

June 8, 1937.

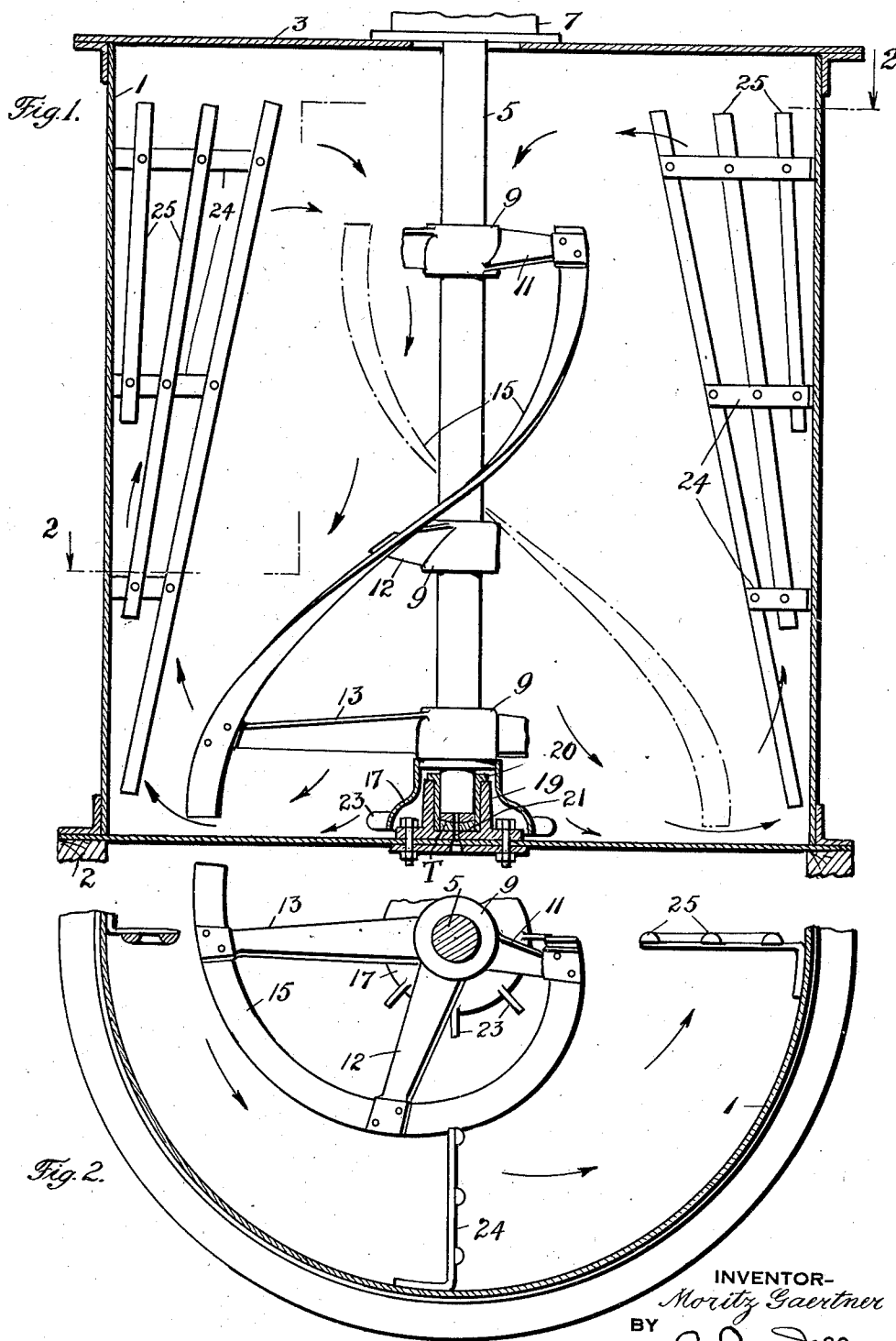
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AGITATOR

