Feb. 28, 1939. F. L. ALLEN 2,148,671

FLUID INJECTOR

Filed Jan. 8, 1937 2 Sheets-Sheet 1

Fig. 1.

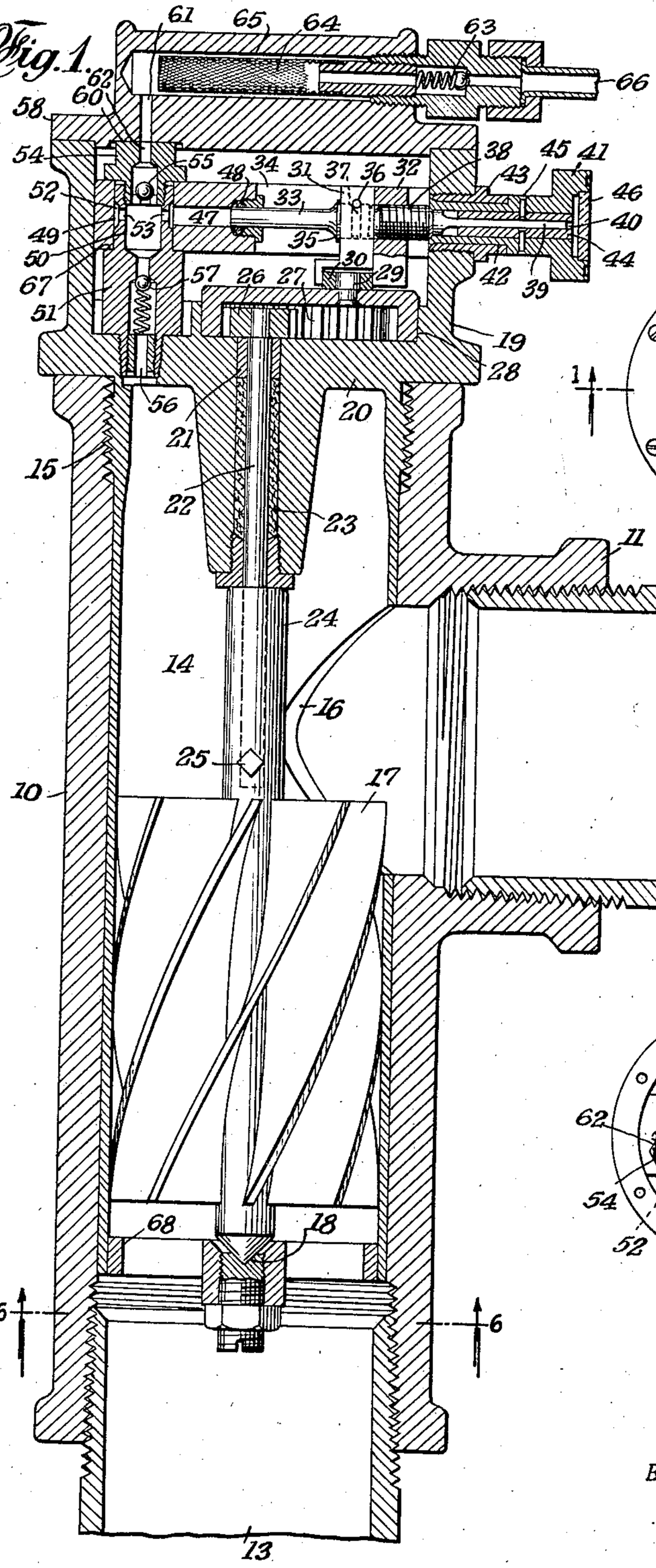


Fig. 2.

