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INJECTOR FOR INJECTING CAUSTIC OR ACID FLUIDS

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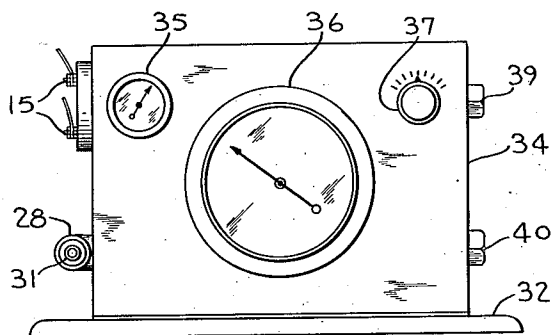


FIG. 1

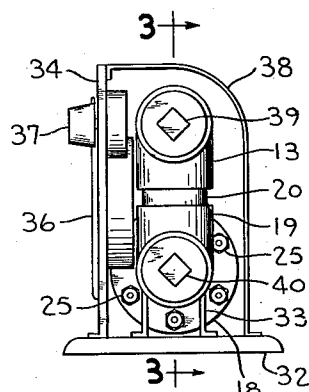


FIG. 2

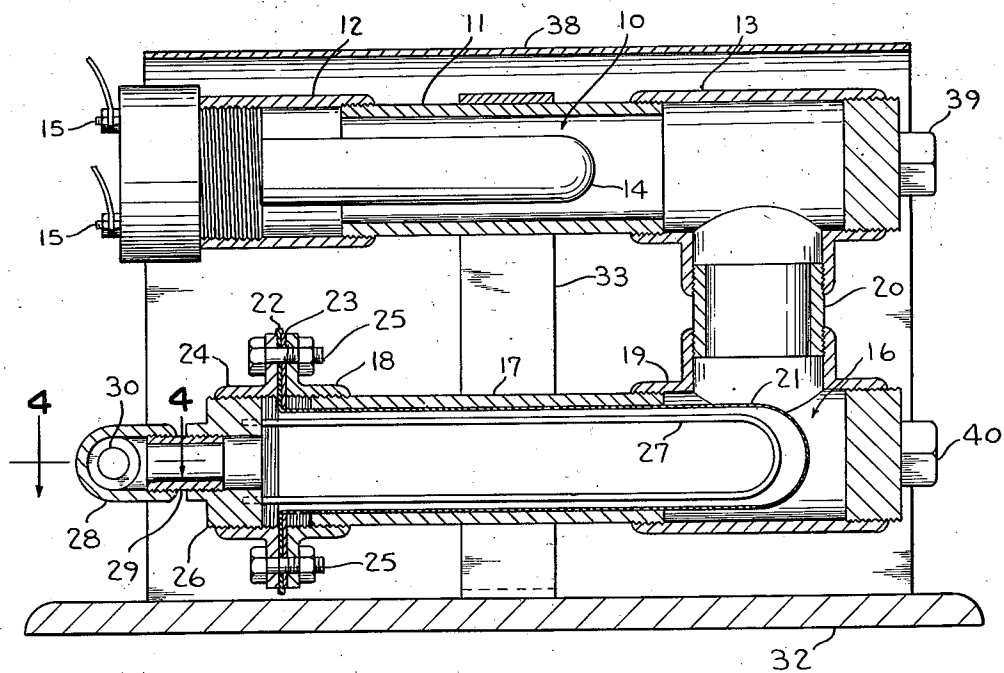


FIG. 3

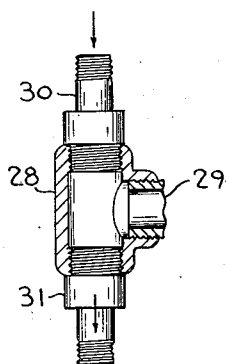


FIG. 4

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INJECTOR FOR INJECTING CAUSTIC
OR ACID FLUIDS

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3 Claims. (Cl. 103-44)

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This invention relates to improvements in injectors particularly of the type adapted to inject highly caustic or acid fluids into water or steam systems for the purposes of conditioning them.

With units of this type, the corrosive action of the caustic acid usually destroys the working parts in extremely short order even when expensive materials are used in their manufacture. Injectors of this type must also inject the caustic or acid fluid into boiler feed and steam lines under considerable pressure.

It is an object of this invention, therefore, to provide an injector which is automatic in its operation, which will resist destruction from the corrosive action of caustic or acid fluids, and which will operate at pressures up to as high as five hundred pounds per square inch.

It is also an object of this invention to provide an injector by which the amount of injection of the fluid may be readily controlled.

It is a further object of this invention to provide an injector which has a minimum number of moving working parts and which may be economically manufactured and operated.