Filed Dec. 21, 1934

2 Sheets-Sheet 1



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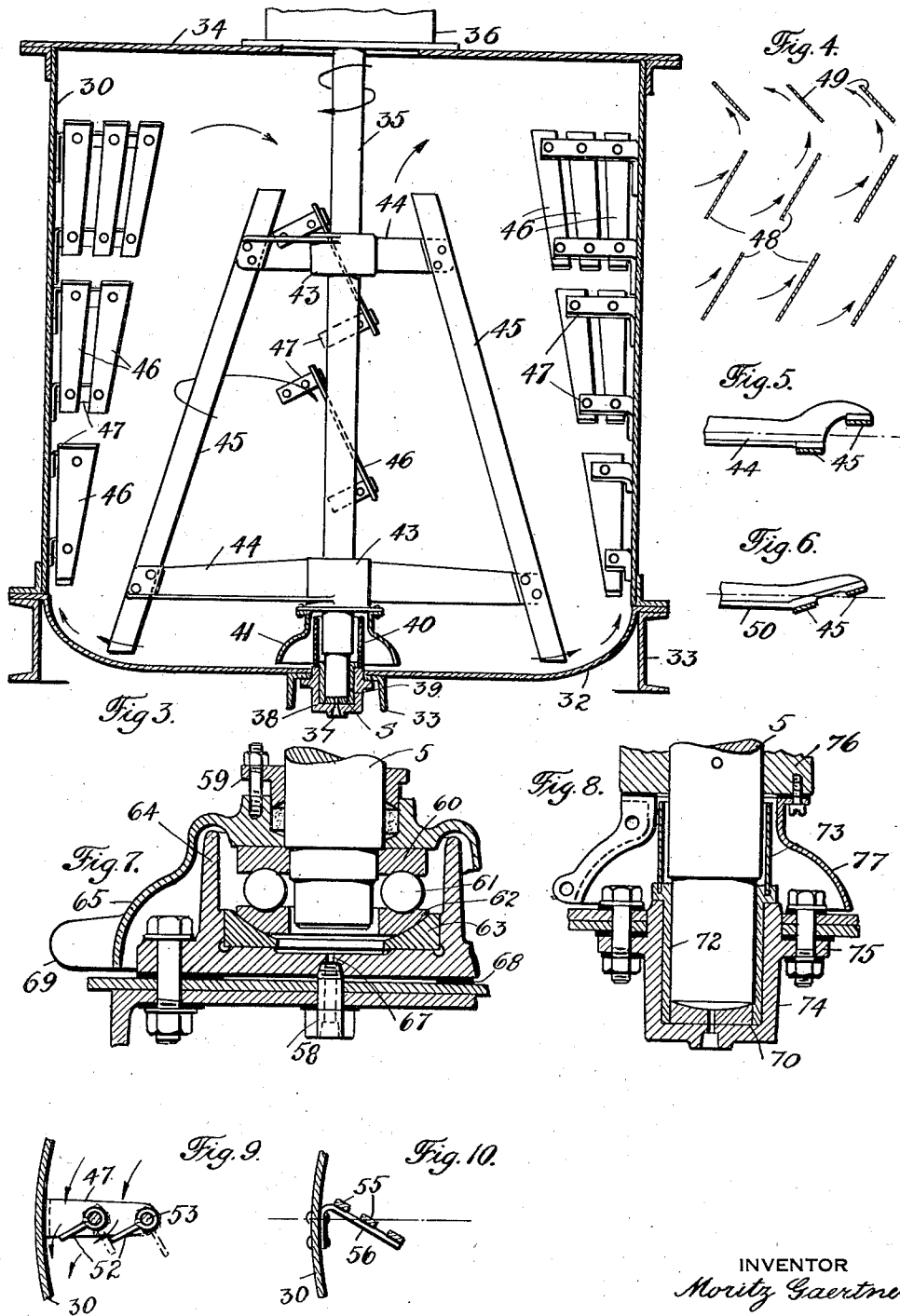
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2,082,796

AGITATOR

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Application December 21, 1934, Serial No. 758,552

4 Claims. (Cl. 259—107)

The present invention relates to agitators, and more particularly, to an agitator for liquid.

