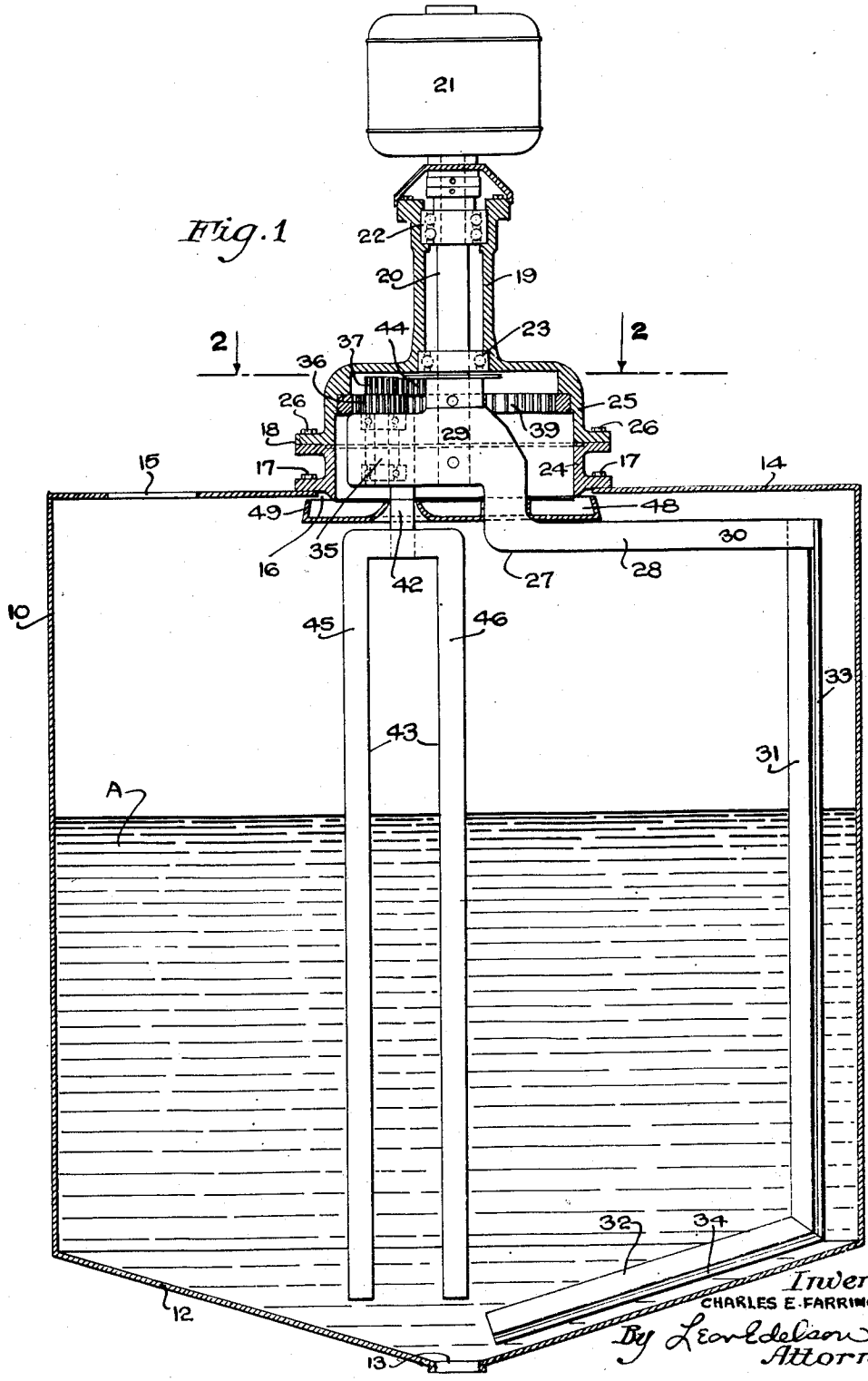
June 4, 1940. C. E. FARRINGTON 2,203,135

