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DETERGENT FEED SYSTEMS

Filed Feb. 24, 1964

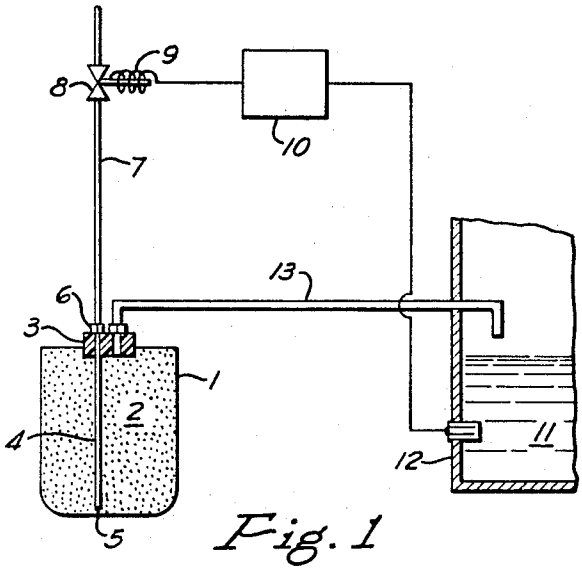


Fig. 1

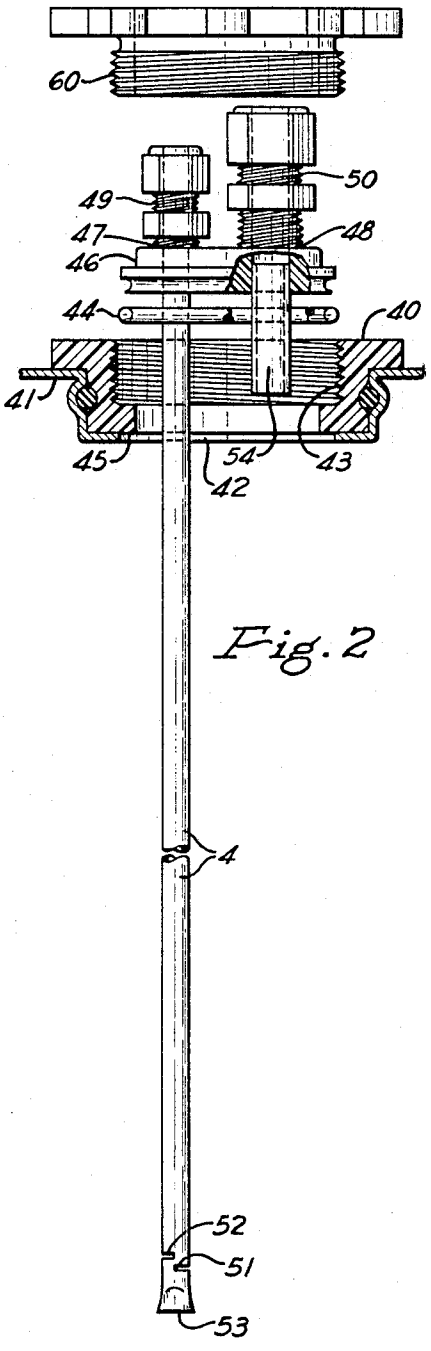


Fig. 2

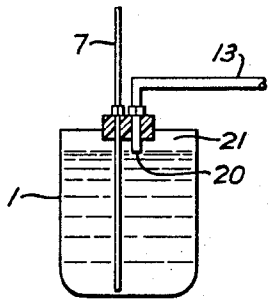


Fig. 3

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DETERGENT FEED SYSTEMS

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This invention relates to fixtures for detergent feed systems of the type used to dispense detergent into commercial automatic dishwashing machines. In particular it is an improvement in detergent dispensers of the type in which a container of dry detergent is connected in a water line and fed therefrom under control of a conductivity regulator.

Reference may be made to U.S. Patent 3,187,767 entitled "Method of Dispensing Dry Detergent Into Dishwashing Machines" issued June 8, 1965 to George E. Sherrard, assignor to the assignee herein. It was known generally prior to the aforesaid disclosure to control the concentration of dishwashing detergent by the conductivity of the dishwater. See, for example, U.S. Patents 2,593,825 and 2,687,139. Patent 3,187,767 discloses an advance in the art which may utilize the original container of detergent by fitting it with inlet and outlet units and a downwardly extending distributor tube for the incoming water. An embodiment of this known apparatus is shown in FIGURE 1 hereof, and a brief description of its operation follows.

Container **1** of dry powdered detergent **2** includes a fixture **3** with provision for distributor tube **4** terminating in at least one orifice **5** near the bottom of the container. Fixture **3** has a lock nut **6** for attaching the inlet to an inlet pipe **7**, which may be turned on and off by valve **8** which is operated by solenoid **9**. Solenoid **9** is operated by conductivity control device **10** of a type known in the art which senses the concentration of detergent in dishwater **11** by means of conductivity cell **12**. When the conductivity falls below the value set in the conductivity control device, valve **8** is opened and water flows into container **1**, dissolving at least some of the detergent and carrying it out through pipe **13** to empty into the dishwater. When the conductivity is elevated by the detergent to the desired point, the valve is closed by the control device.

All of the above is known in the art. Difficulties have developed with such systems, although they are otherwise quite convenient and advantageous. The difficulties stem from two separate factors. First, the hot water and strongly alkaline detergent react adversely on fixture **3** and the inlet and outlet therein, sometimes being made of plastic and perhaps imperfectly sealed to the lid of container **1**. Second, gradual and sudden changes in pressure in the incoming lines can cause great stress on the fixtures and container lid which can be damaging in themselves and which, when combined with the extreme water temperatures sometimes used in commercial establishments, can be quite dangerous as well as damaging to the detergent system. The changes in pressure may occur from operation of the rinse cycle of the machine as well as from other machines, sinks, or the like.