Heretofore, in the use of agitators for mixing solid materials such as coloring matter, pigments and the like with large quantities of liquid for the purpose of mixture, solution or colloidal suspension, a great deal of time and energy was used in accomplishing the mixing. In some instances, deterioration or oxidation set in, if the mixing was prolonged beyond a certain period. The material being mixed was not broken up in the agitator, and if it were broken up beforehand, it tended to coagulate in the agitator with the result that the time consumed for complete mixing was excessive. In addition, when large quantities of such materials had to be mixed together, there was no uniformity between various batches. Former agitators were defective in that dead spaces were present in the mixing chamber or at certain places thereof. In view of the shortcomings of the prior agitators or mixers, various attempts were made to solve the problem confronting the art, but, none, as far as I am aware, were wholly satisfactory and successful in practical industrial operations.

It is an object of the present invention to provide an agitator particularly adapted for mixing large quantities of substances.

It is another object of the present invention to provide an agitator which will be relatively free from inactive or dead spaces.

It is a further object of the present invention to provide an agitator which will have the mechanical parts mounted therein in such a way that the mixing materials will not clog up or hinder the operation of the machine.

The present invention also contemplates the provision of an agitator capable of effecting mechanical operations which will physically break up the solid particularly when in a solid form.

It is also within the contemplation of the present invention to provide an agitator which is inexpensive in construction and maintenance. Other objects and advantages of the present invention will become apparent from the following description taken in conjunction with the drawings, in which:—

Fig. 1 is a longitudinal sectional view of the present agitator;

Fig. 2 is a sectional view of the agitator taken along the line 2—2 of Fig. 1;

Fig. 3 depicts a cross-section view of an agitator in modified form;

Fig. 4 illustrates a schematic elevation view

showing a modified arrangement of the baffle plates;

Figs. 5 and 6 are fragmentary views of modifications of the agitator blades;

Figs. 7 and 8 illustrate enlarged section views of the step bearings; and

Figs. 9 and 10 depict fragmentary top plan views of modified baffle plates.

Referring to the drawings, reference character 1 designates a mixing chamber or casing. For mixing large quantities of material, a casing having sufficient capacity is provided, say about 5 to 15 feet in diameter and about 4 feet to about 20 feet in height. The casing 1 may be supported by channel beams 2 or the like which would leave enough space on the bottom to make the bearings etc. accessible. A cover 3 which may be of any desired form is mounted over the casing.

At the center of the casing, rotatable shaft 5 is located which is driven by a gear driven motor 7 from the upper extremity of said shaft. The lower end of the shaft rests in a thrust bearing T which is mounted on the bottom of the casing.

Fastened to the shaft by means of keys or the like are hubs 9. Arms 11, 12, and 13 extend radially from the hubs and form propellers of varying length, width, pitch in accordance with various conditions which must be fulfilled. The lowermost arm 13 is the longest and the uppermost is the shortest, the remainder having various lengths. Mounted at the ends of the arms and interconnecting the same are blades 15 which preferably have a spiral shape. The lower end of the blade is located near the outer periphery of the casing, at which point a high peripheral speed is maintained as the blades are revolved. The blades spiral up to the top of the casing at which point they approach the center of the casing. The peripheral speed of the upper end will be considerably less than the peripheral speed at the bottom. The width, pitch and angle of spiral can be varied according to the particular liquid and solid which are to be mixed.

For the purpose of protecting the thrust bearing T at the bottom of the shaft from the detrimental effects of the liquid, a bell shaped hood 17 is mounted on the shaft 5 over the thrust bearing T. A close fit is essential between the hood and the shaft so as to prevent the leaking of air out of the hood. A cylindrical sleeve 19 which is fastened to the bottom of the casing encircles bearing lining 20 and prevents liquid from entering the bearing surface. A port 21 is also provided which permits the thrust bearing to be oiled under pressure and generally made acces-

sible without necessitating emptying the casing. It is preferable to apply a grease cup on a pressure lubricating system to the port.

