July 3, 1973 J. P. FIELD 3,743,598

APPARATUS AND PROCESS FOR MIXING CHEMICALS

Filed Sept. 2, 1971 2 Sheets-Sheet 1

Fig. 1

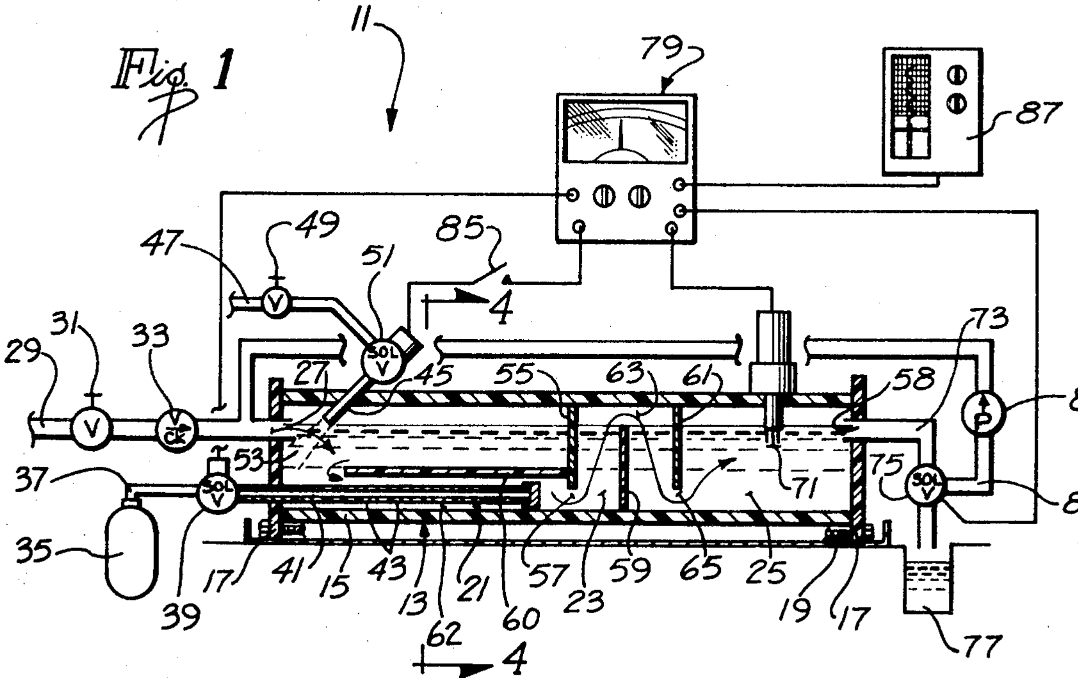


Fig. 2a

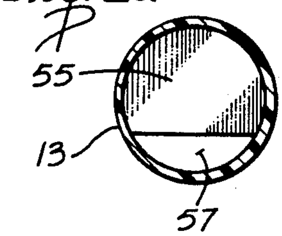


Fig. 2b

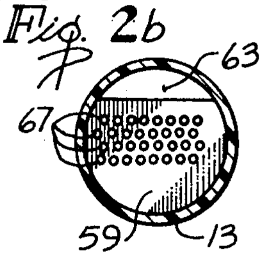


Fig. 2c

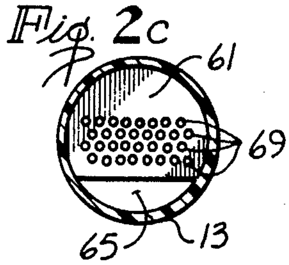


Fig. 3

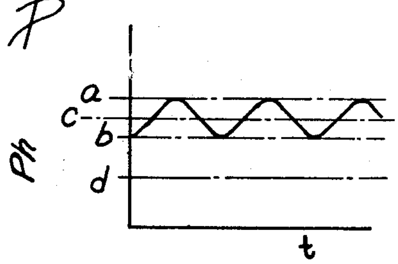
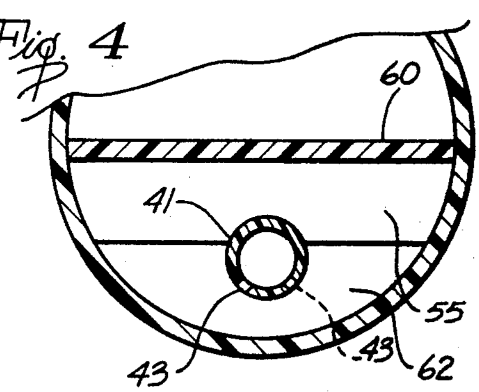


