Dec. 23, 1952 E. G. GETTINS 2,622,859

FLUID CONTACT APPARATUS

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FIG. 1.

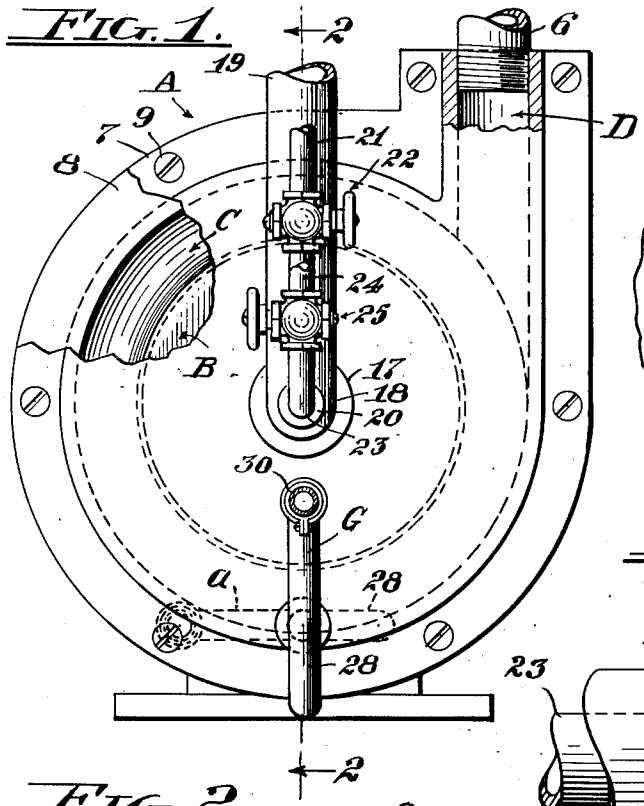


FIG. 3.

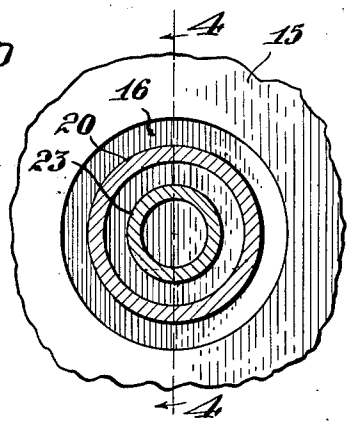


FIG. 4.

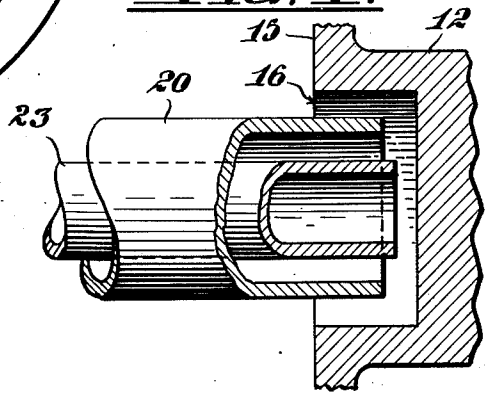
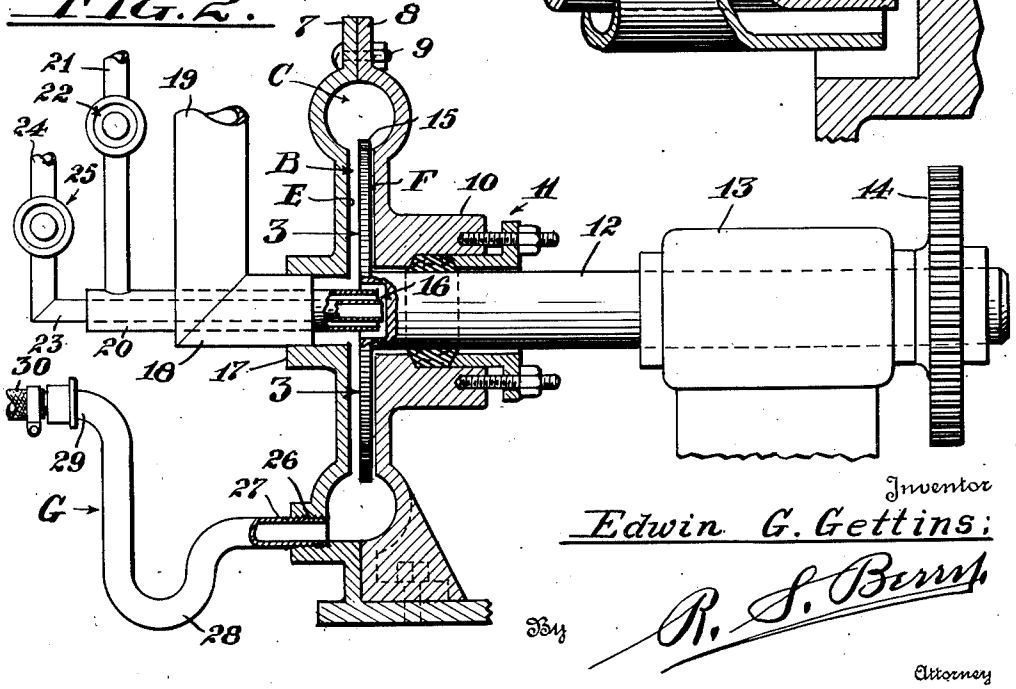


FIG. 2.



