

[54] MIXING AND DISPENSING DEVICE

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[56] **References Cited**
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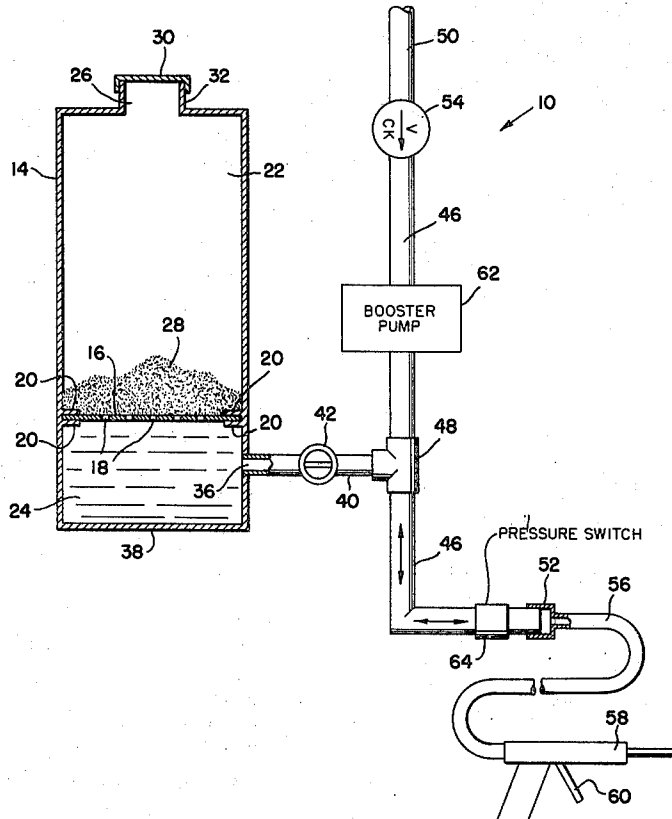
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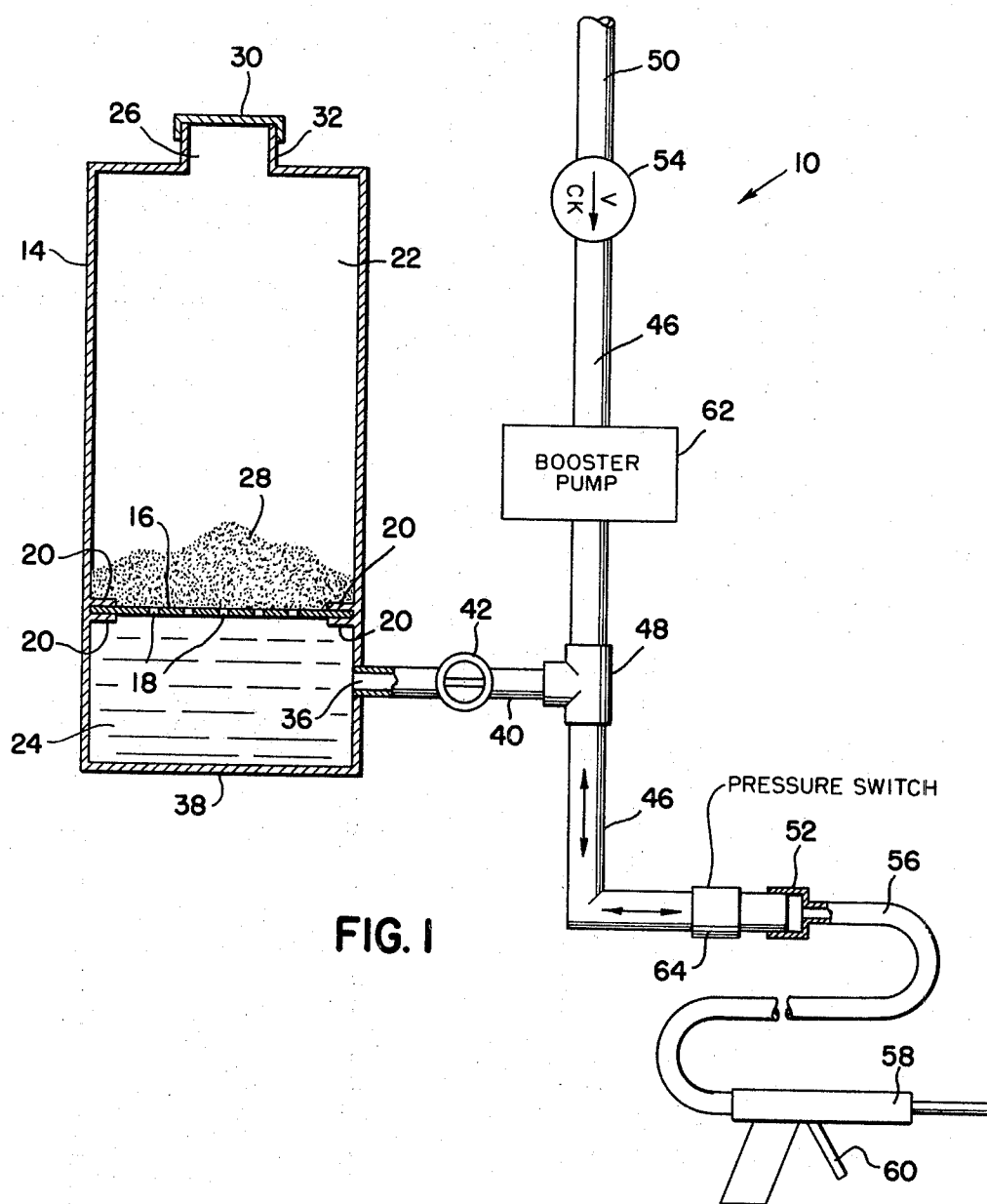
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[57] **ABSTRACT**

