June 20, 1944. D. G. GRISWOLD 2,352,094

ADJUSTABLE INJECTOR

Filed March 10, 1942

Fig. 1.

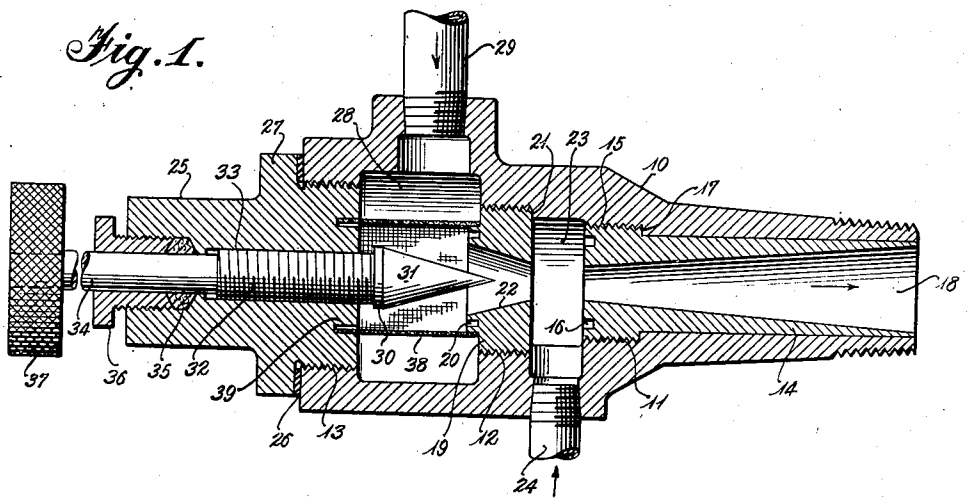


Fig. 2.

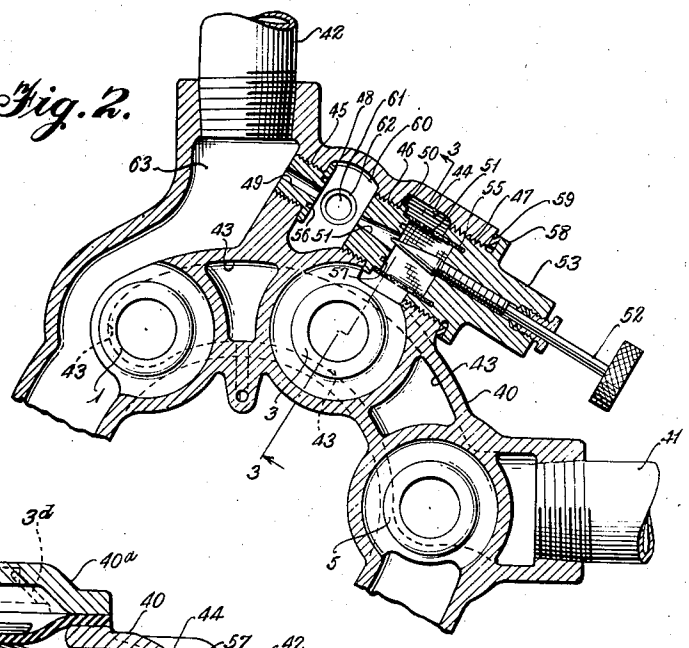
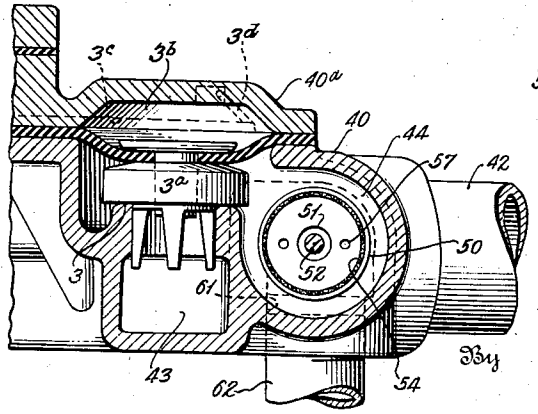


Fig. 3.



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Patented June 20, 1944

2,352,094

UNITED STATES PATENT OFFICE

2,352,094

ADJUSTABLE INJECTOR

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Application March 10, 1942, Serial No. 434,139

6 Claims. (Cl. 103—272)

The present invention relates to an injector and more particularly to an adjustable injector.

One of the principal objects of the invention is to provide an injector in which the rate of flow of the operating medium may be regulated manually as desired in order to control and vary the rate of injection of the material picked up and propelled by the injector.