When the casing has been filled with liquid, 5 water, the pressure at the bottom will tend to force the liquid up into the bell hood 17. However, there is sufficient volume within the hood to prevent the air from being compressed to such an extent that the liquid can rise up around the 10 protecting sleeve 19 into the bearing. In this manner, I have avoided any chance of interference from the liquid.

Around the outside of the hood, I have provided a plurality of fins 23 which rotate and prevent any accumulation of matter. Dead or relatively inactive spots, in and around the vicinity of the central portion of the casing are thus avoided.

Along the sides of the casing on supports 24 are 20 mounted a plurality of baffle plates 25 which are preferably of semicircular cross-section. These baffle plates are set off from the sides of the casing so that there are no corners in which accumulations of the solute or other solid particles might form. By means of such a mounting, eddies and dead spaces are avoided behind the baffle plates. A greater break up results in having a number of narrow bafflesticks instead of one 25 wide baffle plate. In order to slow down and break up the revolving currents of liquid as much as possible particularly on the top, I have arranged my stationary baffle plates so that they follow the outer periphery of the spiralled blades 15. That is, the lower ends of the baffles are located near the outer periphery of the casing and 30 the upper ends are extended further toward the center in proximity to the upper end of the blade 15.

The operation of the improved agitator is obvious to those skilled in the art. By means of the A-shaped construction of the blades, the lower extremities will have a much higher peripheral speed than the top. A faster current is positively produced along the bottom. Aided by the propeller action of the arms, the liquid is thrown 45 outwardly against the lower ends of the baffles. The liquid then spirals upwardly along the baffles as indicated by the arrows until it reaches the top. At the top it will be noted that the blades have a much slower peripheral speed so that the liquid is drawn toward the center where it again comes under the influence of the revolving blades and arms. The liquid is then forced down again with increasing speed.

It is to be observed that a cross-current flow is produced which includes the combination of a vertical and a horizontal circulation. Owing to my cross-current flow, solid particles which might tend to settle on the bottom or float on top, come 60 under the action of the blades and baffles so that there is practically no opportunity to form dead spaces. Better results are thus obtained by continuously rotating and moving the entire content of the tank at an almost even medium speed and dividing and breaking the currents as often as possible, than by whirling a small percentage of the medium at high speed around a limited space.

It is possible, of course, to vary the width and 70 pitch of the blades, baffles and arms in accordance with special conditions of viscosity and the like. They may likewise be pivoted on adjustable mountings so that various angles may be presented. Likewise, the casing may be shaped in 75 any desired manner such as bell-shaped, spheri-

cal or other suitable shape, so as to conform more nearly to the natural flow of the liquid.

In Fig. 3, a modification of the above-described embodiment is shown. A cylindrical casing 30 has a dished bottom 32 which minimizes the 5 accumulation of material in dead spots in the outer bottom corners. Channel beams 33 or the like may be provided to support the casing which is required to carry a considerable load. Cover 34 fits over the top to prevent any liquid from 10 splashing out or to exclude dirt and air as desired. As in the other embodiment, a shaft 35 driven by suitable driving means 36 is mounted in the center of the casing by means of step bearing S. Access from the bottom for oiling and cleaning 15 is provided through opening 37, and if it is desired to demount the device bearing housing 38 and lining 39 may be removed. In fixed relation to the casing is rim 40 which prevents the liquid medium to enter into and clog the bearing. Bell-shaped hood 41, mounted on the shaft, prevents 20 the medium from rising up along the sleeve or rim 40 when the casing is filled with liquid. In the drawings, the hood and the hub are shown mounted together.

