apparatus of the character described, comprising, in combination, a pump housing adapted to be immersed in the liquid being treated, an impeller in said housing, said housing having an intake opening immediately adjacent said impeller and subdivided by the vanes of said impeller, and a nozzle connected to the discharge side of said pump, said nozzle being arranged to direct liquid discharged from said pump across said inlet opening, said intake opening being unscreened, except by the vanes of said impeller.

10. Apparatus of the character described, comprising, in combination, a pump housing adapted to be immersed in the liquid being treated, an impeller in said housing, said housing having an intake opening immediately adjacent said impeller and subdivided by the vanes of said impeller, a nozzle connected to the discharge side of said pump, said nozzle being arranged to direct liquid discharged from said pump across said inlet opening, and means including a prong mounted on said housing and swept by the vanes of said impeller for clearing said vanes.

11. Apparatus of the character described, comprising, in combination, a housing having an intake opening therein, means located within the mouth of said intake opening to subdivide said intake opening into a plurality of smaller openings, said means being rotatable so as to provide a spinning screen for said intake opening, said intake opening being unscreened except by said rotatable means, means mounted on said housing and swept by said rotatable means for clearing said rotatable means, and means to cause flow of liquid and solid material into said intake opening.

12. Apparatus of the character described, comprising, in combination, a vessel having an opening for the withdrawal of liquid therefrom, means located within the mouth of said opening to subdivide said opening into a plurality of smaller openings, said means being rotatable so as to provide a spinning screen for said opening, said intake opening being unscreened except by said rotatable means, stationary means swept by said rotatable means to clear said rotatable means, and means for causing withdrawal of liquid through said opening.

13. Apparatus of the character described, comprising, in combination, a housing having an intake opening therein, an impeller having vanes located within the mouth of said intake opening, said vanes subdividing said intake opening into a plurality of smaller openings, said impeller being rotatable so as to provide a spinning screen for said intake opening, said housing being provided with a member extending over the outer ends of the leading edges of said vanes for clearing the leading edges of said vanes.

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