PAINT MIXING APPARATUS

Filed Sept. 15, 1937 2 Sheets-Sheet 1

Fig. 1



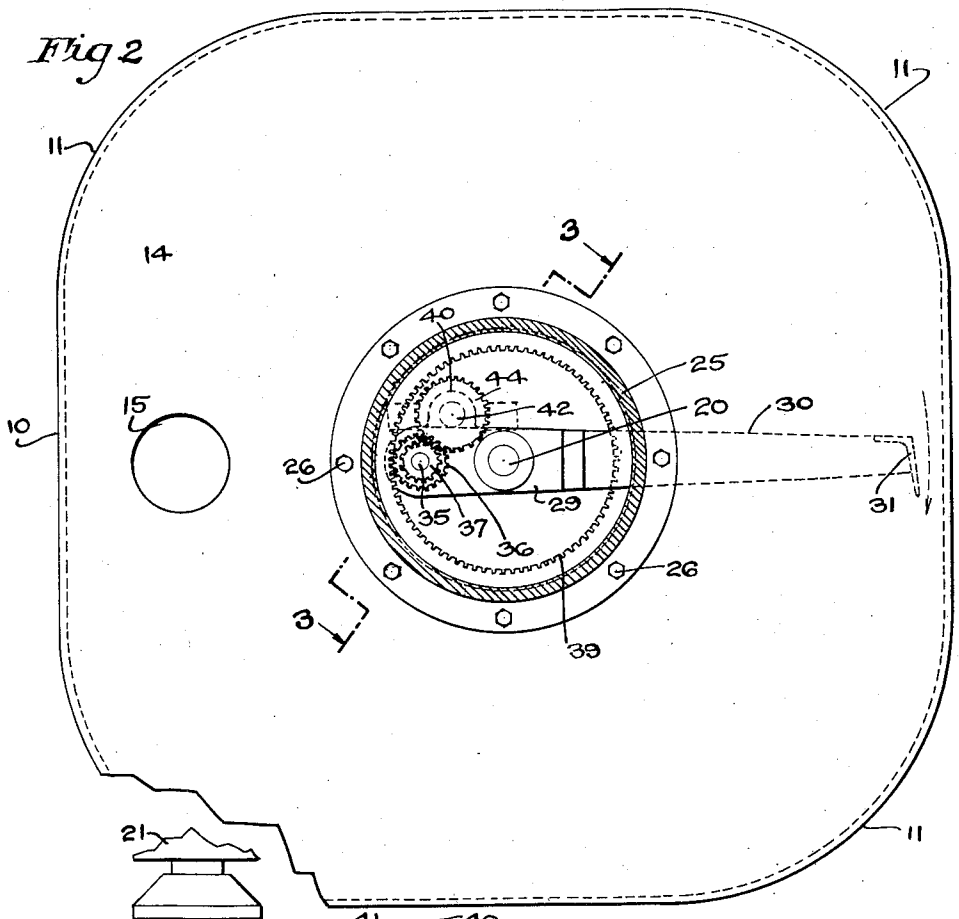
Inventor
CHARLES E. FARRINGTON
By Learldelson
Attorney.