Fig. 4



INVENTOR:
J. Paul Field
By: Smyth, Roston & Pavitt
ATTORNEYS

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APPARATUS AND PROCESS FOR MIXING CHEMICALS

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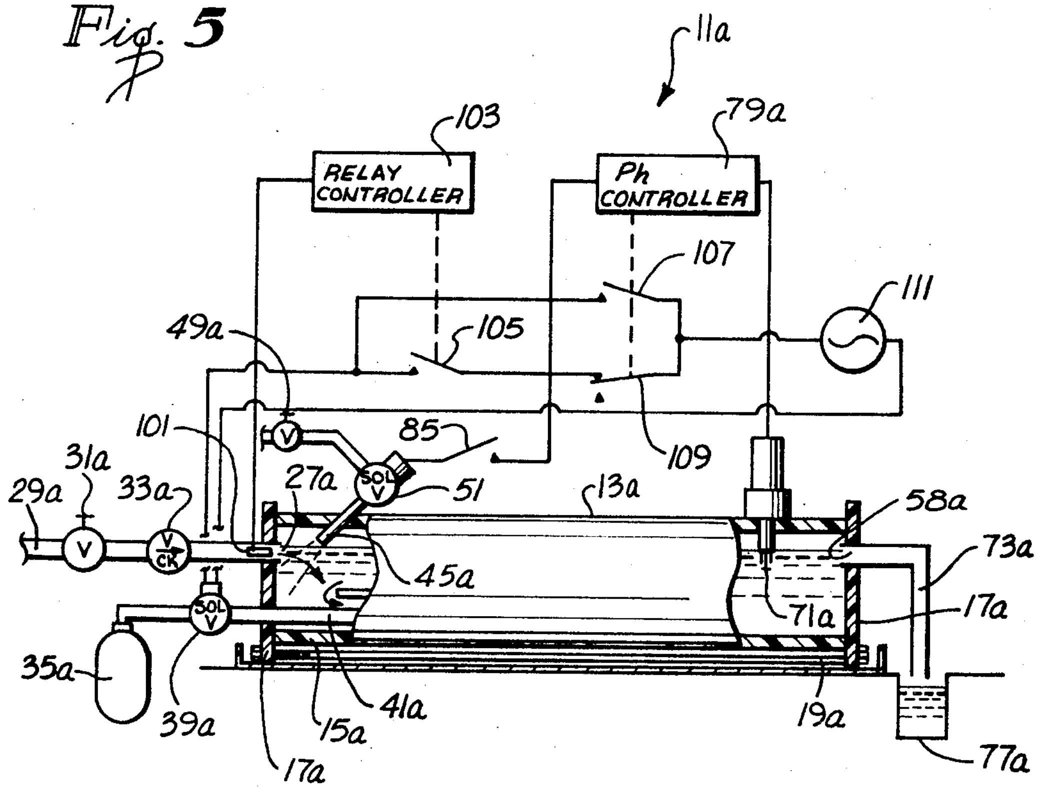
Fig. 5



INVENTOR:
J. Paul Field
By: Smyth, Roston & Pavitt
ATTORNEYS

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APPARATUS AND PROCESS FOR MIXING CHEMICALS

J. Paul Field, 2508 Holly Lane, Newport Beach, Calif. 92660

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U.S. Cl. 210—49 15 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for mixing chemicals comprising a tank having first and second inlets connectible to sources of first and second chemicals, respectively, and an outlet. The chemicals are channeled within the tank so that they come into intimate contact, and the path from the inlets to the outlet is elongated through the use of baffles. Mixing of the two chemicals is accomplished without motor driven means by using the two chemicals to create turbulence within the tank. A sensor adjacent the outlet measures a characteristic of the mixture of chemicals and controls the supply of at least one of the chemicals in accordance with the value of the measured characteristic to thereby control such characteristic of the mixture.

BACKGROUND OF THE INVENTION

Many industries in the normal course of carrying out their business produce an acid waste. One such industry is the newspaper publishing industry. Ecology laws require that acid waste be neutralized before it can be disposed of.

Present systems for neutralizing acid employ large holding tanks. The acid waste and a suitable base are introduced into the tank, and the solution is held in the tank for a long period of time until the mixture reaches a pH of about 7 at which time the mixture can be disposed of. These holding tanks are expensive and require substantial time to accomplish the neutralizing function.

SUMMARY OF THE INVENTION

The present invention employs a mixing apparatus and method which significantly reduces the time required for neutralization. With the present invention the acid waste is not held in a holding tank, but rather is continuously fed through a tank at a rate commensurate with a reasonable drain rate of the acid waste from the chamber in which it is held. Although the mixing apparatus is particularly adapted for acid waste neutralization, it can be readily used for other controlled mixing functions including acid injection.

A mixing apparatus constructed in accordance with the teachings of this invention includes a tank having an acid waste inlet, a base inlet and an outlet. Acid waste is typically in the form of a liquid although it may have undissolved solids, and it may be heavy or sludge-like. The acid waste enters the tank and fills the tank to a predetermined level.