Projecting outwardly from hubs 43 are arms 44 which may be shaped as propellers, screws or other forms of impellers. The arms serve as supports for A-shaped blades 45. That is, the top 25 portion of the blades are closer to the center as the lower portion. The pitch and width of these blades may be varied according to the particular requirements of the liquid to be agitated.

Along the inner walls of the casing are mounted a plurality of baffles 46. Supports 47 may be 35 riveted, bolted etc. to the sides in such a position that the baffles may be inclined to the vertical. In the position shown in the drawings, the baffles are inclined in such a position that they will be perpendicular to the stream lines of particles which are revolving upwardly in the direction of the arrow. The baffle plates may be about 15° off the vertical and may be staggered both horizontally and vertically to be in better position to break up the streams of flow. It is preferable to 45 shape the baffles so that they are wider at the top than at the bottom so that they may more easily project further inward at the top than at the bottom. This shape also tends to reduce the speed of flow of the liquid near the top and outside.

In Fig. 4 a schematic arrangement of the baffles is shown. Plates 48 are tilted so that the current striking them will be forced upward. The top set of baffles 49 are tilted in the other direction so 55 as to prevent the liquid from running too high up on the outer wall of casing. In this manner splashing is minimized and the energy of flow is redirected downward toward the center of the casing, thus, setting up more easily the vertical 60 circulation.

Figs. 5 and 6 illustrate fragmentary views of cross-sections of arms 44 and blades 45. Each arm is shown carrying a plurality of blades. When a greater number of blades are carried, the width 65 of the blades may be reduced. This gives an additional cutting action to the agitators. Arm 50 is so designed that the blades have a certain pitch with relation to a radial line. This tends to throw the liquid more to the outside according to the size of the angle at which the blades are set.

With respect to Fig. 9, an adjustable baffle is depicted. Baffle plates 52 are mounted by bolts 53 which may be loosened and pivoted to any desired position. With this arrangement, it is possible 75

to obtain any amount of interference and cutting up of the flow of liquid. It will be noted, however, that the baffles set out both from the walls of the casing and off from the bottom thereof, so that the opportunity for dead spots and accumulations of solute is limited.

In Fig. 10 a baffle 55 is held by bracket 56 at an angle to a radial line. This pitch will change the direction of current to suit special conditions.

In Figs. 7 and 8 I have shown enlarged views of step bearings including the preferred construction of the hood and protective ring. In the former a ball thrust bearing is used in which the shaft 5 has the lower end stepped so as to seat on bearing ring 60. Balls or rollers 61 carry the load to bearing ring 62 which rests on seat 63. Supporting the entire structure and protecting the same from the surrounding liquids is sleeve 64. Mounted on the end of the shaft so as to make the same air tight is bell hood 65. In the drawings a stuffing box has been included to assure a tight fit so as to prevent water and/or air from passing therethrough and also for easy removal, if an inspection of bearing is desired. It will be noted that this stuffing box is located between two surfaces which are stationary with relation to each other and thus will not readily wear out. In designing the bell, it is essential that the internal volume is sufficiently large so that when the tank is filled with liquid the pressure will not compress the air within the bell to such an extent that the liquid may overflow the top of the sleeve. For the purpose of maintaining the liquid as quiet as possible within the bell and thus avoid splashing, it is desirable to incorporate baffles or vanes projecting outwardly from the sleeve.

Connecting the bottom of the bearing to the outer section of the casing for cleaning, draining and/or oiling purposes, is port 67 having a pipe connection for a grease cup or lubricating tube and the valve or stopper 58 fitting in said port. A gasket 68 separates the rim from the bottom of the casing and thus prevents the liquid from entering the port from below. On the outer periphery of the bell hood, I have provided a plurality of propeller vanes 69 which revolve and prevent dead spots from forming near the center of the casing. This is important since a circulating medium having a comparatively heavy solute tends to deposit the solute at the center near the bottom.

