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CHEMICAL FEEDER

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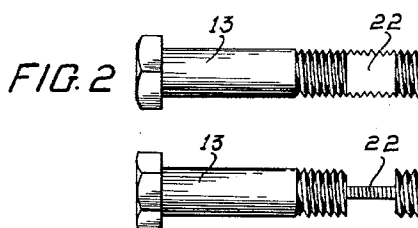
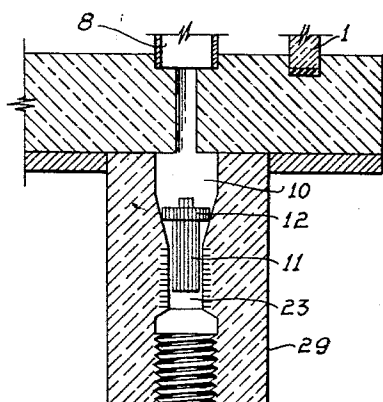
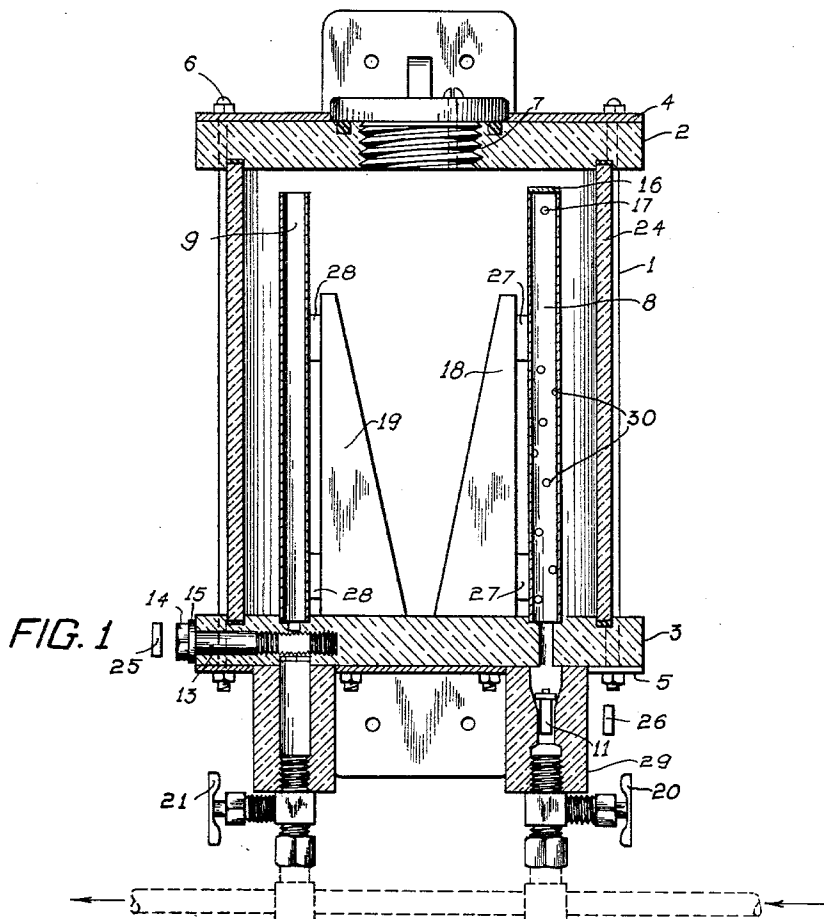


FIG. 4

FIG. 2

FIG. 3

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CHEMICAL FEEDER

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This invention relates to chemical feeders and to improvements in feeding chemicals uniformly into a body of liquid.

Introduction of chemicals in small amounts into a body of liquid is difficult, particularly in continuous and uniform manner. This task is markedly severe when tolerances for variations are limited to the order of one part of chemical to a million of the liquid. Maintaining such tolerance against fluctuating pressure of a supply line, particularly with simple means, is a current problem.

Heretofore ways and means have been devised to by-pass part of a stream of liquid through a reservoir of chemical. The by-pass returns with chemical solution into the main stream. The considerable number of various proposals toward this end attests their lack of sensitivity and control.

This invention is to provide means of marked simplicity to form and feed chemical solution. It is to be reliable and rugged, to require scarcely any oversight for long periods of time, and yet introduce small amounts uniformly. Particularly, this invention is to improve a by-pass reservoir type of feeder. It is to improve the solution supply means within the reservoir and also to provide improved control means for the feed. A special purpose is to overcome variability in concentration of chemical within the feeder. This invention overcomes variations in pressure. It may be adjusted within close tolerances by unskilled labor for extended operation. Other objects of this invention will appear in further description of a preferred form.