To obtain some turbulence and mixing of the acid waste and base, the base is preferably introduced into the tank below liquid level. The base can advantageously take the form of a gas such as ammonia (NH_3) which is soluble in the acid waste and which bubbles up through the acid waste.

A feature of this invention is that the injection of the base into the tank is not modulated, but is controlled solely by an on/off valve in response to the pH of the mixture adjacent the outlet. One advantage of this system is that digital operation simplifies valve and controller construction, and this produces a corresponding cost savings.

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A second advantage of this construction is that it provides additional turbulence which assists mixing of the acid and the base. With the gas under pressure and with on/off control, the gas is spurted or forced at relatively high velocity into the liquid each time the valve opens. These bursts of gas, at least at the outset, produce turbulence and intimate mixing of the gas and the liquid within the tank. Burst duration will depend on different factors including acid and base concentration. Providing bursts of base is not essential as in some instances base may be supplied continuously.

For optimum mixing, an injector is provided within the tank. The injector has a plurality of apertures through which the bursts of gas can pass. The use of multiple apertures distributed along a preselected region provides multiple inlet orifices for the gas with a consequent improvement in mixing. The apertured member can advantageously take the form of an elongated tube having apertures in the wall thereof.

To further provide for intimate contact between the acid and the base, the acid waste is channeled across the injector. This can be accomplished by a baffle and/or a plate which define a relatively confined passage through which the acid waste must flow. By restricting or confining the passage, intimate contact between the acid waste and the base is assured. The portion of the tank upstream from the baffle may be considered as an inlet zone and the apertured tube preferably extends for substantially the full length of the inlet zone.

To elongate the flow path between the inlet and outlet of the tank, a plurality of baffles can be provided to thereby provide a tortuous flow path. In addition to elongating the flow path, the baffles create turbulence in the liquid as the liquid passes around each of the baffles.

Another turbulence creating concept employed by this invention is a plurality of small apertures through one or more of the baffles. This creates a second flow path (the first flow path being around the baffle) so that when the liquid travelling along the two flow paths meet, additional turbulence is created.

Preferably the baffle which assists in defining the restricted passage is not perforated thereby forcing or channeling all of the acid waste over the injector. The region of the tank which contains the baffles may be considered as an intermediate or a mixing zone of the tank.

Acids and bases are inherently difficult to mix. One feature of this invention is that acid waste and a base are thoroughly mixed without employing power driven devices or movable mechanisms. In addition the present invention is adapted for gravity feed through the tank.

The zone of the tank adjacent the outlet is the outlet zone. The outlet zone contains a pH sensor which senses the pH of the mixture adjacent the outlet. The sensor transmits a signal to a pH controller which in turn operates an on/off valve such as a solenoid valve which controls the flow of the base to the tank. Because on/off control of the base is utilized, the pH of the mixture at the outlet will fluctuate between allowable tolerances. However, the average pH over any time span of reasonable length will be substantially neutral. This is acceptable in that short periods of some pH other than substantially neutral can be tolerated by disposal systems so long as the long period average is approximately neutral.

With the pH sensor located adjacent the outlet of the tank, it obviously cannot call for addition of base to the tank until the pH of the mixture at the sensor changes accordingly. This means that at start up there is a period of time during which acid is being fed into the tank and no base is being added. This produces a brief, but acceptable, period during which acidity of the mixture leaving the tank may be relatively high.

While this is not objectionable for many applications, it may be desirable at least in some applications to eliminate the brief period of relatively high acidity. One way to accomplish this would be to provide a second pH sensor adjacent the inlet of the tank. However, pH sensors are relatively expensive instruments and the addition of a second pH sensor would significantly increase the cost of the mixing apparatus.

The present invention teaches that substantially the same results can be achieved much less expensively by utilizing a conductivity cell closely adjacent the acid waste inlet to the tank. A conductivity cell is a relatively inexpensive instrument which measures the conductivity of a liquid. Acid waste is conductive primarily because of the dissolved solids contained therein whereas ordinary tap water is relatively nonconductive.

When the conductivity cell indicates a level of conductivity indicative of acid waste, it initiates the injection of the base into the tank. This eliminates the relatively high acid spike which would appear without the conductivity cell. Thereafter, injection of the base into the tank is under the control of the pH controller and the pH sensor.

An optional, but advantageous, feature of the present invention is that of water injection. Water can be injected into the inlet zone of the tank by a nozzle which directs a stream of water generally toward the stream of acid waste entering the inlet zone through the inlet. Water injection has four important functions. First, it dilutes the acid waste. Second, it creates turbulence which further intimately mixes the acid waste with the base. Third, the acid and base react exothermically to elevate the temperature within the tank, and the water serves to reduce that temperature. Fourth, when ammonia gas is used as the base, it assures that the ammonia gas will be thoroughly dissolved even in the event of a malfunction which might otherwise allow the gas to escape to the atmosphere or to back flow into the acid waste inlet line.