A further embodiment of a step bearing is depicted in Fig. 8 in which the shaft 5 rests in bearing 70 and has surrounding the lower end thereof bearing lining 72. To achieve protection from the outside liquids, I have set the sleeve 73 into the bearing lining with a waterproof fit. The bearing lining sits in the cup-shaped bearing housing 74 having the flange 75 around the top thereof which is bolted to the bottom of the casing. Fixed to hub 76 around the shaft or to the shaft itself, is bell shaped hood 77 which has the functions as set forth above. In this case, however, the hood is shown composed of several parts which are bolted or otherwise fastened together in a readily demountable manner to provide an airtight hood.

The operation of the embodiment of Fig. 3 is similar to that set forth for Fig. 1. The revolving A-shaped blades and arms producing a high degree of horizontal circulation, particularly at the bottom of the vessel, throw the liquid up along the lower periphery in the direction of the arrows. The solid particles are hurled against

the baffles where they tend to disintegrate and pass upward along the other baffles to the top of the tank. From there they are deflected inwardly while continuing to revolve and are drawn down the center of the tank and revolving blades where they again come under the influence of the blades and arms. It will be noted that a combination of a horizontal and vertical flow is produced which militates against the formation of dead spots and accumulations of solute. Furthermore, the baffles are set away from the side and bottom walls of the casing where they will not create pockets or dead spots for the accumulation of solid matter, viscous lumps, and other matter. The vanes on the bell hood prevent the formation of dead spots and eddies at the bottom and help throw the liquid and solid matter outwardly so as to come into contact with the main flow of liquid. In this manner, I achieve an excellent degree of agitation which enables me to mix large quantities of liquid and solute in a surprisingly short time. In addition the degree of mixing is more intimate whereby a greater uniformity is obtained which has not been possible with the prior large agitators.

While the present invention has been illustrated and described in connection with specific embodiments thereof, it is to be observed that variations and modifications are within the contemplation of the present invention as defined by the specification and the appended claims.

I claim:—

1. An agitator which comprises a casing, a powered shaft at the center thereof, a thrust bearing at the bottom of said casing supporting said shaft, spiral blades rigidly mounted on said shaft running from the top to the bottom thereof, said blades being set further from the shaft at the bottom than at the top, and baffles mounted on the sides of the casing being set off from the side, whereby a high peripheral speed is imparted to the lower portion of a liquid in said casing and a low peripheral speed is imparted to the upper portion of said liquid to produce a circulation of said liquid in vertically upward and horizontal direction.

2. An agitator which comprises a casing, a powered shaft at the center thereof, a thrust bearing at the bottom of said casing supporting said shaft, spiral blades rigidly mounted on said shaft running from the top to the bottom thereof, said blades being set further from the shaft at the bottom than at the top, and baffles mounted on the sides of the casing being set off from the side, whereby a high peripheral speed is imparted to the lower portion of a liquid in said casing and a low peripheral speed is imparted to the upper portion of said liquid to produce a circulation of said liquid in vertically upward and horizontal direction.

3. An agitator which comprises a casing, a powered shaft at the center thereof, a thrust bearing at the bottom of said casing supporting said shaft, a plurality of outwardly projecting arms on said shaft, the lower arms being longer than the top arms, spiral blades rigidly mounted on said arms extending from the top to the bottom, and baffles set off from and mounted on the sides of the casing, whereby a high peripheral speed is imparted to the lower portion of a liquid in said casing and a low peripheral speed is imparted to the upper portion of said liquid to produce a circulation of said liquid in vertically upward and horizontal direction.

4. An agitator which comprises a cylindrical casing having a rounded bottom for guiding the currents of liquid therein, a powered shaft at the center thereof, a thrust bearing at the bottom of said casing supporting said shaft, spiral blades rigidly mounted on said shaft running from the top to the bottom thereof, said blades being set further from the shaft at the bottom than at the top, and baffles mounted on the sides of the casing being set off from the side, whereby a high peripheral speed is imparted to the lower portion of a liquid in said casing and a low peripheral speed is imparted to the upper portion of said liquid to produce a circulation of said liquid in vertically upward and horizontal direction. 5

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