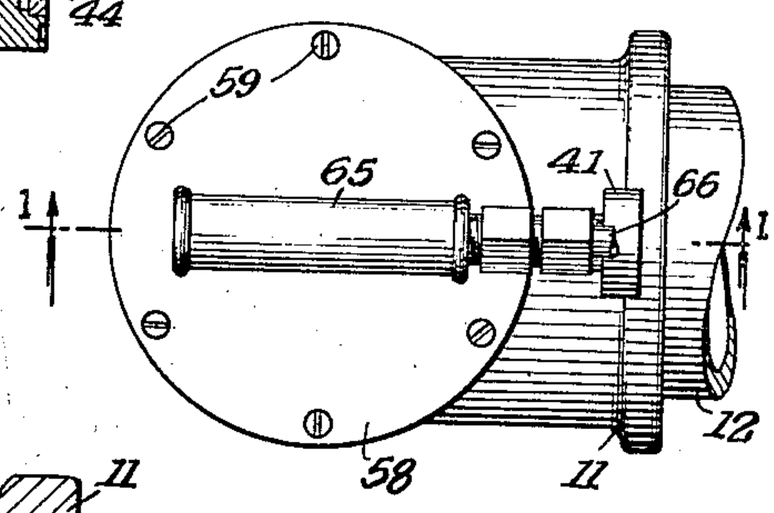
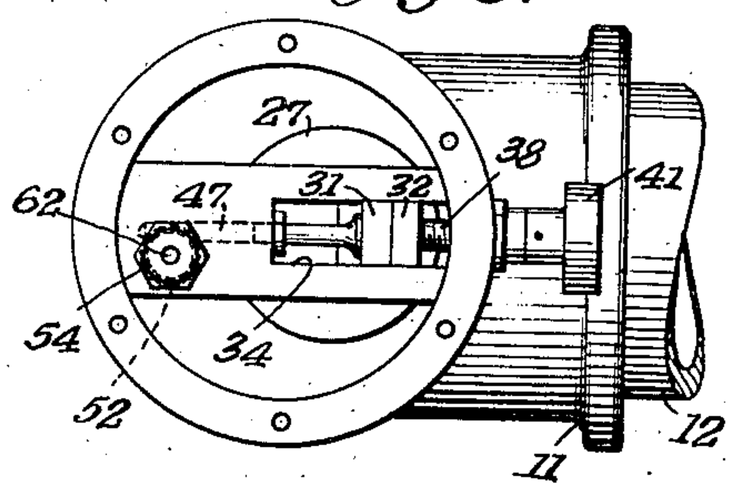


Fig. 3.



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Filed Jan. 8, 1937 2 Sheets-Sheet 2

Fig. 5.