June 4, 1940. C. E. FARRINGTON 2,203,135

PAINT MIXING APPARATUS

Filed Sept. 15, 1937 2 Sheets-Sheet 2

Fig 2



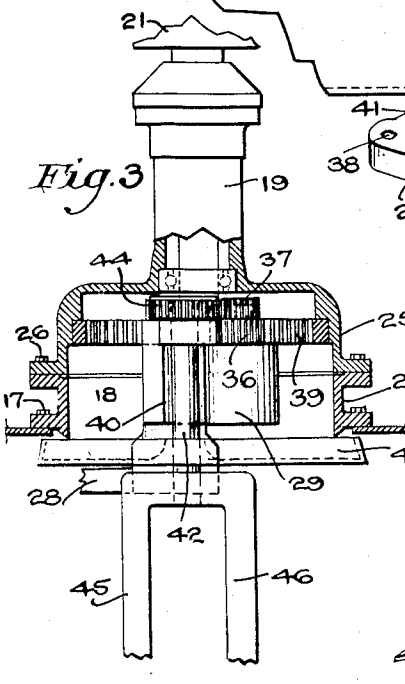


Fig.3

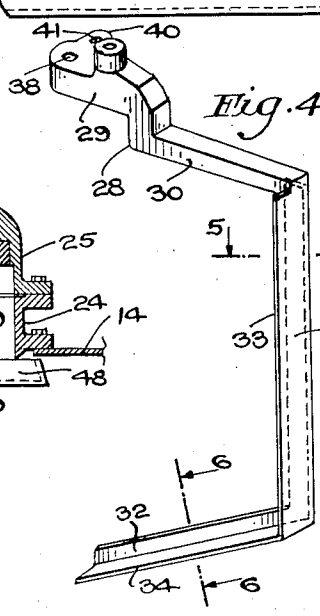


Fig.4

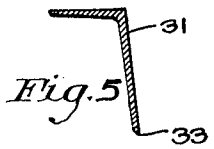


Fig.5

Fig.6

Inventor

CHARLES E. FARRINGTON

By Lew Edelson

Attorney.

Patented June 4, 1940 2,203,135

UNITED STATES PATENT OFFICE

2,203,135

PAINT MIXING APPARATUS

Charles E. Farrington, Phoenixville, Pa.

Application September 15, 1937, Serial No. 163,904

2 Claims. (Cl. 259—102)

This invention relates to a mixing apparatus and more particularly to an improved construction of a motor-driven mixer especially suitable for mixing paints and similar liquid or semi-liquid compounds.

Among the principal objects of the present invention is the provision of a mixing apparatus having a power-driven agitator of such operating characteristics as to insure a rapid and uniform dispersion or dissolution of solids in a liquid body whereby to produce a liquid or semi-liquid mass of uniform consistency.

Heretofore and prior to this invention, the mixing of paints and like compounds containing solids dispersed or dissolved in suitable liquid vehicles was obtained by the use of agitators which operated on the order of paddles to stir or whip the compound into shape. Not only did such apparatus require excessive power and consume a great deal of time, particularly in the case of heavy-bodied compounds, but also it was rarely possible to attain in the mass the desired degree of dispersion efficiency.

The apparatus of the present invention includes a dual set of stirring devices respectively operating at different speeds and in different zones within a tank of such design that every particle of the mass being worked is directly acted upon to insure a rapid and uniform dispersion thereof. The tank employed in the apparatus of the present invention contributes very materially to the high operating efficiency obtained because its design is such as to provide in the wall thereof spaced zones in each of which the pressure of the mass induced by the rotative force of the outer stirrer arm is suddenly released with a consequent turbulous effect upon the mass of material in the vicinity of the zone of released pressure. The turbulency so induced definitely and materially increases the speed of dispersion of the solid particles not only in the mass located in the zones of reduced pressure but also in the main body of the mass. Moreover, because this central body of the mass is maintained in constant motion by a second set of stirring bars no part of the mass remains wholly or partially static as the result of which the undissolved particles of the mixture are prevented from settling or massing at any one point.

From the foregoing, it will be understood that it is an object of the present invention to provide an apparatus in which a dual set of stirrer devices operate in a mixing tank to place in positive motion every particle of the mass and to induce a turbulency therein which increases the dispersive effect of the stirrer devices, the whole combining to provide a dispersion efficiency of a degree not heretofore obtainable.

Other objects of the invention and advantages and economies effected by the apparatus constructed in accordance therewith will be apparent more fully hereinafter.