These objects are attained by providing a pump unit consisting of two chambers connected by a tube or duct. The upper chamber has positioned therein an electrical immersion heater. The lower chamber contains a rubber sack substantially completely filling the interior of such chamber. The interior of the sack is connected to the source of supply of caustic or acid fluid and to the water or steam line into which the fluid is to be injected. A check valve is positioned between such interior and the reservoir and automatically closes when pressure is greater than atmosphere. Another check valve is positioned between such interior and the line into which injection is to be made. This check valve is automatically closed by pressure in such line and opens only when the pressure in the interior of the sack and lower chamber exceeds such line pressure. The upper chamber and that part of the lower chamber exterior of the sack is completely filled with alcohol or other fluid which has a low boiling point and high expansion when converted to vapor. The action of the heater may be controlled by an adjustable timing device. When the element is heated the alcohol boils and converts to vapor exerting a high pressure in the upper chamber. When this pressure exceeds the pressure in the water feed line or steam line into which caustic fluid is to be injected, it will cause the sack to be compressed and will urge the fluid from the interior of the sack into such line. As

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soon as the heater is disconnected the alcohol vapor condenses and the pressure in the upper chamber becomes less than atmosphere. When this condition arises, fluid will be drawn into the interior of the sack from the reservoir.

The novel features, which are considered characteristic of the invention, are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawing, in which:

Fig. 1 is a view in plan elevation of an injector embodying the invention;

Fig. 2 is a view in end elevation of such injector;

Fig. 3 is a sectional view taken on the line 3-3 of Fig. 2; and

Fig. 4 is a fragmentary sectional view taken on the line 4-4 of Fig. 3.

Referring to the drawing by reference numerals, the injector consists of two connected chambers. The chambers and connections between them are all formed of standard high pressure steel pipe fittings, such as nipples, T's, couplings, plugs, and flanges. These fittings are made of sections strong enough to withstand pressures of well over five hundred pounds per square inch. The upper chamber 10 consists of a nipple 11 to one end of which is threaded a coupling 12 and to the other end a T 13. An electrical immersion heater 14 of standard design supplied with terminals 15 is threaded into the coupling 12 and projects a substantial distance into the chamber 10. The lower chamber 16 is also formed of a nipple 17 to one end of which is connected a flange 18 and to the other end a T 19. The two chambers are connected by a nipple 20 between the two T's 13 and 19. The lower chamber 16 contains a rubber sack 21. This sack substantially completely fills the area of such chamber. It is preferably made of pure latex rubber which will remain flexible and which will resist the action of the caustic or acid fluid which is to be pumped by the injector. The end 22 of the sack 21 is stretched over the surface of the flange 18 and a fibre washer 23 is inserted between such end and the flange. Another flange 24 is bolted to the flange 18 by bolts and nuts 25 and grips the ends 22 between itself and the flange 18. A reducer 26 fits within the flange 24. Its inner face holds a U-shaped copper tube support 27. The support 27 is almost coextensive with the sack 21 when in its extended

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shape. Its purpose is to hold the sack 21 in such extended position even when it is collapsed and thus prevent it from being forced out through the reducer 26. A small T 28 is connected by a nipple 29 to the reducer 26. A check valve 30 of standard design is fitted to one opening of the T 28 and opens toward the T to permit fluid to be drawn into the sack 21. Another check valve 31 is secured to the opposite end of the T 28 and operates to permit fluid to pass out of the sack 21. To install the device for operation, the check valve 30 is connected by piping with a reservoir for the caustic or acid fluid and the check valve 31 is connected indirectly by piping or directly to the water or steam pipe line into which injection of the caustic or acid fluid is to be made. The check valves 30 and 31 are of standard construction with the exception that they should preferably be made of acid-resisting steel. The upper and lower chambers 10 and 16 are mounted as a unit on a base 32 by a bracket member 33. A panel 34 is mounted on the base 32 and extends across the face of the unit. In the panel 34 there is mounted a pressure gauge 35, a timing device 36, and an adjuster 37, all of standard design. A cover member 38 may be placed over the injector unit.