Another optional, but advantageous, concept of the present invention is that of recycling the mixture from the outlet back to the inlet zone, or a location upstream thereof, if the pH of the mixture is not within the allowable tolerances. For example, if the supply of base should become exhausted, the pH of the mixture may fall below the allowable level. In this event, the pH controller would operate a three-way valve and energize a pump which would recycle the mixture back to the inlet of the tank until the supply of base could be replenished.

Another advantage of the present invention is that the tank and many of the components of the apparatus can be constructed of an inexpensive plastic material which will not react with the chemicals passing through the tank. For example, in many instances the tank can be constructed of polyvinyl chloride which is lightweight and inexpensive. The baffles, the injector, and the valves and fittings may also be constructed of plastic material.

The invention can best be understood by reference to the following description taken in connection with the accompanying illustrative drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional view in elevation illustrating a mixing apparatus construced in accordance with the teachings of this invention with portions of the apparatus being shown diagrammatically.

FIGS. 2*a*, 2*b* and 2*c* are sectional views through the tank illustrating three of the baffles in the tank.

FIG. 3 is a representative curve of pH values versus time at the outlet of the tank.

FIG. 4 is an enlarged fragmentary sectional view taken generally along line 4—4 of FIG. 1 illustrating the injector or sparge.

FIG. 5 is a diagrammatic elevational view partially in section of a second form of mixing apparatus constructed in accordance with the teachings of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows an apparatus **11** constructed in accordance with the teachings of this invention. The apparatus **11** is particularly adapted for mixing acid waste and a base to thereby neutralize the acid waste. However, the apparatus **11** may be utilized for other mixing operations and is not restricted to an acid neutralization function. Moreover, depending upon the setting of the instruments employed, the acid and base could be mixed to provide an average pH other than 7, if desired.

The apparatus **11** includes a tank **13** which, in the embodiment illustrated, is constructed of a polyvinyl chloride pipe **15** of cylindrical configuration and a pair of polyvinyl chloride end caps **17**, each of which is in the form of a plate. While plastic is preferred because it is inexpensive and relatively lightweight, obviously other materials may be utilized for the tank **13**. Similarly, the tank need not be of cylindrical configuration. The end caps **17** are suitably retained on the pipe **15** as by a plurality of elongated bolt assemblies **19** which clamp the end caps against the opposite ends of the pipe **15**.

The tank **13** is divided into an inlet zone **21**, intermediate or mixing zone **23** and an outlet or sensing zone **25**. The inlet zone **21** is supplied with acid waste in substantially liquid form through an acid waste inlet **27** formed in the end cap **17**. Acid waste is supplied to the inlet **27** from a source (not shown) through a conduit **29**, a manual valve **31** and a check valve **33**.

A base is supplied to the inlet zone **21** from a source **35** through a conduit **37**, an on/off automatic control valve such as a solenoid valve **39** and an injector **41** which, in the illustrated embodiment of the invention, is a sparge. The injector **41** in the embodiment is an elongated tube having two rows of circumferentially offset apertures or base inlets **43** therein (FIG. 4), with the apertures of the two rows being axially offset. To improve mixing the apertures **43** open generally downwardly, e.g., at a 45° angle relative to the vertical.

The apparatus **11** is not limited to use with any particular kinds of acids and bases. The apparatus **11** is particularly adapted, however, to neutralize acid of the type typically produced in publishing newspapers. This acid is typically nitric acid. However, virtually any acid including sulfuric acid and hydrochloric acid can be neutralized.

Although various bases can be utilized, a gas is preferred because no pump is required to supply it and because of the agitation effect which it has when it is discharged through the apertures **43**. Ammonia gas can be used to advantage as it is readily soluble in the acid waste and in water.

A nozzle **45** is suitably mounted on the tank **13**. The nozzle **45** is supplied with water from a source (not shown) through a conduit **47**, a manual valve **49** and an on/off automatic control valve such as a solenoid valve **51**. The nozzle **45** is arranged at an angle to direct a stream of water in a pattern **53** which passes just beneath the inlet **27**. This assures that the water from the nozzle **45** will not be directed into the inlet **27**, but will be directed primarily at the acid waste exiting from the inlet. This water stream agitates the acid base mixture, dilutes the acid, provides a cooling effect on the exothermic reaction in the inlet zone **21** and assures that the ammonia gas will be fully absorbed in the liquid phase within the inlet zone **21** and not allowed to escape as a gas.

