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PROPORTIONING AND MIXING DEVICE

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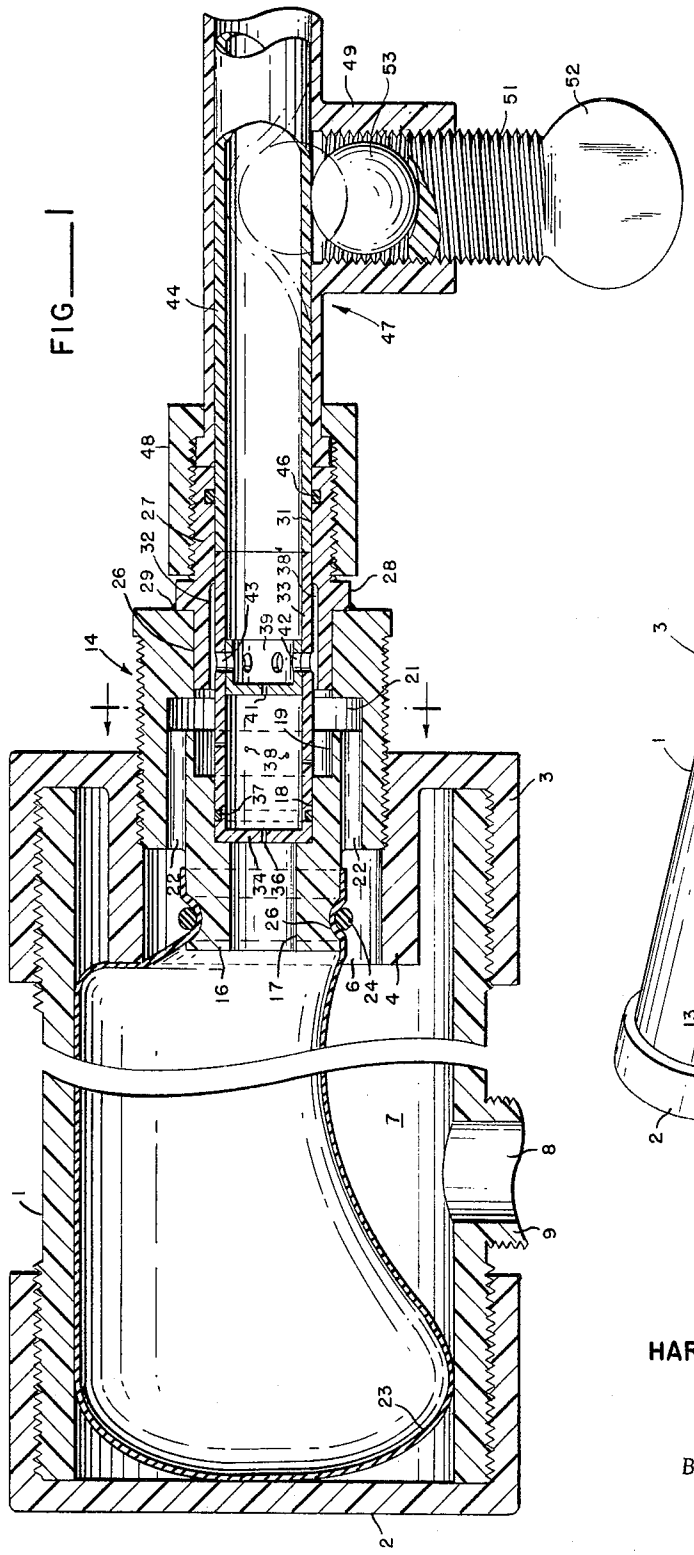