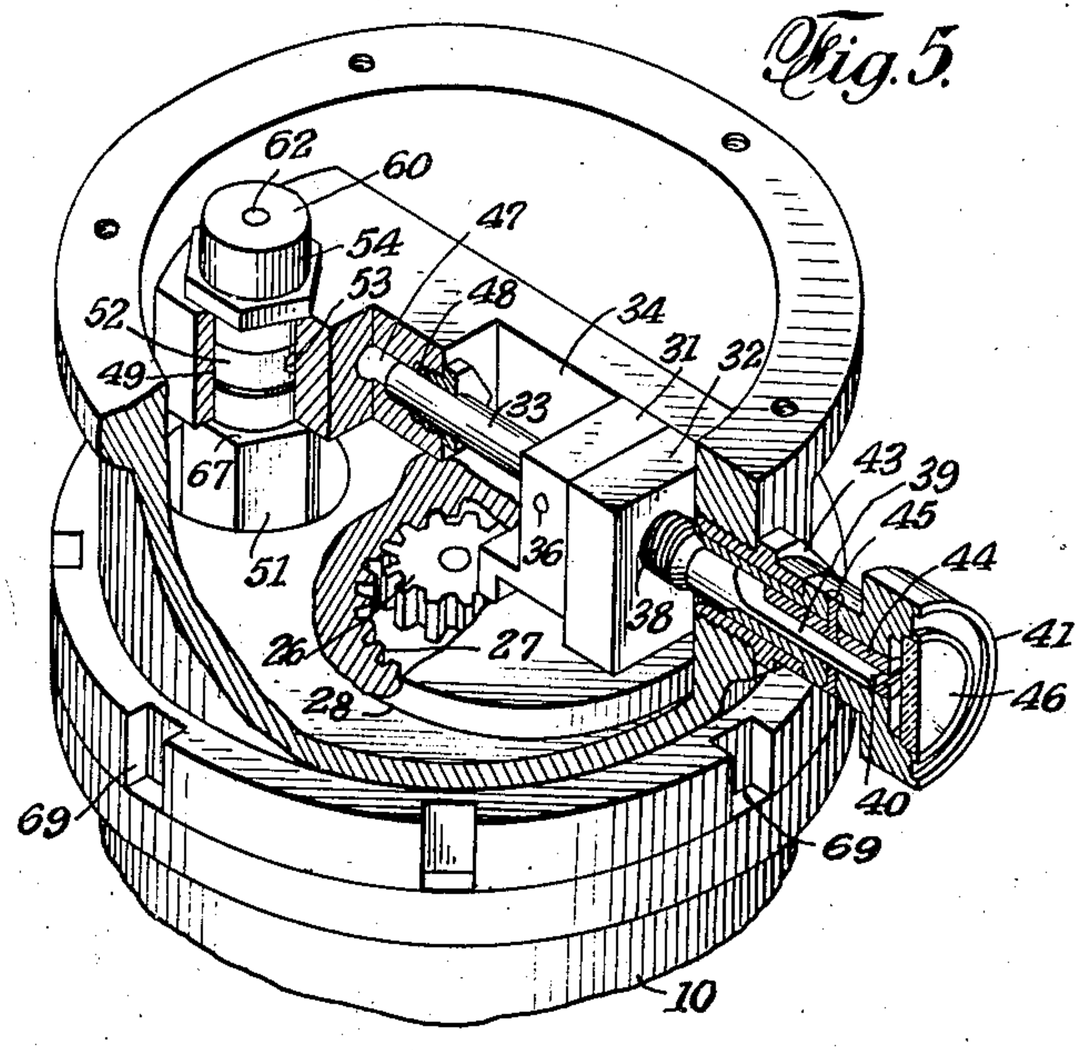


Fig. 6.

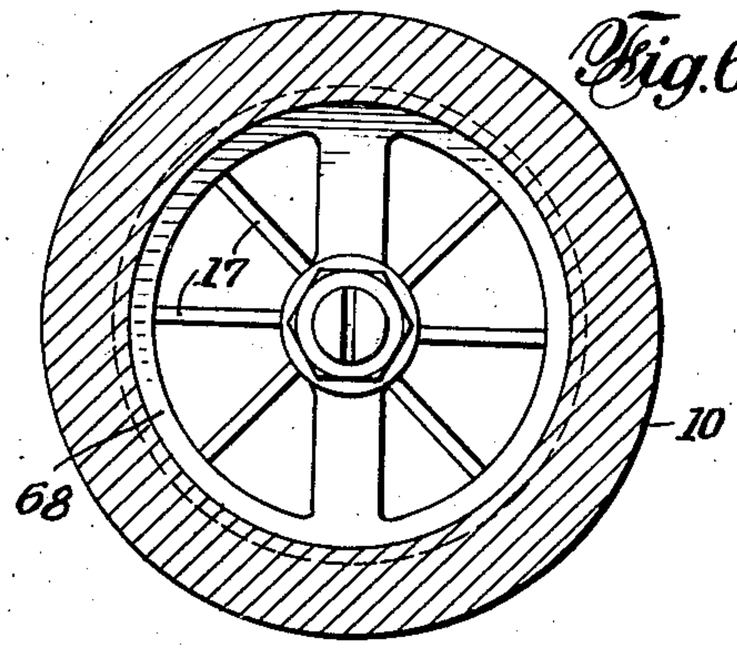
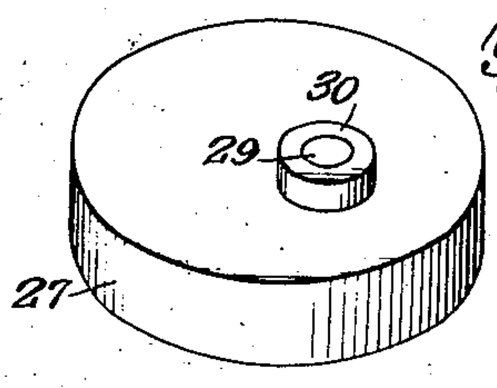


Fig. 7.