The invention consists substantially in the combination, construction, location and relative arrangement of parts, all as will be described in detail in the following specification, as shown in the accompanying drawings, and as pointed out in the appended claims. In the said drawings, which are illustrative of a preferred construction of the present apparatus:

Figure 1 is a vertical sectional view of the apparatus constructed in accordance with and embodying the principles of the present invention;

Figure 2 is a horizontal sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a view partially in vertical section taken on the line 3—3 of Figure 2;

Figure 4 is a perspective view of one of the stirrer devices of the apparatus; and

Figures 5 and 6 are sectional views taken respectively on the lines 5—5 and 6—6 of Figure 4.

Referring now more particularly to the drawings, it will be observed that the apparatus of the present invention includes a tank 10 adapted to receive the material to be mixed. This tank 10 is of generally polygonal shape in horizontal cross section with the corners thereof rounded, as at 11 (see Figure 2). As shown in Figure 2, the tank is provided with four flat sides joined together by rounded corners and while this is the preferred construction, it will be understood that the tank may be constructed of three, five or more sides to obtain a dispersion efficiency comparable to that of the tank shown in the drawings. The bottom 12 of the tank is tapered and may be provided with a central opening 13 normally closed by a plug (not shown) for discharge and clean-out purposes. The top of the tank may be closed or not as desired. In the construction shown in the drawings, the tank is provided with a top closure 14 having a filling opening 15.

This top closure member 14 is provided with a central opening 16 through which is adapted to be projected interiorly of the tank the stirring devices or agitators to be presently described. Mounted upon the top closure member 14 of the tank and secured thereto by the bolts 17 is a gear box or housing 18 having an upwardly

projecting vertical extension 19 through which is projected the shaft 20 of a motor 21. This shaft 20 is suitably journalled, as at 22 and 23, within the vertical sleeve 19 of the housing 18 for free rotation about the central vertical axis of the tank 10. While in the construction shown the motor 21 is employed to directly drive the shaft 20, it will be understood that the said shaft 20 may be provided at its upward extremity with a pulley or the like to adapt it to be belt-driven or gear-driven by any suitable power mechanism stationed more or less remotely from the mixing apparatus per se.

The housing 18 is preferably constructed with a lower section 24 and an upper section 25 secured together by the bolts 26, the purpose of which is to render more readily accessible the interior of the housing. Keyed to the lower extremity of the vertical driving shaft 20 for rotation therewith is that one of the stirring devices shown more particularly in perspective in Figure 4 and designated generally by the reference numeral 27. As appears most clearly in said Figure 4, this stirring device 27 comprises a substantially horizontally disposed head bar 28 of Z shape, the upper branch 29 of which is keyed to the shaft 20 while the lower branch 30 thereof, which is disposed in a plane immediately beneath the top of the tank 10, projects radially of the vertical axis of the tank to a point just short of the side wall thereof. Fixed in any suitable manner to the outer extremity of the head bar 28 is a depending stirrer blade 31 having an inclined lower extension 32 disposed in substantial parallel relation to the inclined plane of the tank bottom. The stirrer blade 31 and its inclined extension 32 are of the obtuse angular cross-sections respectively shown in Figures 5 and 6. It will be apparent that as the head bar 28 is rotated by the driving shaft 20 about the axis of the latter as a center, the stirrer blade 31—32 will describe a circle, the diameter of which is slightly less than the width of the tank 10 measured between opposite flat sides thereof. The stirrer blade 31—32 thus operates to sweep through an outer portion of the mass of material contained in the tank 10, the direction of rotation being such that the edges 33—34 of the stirrer blade constitute the leading edges thereof and tend to cut out of the mass of material undergoing treatment a cylinder of a diameter substantially equal to that of the circle described by the vertical section 31 of the stirrer blade. The inclined lower section 32 of the stirrer blade assists in the cutting out of this cylinder from the mass in that it acts to separate said body from the bottom wall of the tank and so permit it to be freely rotated about the tank central axis.