This invention combines certain internal means to provide chemical in solution with external controls to feed the solution.

An illustrative form of this invention is shown in the accompanying drawings:

FIG. 1 is an elevational section in front of the middle of a cylindrical feeder.

FIG. 2 is a side view of an outlet control valve, showing a cut-out flat valve seat.

FIG. 3 is a side view of the same valve showing the cut-out seat edgewise.

FIG. 4 is an enlarged elevational view of an inlet tube at the bottom of this feeder, showing a flared bore containing a combined float and stop valve.

In the drawings, a reservoir 1 is shown in preferred form as a cylinder of transparent plastic. This lends itself to quantity manufacture yet, under this invention, to precise and simple operation. Cylinder 1 is closed by top and bottom plastic plates 2 and 3 having circular grooves for gasket fitting against the cylinder edges. Against these plastic plates, metal backup plates 4 and 5 are held by stud bolt tie rods 24. The top plates contain a large control opening to receive a plastic plug 7 threaded into plastic plate 2, to admit replenishment of chemical. Through opposite parts of the bottom plates extend tubes 8 and 9 having enlarged extensions below the plates. Inlet tube 8 and outlet tube 9 extend to substantially the same level near the top of the reservoir. Tube 8 is capped and contains several small openings, arranged as will be described. Tube 9 is imperforate and is open at the top. As illustrating order of magnitude, tubes 8 and 9 are of half inch bore in a reservoir of 5 inch diameter.

Near the bottom of each tube are respective means cor-

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related to control passage of liquid through the reservoir. These means are within appropriately massive parts of the plastic.

Below tube 9 proper, a valve 13 is fitted into the side of relatively thick plastic bottom plate 3. As shown in FIGS. 1, 2 and 3, valve 13 is a plug of plastic, threaded at its inner end into plate 3. Tendency of the plastic to jam affords a tight seal and assurance of maintaining the valve at a given setting. Valve 13 terminates at its outer end in a nut 14 to be drawn against a nylon jam washer 15. Valve 13 is cut away to a middle flat plate at an intermediate part of the threaded portion. This plate or stem 22 retains threads of greater or less width along its edges that serve as a sensitive valve seat against tube 9. This is shown particularly in FIG. 3. A slight turn opens or closes valve 13, providing a relatively long finely adjustable, narrow passage.

Below tube 8, the inlet tube, thick plastic plate 3 and its enlarged downward extension contain an extension of the bore. This is enlarged to form a chamber 10 that tapers down to a smaller cylindrical bore 23. In this is placed a float valve 11 which with chamber 10 has double seating means. Valve 11 has a cylindrical bottom of somewhat smaller diameter than its containing cylinder 23. The top of valve 11 is a disk 12 capable of seating against the tapered walls of chamber 10. Upward flow of liquid in this inlet raises this float valve 11 to a position corresponding to the flow. This is sensitive to slight changes in flow or pressure. Position marks at the side of the stem 11 are useful indicators. Valve 11 is shown colored; for example, red, to facilitate observation, or adjustment of flow, or difference of light according to position of the valve. On any fluctuation or drop of pressure in the line, seating of disk 12 shuts off any back flow from reservoir 1.

At the bottoms of tubes 8 and 9 the bores are threaded to receive respective valves 20 and 21 to connect the feeder as a by pass with the main liquid line.

Inlet tube 8 and outlet tube 9, are substantially the same bore and both extend up into reservoir 1 to substantially the same level near the top, for example an inch below top plate 2. Outlet tube 9 is open at its top but preferably its walls are closed.

Inlet tube 8 is constructed in a particular way. Its top is closed but its walls contain a certain arrangement of perforations. Near the top is preferably a single perforation 17 disposed at about right angles to tube 9 and so tangential to the nearby wall of the reservoir. This directs outflow of liquid in small quantity but circumferentially rather than directly toward tube 9. This position may be varied. Yet a gentle current develops across the top.

Below opening 17 the walls of tube 8 are closed for about a third to a half of the tube. Then in the lower half, or more, of tube 8 the walls contain a group of apertures such as perforations 30. These are conveniently disposed as pairs of opposed openings arranged at random around the tube from bottom to half or more up the tube.

In proportion to the bore of tube 8, the group of openings 30 as a whole provide about the same area as the bore. For example, 16 openings of 1/8 inch each provide about 0.2 square inch area. This is about the same as the area of a bore of a half inch. The ratio may vary if desired. Of course, friction reduces flow, so a slow outflow occurs from tube 8, but extensively distributed at one side of reservoir 1.

