

June 22, 1948.

D. W. TURNER

2,443,646

FLUID DISTRIBUTION SYSTEM

Filed April 19, 1943

2 Sheets-Sheet 1

Fig. 1.

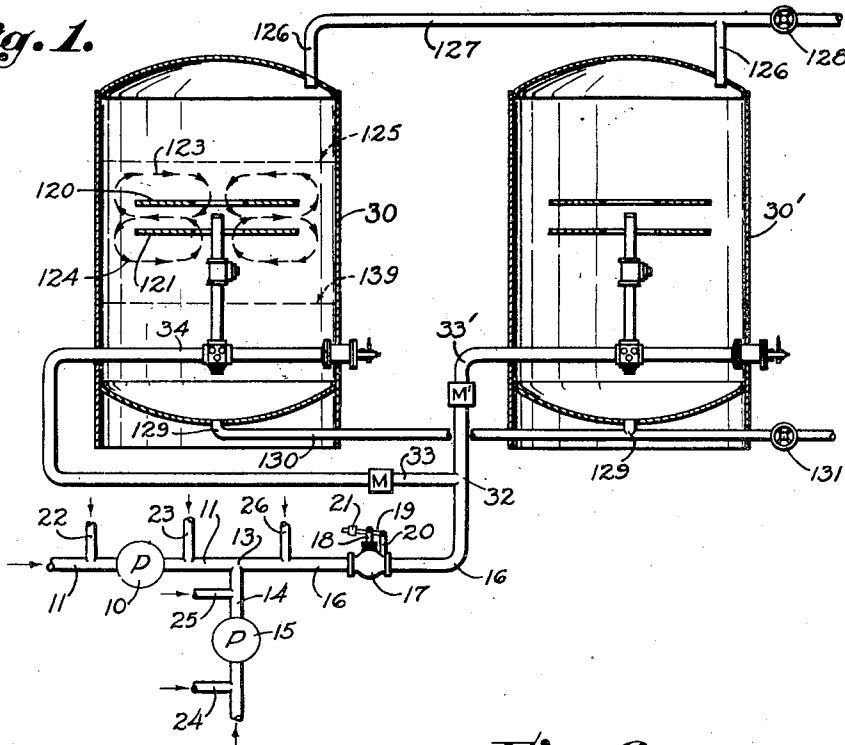
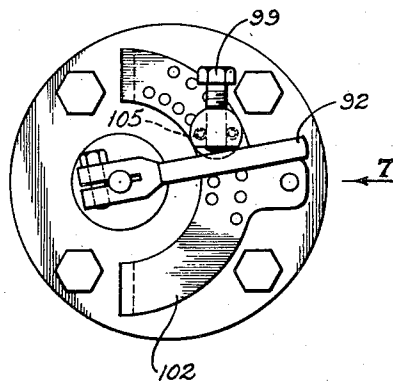
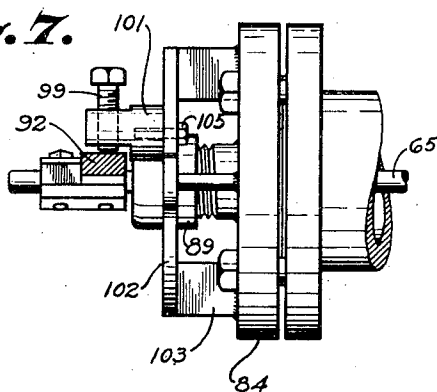


Fig. 6.

Fig. 7.



INVENTOR
 DELBER W. TURNER
 BY
 HARRIS, KIECH, FOSTER & HARRIS
Lawrence F. Kiech
 FOR THE FIRM
 ATTORNEYS

June 22, 1948.

