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COAXIAL TUBE FLUID INJECTION SYSTEM

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Fig. 1

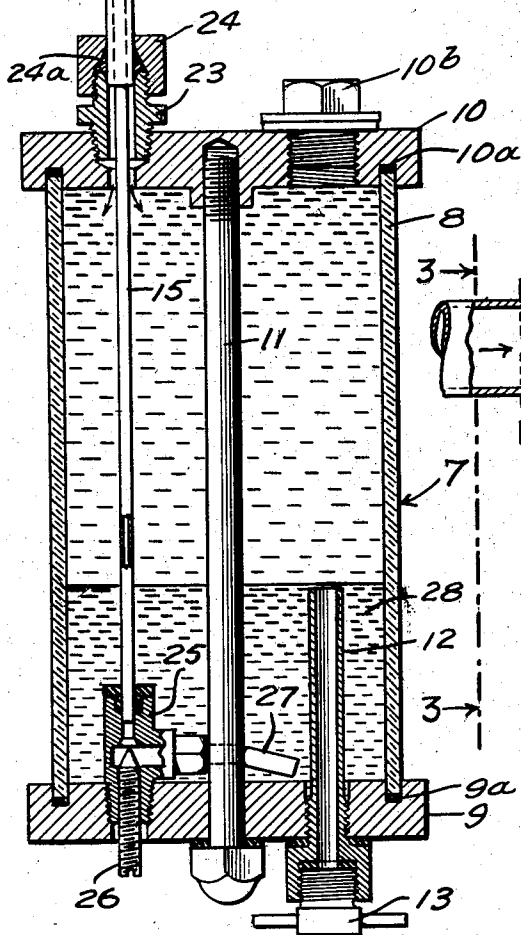
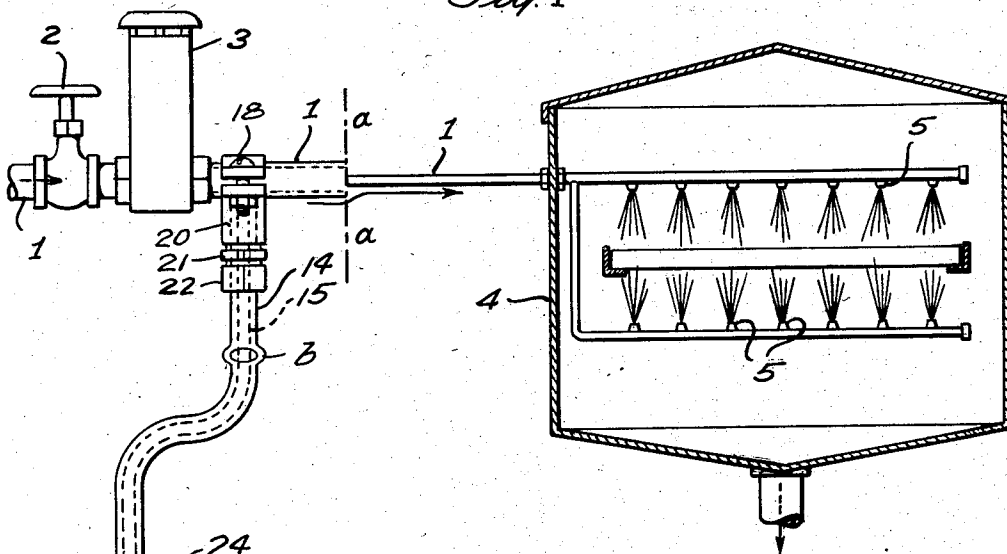
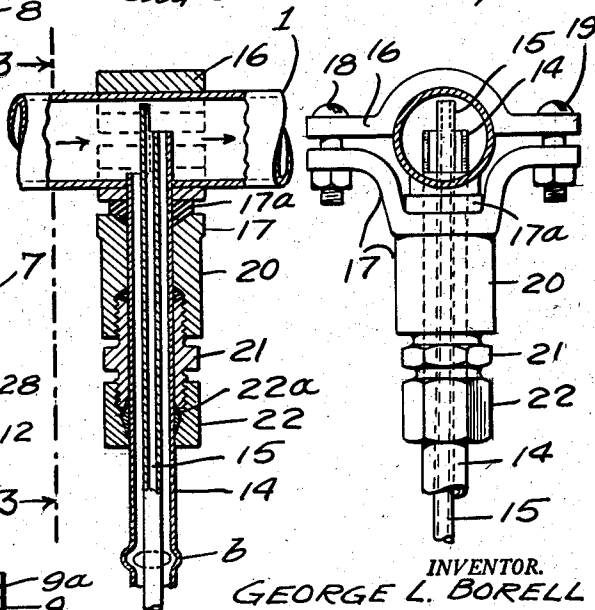


Fig. 2

Fig. 3



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COAXIAL TUBE FLUID INJECTION SYSTEM

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7 Claims. (Cl. 239—205.5)

This invention relates to a system for injecting a fluid into a liquid flow line in which a reduction in pressure at the point of injection is effected by virtue of the liquid flow. The system has special but by no means exclusive application to dish washing apparatus and will be described in that connection.