Another object of the invention is to provide an adjustable injector adapted to be operated by water under pressure and used with apparatus in which a liquid medium is to be injected by the injector.

A further object of the invention is to provide a variable injector for use with apparatus requiring periodic regeneration, such as water softeners, filters, etc.

A still further and more specific object of the invention is to provide an adjustable injector in a fluid distribution unit of the type disclosed and claimed in my copending application, Serial No. 382,803, filed March 11, 1941, and entitled "Fluid distribution and control apparatus," and which application is a division of my Patent 2,243,815, granted May 27, 1941.

Other and further objects of the invention will be apparent from the following description taken in conjunction with the accompanying drawing, in which:

Fig. 1 illustrates an adjustable injector for general use constructed in accordance with the principles of the present invention;

Fig. 2 illustrates an adjustable injector associated with a fluid distribution apparatus for use with a water softener; and

Fig. 3 is an enlarged sectional view taken on the line 3—3 of Fig. 2.

Referring to Fig. 1 of the drawing, the injector comprises a body or housing 10 having a series of axially spaced, concentric threaded openings 11, 12 and 13 of relatively different diameters or sizes. The delivery tube 14 of the injector is enlarged and threaded at one end 15 thereof and is insertable in the body 10 from the end thereof having the threaded opening 13. The delivery tube 14 may be tightened in place in the body 10 by a suitable spanner wrench (not shown) engaged in recesses 16 to screw the enlarged portion 15 tightly against a shoulder 17. It will be understood that the plain exterior of the tube 14 has a tight fit in the surrounding portion of the body 10. The delivery tube 14 is provided with a substantially conical bore or orifice 18 which functions in a well understood manner. A second tube or nozzle 19 is exteriorly threaded and is received in the intermediate threaded opening 12 of the body 10. The tube 19 is also provided with recesses 20 for engagement by a suitable spanner wrench to tighten said tube against a shoulder 21 formed in said body. A conical orifice 22 is formed in the tube 19 in axial alignment with the delivery orifice 18 in the tube 14, the walls of the orifices converging toward each other, as shown. A chamber 23 is formed in the body 10 between the adjacent surfaces of the injector tubes 14 and 19 and communications with a pipe 24 connected to a source of supply of the material to be injected by the injector. If the injector is used with a water-softening apparatus, the pipe 24 may be connected with a brine supply tank (not shown).

An end plug 25 is threaded into the largest opening 13 and a gasket 26 is interposed between a flange 27 on said plug and the end surface of the injector housing 10 to provide a leakproof seal. A chamber 28 is thus formed between the adjacent faces of the plug 25 and the tube 19. The chamber 28 is connected to a source of fluid under suitable pressure by means of a pipe 29. If the injector is used with a water softener, the pipe 29 may be connected to a raw water line (not shown) under pressure.

The rate of flow of operating fluid from the chamber 28 into the nozzle orifice 22 is controlled in the present injector by an adjustable needle valve element 30 disposed in the chamber 28 and having a conical head portion 31 with surfaces complemental to those of the orifice 22. The adjustable needle 30 is provided with a reduced threaded portion 32 engaged with cooperating threads 33 in the plug 25. The needle 30 is further provided with a reduced plain stem portion 34 which projects to a point exteriorly of the plug 25. Leakage from the chamber 28 past the stem 34 is prevented by a packing 35 compressed by a gland 36 mounted in one end of the plug 25. The extremity of the stem 34 carries a knob 37 whereby the position of the conical head 31 can be readily adjusted with respect to the nozzle 22. The knob 37 may be secured to the stem 34 in any suitable manner. It is to be noted, however, that with the present construction the knob 37 is mounted upon the stem 34 after the stem has been assembled and packed in the plug 25.

The foregoing arrangement provides a relatively simple injector construction in which the tubes 14 and 19 are readily mounted in the body 10 through the opening 13 and in which the opening itself is later closed by the plug 25. Thus, the

injector parts are readily accessible for inspection and cleaning or for replacement of the nozzles by similar or different nozzles to meet various operating demands in practice.

If desired, a screen **38** may be soldered at one end to the tube **19** and its opposite end received in an annular groove **39** in the plug **25**. The screen **38** is preferably omitted in cases where steam instead of water under pressure is used as the operating medium for the injector.

In operation, water or steam under pressure is introduced through the pipe **29** into the chamber **28** and passes through the nozzle **22**, across the chamber **23** and into the delivery orifice **18** at high velocity. In passing across the chamber **23** a vacuum condition is produced in said chamber and the suction created thereby tends to draw a liquid through the pipe **24** into the chamber **23** where it is picked up by the rapidly moving stream of water or steam and carried into the delivery nozzle **14** to be discharged therefrom into the particular apparatus with which the injector is associated. The volume of the water or steam passing through the orifice **22** can be varied manually as desired by adjusting the needle valve element **30** relatively to said orifice. The threaded stem **32** enables a very close or minute adjustment of the injector to be made.