FIG. 1

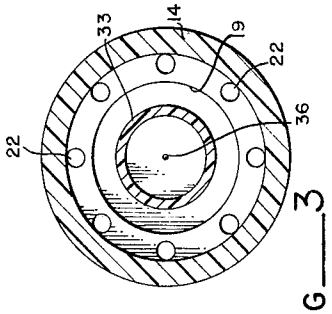

FIG. 3

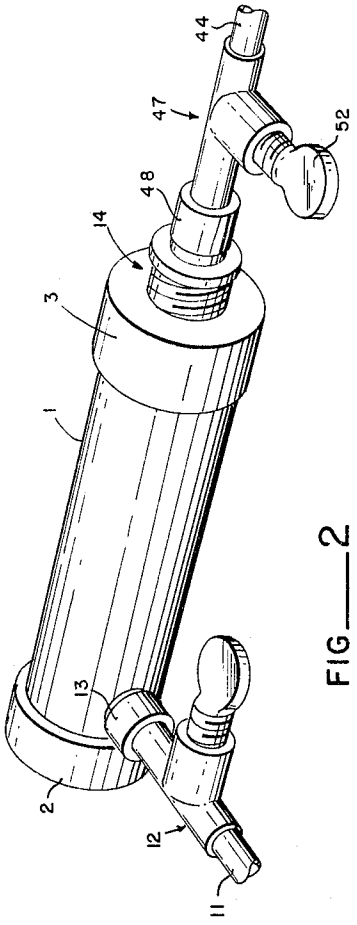

FIG. 2

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PROPORTIONING AND MIXING DEVICE

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The present invention relates in general to mixing devices or sprayers and in particular to the type of device wherein a supply of water soluble liquid chemical and a supply of water under pressure are delivered in metered quantities and mixed and wherein the water pressure source is utilized for delivering both the water and the water soluble liquid chemical and for expelling the mixture.

Accordingly, the prime object of the present invention is to provide a sprayer or mixer of the character described which operates with increased efficiency and economy by the use of a simplified structure such that the operation of the device is not dependent upon mechanical moving parts such as pumps, motors, or the like and wherein the only moving part is a flexible bag containing the water soluble chemical desired to be mixed.

Another object of the present invention is to provide a mixer of the character described wherein the danger of bursting the flexible bag during filling is eliminated by supporting the bag within a tank structure.

Another object of the present invention is to provide a mixing device of the character described wherein increased efficiency and accuracy in proportioning the liquids to be mixed is obtained by an improved structure for proportioning under positive control and wherein the liquids to be mixed meet in a confined chamber under pressure.

Another object of the present invention is to provide an improved mixing device of the character described wherein two or more liquids may be proportionately mixed by a single water pressure source and wherein multiple stage mixing is possible to make available an infinite choice of mixing ratios.

Still another object of the present invention is to provide a mixing or spraying device of the character described having an improved restrictor valve device.

Other more particular objects and advantages of the invention will, with the foregoing, appear and be understood from the following description and claims, the invention consisting of the novel construction and adaptation and combination of parts hereinafter described and claimed.

Reference is made now to the accompanying drawings in which:

FIG. 1 is a cross sectional view of the mixing device of the present invention;

FIG. 2 is a perspective view of the device; and

FIG. 3 is a cross sectional view taken along lines 3—3 of FIG. 1.

Referring now to the drawings wherein like reference numerals are used to indicate identical parts in the various views, a generally cylindrical tank is provided and includes the hollow cylindrical portion **1**, an end cap **2** and a closure member **3** which includes an inwardly directed central cylindrical portion **4** providing a passage or bore **6**. The cylindrical portion **1** and the end members **2** and **3** thus form a chamber **7** of fixed volume for the reception of water under pressure as will presently be described. The cylindrical portion **1** is also provided with an inlet passage **8** defined by the screw threaded nipple **9** in the side of the cylinder. As shown in FIG. 2, water under pressure may be supplied from a conduit **11** through a restrictor valve device **12**, which will later be described in detail, with the valve **12** being connected to the nipple **9** by means such as the gland nut **13**. The entire structure thus far described may

be made from steel, plastic or fiber glass as desired and the particular material used will depend upon the use for which the device is intended and the desire to achieve economy. As will later be explained, the conduit **11** will preferably be made from soft pliable material such as rubber, polyvinyl chloride or other deformable plastic materials for cooperation with the restrictor valve **12**.