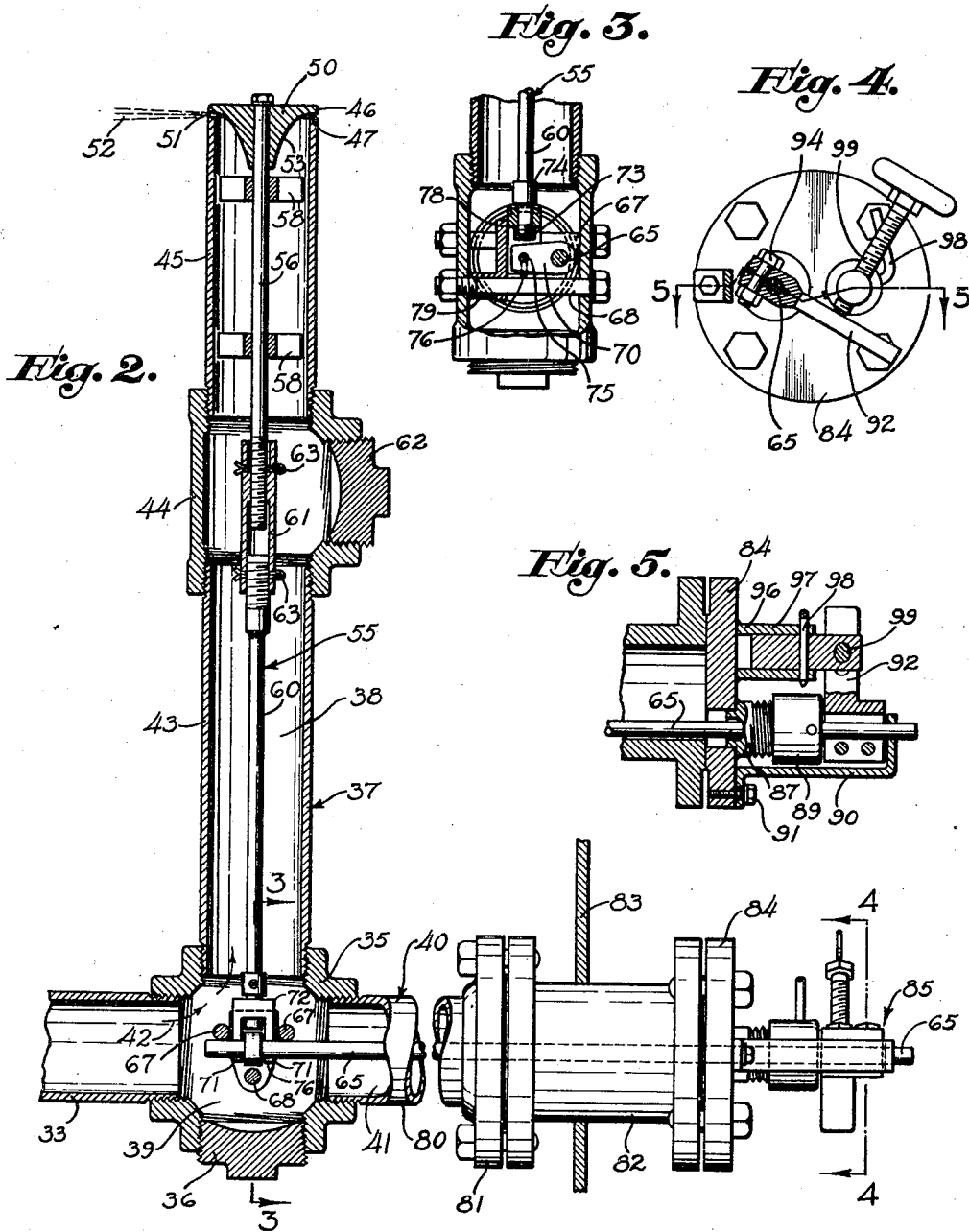
D. W. TURNER

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FLUID DISTRIBUTION SYSTEM

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2 Sheets-Sheet 2



INVENTOR
DELBER W. TURNER
HARRIS, KIECH, FOSTER & HARRIS

Delbert W. Turner
FOR THE FIRM

ATTORNEYS

UNITED STATES PATENT OFFICE

2,443,646

FLUID DISTRIBUTION SYSTEM

Delber W. Turner, Houston, Tex., assignor to
Petrolite Corporation, Ltd., Wilmington, Del.,
a corporation of Delaware

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4 Claims. (Cl. 259-95)

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My invention relates to a fluid distribution system for discharging a stream of fluid to one or more tanks under controlled conditions. It finds particular utility in those arts in which it is desired to discharge a stream of liquid into a space, e. g., the interior of a tank, in a carefully controlled manner.

It is often desirable to discharge such a stream while adjustably controlling the amount of fluid discharged, the velocity of the discharged stream, the "throw" of the stream, the size of such stream, the degree of agitation or mixing during discharge, or the degree of circulation induced in the medium in the tank by the incoming stream. It is an object of the invention to provide a novel fluid distribution system in which one or more of such factors can be controlled or adjusted.