In the final rinsing section of conventional dish-washing machines, it has been found desirable to add special compounds in fluid form to the rinse water in order to increase the rate of evaporation of the water left on the washed utensils after the final rinse. Such compounds are known as wetting agents and it has been usual to inject the agents into the water line either by the direct action of a pump which is of course expensive to install or by a venturi or aspirator system. The latter method makes it difficult to control the percentage of wetting agent in the rinse water unless the active material is greatly diluted before introducing it into the system and a method is devised by which the supply can be observed and replenished when necessary. Also some method of controlling the admixture of water and wetting agent in the proper ratio in the supply tank is necessary in order to maintain the final dispersion rate needed to treat the volume of rinse water used in the machine.

In general this invention contemplates novel means for producing fluid injection from a fluid supply into a liquid flow pipe as a consequence of the liquid flow in the pipe. The injection is effected as an induced flow by virtue of a pressure differential established in the closed circuit which includes the supply tank for the fluid and a pair of conducting tubes connected to the tank and terminating in orifices which are oppositely disposed to each other along the axis of flow within the pipe. The induced flow through the circuit causes the liquid to replace the fluid in the tank which is injected into the pipe at a rate which is proportionate to the liquid flow. Preferably, the tubes are arranged coaxially over their entire length to permit heat exchange between them and to maintain hydrostatic balance in the system. The coaxial arrangement of the tubes and the disposition of their orifices within the pipe in opposite directions along the axis of liquid flow facilitates the assembly of the principal parts in the system and promotes the creation of the desired pressure differential in the closed circuit.

Because the fluid in the tank is constantly replaced by incoming liquid, the amount of fluid on hand may be readily observed during operation. Desirably, therefore, the walls of the tank are of transparent glass or plastic so that the fluid on hand may be readily observed during operation. The rate of fluid injection and the proportioning of active materials in the rinse may be controlled by a metering valve, the rate being set to secure the degree of wetting action desired in the final rinse.

The invention has other features and advantages which will appear from the following description of the em-

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bodiment of the invention shown in the accompanying drawings, in which

Fig. 1 is a composite sectional view of the mechanism comprising the injector system and of a rinse section to which the injector system is shown connected, the scale of the rinse section being reduced and the connecting pipe being shown as correspondingly reduced at *a*—*a*;

Fig. 2 is an enlarged, fragmentary section showing the connection of the pipe and tubes; and

Fig. 3 is an end section taken on line 3—3 of Fig. 2.

As shown in Fig. 1 the injector system is in communication with a water pipe 1 in which there is provided a control valve 2 and a vacuum breaker 3. The pipe 1 is connected on the right to the rinse section 4 of a dishwasher housing spray means 5 located above and below rails for supporting dish trays 6 which are caused to travel through the rinse section by means (not shown).

A wetting agent is injected into the pipe 1 between the vacuum breaker 3 and the rinse section 4, the source for the agent being a tank 7 which comprises a transparent wall section 8 supported in a base 9 and having a top 10. The base 9 and the top 10 are provided with rubber gaskets 9a and 10a, respectively, to seal the tank 7 where the top and bottom closures are joined to the wall section 8. A tie bolt 11 holds the three structural parts of the tank together and is gasketed to prevent leakage from the bottom of the tank. The base 9 has a threaded aperture in which there is disposed a drainage unit 12. The drainage unit 12 includes a drain plug 13 below the base to permit drainage from the tank of the displacement liquid above the opening in the tank of the drainage unit 12. After being drained to this level the tank may be replenished with wetting agent through an opening in the top 10 which is stopped with a conventional filler cap 10^b having a threaded extension which is screwed into opening of the top. The active fluid being heavier than water accumulates at the bottom of the tank.

The connection between the main pipe 1 and the tank 7 consists of an outer pressure tube 14 and an inner or fluid return tube 15 which is coaxially disposed within the outer tube. A pair of clamping brackets 16 and 17 are arranged over and under the pipe 1 having complementary screw holes on each side thereof which receive screws 18 and 19 so that the brackets may be clamped to the pipe as a fitting. The lower bracket 17 is centrally apertured and has a downwardly projecting hollow boss 20. A hollow tube clamping nipple 21 is exteriorly threaded at both ends and is threadably received within the lower end of the boss 20. The outer and inner tubes are received by the nipple 21, boss 20 and bracket 17 and communicate with the interior of the pipe 1 through a hole provided therein which is aligned with the hole in the member 21 on assembly. A gasket washer 17^a is interposed between the boss 20 of bracket 17 and a coating face on the pipe 1. A compression nut 22 on the lower end of the nipple 21 connects the pipe and tube assembly. A ferrule 22^a on the pipe 14 is disposed between the nipple 21 and the nut 22 to secure the fitting. The outer tube 14 is crimped as at point *b* against the inner tube 15 to prevent radial and axial relative movement of the tubes.