The inlet zone **21** extends from the end cap **17** on the left as viewed in FIG. 1 to an imperforate baffle **55**. As shown in FIGS. 1 and 2*a*, the baffle **55** is in the form of a part circular plate suitably affixed to the interior of the tank **13** and generally perpendicular to the axis of the tank. The baffle **55** closes the tank **13** except for a restricted orifice **57** through which the liquid in the inlet zone **21** must pass en route to an outlet **58** of the tank **13**.

Another feature of the invention is that the injector **41** extends for substantially the full length of the inlet zone **21** to thereby distribute the ammonia gas throughout the full length of the inlet zone. The injector **41** terminates closely adjacent the restricted orifice **57**.

A plate **60** is mounted on the baffle and extends toward the inlet end of the tank **13** to thereby define along with the baffle **55** a restricted passage **62** in which the sparge **41** is positioned. The baffle **55** and the plate **60** cooperate to completely close off the tank **13** except for the passage **62**. Accordingly, all of the acid waste is routed over the sparge **41** in close proximity thereto to thereby achieve good initial mixing of the acid and the base. The plate **60** also elongates the flow path through the tank **13**.

The baffle **55** and two additional baffles **59** and **61** are in the intermediate or mixing zone **23** with the baffles **55** and **61** defining the extremities of the intermediate zone. The baffles **59** and **61** are suitably mounted on the tank **13** in generally perpendicular relationship to the axis of the tank and define with the tank restricted orifices **63** and **65**, respectively. The baffles **55** and **61** are mounted so as to provide the restricted orifices **57** and **65** at the lower region of the tank and the baffle **59** is positioned so as to provide the restricted orifice **63** at the upper end of the tank. The flow path through the orifices **57, 63** and **65** is as shown by the arrows in FIG. **1**. The baffles are preferably constructed of sheets of plastic and any suitable number of the baffles may be provided.

The baffles **59** and **61** have small openings **67** and **69**, respectively, therein. Although various numbers and patterns of the openings **67** and **69** may be provided, manufacture of the baffles **59** and **61** is facilitated if the openings in both baffles are identical as to size and position. As shown in FIGS. 2*b* and 2*c*, the openings **67** and **69** lie entirely within the regions of their respective baffles **59** and **61** which directly confront each other. Stated differently, all of the openings **67** and **69** in both of the baffles **59** and **61** lie above a horizontal plane which includes the lowermost edge of the baffle **61** and below a horizontal plane which includes the uppermost edge of the baffle **59**.

The baffles **55, 59** and **61** serve several important functions. First, the baffle **55** assists in channeling all of the liquid in the inlet zone **21** across the injector **41** in passing from the inlet zone to the intermediate zone **23**. Second, the baffles provide disaligned orifices **57, 63** and **65** to thereby provide an elongated flow path through the tank **13** so that the flow path through the tank is longer than the distance between the inlet **27** and the outlet **58**. Third, the elongated flow path provided by the baffles is tortuous, i.e., requires the fluid to make several changes of direction with consequent production of turbulence and agitation which improves mixing.

Fourth, the openings **67** and **69** allow some of the liquid in the intermediate zone **23** to pass directly through one or both of the baffles **59** and **61**. This means that fluid which flows through the restricted orifices **63** and **65** flows along a different path, i.e., a generally axial path than fluid which flows directly through the openings **67** and **69**. The impingement of these two streams flowing in different directions further agitates the mixture with consequent thorough mixing. Thus, thorough mixing of the acid waste and the base is accomplished without any mechanical agitation or power driven agitators.

A pH sensor **71** is located in the outlet zone **25** closely adjacent the outlet **58** and beneath the liquid level in the outlet zone. With the pH sensor **71** so located, the pH of the liquid at the sensor is substantially identical to the pH of the liquid at the outlet **58** and downstream thereof. The mixture in the outlet zone **25** is continuously removed and allowed to flow through a conduit **73** and a three-way control valve **75** to an open drain **77**.

The apparatus **11** is controlled by a pH controller **79** which may be of conventional design. An electrical input signal is provided to the pH controller by the sensor **71** with a characteristic of such signal varying with the pH of the mixture of liquid adjacent the outlet **58**. The pH controller **79** opens and closes the control valve **39** to thereby control the flow of ammonia from the source **35** into the tank **13** in accordance with the pH of the liquid at the sensor **71**. For example, the control valve **39** may be opened by the pH controller **79** as long as the sensor **71** senses a pH of less than a preselected value and may be closed when the pH sensed is greater than such preselected value. The preselected value of pH may be adjusted as necessary to produce the desired results, and the valve **39** can be opened at one pH and closed at another, if desired. With this type of control and with normal flow rates through the tank **13**, the valve **39** will be opened and closed periodically to supply bursts of pressurized ammonia gas through the apertures **43** of the injector **41**. Regardless of the duration of the burst, the beginning of each burst further contributes to the agitation of the acid waste and base in the inlet zone **21**.