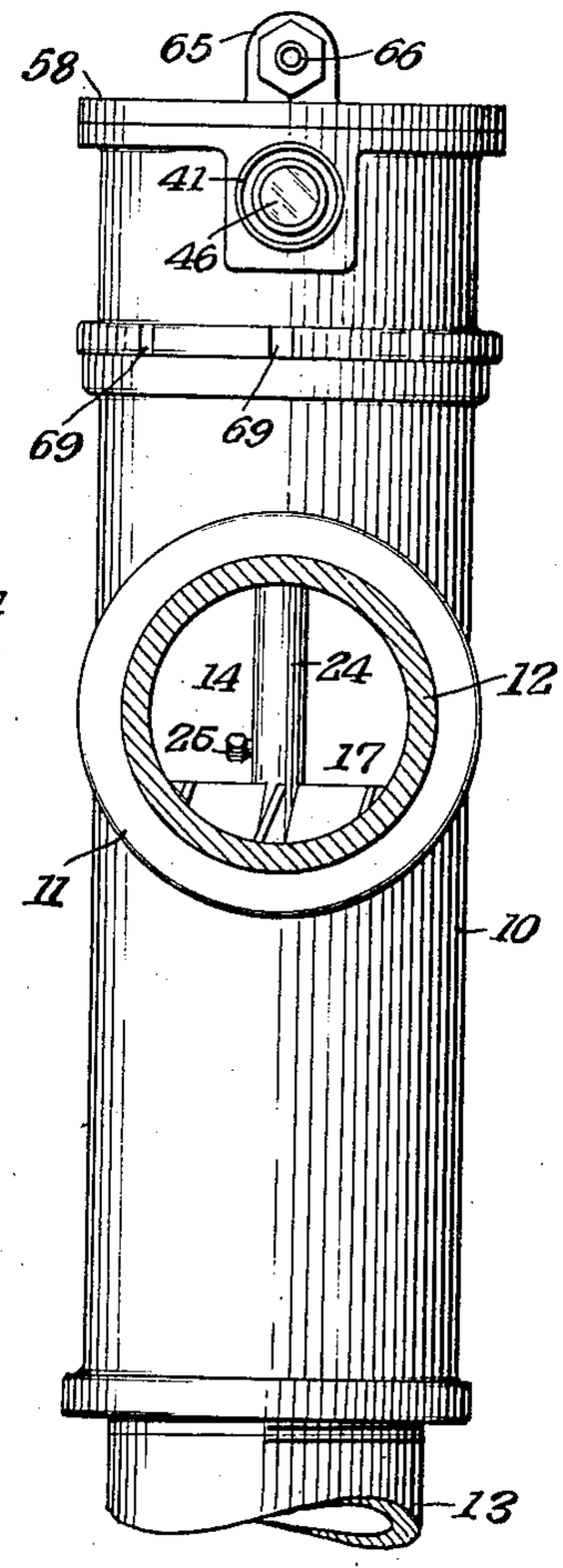


Fig. 4.

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FLUID INJECTOR

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15 Claims. (Cl. 137—165)

This invention relates to the injection of fluids in pipe lines, particularly for the chemical treatment of fluids passing through such pipe lines.

Special objects of the invention are to provide an injector which may be directly incorporated in the pipe line and which will operate automatically from the flow through the line to inject the treating substance at a rate proportioned to the actual flow.

Further special objects are to provide an injector of the type mentioned, which will be of simple, sturdy design, in which all working parts will be enclosed and properly lubricated, which may be conveniently and accurately adjusted to control the amounts injected and which will afford visual indication of the proper operation of the device.

The foregoing and other desirable objects are attained by the novel features of construction, combinations and relations of parts hereinafter described and broadly claimed.

The drawings accompanying and forming part of this specification illustrate a practical and at present preferred embodiment of the invention, but actual physical structure may be modified and changed as regards the present disclosure, all within the true intent and broad scope of the invention as hereinafter defined and claimed.

Figure 1 is a broken vertical sectional view of the injector as incorporated and forming part of a pipe line, this view being taken as on substantially the plane of line 1—1 of Figure 2.

Figure 2 is a broken plan view of the injector, on a smaller scale.

Figure 3 is a similar view, with the top or cover removed to show details of the pump and operating means therefor.

Figure 4 is a side elevation of the apparatus with portions of the pipe line broken away and in section.

Figure 5 is a broken part sectional perspective view of the injector head showing parts appearing as with the cover removed.

Figure 6 is a horizontal sectional view as on substantially the plane of line 6—6 of Figure 1.

Figure 7 is a perspective view of the hollow, internal gear, crank disc for operating the injector pump.

