July 29, 1947. E. COWLES 2,424,679

APPARATUS FOR DISSEMINATING MATERIALS IN LIQUIDS

Filed Nov. 18, 1942 2 Sheets-Sheet 1

Fig. 1.

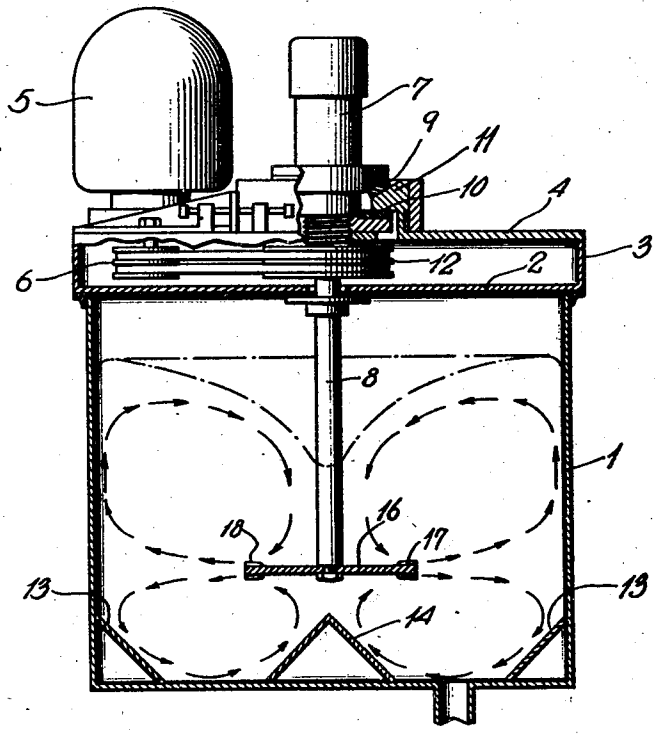


Fig. 2.

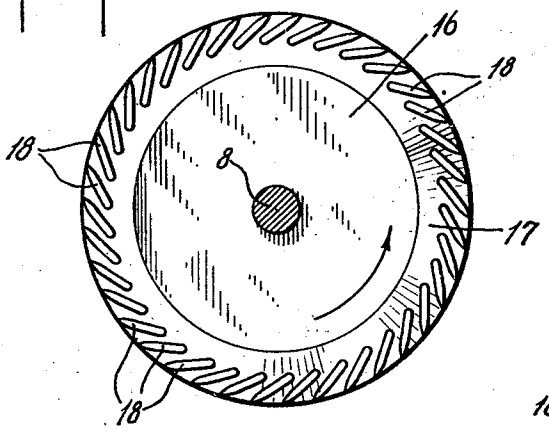
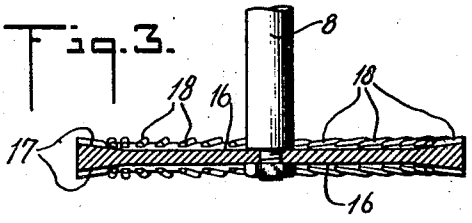


Fig. 3.



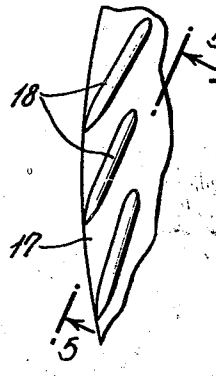


Fig. 4.

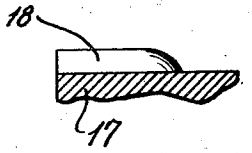


Fig. 5.

INVENTOR

Edwin Cowles

BY

Emery, Vanny, Whittemore & Ix

ATTORNEYS

July 29, 1947. E. COWLES 2,424,679

APPARATUS FOR DISSEMINATING MATERIALS IN LIQUIDS

Filed Nov. 18, 1942 2 Sheets-Sheet 2

Fig. 6.