The invention is most particularly concerned with liquids, but such liquids may be of various composition, depending upon the process with which the invention is used. In some instances, the liquid may be homogeneous in the sense of being of uniform composition throughout, e. g., a single-phase system. On the other hand, particular advantages arise from use of the invention in the making and separating of composite or multi-phase streams constituting non-homogeneous systems. For example, the liquid may be a dispersion or emulsion of two relatively immiscible liquids or a suspension of solid particles in a liquid phase, or a suspension or dispersion comprising a liquid phase carrying both liquid or solid dispersoids. All such non-homogeneous systems are herein referred to as dispersions.

It is an object of the invention to provide a novel adjustable distribution system for such dispersions adapted, among other things, to control the mixing action exerted on a stream of the dispersion upon discharge.

It is an object of the present invention to provide a novel mixing sequence including a controlled mixing or agitation step at the point of delivery to the processing tank and which can be accurately controlled by the operator.

It is an object of the present invention to provide for the accurate control of a mixing action to which a stream comprising a dispersion or a non-homogeneous liquid is subjected at the instant of delivery into a tank.

The invention, in its preferred embodiment, comprehends the formation of a usually substantially horizontal sheet-like stream discharging into the tank at a position within a body of liquid therein. The distance which this stream will "carry" in its movement toward a side wall

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of the tank will depend upon the velocity of discharge, which, in turn, will depend upon such factors as the pressure of the stream and the size of the orifice. It is an object of the present invention to provide a novel system for controlling or adjusting the "throw" of such a stream.

As a part of the processing within the tank, it is often desirable to induce a circulation of the liquid already in the tank. Such an internal circulation can be established by the discharge or jet action of the incoming stream as, for example, by discharge of the stream in a substantially horizontal direction between vertically-spaced members or substantially vertical discharge between horizontally-spaced members. The injector action of the incoming stream can thus be made to recirculate the liquid in the tank through closed circulation paths around each member to aid in the processing and to facilitate separation of a dispersed material, aided, if desired, by association or coalescence of the dispersoid. It is an object of the present invention to provide a control for the discharge means which can be used in varying the circulation paths within the tank.

To obtain these and other desirable effects, it is desirable to use a distributor providing a discharge opening and a movable discharge controlling member cooperating in defining an orifice through which the liquid discharges, the movable member being biased toward orifice-closing position. It is an object of the present invention to provide a novel torsion means for biasing such a movable discharge member and to provide a novel adjustment therefor.

It is a further object of the invention to connect one end of a torsion rod operatively with a discharge controlling member in such manner as to exert a pull on such member as determined by the torsional force in the rod at such end, and to apply a torque to another portion of such rod.

Another object is to provide a conduit means with a variable-area discharge orifice and to change the size of this orifice by twisting a torsion rod extending into a portion of the conduit means.

Still another object of the invention is to extend such a torsion rod to a position outside the tank for application and adjustment of torque.

Another object is to provide for the periodic flushing of the fluid distribution system and for subsequent re-application of the identical biasing force previously applied.

Other objects and advantages of the invention will be evident to those skilled in the art from

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the following description of exemplified embodiments.

Referring to the drawings:

Figure 1 is a diagrammatic view showing the applicability of the invention to the distribution of fluid to a plurality of tanks;

Figure 2 is a view of one embodiment of the fluid distribution system of the invention, partially in vertical section and partially in elevation;

Figure 3 is a fragmentary vertical sectional view, taken on the line 3—3 of Figure 2;

Figure 4 is an end view partially in section, taken on the line 4—4 of Figure 2;

Figure 5 is a sectional view, taken in accordance with the irregular line 5—5 of Figure 4;

Figure 6 is an end view of an alternative control means of the invention; and

Figure 7 is a side view of the control means of Figure 6, taken as indicated by the arrow 7.

The invention will be exemplified with reference to the synthesizing and separation of dispersions and, more particularly, the forming of a dispersion or emulsion of two liquids and the subsequent separation thereof, aided, if desired, by various treating expedients applied either ahead of or within the tanks.