The body of the device is shown in the form of a T casing 10, having a pipe thread flange 11 in the side of the same for the inlet pipe 12 and having the lower end similarly threaded to receive the discharge pipe 13. Seated in this casing is a liner 14 shown as threaded into the upper end of the casing at 15 and as having a port 16 registering with the inlet passage. This liner forms a casing for a spiral bladed rotor 17 and carries an adjustable thrust bearing 18 for the lower end of such rotor.

At the upper end the liner is shown as extended in a casing 19 providing a chamber for the injector pump. The bottom wall 20 of this chamber provides a closure for the upper end of the liner. Centrally journalled in this wall at 21 is a shaft 22 extending downwardly through a stuffing box 23 into the hub 24 of the rotor, where it is secured by set-screw 25.

Fixed on the upper end of shaft 22 is a pinion 26 in mesh with the teeth of an internal gear 27 and which latter is shown as a hollow disc rotatably seated in a bearing 28 in the bottom wall 20 of chamber 19.

The closed upper end of the internal gear 27 is shown as carrying a crank pin 29 and roller 30 and the latter is indicated as operating between abutment blocks 31, 32 on the reciprocating pump plunger 33.

The abutment blocks 31, 32 are shown as held against rotation and as guided for movement in a rectilinear path by operating in a slotted guide 34. The inner block 31 is shown as rotatably confined against a shoulder 35 on the plunger by a cross pin 36 intercepting an annular groove 37 in the plunger stem and the outer block 32 is indicated as longitudinally adjustable on the plunger stem by having a screwthreaded engagement thereon at 38. With the blocks set together as in Figure 1, it will be seen that the full stroke of the crank roller will be imparted to the pump plunger and that by rotation of the plunger stem to separate the outer block from the inner one, the stroke of the plunger may be reduced to any desired extent.

The plunger stem is rotated for stroke adjustment purposes in the present illustration by forming the outer end of the same as a flattened blade 39 slidingly received in a correspondingly shaped flat keyway 40 in the adjusting knob 41. The latter is shown as having a shank portion 42 rotatably held in the bore of a bushing 43 screwed in the side of the chamber 19. The flat keyway 40 for the end of the plunger stem is shown in Figures 1 and 5 as formed by oppositely disposed segmental liners 44 secured as by rivets or other suitable fastenings 45 in the hollow shank of the adjusting knob. The outer end of this passageway is shown closed by a glass cover 46 secured in the face of the knob and which forms a window through which

agitation of liquid in the pump chamber may be observed to check the operation of the pump.

The pump plunger **33** is shown in Figures 1 and 5 as operating in a bore **47** formed in the guide yoke **34** and closed at the outer end by a pump gland **48**. The inner end of the pump bore, in the illustration, opens to a vertical passage **49** fitting over the hollow neck **50** of a valve member **51**, said neck portion having an annular channel **52** and ports **53** providing communication between the interior of this valve member and the end of the pump barrel. A hollow valve cage **54** screwed into the upper end of valve member **51** holds the combined pump barrel and guide yoke in position and carries the inlet valve **55** and the lower end of member **51** is formed as a pump discharge passage **56** and carries the discharge valve **57**.

The upper end of the pump chamber is closed in the illustration by a cover **58** removably secured by screws **59** and this cover is illustrated as having a seat **60** receiving and closely fitting the upper end of the valve cage **54** to bring the complementary inlet passages **61**, **62** in the cover and valve cage into continuous conducting relation.

A check valve member **63** is shown screwed in the cover and as carrying a strainer screen **64** projecting into a cavity **65** formed in the cover and in communication with the passage **61**. The feed line **66** for the injected material is shown connected with the outer end of this check valve member.

In operation, the chamber in the head of the injector may be filled with an oil which will properly lubricate the pump piston, crank roller, crank disc and pinion shaft and which will keep these parts in proper working order over long extended periods of use. The removal of the cover enables inspection and replacement or repair of any or all these parts. The matter of assembling and disassembling is simple. The intake valve cage **54** acts as a nut for holding the pump barrel and guide yoke down on the shoulder **67** of the valve member **51** and the removal of this one fastening enables inspection and cleaning of both inlet and outlet valves and removal of the pump barrel yoke, after the adjusting knob **41** has been removed by unscrewing the mounting bushing **43**. The pump plunger has a bearing at both ends, at one end in the pump bore and packing gland and at the other end in the bore of the adjusting knob and this plunger is braced against the lateral thrust of the crank pin through the operation of the abutment blocks **31**, **32** in the guide yoke **34**.