Rotatably fitted within the horizontal head bar 28 of the stirrer device 27 to one side of the latter's axis of rotation is a stub shaft 35 to the upper end of which are keyed a pair of coaxial gears 36 and 37, the stub shaft 35 therefor being journalled within a vertical socket 38 formed adjacent the inner extremity of the said head bar 28. Coaxial gears 36 and 37 being keyed to the same shaft 35 rotate in unison, the lower and larger gear 36 being in constant mesh with a large internal gear 39 fixedly secured in position within the upper member 25 of the housing 18.

The head bar 28 of the stirrer device 27 is provided at its inner extremity with a laterally extending projection 40 having a vertical bore 41 therein through which is projected the spindle 42 of a secondary stirrer or agitator, designated generally by the reference numeral 43. The spindle 42 of this stirrer device has keyed to its upper end a gear 44 which meshes with the upper and smaller gear or pinion 37 so that upon rotation of the latter gear or pinion the secondary agitator 43 is rotated about the vertical axis of its spindle 42. As most clearly appears in Figure 1, it will be observed that this secondary agitator 43 comprises a pair of parallel vertical bars 45—46 arranged in laterally spaced relation and extending downwardly to a point just short of the bottom of the tank 10. It will also be noted that the axis of rotation of the secondary agitator 43 is offset from the axis of rotation of the main stirrer device 27, which latter axis is, of course, coincident with the central axis of the tank 10.

With the apparatus arranged as just described and particularly with the several gears entrained as shown in the drawings, it will be apparent that upon rotation of the main driving shaft 20, the stirrer device 27 (see Figure 4) will be rotated about the central vertical axis of the tank at a speed equal to that of the driving shaft 20 which ordinarily approximates 35 R. P. M. Inasmuch as the secondary stirrer 43 is carried by the head bar 28 of the main stirrer device 31 but in offset relation to the axis of rotation of the latter, it follows that the said secondary stirring device is caused to describe a circle concentric with but much smaller in diameter than the circle described by the blade 31 of the main stirrer device. Also, as the upper branch 29 of the head bar 28 rotates within the housing 18 about its axis of rotation, the gear 35 thereof which is constantly in mesh with the internal gear 39 is caused to rotate and imparts a like rotation to the gear or pinion 36 which is in mesh with the gear 44 of the secondary stirrer device 43. The result is that as this secondary stirring device 43 revolves about the central axis of the tank at a speed of approximately 35 R. P. M., it is rotated about the axis of its supporting spindle 42 at a speed of approximately 144 R. P. M., this latter speed being, of course, dependent upon the ratio of the entrained gears 36 and 44. The secondary stirring device 43 is thus caused to rotate or spin about a vertical axis which is itself caused to traverse an orbit having as its center the vertical axis of the tank 10. The members 45—46 of the second stirring device may be of any desired cross-section although preferably they are of angular or square cross-section.

In the use of the apparatus as just described, the tank 10 is, of course, filled to the desired level with the material to be mixed, this material being designated in Figure 1 by the reference character A. As the blade 31—32 of the main stirrer device describes its circle of revolution through the mass of material A, it tends to cut out of the mass a cylindrical body for rotation within the tank A. As the vertical section 31 of the stirrer blade passes along the flat sides of the tank, the resistance of the material to the free passage of said blade is of a high order due primarily to the friction engendered in the mass by the closely adjacent side wall of the tank. However, as the vertical section 31 of the stirrer device approaches a corner of the tank, the distance between it and the wall materially increases with the result that the friction is reduced with a corresponding reduction in the resistance of the material to the free passage of the blade therethrough. This sudden reduction in resistance in the vicinity of the rounded cor-

ners of the tank has the effect of creating surges in each of these zones with a resulting turbulence in the mass which is of material assistance in the distribution or dissolution of the solid particles in the liquid content of the mass. These periodic releases in the resistance of the material to the passage of the blade 31 therethrough occur regularly and as many times per revolution of the blade as there are corners to the tank, in the form of tank shown four such periodic releases being encountered for each revolution of the blade 31. These frequent surges so induced in the mass being worked very materially increase the dispersion efficiency of the apparatus.