An embodiment of the invention particularly adapted to continuous operation is shown in Figure 1. Here, a proportioning pump 10 forces a stream of one of the liquids along a pipe 11 to a junction 13 where it is met by a stream of the other liquid introduced through a pipe 14 under the action of a proportioning pump 15. By way of example, the liquid flowing through the pipe 11 may comprise a mineral oil and the pump 15 may be used to disperse therein a liquid capable of reacting chemically or combining physically with certain undesired constituents in the oil, while at the same time being sufficiently immiscible in the oil to form a dispersion. For example, water can thus be introduced into certain oils to remove materials such as water-soluble acids or other water-soluble materials which can be brought into association with the water by mere mixing or by supplementary processing steps within the tank. The oil and water, in the exemplified embodiment, are sufficiently immiscible to form a dispersion which may be made, in part, when the streams are first brought together at the junction 13, or during flow along a pipe 16 receiving the combined liquids, or during flow through a weight-loaded mixing valve 17 which may be disposed in the pipe 16, if desired, and/or at the point of discharge into the tank. The valve 17 is shown as comprising a stem 18 pivoted to a lever 19 which is, in turn, pivotally connected to a post 20, the lever 19 carrying an adjustable weight 21 to exert a downward force on the stem 18 tending to close the valve 17. In some instances, the additional mixing provided by the valve 17 is unnecessary and this valve can be omitted or by-passed.

In some processes, it is desirable to add chemical treating agents or modifying agents to one or the other, or both, of the two streams before formation of the dispersion or even after it is formed. In this connection, Figure 1 shows pipes 22 and 23 through which such materials can be introduced into the pipe 11, either ahead of or beyond the pump 10. If such materials are to be introduced into the stream advanced by the pump 15, pipes 24 and 25 can be used, respectively, to introduce the material into the intake or discharge of the pump 15. If such a material is to

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be introduced into the dispersion, pipe 26 may serve in this capacity, this pipe communicating with the pipe 16 at any desired point. In all instances, it will be apparent that the pipes 22 to 26 can be fed by suitable proportioning pumps, or the material thus added can, if desired, be batch-mixed with one or both of the liquids which are to be mixed at the junction 13, or therebeyond.

The synthesizing means thus far described is employed with one or more tanks to aid further in the processing or separation of the materials. In Figure 1, two tanks are shown, respectively indicated by the numerals 30 and 30'. The stream of dispersion divides at a junction 32 and moves to the respective tanks through pipes 33 and 33'. Flow meters M and M' may be disposed in these pipes to indicate the relative or absolute volumes flowing to the tanks. As the tanks 30 and 30' and related equipment are identical, a specific description of the fluid distribution system for one tank will suffice.

The fluid distribution system for each tank is best shown in Figure 2, which exemplifies the invention with reference to discharge of a horizontal stream of the dispersion into the corresponding tank. In the illustrated embodiment, the dispersion is delivered radially outward from a discharge position coaxial with the vertical axis of the tank and at a vertical position which will be determined by the processing steps employed in the particular system. It is usually desirable that the stream be discharged into the tank in submerged position so as to be jetted outward in a liquid environment.

As best shown in Figures 1 and 2, the pipe 33 forms a part of a conduit means 34. In the preferred construction, a four-way pipe fitting 35 is employed as a part of this conduit means, the downward-extending leg being closed by a plug 36, and the pipe 33, or a continuation thereof, being threaded into one of the horizontal legs. A conduit 37 is threaded into the upward-extending leg of this fitting and provides a fluid-conducting passage 38 receiving fluid from a chamber 39 of the pipe fitting 35. A casing 40 is threaded into the remaining horizontal leg of the pipe fitting 35 and provides a passage 41 opening on the chamber 39.

The incoming dispersion flowing through the pipe 33 under the action of the proportioning pumps 10 and 15, or any other pressure means, moves upward in the conduit 37 as indicated by the arrows 42. This conduit is shown as comprising a riser pipe 43, a T-fitting 44, and a stationary discharge member 45 cooperating in forming the passage 38. The uppermost end of the conduit 37 provides a discharge opening bounded by an annular wall or surface 46 extending substantially horizontally in the preferred embodiment of the invention. Positioned in the path of flow of the fluid rising in the conduit 37 is a discharge controlling member 50 movable with respect to the stationary discharge member 45 to provide a variable-area discharge orifice 51 through which a stream 52 of the dispersion discharges radially in a substantially horizontal direction. The desired degree of vertical flaring of this stream, if any, is determined by the design of the fluid distribution means, and particularly the shape of the annular wall 46 and a cooperating annular wall 47 of the movable discharge controlling member 50.