A mixing and dispensing device comprising a chamber in which material to be mixed with liquid is supported on a diaphragm having a plurality of apertures. A conduit is connected to an inlet opening in the hollow member below the diaphragm. A second conduit is connected to the first conduit. One end of the second conduit may be connected to a supply of liquid having a pressure which fluctuates rapidly over relatively short intervals. The other end of the second conduit serves as a discharge opening through which pure liquid or liquid mixed with the material is discharged.

8 Claims, 1 Drawing Figure





MIXING AND DISPENSING DEVICE

This invention relates to a mixing and dispensing device and more particularly to a mixing and dispensing device of simple inexpensive construction.

It is often desirable to be able to mix solid particulate material with a liquid so that the combination of the two materials can be dispensed. Such arrangements are particularly useful in fire extinguishers and in cleaning devices.

In particular, when dealing with cleaning devices, it is useful to have the soap in particulate form. It may then be mixed with water as desired and dispensed onto a surface to be cleaned.

Many devices have been proposed for accomplishing these ends. However, for the most part they have been relatively inefficient and expensive because they comprised many valves and conduits in order to enable the operator of the device to arrange for the dispensing of clear liquid for rinsing and for dispensing of a mixture of the particulate material and liquid.

The device disclosed herein avoids these disadvantages by providing a relatively simple device which takes advantage of the fact that in a typical fresh water distribution system the water pressure at any point is subject to many fluctuations in pressure over a relatively short period of time. Such fluctuations in pressure are employed in the device disclosed herein in order to mix particulate material with the water as desired so that it can be discharged through a nozzle for cleaning or other purposes.

Generally, the invention relates to a mixing and dispensing device comprising a hollow member. A diaphragm is supported in the interior of the hollow member for dividing it into upper and lower chambers. The diaphragm has a plurality of apertures therein. The upper chamber has an inlet for receiving material to be mixed with a liquid while the lower chamber has an opening which is connected to a first conduit. A second conduit is connected to the first conduit at a juncture. One end of the second conduit is connectable to a supply of liquid while the other end of the conduit defines a discharge opening.

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentality shown and wherein:

FIG. 1 is a schematic drawing of one presently preferred form of the invention.

Referring to FIG. 1, one presently preferred form of the invention is illustrated. The invention comprises a hollow elongated member 14 which has diaphragm 16 in its interior. Preferably member 14 is cylindrical in cross section. The diaphragm may be supported by spaced peripheral flanges 20 which are directed inwardly toward the center of the hollow member 14 or it may be welded or otherwise bonded in place. The diaphragm should preferably be made from a non-rusting metal, inert plastic or the like. It is provided with a plurality of apertures 18 to permit liquid and material mixed therewith to flow across the diaphragm.