In order to charge the unit for operation, it is preferable to connect it in the line, bleed all of the air from the connecting tubing and sack, and to fill such tubing, check valves 30 and 31, T 28, nipple 29, and interior of the sack 21 with the caustic or acid fluid which is to be injected. The sack 21 will then be extended to substantially its full amount as is shown in Fig. 3. When this has been done, the remaining area of lower chamber 16, the interior of connecting nipple 20, and all of upper chamber 10 are completely exhausted of air and filled with alcohol, using either or both end openings in the T's 13 and 19. When this has been accomplished, plugs 39 and 40 are inserted in such end openings to seal the unit. The filling should take place when the immersion heater 14 is deenergized and cool and while the unit is subjected to atmospheric pressures. When the device is so charged, if the immersion heater 14 is energized it causes the alcohol in the chamber 10 to boil. This creates a high vapor pressure which, when it exceeds the pressure in the steam or water line to which the check valve 31 is connected, will cause the rubber sack 21 to collapse, forcing the fluid in such sack out through the check valve 31 into such line. During this action the check valve 30 remains closed preventing pressure from backing up into the reservoir. It has been found that if the immersion heater 14 is heated for two and one-half minutes a pressure of substantially five hundred pounds per square inch is developed. When the heater is deenergized it cools and the vapor pressure decreases. This creates a pressure less than atmosphere in the chamber 10 and the atmospheric pressure on the reservoir forces a new charge of liquid through the check valve 30 into the interior of the sack 21 again filling it and placing the injector in condition for the next injection cycle. The length of time of the energization of the immersion heater 14 depends entirely upon the pressure of the line into which the caustic or acid fluid is to be injected. A chart correlating pressures with time may be prepared and secured to the panel 34. Given a definite pressure the user may then select the proper time to effectuate a single injection. One important fea-

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ture of this invention is the positioning of the upper chamber 10 above the lower chamber 16. As a result, when the alcohol vaporizes, the alcohol in the lower chamber and nipple 20 will remain liquid. Its liquid level, even when the sack 21 is entirely collapsed, will never be below the connecting nipple 20. Hence, heat from the immersion heater 14 is never conveyed in any harmful amount to the lower chamber 16 and the sack 21.

By installing several injector pumps operating in timed sequence, a continuous injection can be arranged. In such instance the amount of the caustic or acid fluid being injected can be properly adjusted and proportioned to the flow of the water or steam into which such fluid is being injected. This adjustment is accomplished by regulating the length of time that the immersion heater is heated.

The construction of the electrical timing device indicated generally at 36 is not important per se and will not be described. Any device, such as a telechron clock, in which there are substituted for the hour and minute hands discs with contact segments, or any other well-known type of timing mechanism, may be used to regulate the time during which the immersion heater 14 is energized. A control for the timing mechanism is indicated at 37. Any well-known circuit in which the immersion heater 14 is connected and disconnected from the source of supply by a direct switch, or by an interposed relay switch controlled by the timing device, may be utilized. In spite of the fact that the timing device is by itself not important, it is an essential element of the combination. Its timing prevents the pump from becoming over-pressurized and coordinates the operation of multiple pump units to obtain a steady delivery. The timing device also acts as an additional safety feature as it causes pressure to drop before the safety pressure factor has been reached even if there were a failure of some other part such as a check valve.

Although only one embodiment of the invention is shown and described herein, it will be understood that this application is intended to cover such changes or modifications as come within the spirit of the invention or scope of the following claims.

I claim:

1. An injector having an upper chamber and a lower chamber formed of high pressure steel pipe nipples connected at respective ends by T's and connecting nipple, there being plugs in said T's to provide access to said chambers, an immersion type heater in said upper chamber, an inlet having an inwardly opening check valve and an outlet having an outwardly opening check valve both connected to said lower chamber, a flexible rubber sack in said lower chamber having an expanded volume substantially equal to the volume of said lower chamber, the open end of said sack being held between connecting flanges positioned on the end of the nipple comprising said lower chamber and communicating with said inlet and outlet, and a charge of alcohol normally in liquid state in said upper chamber duct and portion of the lower chamber exterior of said sack, said alcohol being vaporized by said heater to cause the collapse of said sack.

2. An injector having a chamber with several portions, one of said portions having a length greater than its width, a collapsible elongated sack in said one portion having its open end

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secured at one end of said chamber, a valved inlet and outlet for said chamber communicating with the interior of said sack, an immersion heater in another of said portions, and a charge of alcohol normally in liquid state filling the space within said chamber not occupied by said sack and said heater, said alcohol being vaporized by said heater when energized to collapse the side walls of said sack.

3. An injector having a chamber with several portions, one of said portions having a length greater than its width, a collapsible elongated sack in said one portion having its open end secured at one end of said chamber, a valved inlet and outlet for said chamber communicating with the interior of said sack, a rigid support member mounted within said sack and preventing the closed end of said sack from being moved to the open end thereof as said sack is collapsed,

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an immersion heater in another of said portions, and a charge of alcohol normally in liquid state filling the space within said chamber not occupied by said sack and said heater, said alcohol being vaporized by said heater when energized to collapse the side walls of said sack.

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