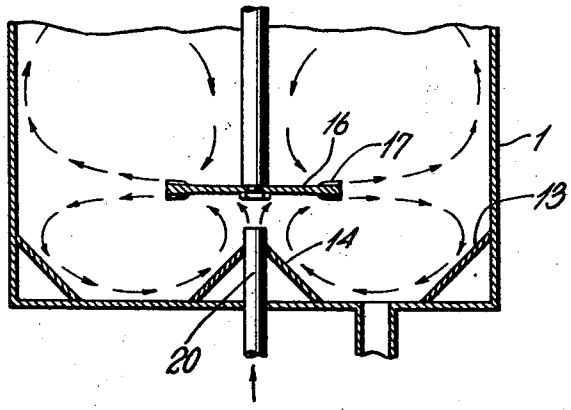
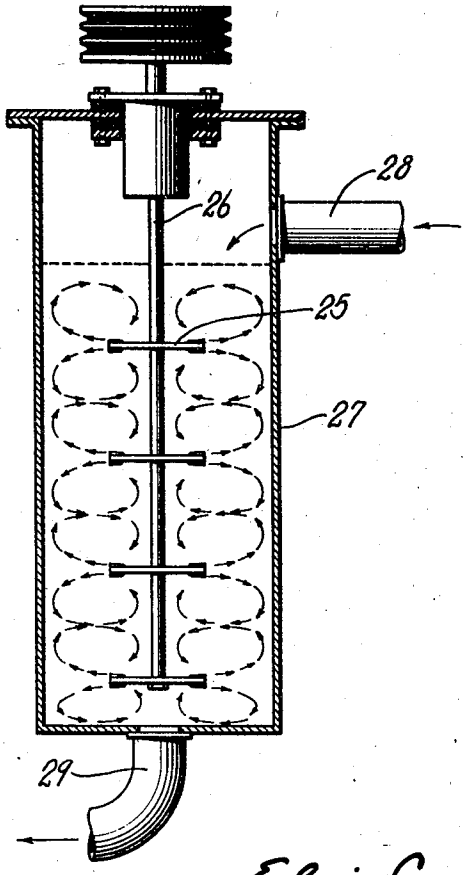


Fig. 7.



INVENTOR

Edwin Cowles

BY

Emery, Vanny, Whittemore & Ely

ATTORNEYS

Patented July 29, 1947 2,424,679

UNITED STATES PATENT OFFICE

2,424,679

APPARATUS FOR DISSEMINATING MATERIALS IN LIQUIDS

Edwin Cowles, Cayuga, N. Y., assignor to The Cowles Company, Princeton, N. J., a corporation of New Jersey

Application November 18, 1942, Serial No. 465,965

4 Claims. (Cl. 259—96)

1

This invention relates to apparatus for disseminating or dispersing solids, gases or liquids in liquids. For example, the apparatus may be used for disintegrating, dispersing and maintaining in suspension divisible insoluble solids, and for breaking up and putting into solution solids which are soluble. The apparatus may also be used for disseminating gases in liquids, and for disseminating one liquid in another liquid. Such machines are adapted for a wide range of uses, as for example, for the treatment of paper stock, for defiberizing, for dissolving, for paint mixing, for the preparation of emulsions, etc.

The apparatus described and claimed herein constitutes improvements in machines such as shown in my prior Patents Nos. 2,219,571 and 2,265,936 and in my copending application Serial No. 314,107, filed January 15, 1940, particularly with reference to the rotary impellers of such machines. It is an object of the present invention to provide a machine having a rotary impeller of improved efficiency and effectiveness.

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 vertical section through the machine.

Figure 2 is a top plan view of the impeller.

Figure 3 is a vertical section through the impeller.

Figure 4 is an enlarged fragmentary plan view of the rim of the impeller.

Figure 5 is a section on the line 5—5 of Figure 4.

Figure 6 is a vertical section through a modified type of machine.

Figure 7 is a vertical section through a machine adapted for continuous operation.

Referring to Figures 1 to 5 of the drawings, the invention is illustrated as applied to a machine particularly adapted for use for mixing or dissolving. The apparatus comprises a tank or casing 1 having a cover 2. Extending upwardly from the cover is a vertical flange 3 supporting a platform 4 supporting a motor and drive assembly adapted to rotate the impeller.

In the embodiment illustrated a motor 5 having a vertical shaft is mounted on the platform, the lower end of the shaft carrying a pulley 6 located in the compartment between the cover 2 and platform 4. A bearing housing 7 is also mounted on the platform 4, the impeller shaft 8 extending downwardly therefrom. Preferably the bearing

2

housing is resiliently mounted on the platform as by interposing the rubber blocks 9 and 10 between the housing assembly and the supporting flange 11. A pulley 12 is mounted on the shaft 8 and is driven by a V-belt connection to the motor pulley 6.