The diaphragm 16 divides the interior of hollow member 14 into an upper chamber 22 and a lower chamber 24.

The upper chamber 22 has an opening 26 through which material to be mixed and dispensed can be inserted. The opening 26 is closed by a cap 30 which may

be threadedly connected to an upstanding flange 32 surrounding the opening. Preferably, the cap can be brought into air-tight sealing contact with the flange 32.

An opening 36 is provided in the lower chamber 24 slightly above bottom wall 38. A first conduit 40 is connected to the opening 36 to permit liquid to flow in and out of the lower chamber in a manner which will be more completely described herein.

Means for halting the flow of liquid and material through conduit 40 is provided. Preferably, such a means takes the form of a manually or remotely operated valve 42 disposed within conduit 40.

Conduit 40 may be connected to a second conduit 46 at a suitable juncture 48 which may be defined by a "T" section or it may be formed integrally therewith.

One end 50 of conduit 46 may be connected to a supply of liquid while the other end of the conduit may be provided with a suitable discharge opening 52. The juncture of the first and second conduits being disposed between ends 50 and 52.

Suitable means may be provided in conduit 46 upstream of juncture 48 for preventing the flow of liquid toward the supply. Preferably, such a means takes the form of check valve 54.

The discharge opening 52 in conduit 46 may be connected to elongated flexible hollow member 56 such as a hose or the like. The hose in turn may be connected to a nozzle 58 which has a lever operated valve 60 for controlling the flow of liquid therethrough.

If desired, the device may be constructed with pressure boosting means so that the pressure in the water supply need not be relied upon.

In this regard, a suitable electrically operated pump 62 may be connected to conduit 46 upstream of juncture 48 and a pressure switch 64 be installed in conduit 46 downstream of the juncture 48. Suitable means may be provided for coupling the pressure switch to the pump so that when a predetermined maximum pressure is reached in conduit 46 the pump is de-energized.

In order to operate the device conduit 50 is connected to a supply of liquid such as a water tap and the particulate material which is to be mixed with the water is placed in the upper chamber 22 by way of opening 26. As illustrated in FIG. 1 the particulate material 28 will rest on diaphragm 16.

Liquid flowing through conduit 50 from the supply will enter the lower chamber 24 at juncture 48 by way of conduit 40 valve 42 and opening 36. Some of the liquid will continue to flow through conduit 46 and be discharged through nozzle 58 if the valve in the nozzle is opened.

If conduit 50 is connected to a water tap the pressure therein will fluctuate rapidly over short intervals. This is an inherent characteristic of treated water systems which is used advantageously in the disclosed device. This fluctuation in pressure results in flow of water back and forth through conduit 40 between the conduit 46 and the lower chamber 24. During an increase in pressure in conduit 50 the liquid flows into the lower chamber 24 and rises in the hollow member to compress the air trapped in the upper portion of chamber 22 until the air pressure equals the water pressure. When the pressure in conduit 46 is reduced, the flow of liquid in conduit 40 is from the lower chamber 24 to conduit 46. This results in an expansion of the air trapped in the upper portion of upper chamber 22. The

resultant expansion forces the particulate material through the apertures 18 in the diaphragm 16 whereby it is mixed with the liquid in lower chamber 24 and is dispensed through conduit 40 into the conduit 46. Since opening 36 is spaced above the bottom wall 38, particulate material which falls to the bottom wall cannot clog the opening and interfere with the operation of the device.

As is apparent rapid fluctuations in liquid pressure over a relatively short period of time will result in a constant stream of liquid having particulate material mixed therewith flowing through conduit 46 below check valve 54 and out nozzle 58.

It should be understood that conduit 40 is relatively short and narrow while the cross sectional area of hollow member 14 is relatively large.

In particular, in order to understand the relative size of the components which comprise the device it should be appreciated that 0.035 pounds per square inch of pressure is the equivalent of the height of one inch of water. Thus, if there should be a pressure variation in conduits 46 and 40 of only 0.035 pounds per square inch, the air-water interface in hollow member 14 will be displaced by about 1 inch.

If it is assumed that the hollow member 14 is cylindrical and has a diameter of 12 inches, a 1 inch displacement of the air-water interface results in a movement through conduit 40 of 112.5 cubic inches of water. If hollow member 14 has a diameter larger than 12 inches, even larger amounts of water are moved through conduit 40.