With this type of control, the pH of the liquid fed to the open drain **77** may vary generally in accordance with the curve shown in FIG. 3. As shown in FIG. 3, the pH of the liquid at the outlet **58** varies generally in sawtooth fashion between an upper level *a* and a lower level *b* with the average pH being at an intermediate level *c*. For example, the pH of the levels *a, b* and *c* may be 9, 5 and 7, respectively. Over a period of time, the pH of the liquid at the outlet averages out at the average level *c* which, in the specific embodiment disclosed herein, is 7. However, the pH controller **79** can be adjusted to maintain the average pH at other values.

The pH controller **79** has a second set point or alarm point so that if the pH of the liquid at the outlet **58** drops below a preselected value *d* which is the minimum acceptable value, an electrical control signal is fed to the control valve **75** so that further flow from the outlet **58** is through a conduit **81** and a pump **83** back into the conduit **29** just upstream of the inlet **27**. With the control valve **75** in this position, there is no flow into the open drain **77**. This recycling or bypassing of the liquid from the outlet **58** will continue until the pH of the liquid at the outlet **58** rises so as to be above the acceptable minimum *d*. The pH level represented by *d* in FIG. 3 can be adjusted to any suitable value by the pH controller **79**.

In operation of the apparatus **11**, the three-way control valve **75** is normally open to the drain **77**. It is contemplated that the control valve **75** will recycle liquid back through the conduit **81** only in situations where there is a malfunction or in other extraordinary circumstances such as when the source **35** of ammonia is depleted, or when an unusually highly concentrated acid waste is supplied to the tank **13**, etc. Thus, the control valve **75** serves as a safety device to positively prevent dumping of a liquid into the drain **77** which has a pH below the acceptable minimum value *d*.

When the liquid is recycled, the pump **83** is operative to supply the necessary pressure to accomplish the recycling. In addition, the valve **51** is closed by the pH controller **79**. So long as the pH of the liquid adjacent the outlet **58** is within acceptable tolerances, the pH controller **79** has no effect on the solenoid valve **51**, in which event the valve **51** can be opened to supply water to the nozzle **45** by merely closing of a manual switch **85**. If desired, a recorder **87** can be coupled to the pH controller **79** to make a permanent record of the variation in pH at the outlet **58** with time.

The tank **13** should be installed in a position so that a residual of liquid will remain in the tank when the apparatus **11** is not in use. For example, with the outlet **58** located in the end cap **17** as shown in FIG. 1, the tank **13** can advantageously be installed with the longitudinal axis horizontal or inclined slightly toward the outlet. The residual level should be sufficient so that the sensor **71** remains submerged.

In operation of the system, the residue in the tank is sufficient so that the sensor 71 is always submerged. The switch 85 is first closed to cause the nozzle 45 to supply water to the tank 13, and the manual valve 31 is opened to allow acid waste to be fed into the inlet zone 21. This addition of acid waste to any liquid residue left in the tank 13 will ultimately bring the pH at the sensor 71 below the average level *c* to thereby cause the pH controller 79 to open the control valve 39. A burst of ammonia gas is then supplied through the valve 39 and the apertures 43 to mix with the incoming acid waste in the manner described hereinabove. The liquid from the inlet flows through the intermediate zone 23 as described hereinabove to the outlet zone 25. After a period of time the pH at the sensor 71 rises above the level *c*, at which time the control valve 39 is closed by the controller 79. The flow through the tank 13 is continuous and under the influence of gravity. The flow of liquid through the outlet 58 is also continuous. Accordingly, there is no holding time absent an alarm condition which would actuate the control valve 75 to cause recycling.

In the above-described operation of the apparatus 11, it is assumed that operating conditions will cause the solenoid valve 39 to be cycled open and closed repeatedly so that ammonia gas is periodically supplied through the apertures 43. While the apparatus 11 is capable of functioning in this manner, it should be understood that the opening and closing of the solenoid valve 39 is controlled by the sensor 71 and the pH controller 79 in accordance with the pH of the mixture adjacent the outlet 58. Accordingly, the solenoid valve 39 may cycle on and off infrequently, or may remain open continuously, or be otherwise controlled by the pH controller 79 to achieve preselected pH conditions adjacent the outlet.

FIG. 5 shows a second form of apparatus 11*a* which is identical to the apparatus 11 (FIGS. 1–4) in every way not specifically shown or described herein. Portions of FIG. 5 corresponding to portions of FIG. 1 are designated by corresponding reference characters followed by the letter *a*.

The apparatus 11*a* does not have the three-way control valve 75, the pump 83, nor the conduit 81 all of which were shown by way of example in FIG. 1. In all other respects, the apparatus 11*a* is identical to the apparatus 11 except for the manner in which the apparatus 11*a* is controlled.