The injector is particularly useful in connection with water softeners and like apparatus, inasmuch as it enables the rate of application of the brine to the zeolite bed to be controlled, and, furthermore, avoids possible excess dilution of the brine by the injecting water. By the use of the present injector the desired concentration of the brine can be maintained while utilizing raw water as the injecting medium.

Figs. 2 and 3 illustrate a fluid distribution unit of the type disclosed in my patent, supra, and claimed in my copending application Serial No. 382,803, supra. The fluid distribution unit comprises a housing or casing **40** and six flow control valves, all of which need not be shown for the purposes of the present invention. A raw water supply pipe **41** is connected to one side of the casing **40** and a pipe **42** is connected to the upper end of said casing and provides a connection between the fluid distribution unit and a water softener tank (not shown). The casing **40** is provided with a continuous passageway **43** which leads from the inlet at the raw water pipe **41** to a point under a seat **1** for a diaphragm valve (not shown). Another diaphragm valve (not shown) is associated with a seat **5** and still another diaphragm valve **3a** (see Fig. 3) is associated with the valve seat **3**. A chamber **3b** for fluid under pressure is provided above the valve **3a** in the cover plate **40a** of the housing **40**. Operating fluid is admitted and exhausted from the chamber **3b** through passages **3c**, **3d** for the purpose of controlling the closing and opening of the valve **3a**. It will be apparent from Figs. 2 and 3 that when flow is obstructed through the seats **1** and **5** and pressure fluid is exhausted from the chamber **3b**, the valve **3a** is raised from its seat by the pressure of the raw water in the passageway **43** and said water will then flow from said passageway into a chamber **44** in the casing **40** arranged outwardly of and alongside the passageway **43**. The valve seats **1** and **5**, when unobstructed, cooperate with their associated valves (not shown) to perform certain functions fully described in my patent and application, respectively, supra, and which functions need not be described herein.

The housing **40**, like the injector housing **10**, is provided with three concentric, axially spaced, threaded openings **45**, **46** and **47** of progressively increasing size. A delivery tube **48** is mounted in the smallest opening **45** and is provided with a plain circular orifice **49**. The orifice **49** can be made conical, of course, if desired, and extend in a manner similar to the orifice **18** described in connection with Fig. 1. A second tube **50** is mounted in the intermediate threaded opening **46** and is provided with a conical orifice **51**, the surfaces of which converge toward the orifice **49**. An adjustable needle valve element **52**, somewhat similar to the needle valve **30** of the previously described injector, is associated with the orifice **51** to vary the flow of water from the chamber **44** into said orifice. The needle valve **52** is mounted in a plug **53** having a portion engaged in the threaded opening **47**. The general construction of the plug **53** is similar to the plug **55** and further description is, therefore, believed unnecessary.

The injector shown in Figs. 2 and 3 is preferably provided with a screen **54** disposed between the plug **53** and the injector tube **50**. One end of the screen may be soldered to the adjacent end of the injector tube **50** and its opposite end may be received in an annular groove **55** formed in the end of the plug **53**.

The injector tubes **48** and **50** may be provided with recesses **56** and **57**, respectively, for engagement by a spanner wrench whereby the tubes can be tightened in place. The flange **58** of the plug **53** may be made hexagonal to facilitate securing the same in place. Leakage between the flange **58** and the adjacent surface of the casing **40** is prevented by a gasket **59**.

The chamber **44** will be observed to lie between the plug **53** and the tube **50**. A second chamber **60** lies between the adjacent faces of the tubes **48** and **50** and communicates through an opening **61** in the casing with a pipe **62** connected with a brine tank (not shown).

The operation of the injector shown in Figs. 2 and 3 is similar in principle to that shown in Fig. 1, but it will be noted that the impelling water and brine discharged from the orifice **49** emerge into a passage **63** in the housing **40** and can enter the pipe **42** and thus be introduced into a softener tank to regenerate the bed. The screen **54**, of course, prevents any solids in the raw water from entering either the injector tubes or the softener tank.

The arrangement shown in Figs. 2 and 3 not only affords the convenience and economy of a built-in injector unit, but also makes it possible to better control the rate of admission of the brine into the brine tank and the relative dilution thereof by the impelling water.

It will be understood that various changes and modifications in the injectors shown herein may be made without departing from the spirit of the invention or the scope of the annexed claims.