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FLUID CONTACT APPARATUS

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7 Claims. (Cl. 261—84)

1

This invention relates to an apparatus for bringing fluids into contact with each other as in treating liquids with gases, or in intermixing liquids, gases or liquids and gases.

The primary object of the invention is to provide an apparatus whereby fluids of various natures may be rapidly brought into thorough intimate contact with each other while flowing from a source or sources of supply to discharge.

Another object is to provide an apparatus wherein the contact of fluids therein is effected by first coincidently breaking down or separating the fluids to be contacted into a finely divided intermixed condition approaching the molecular state and immediately thereafter subjecting the intermixed fluid spray to impact while in its finely divided state.

Another object is to provide an apparatus of the above character which is adapted to be constructed to effect simultaneous contact of a multiple of fluid substances, either liquid or gaseous, and whereby any desired number and variety of fluids may be intermixed or contacted as occasion may require.

Another object is to provide an apparatus embodying effective means for contacting or intermixing liquids and gases in which the liquid is separated into minute particles in the presence of rapidly disbursed gas or gases by centrifugal force in a manner to insure thorough intermingling of the fluids, and including means whereby the finely divided intermixed particles will be subjected to impact against a contoured surface and caused to rebound into the path of following particles and thereby be subjected to bombardment by the latter, and in which the intermixed fluids will be caused to flow at least in most part with great rapidity in a spiral motion within a confined space under violent agitation, all in a fashion to insure a complete, or at least a substantially complete association of liquid molecules with the gas in a short space of time.

Another object is to provide a fluid mixing or contacting apparatus embodying an upright revoluble circular disk operable to disburse outwardly thereon and therefrom fluids directed to the central portion thereof, together with an effective means for delivering fluids to the central portion of the disk and an annular chamber encircling the margin of the disk open thereto into which the fluids are directed from the disk, and in which adjustable means are provided whereby liquid delivered to the chamber may be either completely drained therefrom, or allowed to accumulate in part therein such as to submerge

2

a portion of the margin of the revolving disk and thereby be re-disbursed by the latter.

A further object is to provide a fluid contact apparatus which is extremely compact in proportion to its capacity and which involves few parts in a simple assemblage.

With the foregoing objects in view together with such other objects and advantages as may subsequently appear, the invention resides in the parts and in the combination, construction and arrangement of parts as hereinafter described and claimed, and illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is a view of the apparatus as seen in front elevation with portions broken away;

Fig. 2 is a vertical section and a partial side elevation taken on the line 2—2 of Fig. 1;

Fig. 3 is a detail in section and elevation as seen on the line 3—3 of Fig. 2;

Fig. 4 is a detail in section and elevation taken on line 4—4 of Fig. 3.

Referring to the drawings more specifically A indicates generally a housing which is formed to provide interiorly thereof an upright narrow central circular chamber B peripherially encircled by and opening throughout to the inner peripherial portion an enclosed annular chamber C of circular cross section which is enlarged laterally relative to the chamber B.

Leading tangentially from the passage C is an upwardly extending passage D with which is connected a conduit 6 leading to any suitable point of discharge.

The housing A is here shown as comprising front and back plates 7 and 8 arranged in abutting relation to each other and detachably connected together as by bolts 9 which plates are contoured on their adjacent faces to form the chambers B and C and the passage D.

The back plate 8 is formed with a central hub 10 fitted with a packing gland 11 through which extends a horizontal revoluble shaft 12 journalled in a bearing 13 and fitted with a gear wheel 14 geared to a suitable driving mechanism (not shown) for rotating the shaft 12. Arranged within the chamber B and spaced from the walls E and F thereof is an upright circular flat faced disk 15 fixed on the inner end of the shaft 12 and preferably integral therewith; the disk 15 having a diameter such that the outer margin thereof will extend into the inner peripherial portion of the annular chamber C. Formed centrally of the outer face of the disk 15 is a cylindrical recess 16 here shown as extending into the

inner end of the shaft 12 axially thereof and concentric therewith.