The discharge controlling member 50 is preferably biased toward closed-orifice position by a biasing means to be later described. In the pre-

ferred embodiment of the invention, the discharge controlling member 50 is movable under the action of the incoming stream in a direction opposite to the biasing force. In the illustrated embodiment, this is accomplished by forming the movable member 50 as a head extending across the upper end of the opening of the stationary discharge member 45. Liquid forced upward in the conduit will thus exert on the movable member 50 an upward force tending to lift the movable member 50 against the biasing force and toward open-orifice position to increase the thickness of the stream 52. In the absence of this flow of liquid, the movable member 50 will be resiliently seated on the stationary discharge member 45 in orifice-closing position. So long as a stream of liquid is moving upward in the fluid-conducting passage 38 of the conduit 37, this stream will exert the upward force on the movable member 50, irrespective of the configuration of the lower surface thereof. However, better control of the mixing action and a better centering action can be obtained by curving this lower surface as indicated by the numeral 53 to form a point-like extension which spreads the stream toward the discharge orifice 51.

The downward resilient biasing force exerted on the movable member 50 is preferably exerted by an actuating member or tension member 55 extending longitudinally along the first conduit 37. The uppermost end of such a tension member is operatively connected to the movable discharge member 50. In the particular construction shown, the tension member 55 includes an upper member 56 extending through and secured to the movable member 50. Spiders 58 may be secured to the upper member 56 to guide the member 50 in its vertical movement and to center the upper member 56. The tension member 55 also includes a lower member 60, the adjacent ends of the members 56 and 60 being differentially or oppositely threaded to extend into a correspondingly threaded sleeve 61 adjacent the T-fitting 44. Removal of a plug 62 in this T-fitting gives access to the sleeve 61 which, by being rotated in one direction or the other, serves to adjust the total length of the tension member 55. Once adjusted, a suitable locking means, such as cotter pins 63, serve to lock the assembly.

A resilient downward pull is exerted on the lower end of the tension member by a novel torsion means adjustable from a position outside the tank 30. This torsion means preferably includes an operating member in the form of a spring rod 65 extending from the chamber 39 along the passage 41 of the casing 40 to a position outside the tank. As will be later described, a torque is applied to that portion of the torsion rod 65 outside the tank, thus establishing a torsion throughout the length of this rod and thus tending to turn about its axis that portion of the torsion rod within the chamber 39. The inner end of the torsion rod 65 is operatively connected to the movable discharge controlling member 50 through the tension member 55 by a means which translates rotary motion of the torsion rod into a substantially linear motion, which is transmitted to the lower end of the tension member 55 to exert a downward pull. The resiliency of the downward biasing force depends primarily upon the torque resiliency of the torsion rod 65, aided in part by the longitudinal elasticity of the tension member 55. These two sources of resiliency can be relatively varied by changing the size of the torsion rod

65 and the tension member 55, but it is usually preferred that a major portion of the resilient action arise from the twist or torque in the torsion rod 65.

The preferred way of translating a twist or rotary motion at the inner end of the torsion rod 65 into a longitudinal pull on the lower end of the tension member 55 is best shown in Figures 2 and 3. As there shown, two upper members or bolts 67 traverse the chamber 39 in a horizontally-aligned position. A similar lower member or bolt 68 traverses the chamber at a lower position. The inner end of the torsion rod 65 extends between the upper and lower bolts, and its uppermost position is determined by engagement with the lower surfaces of the upper bolts 67, as shown. Similarly, its lowermost position is determined by engagement with the upper surface of the lower bolt 68.

In the preferred embodiment, a linkage is employed to interconnect the torsion rod 65 and the tension member 55. As best shown in Figure 3, this linkage may include a lever 70 welded or otherwise secured to the torsion rod 65 at a position below the tension member 55. The end of this lever extends between depending bifurcations 71 of an attachment member 72, through which the lower member 60 of the tension member extends, this lower member being threaded to receive a nut 73 and carrying a collar 74 above the attachment member 72 to limit the downward movement of the lower member 60. A pin 75 traverses the bifurcations 71 and the lever 70 to connect pivotally the lever to the attachment member 72. A set screw 76 in one or both of the bifurcations retains the pin 75 against axial movement. Correspondingly, any tendency for the torsion rod 65 to turn in a counterclockwise direction, as viewed in Figure 3, will exert a resilient downward pull on the tension member 55.