Somewhat centrally of the reservoir an upstanding plate 18 is affixed by spacers 27 along the inner side of inlet tube 8. This rises to somewhat over half the height of tube 8. The inner side of plate 18 inclines downwardly

away from tube 8. Preferably a complementary plate 19 is affixed likewise by spacers 23 to outlet tube 9. Together plates 18 and 19 leave an open, downwardly converging space to facilitate break-up of a central pile of solid chemical. These may be termed breaker plates. Circulation of liquid around these plates tends to minimize caking of chemical as concentrated solution forms over the bottom. Differences of concentration gradient occur at random from one side to another and from top to bottom. These intermingle gradually until finally gentle cross-circulation at the level of opening 17 substantially equalizes the concentration of chemical at outflow into tube 9.

In utilizing this feeder, a supply of solid chemical is introduced through the top opening. The solid accumulates to about the height of plates 18 and 19. With top plug 7 in place, the reservoir is water-tight against usual line pressures, say 40 pounds per square inch. On opening valves 20 and 21 to the main line, the reservoir fills with liquid. However, the by-pass flow through reservoir 1 and its various constructions imposes no severe pressure burdens.

As liquid enters within the pile of solid chemical around inlet tube 8 wet areas appear, then solution and then development of complex circulation currents. These are gentle however. Severe agitation would lead to irregular concentrations of chemical at the outlet and to by-passing of concentrate from stockpile to outlet.

Outlet valve 13 is sensitive. It combines in action with sensitive inlet float valve 11 to indicate and even to control the rate of flow of chemical solution. Plug 11 may automatically control flow by servo mechanisms well known of themselves. This is indicated in the drawings by simple boxes 26 and 25 at valves 11 and 13 respectively, actuated for example by light transmission at given levels of colored valve plug 11.

The feeder of this invention operates without moving elements to supply uniform feed of chemical within continued tolerance of one part in a million. It applies an extensive variety of chemicals that are characterized by acceptable distribution in the feed liquid. Soluble solid chemicals that are suitable are, for example, phosphates for water treatment, or copper sulfate, or fertilizer or nutritional chemicals, or boiler water feed chemicals such as borates or carbonates, acid corrosion cleaners, and many others. Replenishment may be infrequent for output may dependably be at a low rate. Any tendency to surges from the main line are choked out by the shouldered float valve 11 in the inlet.

Materials of construction may vary in this feeder, but preference for transparent plastic follows from visibility, corrosion resistance, ease of cleaning, reproducibility to close tolerances at high rate of production, and snug fit of threaded surfaces. Many suitable plastics are well-known of themselves, such as acrylates, polyvinyl, polyethylene and polypropylene, for example.

Variations from details of this description now will occur to those skilled in the art, yet within the meaning of the attached claims. The present purpose has been to describe this invention and set forth its principles and best mode of operation within the patent statutes.

What is claimed is:

1. Improvement in chemical feeders comprising a tank having an opening at the top for introduction of solid material into the tank and having means for connection as a by-pass in a liquid flow line, the said means comprising an inlet tube closed below the top of the tank and containing at the bottom of the tank a group of small apertures and near its top a small inlet aperture of less area than the said lower aperture group and directed toward a nearby side of the tank for discharge therefrom to induce crosscurrents in liquid at the aperture level, and an outlet tube having an opening near the top of the tank at substantially the level of the said small inlet aperture establishing a space and a top surface level below the top of the tank, the said inlet and outlet tubes rising through the tank from the bottom to the said outlet level and spaced at opposite sides of the tank, the outlet tube containing a fine-adjusting valve to control fluctuation and throughput of liquid in the tank, the inlet tube containing below the said group of bottom apertures a bore enlarged to form a chamber, and disposed in the chamber a float valve and double seating means to seat the float valve alternatively against fluctuations of liquid through the chamber, whereby to promote uniform conditions in liquid outlet levels into which the said upper small inlet aperture opens.

2. Improvement in chemical feeders comprising a tank having an opening at the top for introduction of solid material into the tank and having means for connection as a by-pass in a liquid flow line, the said means comprising outlet and inlet tubes rising in the tank from its bottom, the outlet tube being open at its top below the top of the tank, the inlet tube having a group of small inlet apertures near the bottom of the tank and having at its top at the outlet level an opening of small area relatively to said bottom group, the said tubes being spaced apart at opposite sides of the tank, and baffle means at the lower portion of the tank between and spacing the said inlet and outlet tubes apart, the outlet tube containing a fine-adjusting valve to control fluctuations and throughput of liquid in the tank, the inlet tube containing below the said group of bottom apertures a bore enlarged to form a chamber, and disposed in the chamber a float valve, and double seating means to seat the float valve alternatively against fluctuations of liquid through the chamber, whereby to promote uniform conditions in outlet liquid levels.

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