Formed on the outer plate 7 is a hub 17 opening opposite the cylindrical recess 16 concentric therewith and connecting at its outer end with the elbow 18 of a feed pipe 19 leading from any suitable source of controlled gas supply not necessary to be here shown.

Extending through the elbow 18 and leading through the hub 17 is a nozzle 20 the inner discharge end of which projects into the cylindrical recess 16 and terminates in open spaced relation to the bottom wall of the latter; the outer end portion of the nozzle 20 connecting with a conduit 21 leading from any suitable source of fluid supply through a control valve 22.

The conduit 21 leads laterally from the nozzle 20 so that when desired another nozzle 23 may be positioned to extend longitudinally through the nozzle 20 as where three fluids are to be fed to the apparatus; the nozzle 23 opening at its discharge end to the recess 12 and having its intake end connected to a feed pipe 24 leading from any initial source of fluid supply through a control valve 25. Manifestly any desired member of telescoped nozzles may be arranged in the fashion set forth according to the number of fluids to be contacted or intermixed in the apparatus, and accordingly while two of such nozzles are here shown it will be understood that the invention embraces the employment of a single nozzle or any multiple thereof as occasion may require.

Extending laterally from the lowermost portion of the annular chamber C is a liquid discharge passage 26 which is fitted with an adjustable means G for regulating the flow of liquid from the chamber C and which means is here shown as comprising a tube formed with a threaded end portion 27 having screw engagement with the wall of the passage 26 for turning movement relative thereto; the tube being formed with a U-bend 28 having an outwardly extending end portion 29 connecting with a hose 30 leading to any suitable point of discharge. It will be observed that when the U-bend 28 is disposed in a dependent position as shown in Fig. 2 it will serve as a trap and when disposed in a horizontal position as shown in dotted lines *a* in Fig. 1, the tube will afford an open passage through which liquid may freely flow from the chamber C.

The outer or discharge end 29 of the tube is outwardly offset relative to the inner end of the tube a distance exceeding the distance between the lower marginal portion of the disk 15 and the contiguous bottom of the lowermost portion of the chamber C so that when the trap 28 is disposed in its pendant upright position and filled with liquid to the overflow point a liquid level will be established in the chamber C such as to submerge the lower marginal portion of the disk 15.

The apparatus above set forth is applicable for use in intermixing liquids as in contacting two or more liquids that are miscible although of greatly different gravities to bring about an instant homogeneous mixture or solution; and for contacting a gas with a liquid to bring about a quick reaction and separation of the gas and liquid with the liquid retaining the precipitated products of reaction; and also for contacting two or more immersible liquids in the presence of a gas to instantly form an emulsion.

In the operation of the invention, generally considered, liquids are delivered to the recess 16, while the disk 15 is being rotated, from whence the liquid flows evenly over the margin of the recess onto the adjacent surface of the disk 15 and is directed under the urge of centrifugal force outwardly over the face of the disk in a thin film and is spun from the margin of the disk in a mist of finely divided particles into the annular chamber C; the particles being thus forcibly impacted against the wall surface of chamber C and then flowing downward and out the discharge tube G. As before stated, in some instances the liquid may be caused to flow freely to discharge or may be collected in part in the trap 28 or may be accumulated within the lower portion of the chamber C to a predetermined depth according to the adjustment of the tube G.

Gas is introduced at the central portion of the disk 15 through the feed pipe 19 and is forcibly carried across the face of the rotating disk under the urge of centrifugal force and is directed into the chamber C where it is bombarded by the finely divided particles of liquid ejected from the disk and rebounding from the walls of the chamber C. The gas delivered from the margin of the disk 15 will be caused to strike the walls of the chamber C and will thereby be deflected back toward the advancing liquid spray flowing from the margin of the disk. The walls of the chamber C being curved and the fluids being directed angularly thereagainst imparts a somewhat spiral motion to the gas thus causing it to be recontacted many times as it flows to discharge through the passage F. By raising the sump level of liquid in the chamber C until it touches the edge of the disk C a portion of the liquid will thereby be reacted upon by the disk and caused to be recirculated.

By the operation above set forth the fluids being acted on will be broken down to approach the molecular state so that thorough contacting and intermingling of the fluids will be rapidly effected.

An example of the use of the apparatus in mixing liquids is in the treatment of gasoline with sulphuric acid. In this instance cold gasoline is delivered to the recess 16 through one of the nozzles 20 or 23 and concentrated sulphuric acid is coincidently delivered to the recess 16 through the other nozzle so that on rotating the disk 15 a homogeneous mixture of the liquids will be immediately formed which is directed to a settling tank through the discharge 26. During this operation the gas discharge conduits 6 and the gas feed pipe 19 are closed in a conventional fashion.