A mixing head indicated generally at **14** which is generally cylindrical in overall form is threadably received in the outer end of the bore or passage **6** of the closure member **3**. The mixing head **14** may be constructed from a moldable hard plastic such as polyvinyl chloride or the like and includes an extended cylindrical portion **16** of reduced diameter located within the bore **6** when the head **14** is in place as shown in FIG. 1. As shown in FIG. 1, the spacing between the extended portion **16** and the wall of the bore **6** form a first annular chamber in direct communication with the chamber **7** of the tank for the passage of water under pressure as will presently be explained. The member **16** is provided with a central passage **17**, a first counter bore **18** and a second counter bore **19** of enlarged diameter. An internal annular chamber **21** is formed in the body of the mixing head **14** and communicates with the annular chamber formed by the bore **6** via a plurality of circumferentially spaceed passages **22** equally spaced about the cylindrical member **16** as shown most clearly in FIG. 3. The chamber **21** and the bore **19** are thus connected to the source of water under pressure through the passages **22** and the bore **6**.

A collapsible bag **23** is located in the chamber **7** of the tank and has its opening sealed about the inner end of the cylindrical member **16** by means of an elastic O-ring **24** which presses the bag opening into an annular groove **26** about the outer periphery of the cylindrical member **16**. The bag **23** may be formed from any light weight flexible plastic and provides the collapsible chamber for containing a supply of the liquid chemical which is desired to be mixed with water.

Mounted within a bore **26** in the outer end of the mixer head **14** is a cylindrical bushing **27** having a shoulder **28** which engages the outer face of the mixer head. The bushing **27** may be fixed to the mixer head by means of a permanent seal **29** about the shoulder . The bushing **27** will also be molded from a hard plastic with the sealing **29** being applied after the bushing is in place according to any well known method in the art. The bushing **27** has a central bore **31** with a counter bore **32** of an enlarged diameter for a purpose to be described. The bushing **27** is designed to receive a tubular mixing chamber **33** the outer end of which is open and the inner end of which includes a wall **34** having an orifice **36**. The mixing chamber is assembled by merely inserting it within the bore **31** until the inner end thereof is completely within the counter bore **18** of the member **16** as illustrated in FIG. 1. An O-ring seal **37** is provided between the inner end of the chamber **33** and the bore **18**. Thus it will be seen that the mixing chamber **33** communicates with the interior of the collapsible bag **23** by means of the passage **17** and the orifice **36**. The mixing chamber **33** also includes a plurality of orifices **38** about its periphery which communicate with the chamber provided by the bore **19** and hence the internal chamber **21** of the mixing head.

As aforementioned, the bushing **27** includes a counterbore **32** of increased diameter resulting in the formation of an elongated annular chamber **38'** about the outside surface of the mixing chamber **33**. For the purpose of dividing the chamber into compartments, a cup shaped insert **39** may be fixed inside the tubular member **33** and

provided with an end orifice 41 and a plurality of peripherally spaced larger orifices 42 which register with similar orifices 43 in the body of the member 33. The orifices 42 and 43 provide for the passage of water under pressure beyond the restricted orifice 41 which allows the mixture under pressure from the first stage or compartment of the mixing chamber to be further diluted by the water for a purpose to be described in detail as the specification progresses.