The T-formation of the casing locates the rotor in what constitutes in effect a part of or continuation of the pipe line so that the rotor is subjected to the full flow and operates according to the velocity of such flow. The pump is connected with the rotor through a simple reduction gear and hence operates at a desirably slower rate but in direct proportion to the speed of the rotor. Consequently the ratio of fluid injected will be proportional to the pipe flow at all times.

The unitary construction makes the device small and compact and enables it to be used in places where space is limited. It may be quickly connected in a pipe line by simply making the two connections, one at the side and one at the end of the T casing. The location of the pump mechanism at the opposite end of such casing places it in position for easy inspection, repair or other attention. The entire working mechanism may be quickly removed by simply unscrewing the injector head from the casing. The in-line relation between the rotor and pump drive gearing enables relative separation of such parts upon simply loosening the set-screw **25**. The spider **68** which carries the rotor thrust bearing **18** may be rotatably secured in the lower end of the liner, as by a screw connection, to permit ready removal of the rotor. The internal gear drive between the rotor and pump enables the use of reduction gearing without necessitating an increase in the overall dimensions of the unit and the constructing of the internal gear element as an operating crank for the pump plunger keeps the vertical dimensions of the unit within desired limitations.

The arrangement of the complete unit in what constitutes in effect an elbow of the pipe line keeps projecting portions down to a minimum and locates the pump and adjusting mechanism in convenient relation for all attention that may be required. Operation of the pump can be checked at any time and the amount of pump feed judged by the agitation visible through the glass **46** and adjustments be made accordingly. The parts may be so proportioned that rotation of the knob **41** may effect adjustment of the pump all the way from full stroke to idle or neutral. Thus the pump at any time may be shut down by simply turning the knob **41** to back off the abutment **32** so far that the crank roller will be unable to return the pump plunger from its inner, neutral position. To facilitate the engagement of a proper tool for removing the injector head, the latter may be angled to take a wrench or be notched as indicated at **69** in Figures 4 and 5 to take the jaws of a suitable spanner. All operating parts are enclosed so that possibility of leakage of either the pipe line fluid or of the injected fluid is avoided. The spiral vaned rotor located axially forms an effective drive for the pump and serves to thoroughly mix the introduced chemical with the impelling fluid.

While practical to have the liner and the head of the injector made as a single part, these may, if desired, be made as separate parts and be suitably connected, as by a union permitting relative rotation of such parts in different angular relations. It will be realized from these facts and from the disclosure generally that many changes may be made to suit different requirements all within the true scope of the invention. Also it will be realized that the terms employed herein have been used in a descriptive rather than in a limiting sense, except possibly as limitations may be imposed by state of the prior art. The invention is adapted to many different uses and while particularly adapted for water treatment and the handling of liquids in general, it may be employed in connection with any fluids, whether they be liquid, vaporous or gaseous or combinations of any of these. Furthermore, adjustments of the plunger stroke may be made while the injector is in operation, enabling differences in effects or results to be immediately checked and adjustments as fine as required, made accordingly.

In addition to the entire mechanism of the injector, the stuffing box between the injector chamber and pipe passage is fully enclosed and protected. The removability of the working unit from the main body of the injector without disconnecting the body of the injector from the pipe line is important, enabling, as it does, a worn or faulty unit to be quickly replaced by a new or

reconditioned unit by simply unscrewing and removing the complete unit out of the upper end of the T casing. The screen **64** may be taken out any time for cleaning or replacement by simply unscrewing the check valve plug **63** which carries it. The three ball checks at **63**, **55** and **57** effectively guard against flow of fluid from the pipe line back to the chemical container. When the screen is removed or the top cover taken off, the two ball checks **55** and **57** hold the fluid in the pipe line and the single valve **57** will hold in the same fashion if, when the cover is removed, the upper valve cage **54** is removed to permit working on the injector pump or removal of the latter.

I claim:

1. A fluid injector of the character disclosed comprising a casing having a flow passage therethrough and adapted for connection in a pipe line, a fluid impelled rotor operating in said passage, a chamber at one end of said casing and separated from said flow passage, an injector pump enclosed in said chamber and having an inlet passage provided with an external supply connection for injected fluid and an outlet passage discharging into said flow passage, a shaft extending from the rotor into said closed chamber and reduction gear operating connections from said shaft to said pump and located in said closed chamber.