The open ends of the tubes within the pipe are oppositely stepped cut so that with water flowing in the pipe toward the rinse section 4 the open end of the outer tube 14 presents its lateral opening against the flow while the lateral opening in the end of the inner tube 15 faces in the direction of the flow. An increase in water pressure at the opening of the outer tube and a decrease in water pressure at the opening of the inner tube is thereby produced. The stepped cut openings in the tubes per-

mit continuously straight wall sections within the pipe thereby facilitating assembly without sacrificing the desired pressures at these points.

The other end of the outer tube 14 is secured in a second opening in the top of the tank by means of a nipple 23, which is screwed into the top 10 and a compressing nut 24 mounted on outer threaded end of the nipple 23 serves to clamp ferrule 24^a located between the nut 24 and the nipple 23 tightly about the tube 14.

The inner tube 15 extends through the top of the tank into the tank and is received by metering valve 25. A needle 26 is adapted to be seated in the chamber of the valve with which a pick-up tube 27 in the tank is in communication. The needle 26 extends through the base of the tank enabling the operator to control the rate of flow of wetting agent 28 from the tank into the inner tube 15 and therefore the injection of the agent into the pipe 1.

In operation when water is admitted to the system by the valve 2, hot water is caused to flow into the outer tube 14 and the tank 7. The water flow causes the pressure at the opening of the inner tube 15 to fall below the pressure at the opening of the outer tube creating a suction in the inner tube resulting in an upward flow of wetting agent in the inner tube 15 and its injection into the water stream in the pipe. Accordingly, a mixture of water treated with wetting agent is sprayed in the rinse section. Because the outer and inner tubes are coaxial, the water traveling down the outer tube transmits heat to the inner tube and is cooled. As shown in Fig. 1, the wetting agent 28 is dyed red so that the interface of the water and agent is readily observed through the plastic tank. With cold water to displace the agent the interface is more distinct than would be the case for hot water which has a greater tendency to cloud the fluid and the displacement liquid in the tank despite the disparity in their specific gravities. When the interface reaches a level below the opening in the tank of the drainage unit 12, the water flow in the pipe is turned off and the water in the tank is drained off so that the tank may be supplied with additional agent. Through proper adjustment of the needle valve 25 an experienced operator can readily determine the rate of injection of the agent into the water pipe by observing the degree of wetting action in the final rinse.

It should be understood that the operation of the described injector system may be reversed so that the inner tube 15 becomes in effect the liquid pick-up tube and the outer tube 14 the ejector tube. This mode of operation, for example, might be desired when the active agent is introduced to the tank 7 as a soluble powder. While the preferred embodiment of the invention is described with reference to dishwashing equipment its application is not necessarily restricted to that art, and the invention should therefore be construed solely in accordance with the following claims.

What is claimed is:

1. A device for injecting a fluid into a flow pipe adapted

to conduct a liquid in a given direction comprising a pipe, a tank for containing a fluid to be injected into said pipe, a pair of coaxial tubes connecting said tank to said pipe, said tubes having continuously straight wall sections within the pipe and presenting openings therein at one of their end portions, said openings being oppositely directed along the line of liquid flow in said pipe, one of said tubes terminating at its other end portion in an aperture in said tank, and the other of said tubes having its other end portion disposed within the tank substantially below the level of said aperture, said tank being provided with a drainage unit, said drainage unit having an outlet opening disposed above the bottom of the tank whereby the liquid may be drained from the tank before the fluid to be replenished is entirely exhausted.

2. An injection system as claimed in claim 1 wherein the said other tube of said coaxial tubes terminates in a meter valve in said tank, said valve being adjustable from without the tank whereby the rate of fluid injection may be controlled.

3. An injection system as claimed in claim 1 wherein said tank is fabricated of transparent material.

4. An injection system as claimed in claim 3 wherein the outer tube is crimped against the coaxial inner tube at a point intermediate the flow pipe and said tank whereby the tubes are secured against axial and radial relative displacement.

5. In a dish washing apparatus or the like, a fluid supply tank, a pipe adapted to supply a liquid to said dish washing apparatus, a pair of coaxial tubes extending into said pipe, the inner of said tubes extending within the pipe to a greater distance than the outer of said tubes, each of said tubes being provided within said pipe with a lateral opening directed axially with respect to said pipe, said lateral openings being oppositely directed, said tubes also extending into said supply tank, the inner of said tubes extending into said tank to a greater distance than said outer tube.

6. In a dish washing apparatus or the like as claimed in claim 5, a drainage unit, said drainage unit having an opening disposed in said tank and above the bottom thereof whereby the liquid may be drained from the tank before the fluid to be replenished is entirely exhausted.

7. In a dish washing apparatus or the like as claimed in claim 6, a meter valve in said tank, said inner tube terminating in said meter valve, said valve being adjustable from without the tank whereby the rate of fluid injection may be controlled.

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