After the water and chemical have been mixed in the proper proportion in the two compartments of the mixing chamber 22, it may pass to a discharge conduit 44 fitted in the outer end of the bushing 27 and sealed by an O-ring seal 46. The conduit 44, according to the present invention, will be constructed of a flexible plastic material for a purpose to be described. On the outer end of the bushing 27, a T-fitting 47 surrounds the conduit 44 and may be held in place against the bushing 27 by a suitable gland nut 48. The T-fitting 47 includes the internally screw threaded nipple 49 which receives a screw threaded stem having a flattened end 52 to enable the stem to be advanced within the nipple 49 by turning with the thumbs. A ball member 53 is located within the nipple 49 and positioned to be forced against the flexible tubing 44 by advancing the stem 51 as illustrated in FIG. 1. The T-fitting 47 thus comprises a restrictor valve which acts to either restrict the flow by compressing the material of the conduit 44 or may act as a positive shut off valve when the stem 51 is advanced sufficiently to completely bring the walls of the conduit together. The ball member 53 may be made either from a hard plastic material or may be made of metal as desired. It will be understood that the restrictor valve 12 at the inlet fitting of the tank 1 is identical in structure with the valve of the T-fitting 47. In this manner, the internal portion of the mixer device may be completely blocked off at the inlet and outlet to avoid any back pressure or static pressure when the mixer is not in use. It will be observed that, since there is no contact between the material of the restrictor valves and the liquid being handled, there is no chance of leakage or any chance of corrosion or rust in case metallic parts are used.

The operation of the mixing device will now be described in detail. The device is initially charged with a quantity of the liquid chemical to be mixed with water by removing the gland nut 48 and the mixing chamber 33. The liquid is introduced into the collapsible bag 23 through the bore 17 until the bag is completely or partially filled as desired. It will be noted that there is no danger of rupturing the bag 23 since the bag is supported by the walls of the cylindrical tank 1. The restrictor valve 12 will, of course, be closed during filling of the bag in order to block the water pressure conduit 11 and, if desirable, the entire tank 1 may be removed by disconnecting the gland nut 13.

Once the bag 23 is filled, the mixing chamber 33 is again inserted into the mixing head 14 and the gland nut 48 is used to connect the T-fitting 47 and the conduit 44. When the parts are assembled as illustrated in FIGS. 1 and 2, water under pressure may be admitted to the passage 8 with the water pressure acting to pressurize the liquid within the bag 23 which starts to collapse under the pressure. The liquid within the bag 23 will thus be under the same pressure as the water entering the chamber 7. The water flows from the chamber 7 to the bore 6 and passages 22 to the inner annular chamber 21 and thence to the bore 19 and through the orifices 38 into the mixing chamber. Simultaneously, the liquid chemical is forced through the orifice 36 and is mixed and thoroughly blended with the water while under pressure in the mixing chamber between the cup shape member 39 and the end wall 34 of the chamber. Since the liquids meet in a confined chamber under pressure, a thorough blending is accomplished which is not possible with mechanical mixers. Since the liquid and the water are both under the same pressure, positive proportioning is accomplished by controlling the proportionate areas of the orifices 38 and that of the orifice 36. Thus, if the port area of the orifice 36 is one hundredth of that of the orifices 38, the mixture obtained is precisely one hundred parts of water to one part of chemical. By the use of the cup shape member 39, a second mixing stage may be obtained by the action of the orifices 41 and 42. Again, positive proportioning is obtained in the second stage by controlling the ratio between the total port area of the orifices 42 and the area of the orifice 41. The previously mixed water and chemical will be forced through the orifice 41 and the water will enter through the orifices 42 from the chamber 21. In the present example, with the mixing proportion being one hundred to one in the first mixing chamber or compartment and one hundred to one in the second mixing chamber or compartment, a ten thousand to one mixture may be achieved. It will be understood that additional members such as the cup shaped member 39 may be added to the device to add additional mixing stages to thus obtain an almost infinite choice of mixing proportions. After the mixture leaves the mixing chamber or chambers, it may, of course, be delivered to the point of use through the conduit 44 and a nozzle as desired.