2. A fluid injector of the character disclosed comprising a T casing having a closed chamber at one end and fluid passages at the opposite end and in the side of the same, a rotor journalled axially in said casing, a shaft extending from said rotor into said chamber at the first mentioned end of the casing, an injector pump located in said chamber and having a plunger reciprocating at a right angle to said rotary shaft, said pump provided with an inlet passage and with an outlet passage discharging into that part of the casing in which the rotor is located and drive gearing from the rotor shaft to the reciprocating pump plunger also located in said closed chamber.

3. A fluid injector of the character disclosed comprising a T casing having a closed chamber at one end and fluid passages at the opposite end and in the side of the same, a rotor journalled axially in said casing, a shaft extending from said rotor into said chamber at the first mentioned end of the casing, an injector pump located in said chamber and having a plunger reciprocating at a right angle to said rotary shaft, said pump provided with an inlet passage and with an outlet passage discharging into that part of the casing in which the rotor is located, drive gearing from the rotor shaft to the reciprocating pump plunger also located in said closed chamber and means accessible at the outside of said closed chamber for varying the drive gearing between the rotor shaft and pump plunger.

4. A fluid injector of the character disclosed comprising a T casing having a closed chamber at one end and fluid passages at the opposite end and in the side of the same, a rotor journalled axially in said casing, a shaft extending from said rotor into said chamber at the first mentioned end of the casing, an injector pump located in said chamber and having a plunger reciprocating at a right angle to said rotary shaft, said pump provided with an inlet passage and with an outlet passage discharging into that part of the casing in which the rotor is located, drive gearing from the rotor shaft to the reciprocating pump plunger also located in said closed chamber, including a pinion on said shaft, an internal gear about said pinion, a crank element carried by said internal gear and connecting means between said crank element and reciprocating pump plunger.

5. A fluid injector of the character disclosed comprising a T casing having a closed chamber at one end and fluid passages at the opposite end and in the side of the same, a rotor journalled axially in said casing, a shaft extending from said rotor into said chamber at the first mentioned end of the casing, an injector pump located in said chamber and having a plunger reciprocating at a right angle to said rotary shaft, said pump provided with an inlet passage and with an outlet passage discharging into that part of the casing in which the rotor is located, drive gearing from the rotor shaft to the reciprocating pump plunger also located in said closed chamber, including a pinion on said shaft, an internal gear about said pinion, a crank element carried by said internal gear and connecting means between said crank element and reciprocating pump plunger, including abutment blocks on the pump plunger relatively separable to effect variations of the plunger stroke.

6. A fluid injector of the character disclosed comprising a T casing having a closed chamber at one end and fluid passages at the opposite end and in the side of the same, a rotor journalled axially in said casing, a shaft extending from said rotor into said chamber at the first mentioned end of the casing, an injector pump located in said chamber and having a plunger reciprocating at a right angle to said rotary shaft, said pump provided with an inlet passage and with an outlet passage discharging into that part of the casing in which the rotor is located, drive gearing from the rotor shaft to the reciprocating pump plunger also located in said closed chamber, including a pinion on said shaft, an internal gear about said pinion, a crank element carried by said internal gear, connecting means between said crank element and reciprocating pump plunger, including abutment blocks on the pump plunger relatively separable to effect variations of the plunger stroke, one of said blocks being held in relatively rotatable relation to the plunger, the companion block having a screw connection with the plunger and means at the outside of the chamber for operating said screw connection.

7. A fluid injector of the character disclosed comprising a T casing having a closed chamber at one end and fluid passages at the opposite end and in the side of the same, a rotor journalled axially in said casing, a shaft extending from said rotor into said chamber at the first mentioned end of the casing, an injector pump located in said chamber and having a plunger reciprocating at a right angle to said rotary shaft, said pump provided with an inlet passage and with an outlet passage discharging into that part of the casing in which the rotor is located, drive gearing from the rotor shaft to the reciprocating pump plunger also located in said closed chamber, including a pinion on said shaft, an internal gear about said pinion, a crank element carried by said internal gear, connecting means between said crank element and reciprocating pump plunger, including abutment blocks on the pump plunger relatively separable to effect variations of the plunger stroke, one of said blocks being held in relatively rotatable relation to the plunger, the companion block having a screw connection with the plunger and means at the outside of

the chamber for operating said screw connection, including a knob journalled in the side of the chamber and provided with a longitudinal keyway, the pump plunger having a stem with a corresponding key extension entered in said keyway.