An example of the employment of the apparatus in subjecting a gas to the action of a liquid is the treatment of gasoline vapor with an aqueous solution of zinc chloride, in which instance the gasoline vapor is delivered to the revolving disk 15 through the feed pipe 19 and the solution of zinc chloride is delivered to the recess 16 through the central nozzle 23 while steam of sufficient temperature to produce enough condensate to replace moisture evaporated from the cold zinc chloride solution is delivered through the nozzle 20. The resultant liquids containing precipitated gums and mercaptans together with precipitated zinc is drawn off through the discharge tube G while resultant gases and vapors flow to discharge through the conduit 6.

As an example of the employment of the apparatus in effecting the intermixture of immiscible

liquids in the production of an emulsion is to direct castor oil and water to the recess 16 through the nozzles 20—23 and to pressurize the gas connections with an aromatic to give the emulsion a pleasing odor, the gas discharge conduit 6 and feed pipe 19 being left open or capped as occasion may require.

It will be manifest that the apparatus is subject to many uses other than the examples above given.

While the apparatus has been shown and described with the disk 15 disposed in an upright position, the apparatus is subject to being operated with the disk in a horizontal or inclined position, and while I have shown and described a specific embodiment of the invention it is to be understood that it is subject to modifications without departing from the purview of the accompanying claims.

In the operation of the apparatus the disk 15 may be rotated to advance upwardly toward the discharge passage where gases are to flow rapidly to discharge and to be rotated in the opposite direction in intermixing liquids.

I claim:

1. A fluid contact apparatus comprising a housing enclosing an upright narrow circular chamber, an annular chamber peripherially encircling the circular chamber and communicating therewith throughout the inner portion of said annular chamber, said annular chamber being enlarged laterally relative to said circular chamber, and a tangentially extending discharge passage leading from said annular chamber; an upright flat faced circular disk arranged in said circular chamber the periphery of which is contiguous the juncture of said chambers, a rotary shaft affixed axially to the back face of said disk, an axial cylindrical recess in the front face of said disk, at least one fluid conducting nozzle opening wholly within and adjacent the bottom of said recess, a fluid conducting nozzle opening into said circular chamber opposite said recess in spaced relation to the front face of said disk, and a liquid discharge passage leading from the lower portion of said annular chamber.

2. The structure called for in claim 1 together with means for entrapping liquid in the lower portion of said annular chamber at a predetermined level therein.

3. The structure called for in claim 1 together with a discharge tube threaded in said discharge passage for rotary adjustment therein, said tube being formed with a U-bend and having a discharge end terminating on a plane above the lower marginal portion of the disk when the U-bend is positioned in an upright dependent position.

4. The structure called for in claim 1 together with a tube formed with a U-bend having one end thereof connected to said discharge passage in turnable relation thereto for positioning said U-bend in either an upright, horizontal or angular position; said tube having a discharge end terminating on a plane above the lower marginal portion of the disk when the U-bend is positioned in an upright dependent position.

5. In a fluid contact apparatus, a housing having upright spaced apart parallel walls forming

a narrow circular chamber, an annular chamber of circular cross section in said housing peripherially encircling said circular chamber and opening thereto throughout the inner peripherial portion of the annular chamber, said annular chamber being laterally enlarged relative to said circular chamber, a tangential fluid discharge passage leading from said annular chamber, a flat faced circular disk in said circular chamber having a peripherial portion extending into the annular chamber and spaced from the outer peripherial portion of the latter, a rotary drive shaft affixed to said disk extending axially thereof from one side thereof, an axial recess in said disk, a fluid discharge nozzle opening to said circular chamber opposite said recess, and a fluid discharge nozzle leading through said first named nozzle and opening within said recess.

6. The structure called for in claim 5 together with a liquid discharge passage leading from the lower portion of said annular passage, and means for controlling the discharge of liquid through said passage.

7. In a fluid contact apparatus, a housing having upright spaced apart but contiguous parallel walls forming therebetween a narrow circular chamber, said housing enclosing an annular chamber of circular cross section peripherially encircling said circular chamber and opening thereto along the inner peripherial portion of the annular chamber, said annular chamber having a diameter exceeding the width of said circular chamber at its juncture with the annular chamber, a tangential fluid discharge passage leading upwardly from said annular chamber, an upright revoluble flat faced circular disk in said circular chamber having a peripherial portion spaced from the outer peripherial portion of said annular chamber, means for rotating said disk, a gas feed pipe having a discharge end leading to said circular chamber opposite to and spaced from the central portion thereof, said disk having an axial cylindrical recess presented to the discharge end of said gas feed pipe, at least one liquid feed pipe having a discharge end located within said recess, a liquid discharge pipe leading from the lower portion of said annular chamber, and means for controlling the discharge of liquid from said annular chamber through said discharge pipe whereby said annular chamber may be either drained of liquid or adapted to contain a body of liquid at various levels therein.

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