The apparatus 11*a* includes a conductivity cell 101 located adjacent the inlet 27*a*. In the embodiment illustrated, the conductivity cell 101 is within the conduit 29*a* near the location at which the conduit dumps into the tank 13*a*. Of course, the conductivity cell 101 may be located at various locations in the path of fluid which enters the tank 13. As will become apparent, the conductivity cell 101 could be located within the tank anywhere upstream of the sensor 71*a*. However, optimum results can be obtained by locating the conductivity cell 101 in the stream of fluid entering the tank.

The conductivity cell 101 is of conventional design and provides a signal to a relay controller 103. A characteristic of the signal is proportional to the conductivity of the liquid in which the conductivity cell 101 is immersed. The relay controller 103 is operative to open and close a relay 105 in response to predetermined signals, respectively, from the conductivity cell 101. The relay controller 103 is adjustable so as to respond to different signal values.

The sensor 71*a* provides a signal which varies in accordance with the pH of the mixture adjacent the outlet 58*a*. This signal is received by the pH controller 79*a* which operates a low pH relay 107 and a high pH relay 109. A suitable power source 111 is coupled into the circuit to operate the solenoid 39*a*.

The relay 109 remains closed so long as the pH of the liquid adjacent the outlet 58*a* remains below a preset value such as 9. The low pH relay 107 remains open so long as the pH of the liquid adjacent the outlet 58*a* remains above a pH value such as 6. The relay 105 remains open so long as the liquid at the conductivity cell 101 has a conductivity below a preselected value. It is apparent from FIG. 5 that the solenoid valve 39*a* will be energized and therefore open if (1) both of the relays 105 and 109 are closed or (2) the relay 107 is closed as these two sets of relays provide parallel conductive paths.

Acid waste is typically much more conductive than ordinary tap water. This is due in large part to the presence of a relatively larger amount of acid ions in the acid waste. By way of example, if ordinary tap water were run through the conduit 29*a* to flush the conduit or for other purposes, the signal from the conductivity cell 101 would not operate the relay controller 103, and the relay 105 would remain open. In this event, assuming the pH of the liquid adjacent the outlet 58*a* to be greater than 6, the solenoid valve 39*a* would remain closed. However, if acid waste is run through the conduit 29*a*, the conductivity thereof is sufficiently high so that the signal from the conductivity cell 101 causes the relay controller 103 to close the relay 105. Ordinary tap water would not have sufficient conductivity to cause closing of the relay 105. A circuit is then completed through the relays 105 and 109 to the solenoid valve 39*a* thereby opening the valve to supply base through the injector 41*a*. The relay 105 remains closed so long as the conductivity cell 101 is in acid waste. Thereafter, the system is under the control of the sensor 71*a* and the pH controller 79*a*. For example, if the pH rises above a certain value such as 9, the relay 109 opens to close the solenoid valve 39*a*. As the relay 107 is normally open under these conditions, the solenoid valve 39*a* closes.

The relay 107 operates primarily as a safety device in the event that the relay 105 should fail to close. For example, if for any reason the relay 105 should fail to close, the addition of acid to the tank 13 would ultimately cause the pH adjacent the outlet 58 to drop below a preset value such as 6. At this instant, the relay 107 is closed to provide a path around the relay 105 to thereby open the solenoid valve 39*a* giving the pH controller 79*a* and the pH sensor 71*a* overriding control of the apparatus.

Although an exemplary embodiment of the invention has been shown and described, many changes, modifications and substitutions may be made by one having ordinary skill in the art without necessarily departing from the spirit and scope of this invention.

I claim:

1. A mixing apparatus for mixing a plurality of chemicals comprising:

a tank having first and second inlets for receiving a first and a second of said chemicals, respectively, said tank having an outlet, said tank defining a flow passage between said inlet and said outlet, said chemicals flowing through the flow passage from their respective inlets to said outlet;

at least one baffle in said flow passage to assist the mixing of the first and second chemicals to thereby provide a chemical mixture adjacent the outlet;

sensing means for measuring a characteristic of the mixture; and

means responsive to the measured characteristic of the mixture for controlling the amount of the first chemical which is received by said tank whereby said characteristic of the mixture is controlled.

2. A mixing apparatus as defined in claim 1 wherein said last mentioned means includes an on/off valve for controlling the amount of first chemical which is received by the tank.

3. A mixing apparatus as defined in claim 1 including a nozzle at least partially in said tank for directing a stream of liquid against the incoming second chemical, said stream of liquid creating turbulence which assists the mixing of the first and second chemicals.

4. A mixing apparatus as defined in claim **1** including means responsive to said measured characteristic being of predetermined value for conducting the mixture flowing through the outlet to a location upstream of said baffle.