I claim:

1. An adjustable injector comprising: a housing having three axially spaced openings of progressively smaller size; an injector tube in each of the two smaller openings; a plug mounted in the largest of said openings, said injector tubes being arranged to form a chamber therebetween, and said plug and the adjacent injector tube being arranged to form a second chamber therebetween; means for connecting said first-men-

tioned chamber with a source of fluid to be injected by the injector; means for connecting said second chamber with a source of operating fluid under pressure; and adjustable means carried by said plug and extending into said second chamber for controlling the rate of flow of operating fluid from said second chamber into said adjacent injector tube.

2. An adjustable injector for use with a water softener comprising: a housing having three axially spaced threaded openings of progressively smaller diameter; an injector tube in each of the two smaller threaded openings; a plug mounted in the largest of said threaded openings, said injector tubes being arranged to form a chamber therebetween, and said plug and the adjacent injector tube being arranged to form a second chamber therebetween; means for connecting said first-mentioned chamber with a source of brine to be injected by the injector; means for connecting said second chamber with a source of raw water under pressure; a needle valve threadedly carried by said plug and including a head portion extending into said second chamber for controlling the rate of flow of pressure fluid from said second chamber into said adjacent injector tube; and a knob exterior of said plug operatively connected with said needle valve for adjusting said head portion relative to said adjacent injector tube.

3. An adjustable injector comprising: a housing having three axially spaced openings of progressively smaller size; an injector tube in each of the two smaller openings; a plug mounted in the largest of said openings, said injector tubes being arranged in said housing to form a chamber therebetween, said plug and the adjacent injector tube being arranged in said housing to form a second chamber therebetween; means for connecting said first-mentioned chamber with a source of fluid to be injected by the injector; means for connecting said second chamber with a source of operating fluid under pressure; a needle valve carried by said plug, said needle valve comprising a head portion extending into said second chamber for controlling the rate of flow of pressure fluid from said second chamber into said adjacent injector tube, a threaded portion engaged in a threaded opening in said plug, and a plain stem portion having an extremity projecting exteriorly of said plug; a packing gland carried by said plug arranged to prevent leakage of operating fluid from said second chamber along said stem; and means carried by the extremity of said stem for adjusting said head portion relative to said adjacent injector tube.

4. Injector means for use with a water softener comprising: a hollow body; a delivery tube in said body and a plug mounted in said body in spaced relation to said delivery tube; a nozzle in said body between said delivery tube and plug, said nozzle and delivery tube having aligned orifices, said body having a chamber between said nozzle and delivery tube for the reception of brine to be injected by the injector and also having a second chamber between the plug and said nozzle for the reception of raw water under pressure; means providing a passageway in said body opening into said second chamber for conducting raw water to said second chamber; pressure fluid operable control valve means in said hollow body controlling the admission of raw water from said passageway into said second chamber; and a needle valve carried by said plug adjustable axially in said second chamber for varying the rate of flow of said operating fluid through said nozzle.

5. Injector means for use with a water softener comprising: a hollow body; a delivery tube in said body and a plug mounted in said body in spaced relation to said delivery tube; a nozzle in said body between said delivery tube and plug, said nozzle and delivery tube having aligned orifices, said body having a chamber between the nozzle and delivery tube for the reception of brine to be injected by the injector and also having a second chamber between the plug and said nozzle for the reception of raw water under pressure; means providing a passageway in said body for conducting said raw water to said second chamber; a diaphragm valve operatively associated with said passageway for controlling the admission of raw water into said passageway for flow to said second chamber; and a needle valve carried by said plug adjustable axially in said second chamber for varying the rate of flow of said operating fluid through said nozzle to thereby vary the rate of injection of said brine.

6. Injector means for use with a water softener comprising: a hollow body; means in said body having an aperture serving as a delivery opening; means carried by said body having a threaded opening with an adjustable needle valve mounted in said opening; means between said delivery opening and said needle valve provided with an opening serving as a nozzle, said nozzle and delivery opening being in alignment and said needle valve being aligned with said nozzle, said body having a chamber between said nozzle and delivery opening for the reception of brine to be injected and also having a second chamber between said nozzle and said threaded opening for the reception of raw water under pressure; means providing a passageway in said body for conducting raw water to said second chamber; and valve means in said hollow body operatively associated with said passageway for controlling the admission of raw water into said passageway for flow to said second chamber, said needle valve being adjustable axially in said second chamber for varying the rate of flow of said raw water through said nozzle to thereby vary the rate of injection of said brine.

DONALD G. GRISWOLD.