The tank or casing may be of any suitable shape and dimensions, but is shown herein as cylindrical in shape with the axis of the impeller shaft arranged coaxially with the axis of the cylinder. In order to avoid "dead spots" or sluggish circulation in certain parts of the tank, the diameter of the tank should not too greatly exceed the diameter of the impeller. Good results are obtained when, as illustrated, the diameter of the tank is approximately three times the diameter of the impeller. As an additional precaution against "dead spots" the places in the interior of the tank where the circulation is most likely to be sluggish may be filled as by the corner fillets 13 and the conical hood 14 located centrally below the impeller.

The impeller 16 is secured to the lower end of the shaft 8 in any suitable manner and is spaced from the bottom of the tank to permit circulation both above and below the impeller as hereinafter described. The impeller comprises an imperforate disk flared near the rim thereof to provide the bevelled surfaces 17 inclining upwardly from the upper surface of the disk and downwardly from the bottom surface thereof.

Mounted on the impeller adjacent the rim and projecting upwardly and downwardly therefrom within the area of the bevelled surfaces 17 are a multiplicity of impeller vanes 18, which are generally similar to the impeller vanes disclosed in my copending application Serial No. 314,107 and in Patent No. 2,265,936. As shown, such vanes are rounded at their leading ends in both horizontal and vertical sections, and these rounded portions merge into flat side walls. At the trailing ends of the vanes the side walls converge to form pointed tails. As set forth in said application Serial No. 314,107, the height of said vanes above the surface of the disk is small relative to the diameter of the disk, and should preferably not exceed a ratio of 1 to 30. For example, using a disk having a diameter of 12", the height of the vanes should not exceed .4" and should preferably be somewhat less, so that the disks of materials discharged from the impeller by the action of the vanes will be relatively thin. In the case of impellers of very small diameter, as for example, impellers having a diameter of 6" or less, the above-mentioned ratio of 1 to 30 may

be exceeded in some cases, provided the vanes do not exceed .3" in height.

The impeller should be rotated at a rate sufficient to discharge the material at a velocity of at least 1000 ft. per minute, and in some cases at considerably higher velocities, as for example, between 1000 and 2000 ft. per minute, the particular velocity selected in excess of 1000 ft. per minute depending on the nature of the material being treated.

It will be noted that due to the presence of the bevelled surfaces 17, the material discharged by the upper vanes is deflected upwardly and the material discharged from the lower vanes is deflected downwardly, thus causing the upper and lower disks of discharged material to diverge.

This is of great importance to the efficiency of operation of the apparatus, and the reasons for its importance may be explained as follows. It will be understood that in utilizing the principle of high velocity discharge as set forth in my prior patents previously referred to, the greatest disintegrating effect takes place along the surfaces of the material which is moving at high velocity, i. e., at the places where there is the greatest differential in velocity between the high velocity material discharged from the impeller and the surrounding body of relatively slow moving material. In using impellers having impeller vanes on both the upper and lower surface of the impeller disk, I have discovered that the upper and lower disks of discharged material tend to converge and merge, and since the lower surface of the upper disk of discharged material is moving at the same velocity as the upper surface of the lower disk, the desired disintegrating effect is lost along those surfaces. As a result, while the power consumed by the impeller is greatly increased by the extra set of vanes, the disintegrating effect is hardly increased at all, and the efficiency of the machine is lowered considerably.

By the use of bevelled surfaces at the rim of the impeller, however, the discharged disks of material are caused to diverge so that there exists a body of relatively slow moving material therebetween against which the high velocity material may act to secure the differential of velocity required for effective disintegration. Thus, effective disintegrating action takes place at both the upper and lower surfaces of the upper disk of discharged material, and at both the upper and lower surfaces of the lower disk of discharged material.

As indicated by arrows in Figure 1, the lower vanes induce a circulation in the bottom of the tank which, in the vertical plane, is outward from the impeller, downward, inward and upward, while the upper vanes induce a circulation which is outward from the impeller, upward, inward and downward. Such circulation in the vertical plane is combined, of course, with circulation in the horizontal plane, resulting in vortical type circulation below the impeller and in the creation of a hollow core vortex above the impeller. The latter is extremely useful in submerging any material which may tend to float on the surface, thus carrying such material immediately to the impeller where it is subjected to disintegrating action.