The action of the outer vertical sweep member 31 upon the material in the rounded corners of the tank also may be described as creating a compressed volume of material which is carried or swept before the member 31 against the frictional resistance of the side walls of the tank. When this compressed volume of material is swept into the rounded corners of the tank it is met with the resistance of the relatively static material in the corner zones of the tank with the result that this latter material, in order to escape the pressure thus exerted on it, surges upwardly to create the turbulent effect above described. The extraordinary surging action thus developed in each corner zone of the tank as the vertical sweep member 31 passes therethrough may be controlled, as desired, by suitably regulating the rotative speed of the member 31.

Also having an important effect upon the dispersion efficiency of the apparatus is the secondary stirring mechanism 43 due to the fact that as it spins about its vertical axis of rotation it traverses an orbit of a diameter sufficiently large to insure against any static condition in the center of the mass, it being noted in this connection that the rotative speed of the secondary stirring bars 45—46 is several times greater than that of the main outer stirrer blade 31. In other words, due to the action of this secondary stirring device the central body of the mass is constantly in agitation to such extent as to eliminate entirely the idling and down-draft center which is normally present in the paddle types of mixing devices heretofore in use. Such an idling and down-draft center is usually evidenced by a perceptible meniscus formed in the top surface of the material being mixed. However, no such perceptible meniscus is to be observed while the material is being mixed in the present apparatus, thereby indicating that the central as well as the marginal portions of the mass are in motion and that all particles thereof are influenced to insure a rapid and uniform dispersion thereof throughout the liquid content of the mass.

In order to prevent the gear shaft lubricant from entering the tank and so contaminate the material being mixed therein, it is desirable to provide an oil drip pan 48 as shown in Figure 1. This pan is affixed to and carried by the head bar 28 of the main stirrer device and rotates therewith, the pan being provided with a marginal flange 49 to prevent the overflow of any entrained oil or grease.

As has been heretofore indicated, the top of the tank need not be closed as shown in the drawings but instead may be open and in such event the stirring mechanism may be mounted in any suitable manner centrally of the tank and at the requisite elevation, as, by means of a spider or other such skeleton frame supported from the top edges of the tank walls.

It will be understood, of course, that the invention is susceptible of various changes from time to time without departing from the real spirit or general principles thereof and it is accordingly intended to claim the invention broadly, as well as specifically, as indicated by the appended claims.

What is claimed as new and useful is:

1. In a mixing apparatus, in combination, a tank for receiving the material to be mixed, said tank having flat side walls joined together by rounded corners and having also a tapered bottom of substantially inverted conical shape, and an agitator disposed for rotation within said tank, said agitator including a vertically extending member adapted to describe a circle of revolution disposed in closely spaced relation with respect to the interior of the tank and including also an inclined bottom member movable in a plane spaced above and in parallel relation to the bottom wall of the tank, said agitator coacting with said rounded corners of the tank to create a turbulent condition in the material due to the suddenly reduced resistance encountered by the agitator in passing through the material in the immediate vicinity of said rounded corners.

2. In a mixing apparatus, in combination, a tank for receiving the material to be mixed, said tank having flat side walls joined together by rounded corners and having also a tapered bottom of substantially inverted conical shape, and an agitator disposed for rotation within said tank, said agitator including a vertically extending member adapted to describe a circle of revolution disposed in closely spaced relation with respect to the interior of the tank and including also an inclined bottom member movable in a plane spaced above and in parallel relation to the bottom wall of the tank, said agitator coacting with said rounded corners of the tank to create a turbulent condition in the material due to the suddenly reduced resistance encountered by the agitator in passing through the material in the immediate vicinity of said rounded corners, said vertically and transversely extending members of the agitator being of angular cross-section and arranged so that corresponding flanges thereof project in the direction of rotation of the agitator whereby the leading edges of said flanges act to cut through the mass of material in the tank.

CHARLES E. FARRINGTON.