It will be apparent from Figures 3 and 5 that the torsion rod 65 is displaced to one side of, but substantially parallel to, the axis of the passage 41 of the casing 40. It is desirable that the axis of the torsion rod lie along a straight line, thus preventing bends which might cause undue stresses in local sections of the rod when the torsion is applied. Engagement of the circular portion of the lever 70 with the inside wall of the chamber 39 limits the rightward movement of the inner end of the tension member 55, as viewed in Figure 3. Leftward movement of these elements can be prevented by any suitable means, such as a plate 78, slidably engaging the sides of the attachment member 72 and its bifurcations. As best shown in Figures 2 and 3, this plate 78 is of a size to fit snugly between the bolts 67, and it carries at its lower end a spacing sleeve 79 surrounding the bolt 68 and extending to a side wall of the pipe fitting 35 to retain the plate 78 in guiding relationship with the attachment member 72.

The casing 40 extends to a wall of the tank 30 and preferably to a position therebeyond. As shown, the main portion of this casing comprises a pipe 80 carrying a flange 81 connected to a flanged nipple 82, also forming a part of the casing 40, welded or otherwise secured to a wall 83 of the tank 30, the wall 83 being either a portion of the main side wall of the tank or being a removable section thereof. A head 84, outside the tank 30, closes the end of the passage 41 formed by the second conduit.

A suitable control means 85, positioned outside

the tank 30, is used to apply a torque to the outer end of the torsion rod 65 to place same under torsional strain and thereby control the downward resilient force applied to the movable discharge member 50. The details of one embodiment of the control means are best shown in Figures 2, 4, and 5. Referring thereto, the torsion rod extends through a neck 87 welded to the head 84 and carrying a packing gland 89 which guides the torsion rod and forms a motion-permitting, fluid-tight seal or bearing therefor. That portion of the torsion rod 65 beyond the gland 89 is journaled in a bracket 90 detachably connected to the head 84 by a bolt 91. Between the journalling portion of the bracket 90 and the gland 89 is positioned a lever 92 bifurcated to be clamped by a bolt 94 to the torsion rod 65.

The control means 85 includes also a means for adjustably moving the lever 92 to establish an adjustable torsional force in the torsion rod. This means is shown as including a tube 96 welded or otherwise secured to the head 84 and carrying a support means 97 removably held in position by a bent pin 98. The support means 97 threadedly receives an engagement member 99, shown as comprising a wing-headed bolt engaging the lever 92. By turning the engagement member to advance through the support means 97, an increasing torque is applied to the torsion rod 65 through the lever 92.

An alternative form of control means is shown in Figures 6 and 7, in which the support means 97 comprises an adjustable block 101 carrying a conventional bolt acting as the engagement means 99 and bearing against the lever 92. The block 101 is adjustably positioned with respect to an arcuate plate 102 mounted in spaced relationship with the head 84, as by short legs 103. The annular plate provides two series of holes disposed in pairs and bolts 105 extend through any selected pair of holes to retain the support means, comprising the block 101, in any selected position. In this embodiment, a suitable weight can be applied to the end of the lever 92 to establish a torque approximately of the desired value. Thereafter, the block 101 can be bolted in place and additional adjustments can be made by turning of the engagement member 99.

It will be apparent from the foregoing that the fluid distribution system can be adjusted from a position outside the tank and that this adjustment can be made without interfering with the operation of the equipment. The movable member 50 is urged upward toward orifice-opening position by the pumped stream. The downward resilient or biasing pressure applied to this movable member can be adjusted by turning the engagement member 99. By increasing the downward-acting biasing force, it is possible to control accurately the volume of fluid discharged, the velocity of the stream 52, the "carry" of the stream, the mixing action in the fluid distribution system at the point of discharge, the pressure drop across the discharge orifice 51, the relative amounts of liquid entering the tanks 30 and 30', etc.

An important feature of the invention is that the biasing force can be removed at intervals to permit flushing of the fluid distribution system without draining the tank, after which the apparatus can be returned to the previous biasing force without difficulty. In certain processes, it is found that accumulations or scale tend to form in the fluid distribution system. These are particu-

larly harmful adjacent the discharge orifice 51, and it is often found that foreign bodies, such as scale, etc., may accumulate at one or more peripheral positions to avoid the peripherally-continuous, sheet-like discharge desired. When this occurs, it is desirable to relieve the biasing pressure to flush out the system. With the control means of Figures 2, 4, and 5, the bent pin 98 can be removed and the support means 97 withdrawn, the setting of the engagement member 99 being retained. This will release the torsion in the torsion rod 65. The corresponding release in biasing pressure applied to the movable member 50 may dislodge any obstruction in the fluid distribution system, though it is usually desirable to decrease or eliminate the supply of liquid and to oscillate the lever 92 to transmit a rapid vibration to the movable member 50, causing it to move upward and downward with respect to the stationary discharge member 45. It will be observed that the invention provides for a positive connection between the torsion rod and the movable member so that this member may be raised positively from its seat. This facilitates dislodgment of scale or obstructions, particularly if the movable member is rapidly oscillated to apply percussion blows to the stationary discharge member 45.