5. A mixing apparatus as defined in claim **1** including means responsive to the conductivity of the second chemical for initiating flow of the first chemical into the tank.

6. A mixing apparatus as defined in claim **5** wherein said sensing means and said means responsive to the measured characteristic can override said means responsive to the conductivity of the second chemical.

7. A mixing apparatus as defined in claim **1** wherein said baffle includes a first baffle, said mixing apparatus including a second baffle, said first and second baffles projecting from opposite sides of the tank to provide a tortuous flow path, one of said baffles having at least one aperture therein to create turbulence which assists the mixing of the first and second chemicals.

8. A pH controlling apparatus for a plurality of chemicals including first and second chemicals in substantially fluid form wherein said chemicals have different values of pH, said apparatus comprising:

a tank having an inlet and an outlet, said inlet being connectible to a source of the first chemical;

an injector within the tank connectible to a source of the second chemical for supplying the second chemical to the tank;

means for channeling the first chemical across the injector as the first chemical flows from the inlet toward the outlet;

means for creating turbulence as the chemicals move toward the outlet to mix said chemicals to provide a mixture of the chemicals;

sensing means for measuring the pH of the mixture;

means responsive to the pH of the mixture for controlling the quantity of at least one of said chemicals which is supplied to the tank;

said channeling means including means for providing a restricted region in the flow path between the inlet and the outlet of said tank, at least a portion of said injector being closely adjacent the restricted region; and

said injector having a plurality of apertures, said first chemical being a liquid and said second chemical being a gas, said injector being submerged in the liquid, said means responsive to the pH of the mixture including an on/off valve for controlling the amount of the gas which is received by the tank, said on/off valve causing the gas to be periodically spurted through the apertures of the injector to thereby create turbulence which assists mixing of the chemicals, said means for creating turbulence including a plurality of baffles, at least some of said baffles having apertures therein through which the chemicals can pass to create turbulence to thereby assist mixing of the chemicals.

9. A pH controlling apparatus as defined in claim **8** wherein said tank includes a pipe constructed of a plastic which is not reactive with said chemicals and end caps for closing the ends of said tank.

10. A pH controlling apparatus for a plurality of chemicals including first and second chemicals in flowable form wherein said chemicals have different values of pH, said apparatus comprising:

a tank having an inlet and an outlet and defining a chamber, said inlet being connectible to a source of the first chemical;

an injector within the tank connectible to a source of the second chemical for supplying the second chemical to the tank;

means for defining a restricted passage in said chamber of said tank which is of lesser cross sectional area than said chamber;

said injector extending into said restricted passage whereby the first chemical is channeled over the injector as the first chemical flows from the inlet toward the outlet;

means for creating turbulence as the chemicals move toward the outlet to mix said chemicals to provide a mixture of the chemicals;

sensing means for measuring the pH of the mixture; and

means responsive to the pH of the mixture for controlling the quantity of at least one of said chemicals which is supplied to the tank.

11. An apparatus as defined in claim **10** wherein said means defining a restricted passage includes first and second members extending generally transverse to and longitudinally of the direction of flow between the inlet and the outlet, respectively.

12. An apparatus as defined in claim **10** wherein said turbulence creating means includes at least one baffle in said chamber to assist the mixing of the first and second chemicals.

13. A method of neutralizing acid waste comprising:

providing a neutralizing tank having an inlet zone, an outlet, a flow passage between the inlet zone and the outlet, and a baffle in said flow passage;

introducing acid waste into the inlet zone;

introducing a base into the tank to mix with the acid waste, said base being chemically reactive with the acid;

causing the acid waste and the base to flow in the flow passage toward the outlet with the baffle assisting the mixing of the acid waste and the base whereby a mixed solution is formed;

continuously removing some of the mixed solution from the tank through the outlet whereby flow through said tank is continuous;

sensing the pH of the mixed solution; and

controlling the addition of the base in accordance with the pH of the mixed solution to at least substantially neutralize the acid waste.

14. A method as defined in claim **13** including providing a restricted region in said flow path and channeling the acid waste through said restricted region, and said steps of introducing a base including introducing at least some of the base at said restricted region.

15. A mixing apparatus for mixing an acid and a base wherein the acid and base are in flowable form, said apparatus comprising:

a tank having first and second inlets for receiving the acid and the base, respectively, said tank having an outlet, said tank defining a flow passage between said inlet and said outlet, said acid and base flowing through the flow passage from their respective inlets to said outlet and mixing as they flow toward the outlet to thereby form a mixture;

sensing means for measuring the pH of the mixture;

means responsive to the pH of the mixture for controlling the amount of the base which is received by said tank whereby the pH of the mixture is controlled; and

means responsive to the conductivity of the acid fed to the tank for initiating the flow of the base to the tank.

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