If, during use, it in desirable to halt the mixing temporarily, the restrictor valves at the inlet and outlet of the device may be used to completely block off the inlet and outlet conduits to thus hold the liquids within the device in a static state. When the device is ready for reuse, the restrictor valve 12 will be first opened and then the restrictor valve of the T-fitting 47 opened and the mixing operation will continue.

It will be understood by those skilled in the art that the present invention provides new and useful improvements in mixing devices of the character described. The arrangement and types of structural components utilized in the present invention may be subjected to numerous modifications well within the purview of this invention and applicant intends only to be limited to a liberal interpretation of the specification and appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a device for mixing liquid chemicals having a water pressure tank and a collapsible receptacle for liquid chemical subject to the pressure within said tank, a mixing device comprising in combination; means defining a confined mixing chamber and a separate chamber communicating with an outlet, means for admitting liquid from said receptacle and water from said tank under pressure in predetermined proportions to said confined chamber to form a mixture, and means for admitting said mixture and water from said tank to said separate chamber in predetermined proportions to further dilute said mixture.

2. The combination according to claim 1 including; a flexible outlet conduit in communication with said separate chamber, a rigid conduit closely surrounding said flexible conduit, a valve member mounted for contact with the outside surface of said flexible conduit, and operator means for moving said valve member against said flexible conduit to pressure the same against the walls of said rigid conduit to restrict the flow of liquid therethrough.

3. The combination according to claim 1 including; a flexible outlet conduit in communication with said separate chamber and a flexible water pressure inlet conduit in communication with said tank, rigid conduits closely surrounding each flexible conduit, and valve means for each of said flexible conduits, each of said valve means comprising a valve member mounted for contact with the outside surface of the flexible conduit, and operator means for moving the valve member against the flexible conduit to pressure the same against the walls of the rigid conduit to restrict the flow of liquid therethrough.

4. A device for diluting liquid chemicals comprising in combination; a pressure tank, a collapsible receptacle in

said tank for storing a liquid chemical, means for admitting water from a pressure source to the interior of said tank but exteriorly of said receptacle for pressurizing the liquid therein, a mixing head in the wall of said tank, means in said mixing head defining a confined mixing chamber and a separate outlet chamber, means for admitting liquid chemical from said receptacle and water from said tank under the pressure of said water pressure source in predetermined proportionate volumes to said mixing chamber to form a proportionate mixture under pressure, and means for admitting said mixture and water from said tank to said outlet chamber in predetermined proportions to further dilute said mixture.

5. A device for diluting liquid chemicals comprising in combination; a pressure tank, a collapsible receptacle in said tank for storing a liquid chemical, the walls of said tank providing support for said receptacle in the filled condition, means for admitting water from a pressure source to the interior of said tank but exteriorly of said receptacle for pressurizing the liquid therein, a mixing head in the wall of said tank, an elongated mixing chamber mounted in the mixing head, means to divide said chamber into a first confined mixing compartment and a second outlet compartment, means for admitting liquid chemical from said receptacle and water from said tank under the pressure of said water pressure source in predetermined proportionate volumes to said confined compartment to form a mixture under pressure, and means for admitting said mixture and water from said tank to said outlet compartment in predetermined proportions to further dilute said mixture.

6. The combination according to claim 5 wherein said elongated mixing chamber comprises a tubular member

having an open end and a closed end, said means to divide said chamber comprising a wall in said tubular member cooperating with the closed end to define said confined mixing compartment, means to mount said tubular member within said head with the closed end in sealed communication with said receptacle and the open end thereof defining the outlet compartment for said head.

7. The combination according to claim 6 wherein, said means for admitting the liquid and the water to the confined compartment comprises first orifice means in the closed end of said tubular member and a first plurality of orifices in the wall of said tubular member with passage means in said head connecting said first plurality of orifices with said tank, said means for admitting said mixture and water to said outlet compartment comprising a second orifice means in said wall and a second plurality of orifices in the wall of said tubular member with passage means in said head for connecting said second plurality of orifices to said tank.

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