I have invented an improvement in the container fixture and the outlet line which virtually eliminates all serious consequences of temperature and pressure extremes in the inlet line. My invention contemplates the protrusion of outlet line **13** or an extension thereof into container **1** for at least a short distance, and will be discussed further with reference to FIGURES 2 and 3.

FIG. 2 is an example of a detergent container fixture exhibiting my invention of a short tube added to protrude below the lower surface of the fixture. In FIG. 2, an exploded view shows the top **41** of the container or drum of

detergent is fitted with a plastic cup **40** including an orifice **42** having threads **43**. Washer or gasket **44** seats on a horizontal circumferential rim **45**. Plastic fitting insert **46** is placed directly on washer **44**. It is a solid disc of plastic having two threaded holes **47** and **48** into which fittings **49** and **50** are inserted. Fittings **49** and **50** are adjusted to receive water pipes or tubing in water-tight relation. Fitting **50** is adapted to extend about one-half inch below the lower surface of drum **41** by means of an extension tube **51**.

FIG. 3 shows the assembled fixture and the top portion of the drum during operation of the device. Extension **20** of the outlet is illustrated as terminating exactly at the solution level in the drum. However, it is possible, by extending device **20** even further downward to have a solution level higher than the terminus of device **20**. The initial depth of air pocket **21** is determined primarily by the amount of air in the drum or container originally, both above the top level of the dry detergent and between the granules. In a fully packed drum of one gallon volume of detergent, there is generally about 80 to 100 cubic inches of air between the granules, where the detergent has the common mesh size of about **20**. Of course, larger mesh sizes result in larger quantities of air and the smaller mesh size of detergent will be more closely packed. In a typical 8½ gallon container of detergent, there may normally be about 500 cubic inches of free space above the detergent after it has settled. The usual cushion of air, however, is not quite so large, most of it being carried out the outlet. The remaining cushion of air created in the free space is, where extension **20** is no greater than two inches, determined by the length thereof, but rarely will exceed 80–200 cubic inches because the air tends to dissolve in the detergent solution and some is carried out because of turbulence.

The air pocket **21** completely insulates the fixture and all sealing surfaces around it not only from the hot detergent solution but it also provides a compressible cushion or absorber for shocks and pressure changes in the line.

In a typical 8½ gallon detergent container about 14–15 inches in height, I prefer to use a tube **20** of about ¼″ to about 2″. Although a longer tube is operable, it is not desirable to use a tube which terminates at a point which would create and maintain an air pocket **21** of greater than one-sixth of the volume of the container. An air pocket greater in volume than one-sixth of the container will tend to cause undesirable surging, e.g. the alternate compression and expansion of the air caused by the initial shock of water pressure will in turn cause rapid changes in velocity and volume of detergent solution passed through the outlet. When the inlet valve is suddenly closed, the remaining compression of the air will cause a momentary continuation of feeding of solution which is unnecessary and uneconomical.

Where plumbing codes require a vacuum or siphon breaker, air will be introduced into pipe **7** each time the inlet valve is turned on and off, thus tending to maintain the air pocket at the maximum volume permitted by the terminus of tube **20**, even though some air will become dissolved in the solution or otherwise dissipated. Thus, the length of tube **20** effectively controls the volume of air pocket **21**. Whether or not a siphon breaker is used, the terminus of tube **20** should be placed such that the air pocket formed above it is sufficiently large in volume to insulate the fixtures from hot detergent solution and to provide sufficient air to form a cushion effective to protect the container seal from the shock of a change of pressure when water is turned on and off. In particular, I prefer to maintain the terminus of tube **20** at a point such as to form, when the container is upright, an air pocket extending down to said terminus and occupying

about one-sixth to about one-twentieth of the volume of the container.

The above illustrations and discussion are mentioned for explanatory purposes only and are not to be construed as limiting my invention. It may be otherwise variously embodied within the scope of the following claims.

I claim:

1. A granulated detergent package for automatic dispensing of detergent in solution comprising a rigid sealed container substantially filled with dry granulated detergent, a water inlet fixture on said container, an outlet fixture on the top of said container including a terminus in the interior of said container at a point on a horizontal plane such that when the container is upright, the volume above which plane is no greater than about one-sixth of the total volume of the container but which is sufficiently great when occupied by air to provide insulation for said fixtures from hot detergent solution and effective protection for the container seal from pressure shocks.

2. In a detergent dispensing system wherein flow of water through a sealed container filled with originally dry granulated detergent is controlled by conductivity of a washing solution, including a rigid sealed container for automatic dispensing of detergent therefrom in the dissolved state, said container having an inlet fixture and an outlet fixture, the improvement comprising an outlet tube extending a sufficient distance downward from said outlet fixture into the interior of said container whereby

when the detergent is dissolved by water entering the inlet fixture, air present in the detergent mixture and elsewhere in the container will form an air pocket at the top of said container no greater in depth than the point of termination of said outlet tube and having a volume of about one-twentieth to about one-sixth of the total volume of the container, to insulate said fittings from hot detergent solution and shock from changes in pressure.

3. In a dry granulated dishwashing detergent package for automatic dispensing of said detergent in the dissolved state comprising a sealed rigid container filled with dry granulated dishwashing detergent and having an inlet fixture and an outlet fixture, the improvement comprising an outlet tube extending from said outlet fixture into the interior of said package a sufficient distance that, when the container is upright, an air pocket may be formed above the terminus of said tube, said air pocket being of a volume sufficient to insulate said fittings from hot detergent solution and to substantially absorb the shock of sudden pressure changes in said container.

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