At the same time, the invention provides a means for re-applying the same biasing force as was present before the flushing operation. In many instances, the previously-applied biasing force may have been quite critical and it is desirable to re-apply exactly the same force. This is accomplished merely by re-inserting the support means 97 and inserting the bent pin 98, all without disturbing the setting of the engagement member 99. In reinserting the support means, the lever 92 may be depressed manually or by any suitable means. Upon release of this depressing force, the lever will return to its former position, as determined by contact with the engagement member 99.

Similarly, the control means shown in Figures 6 and 7 provides for the same flushing action and return of the previous biasing force. In this embodiment, the block 101, comprising the support means, can be detached by loosening the bolts 105, the setting of the engagement member 99 being not changed. This will release the lever 92 and the system can be flushed or cleaned as previously described. Thereafter, the block 101 can be replaced without disturbing the setting of the engagement member 99, whereby an identical biasing force is re-applied.

If the complete apparatus shown in Figure 1 is employed for synthesizing and separating dispersions, it will be apparent that the separate streams delivered to the tanks 30 and 30' can be individually adjusted in volume, degree of mixing action upon discharge, etc., by adjustment of the corresponding engagement member 99. For example, if it appears that the processing capacity of one tank is being exceeded, the operator can adjust the biasing force to reduce the flow thereto or change the mixing action at the point of discharge. In some instances, the processing steps may be largely completed before the dispersion enters the tanks, as, for example, by permitting completion of reactions or physical associations before discharge into the tanks. In this instance, the tanks may serve merely as a separating means. On the other hand, processing steps in addition to mere separation may be conveniently performed in the tanks or additional aids to resolution or separation may be utilized within

the tanks. Numerous types of such aids are familiar to those skilled in the arts, such, for example, as the use or application of heat, pressure, agitation, chemicals, electric fields, etc., within the tank.

Various types of processing steps performed in the tanks can be facilitated by agitation or circulation within the tank induced by the incoming stream. For example, in Figure 1 the discharge may be in submerged position and may desirably establish recirculation paths within the liquid in the tank. Figure 1 shows upper and lower annular members 120 and 121 mounted to extend substantially horizontally at positions respectively above and below the elevation of the discharging stream 52. Such members may be perforate or imperforate and may be held in position by any suitable means, not shown. The stream 52 may be discharged in spaced relationship with each of these members and the injector action of the stream will draw liquid into the central openings of the annular members and establish upper and lower closed circulation paths therearound, as indicated respectively by arrows 123 and 124.

Such a system may be advantageously employed to prolong the time of contact between chemical materials and the constituents of the stream. It may also be employed advantageously to discharge the incoming stream into a body of washing liquid. If the incoming stream comprises oil, washing through a body of water is often desirable, and the upper surface of this water may be carried above the fluid distributor, as indicated, for example, by the numeral 125. In such instances, the washed oil can be removed through an upper pipe 126 to a header 127, suitably valved at 128 to maintain a back pressure on the tank, while the washing or other liquid can be withdrawn from the lower end of the tank through a pipe 129 to move to a header 130, also suitably valved at 131 for a similar purpose. If both tanks are being employed, the upper effluent from the tank 30' is preferably moved to the header 127 ahead of the valve 128 through pipe 126', the lower effluent being similarly delivered to the header 130 ahead of the valve 131 through pipe 129'. Control of back pressures by throttling the effluent flows in the headers produces advantageous results as compared with throttling the individual flows from the individual tanks. In this connection, the upper effluents of the two tanks are always at the same pressure, as are also the lower effluents of these tanks, and the relative amounts of liquids delivered to the two tanks are directly determined by the relative settings of the two control means.

On the other hand, if the interfacial level is carried below the distributor at a level indicated, for example, by the dotted line 139, the incoming stream will be discharged into the upper of two separated, or partially-separated, bodies and the induced recirculation, indicated by the arrows 123 and 124, may aid in the treatment being carried out within the tank 30. For example, the recirculation may retain any material not completely processed until this processing is complete, at which time the material can separate from the recirculation paths. In other instances, the induced recirculation can be very advantageously used if some treating action takes place between the annular members 120 and 121, for example, if these members are maintained at a different potential to establish therebetween a cataphoretic or coalescing electric field.