8. In a device of the character disclosed, a chambered support, a cover removably closing the chamber of said support, a valve casing extending between said cover and the base of said support, said valve casing having passages at the ends of the same and the cover and base having registering passages, inlet and outlet valves in said valve casing, a pump barrel yoked about said valve casing and in communication with the interior of the same, said pump barrel having a guide extension, a pump plunger operating in said barrel, a crank disc journalled in the chamber of the support, a crank element carried by said crank disc, abutment means on said pump plunger engaging said crank element and operating over the guide extension of the pump barrel, a rotor and drive connections from said rotor to said crank disc.

9. A fluid injector comprising a casing forming an elbow for a pipe line, a chambered support detachably mounted on the end of said elbow, a rotor journalled in said elbow, a shaft connected with said rotor and projecting from the interior of the elbow into said chambered support, an injector pump in said chambered support at the end of said shaft having a discharge passage opening into the elbow and drive connections from the end of said shaft to said pump.

10. A fluid injector comprising a casing forming an elbow for a pipe line, a rotor journalled in said elbow, a shaft connected with said rotor and projecting from the interior of the elbow, an injector pump at the end of said shaft having a discharge passage opening into the elbow, drive connections from the end of said shaft to said pump, said drive connections including an internal gear about the end of the shaft and a pinion on the shaft in mesh with said internal gear.

11. A fluid injector comprising a T casing having end openings and a side opening, a chamber closing one of said openings and the other two openings forming portions of a flow passage through said casing, an injector pump within said chamber and connected to discharge to said flow passage, a rotor operating in said flow passage, drive connections from said rotor to said pump, including a shaft extending from the flow passage into the pump chamber and a stuffing box for said shaft, said stuffing box, operating connections and pump mechanism being wholly enclosed within the flow passage and pump chamber portions of said casing.

12. A fluid injector comprising a casing for connection in a pipe line and a complete working unit removably and replaceably mounted in said casing and including a sleeve portion entering the casing and a chamber portion forming an external head for said sleeve portion, a rotor journaled in the sleeve portion, an injector pump within the chamber portion, operating connections from said rotor to said injector pump and readily releasable screw connecting means between said casing and removable working unit.

13. A fluid injector, comprising a T-casing for connection in a pipe line at one end and at the side of the same, a closure removably attached to the other end of said T-casing and provided with a chamber therein, a rotor journalled for rotation in said casing, a shaft extending from said rotor through said closure into the chamber therein, gearing in said chamber operated by said shaft and a pump in said chamber operated by said gearing and having a discharge passage extending through said closure into the rotor containing portion of the casing.

14. A combination of the character disclosed, comprising a chambered support, a valve casing secured therein and having valved inlet and outlet at opposite ends of the same and a pump passage in the side of the same intermediate said valved inlet and outlet, a pump barrel having a yoke engaged about said valve casing and in communication with said passage in the side of said valve casing, said pump barrel having a guide extension projecting from the end of the same, a pump plunger operating in said barrel, abutment means on said pump plunger and operating over said guide extension of the pump barrel, a crank disc journalled on said support and operatively engaging said abutment means, driving means for said crank disc and means for detachably securing the yoke of the pump barrel over said valve casing.

15. In a device of the character disclosed, a casing having means for connecting the same in a pipe line to establish flow therethrough, a chamber mounted on said casing and separated from the flow passage through said casing, a rotor journalled in said flow passage, shafting extending from said rotor into the chamber mounted on said casing, a pinion on the end of said shafting within said chamber, an internal gear journalled in said chamber about said pinion and in mesh therewith, a crank pin on the back of said internal gear, a pump within said chamber over the back of said internal gear and having a plunger equipped with abutment means in engagement with said crank pin, said pump having valved inlet and discharge passages and said pump discharge passage being located at one side of said internal gear and extending from said pump chamber directly into said flow passage of the casing.

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