In Figure 6, the invention is illustrated as applied to the disseminating of gases in liquids or to the disseminating of one liquid in another liquid. In this case a pipe or tube 20 is led in through the bottom of the tank 1 to a point beneath the impeller, preferably immediately below

the axis thereof. The gas or liquid to be disseminated is then discharged slowly through the pipe 20, and the circulation of the liquid in the tank together with gravity, in the case of gases, brings the gas or liquid against the bottom face of the impeller, whence it is quickly subjected to the disseminating action of the impeller.

In Figure 7, the invention is illustrated as applied to a continuous, as distinguished from a batch, operation. In this case a plurality of impellers 25 are mounted on a common shaft 26 which extends downwardly through a cylindrical casing 27. For best results, each of the impellers should have a diameter not less than one third the diameter of the casing, and the impellers should be spaced along the shaft at distances not less than the radius of the impellers. The impeller shaft may be hung from the top of the casing and driven in a manner similar to the shaft 8 of Figure 1.

A pipe 28 is connected to the casing along the side wall thereof near the top, preferably above the topmost impeller and a second pipe 29 is connected to the bottom of the casing. These pipes 28 and 29 may be used interchangeably as inlet and outlet passages, i. e., the pipe 28 may be used as an inlet passage and the pipe 29 as an outlet passage, or the pipe 29 may be used as an inlet passage and the pipe 28 as an outlet passage.

The circulation of the material in the casing is indicated by the arrows, and as indicated, each impeller induces a circulating movement both above and below its plane. If it be assumed now that new material is introduced into the casing through the pipe 28, and treated material is withdrawn at approximately the same rate through the pipe 29, it will be seen that there will be a gradual downward movement of the material in the casing, with the material passing successively from one circulating zone to the next and being subjected to disintegrating action in each zone. By maintaining the impeller diameter relationships above described, the circulatory movement is sufficiently vigorous throughout the casing to prevent material from moving through the casing without being caught in the circulating paths and subjected to repeated disintegrating action.

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 class described, comprising, a casing, an imperforate impeller mounted for rotation in said casing, said impeller having diverging surfaces adjacent the rim thereof, and a multiplicity of impeller vanes projecting upwardly and downwardly from said diverging surfaces and discharging material along each of said diverging surfaces in diverging directions.

2. Apparatus of the class described, comprising, a casing, an imperforate impeller mounted for rotation in said casing, said impeller comprising a disk flared near the rim thereof to provide diverging bevelled surfaces inclining upwardly from the upper surface and downwardly from the lower surface thereof, and a multiplicity of impeller vanes projecting upwardly and downwardly from said impeller within the area of said bevelled surfaces and discharging material along each of said diverging surfaces in diverging directions.

3. Apparatus of the class described, comprising, a casing, an imperforate impeller mounted for

rotation in said casing, said impeller comprising a disk flared near the rim thereof to provide diverging bevelled surfaces inclining upwardly from the upper surface and downwardly from the lower surface thereof, a multiplicity of impeller vanes projecting upwardly and downwardly from said impeller within the area of said bevelled surfaces and discharging material along each of said diverging surfaces in diverging directions, and means for discharging material to be disseminated at a point below said impeller near the axis thereof.

4. Apparatus of the class described, comprising, a casing, a shaft extending into said casing, said shaft carrying a plurality of imperforate impellers mounted for rotation in said casing and submerged in the liquid contents of the container, each of said impellers having diverging surfaces adjacent the rim thereof, a multiplicity of impeller vanes projecting upwardly and downwardly from said diverging surfaces and discharging material along each of said diverging surfaces in diverging directions, and said casing being provided with openings at opposite ends of

said casing through which material may be introduced into and withdrawn from said casing, said material being subjected to successive action by said impellers while passing from one opening to the other.

EDWIN COWLES.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,208,534	Foret	Dec. 12, 1916
1,768,957	Johnson	July 1, 1930
1,819,118	Preleuthner	Aug. 18, 1931
2,270,480	Seyfried	Jan. 20, 1942
2,235,604	Brumagim	Mar. 18, 1941
2,265,936	Cowles	Dec. 9, 1941

FOREIGN PATENTS

Number	Country	Date
517,797	Great Britain	Feb. 8, 1940
848,103	France	July 17, 1939