While the invention has been particularly exemplified with reference to the synthesizing and separation of dispersions, it should be clear that the apparatus may be used in the processing of homogeneous liquids without departing from the spirit of the invention. In this event, the pump 10 may, for example, deliver the homogeneous liquid to the system and the pump 15 may deliver another liquid miscible therewith. This second liquid may be of such character as to throw down precipitates which settle in the tanks, or it may be of such nature as to partially complete its action before discharge through the orifice 51 and partially after discharge into the liquid body in the tank. If the process is one to produce precipitates, these can be separated in the tank and withdrawn, for example, through the pipe 130, or they may remain in the main stream of liquid to discharge through the pipe 126.

Various changes and modifications can be made without departing from the spirit of the invention as defined in the appended claims.

I claim as my invention:

1. In a fluid distribution system, the combination of: a conduit for said fluid, said conduit being provided with a discharge opening; a movable discharge controlling member cooperating with said opening to define a fluid discharge orifice, said member being positioned to be urged toward orifice opening position by fluid under pressure in said conduit; and means for resiliently urging said member toward orifice closing position against the pressure of said fluid, said means including a spring torsion rod, connections between one portion of said rod and said member for moving said member toward said orifice closing position upon angular movement of said portion about its axis in one direction, and means for holding another portion of said rod in adjusted angular position to twist said rod and resiliently urge said one portion of said rod in said one direction.

2. In a fluid distribution system, the combination of: a conduit for said fluid, said conduit being provided with a discharge opening; a movable discharge controlling member cooperating with said opening to define a fluid discharge orifice, said member being positioned to be urged toward orifice opening position by fluid under pressure in said conduit; and means for resiliently urging said member toward orifice closing position against the pressure of said fluid, said means including a spring torsion rod having a portion extending into said conduit, connections positioned in said conduit and extending between said portion of said rod and said member for moving said member toward said orifice closing position upon angular movement of said portion about its axis in one direction, a casing for said rod communicating at one of its ends with said conduit, and means positioned at the other end of said casing and exteriorly thereof for holding another portion of said rod in adjusted angular position to twist said rod and resiliently urge said one portion of said rod in said one direction.

3. In a fluid distribution system, the combination of: a conduit for said fluid, said conduit being provided with a discharge opening; a movable discharge controlling member cooperating with said opening to define a fluid discharge orifice, said member being positioned to be urged toward orifice opening position by fluid under pressure in said conduit; a spring torsion rod having a portion extending into said conduit; a crank and linkage mechanism in said conduit and connected between said portion of said rod

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and said member for moving said member toward orifice closing position upon angular movement of said portion about its axis in one direction; a casing surrounding said rod and communicating at one of its ends with said conduit, said rod having another portion extending from the other end of said casing, said casing having a fluid-tight bearing for said rod providing for angular movement of said other portion; and means for holding said other portion of said rod in adjusted angular position to twist said rod and resiliently urge said first mentioned portion thereof in said one direction, said means comprising an element secured to said other portion of said rod exteriorly of said casing and means for holding said element in adjusted angular position against reverse angular movement.

4. In a fluid distribution system, the combination of: a closed tank; a conduit for said fluid extending through a wall of said tank and having a portion positioned in the interior of said tank, said conduit having a discharge opening within said tank; a movable discharge controlling member cooperating with said opening to define a fluid discharge orifice, said member being positioned to be urged toward orifice opening position by fluid under pressure in said conduit; a spring torsion rod having a first portion extending into said conduit; a casing for said rod communicating with said conduit and extending through a

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wall of said tank, said casing having a fluid-tight bearing for said rod at the end of said casing remote from said conduit, said rod having another portion extending through said bearing to the exterior of said casing; connections positioned in said conduit between said first portion of said rod and said member for moving said member toward said orifice closing position upon angular movement of said first portion about its axis in one direction; and means positioned exteriorly of said casing for holding said other portion in adjusted angular position to twist said rod and resiliently urge said first portion in said one direction.

DELBER W. TURNER.

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Certificate of Correction

Patent No. 2,443,646.

June 22, 1948.

DELBER W. TURNER

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Column 5, line 55, after the word "spring" insert *torsion*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of October, A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.