Thus, if conduit 40 is only about 2 inches in diameter it is apparent that the water therein would change completely each time the pressure in conduit 50 changed slightly.

If it is desired to dispense plain liquid without any material concentrate therein, valve 42 is merely turned to block the flow of liquid through conduit 40 whereby hollow member 14 is isolated from the rest of the system. In like manner, the concentration of particulate material in the water can be varied by only partially opening valve 42.

Additionally, it should be appreciated that momentarily closing the nozzle 58 as by releasing trigger 60 causes the pressure in hollow member 14 to build up so that when the trigger is released an increased concentration of material is dispensed into conduit 46. This follows from the fact that pressure will rise in the chamber when the discharge of water through conduit 46 is stopped. Thus, if the operator continuously opens and closed the nozzle 58, the concentration of material being dispensed can be increased.

Check valve 54 serves to assure that the supply of liquid upstream therefrom does not get contaminated by liquid which has the particulate material therein. Thus, due to the fluctuating pressure of the water it is conceivable that from check valve 54 through nozzle 58 each component of the system has liquid with particulate material therein.

Under certain circumstances, the normal pressure supplied in a water system (which is normally between about 30 and 60 pounds per square inch) is not satisfactory and additional pressure boosting means may be required. In such a circumstance, a booster pump such as pump 62 may be connected into conduit 46 intermediate check valve 54 and juncture 48. The booster

pump may be any convenient small hydraulic pump which is electrically operated.

A pressure switch 64 may be connected to conduit 46 downstream from juncture 48. The pressure switch may be anyone of a number of well known switches which are operative to open a circuit when a predetermined maximum pressure has been reached. The pressure switch 64 is electrically connected to booster pump 62. Energization of the pump causes the liquid to flow through the system at a much more rapid rate. However, when the nozzle is closed as by releasing lever 60 pressure builds rapidly in conduit 46 under the influence of pump 62. Upon sensing a predetermined maximum pressure, switch 64 deenergizes pump 62 so that the system comes to rest with only the water supply pressure therein.

While the invention has been described with reference to one form thereof, it is apparent that many other forms and embodiments will be obvious to those skilled in the art in view of the foregoing description. Thus, the scope of the invention should not be limited by this description, but rather, only by the scope of the claims appended hereto.

I claim:

1. A mixing and dispensing device comprising a hollow member, a diaphragm, means supporting said diaphragm in the interior of said hollow member, said diaphragm dividing said member into upper and lower chambers, said diaphragm having a plurality of apertures, said upper chamber having an inlet for receiving material to be mixed with a liquid, said lower chamber having an opening therein, a first conduit connected to said chamber at said first opening for communicating with the interior of said chamber, a second conduit, one end of said second conduit being connectable to a supply of liquid of which is subject to rapid fluctuations of pressure over very short intervals, the other end of said conduit defining a discharge opening, means for coupling said first conduit to said second conduit intermediate said first and second ends of said second conduit so that water with material is discharged from said discharge opening, and means for halting the flow of liquid through said first conduit, said halting means being disposed in said first conduit so that water without material is discharged from said discharge opening.

2. A device as defined in claim 1 wherein said hollow member has a bottom wall, and said inlet is spaced therefrom.

3. A device as defined in claim 1 including a means in said second conduit for preventing the flow of liquid toward said supply, said means being disposed between said supply and the juncture of said first and second conduits.

4. A device as defined in claim 3 comprising a pump, said pump being disposed in said second conduit intermediate said means for preventing the flow of liquid and said juncture, and a pressure switch disposed in said second conduit intermediate said juncture and said discharge opening, and means for coupling said pressure switch to said pump so that a predetermined pressure said pump is de-energized by said pressure switch.

5. A device as defined in claim 1 including a nozzle, said nozzle being coupled to said discharge opening on said second conduit, and means for regulating the flow of liquid through said nozzle.

6. A device as defined in claim 5 wherein said second conduit comprises an elongated flexible member, and said nozzle is coupled to said elongated flexible member.

7. A device as defined in claim 6 wherein said diaphragm is comprised of non-rusting material.

8. A device as defined in claim 1 including means for making said inlet in said upper chamber air tight.

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