Dec. 5, 1961 D. F. GLOVER 3,011,196

APPARATUS FOR INJECTING CLEAN-OUT MEMBERS INTO FLOW LINES

Filed May 31, 1955 2 Sheets-Sheet 1

Fig. 1.

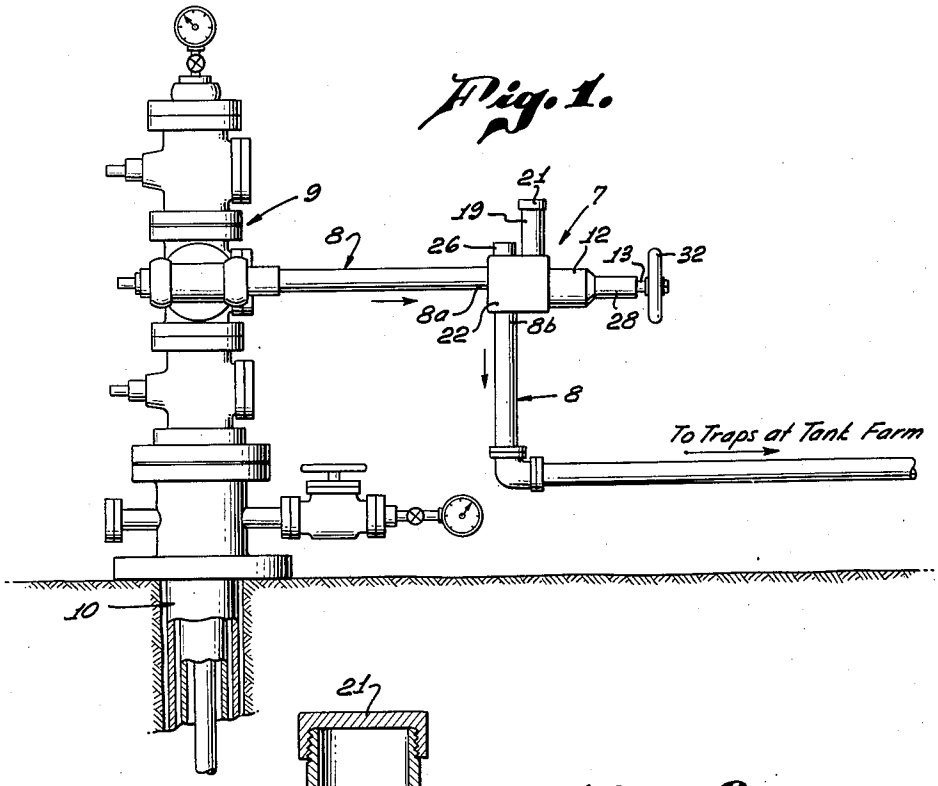
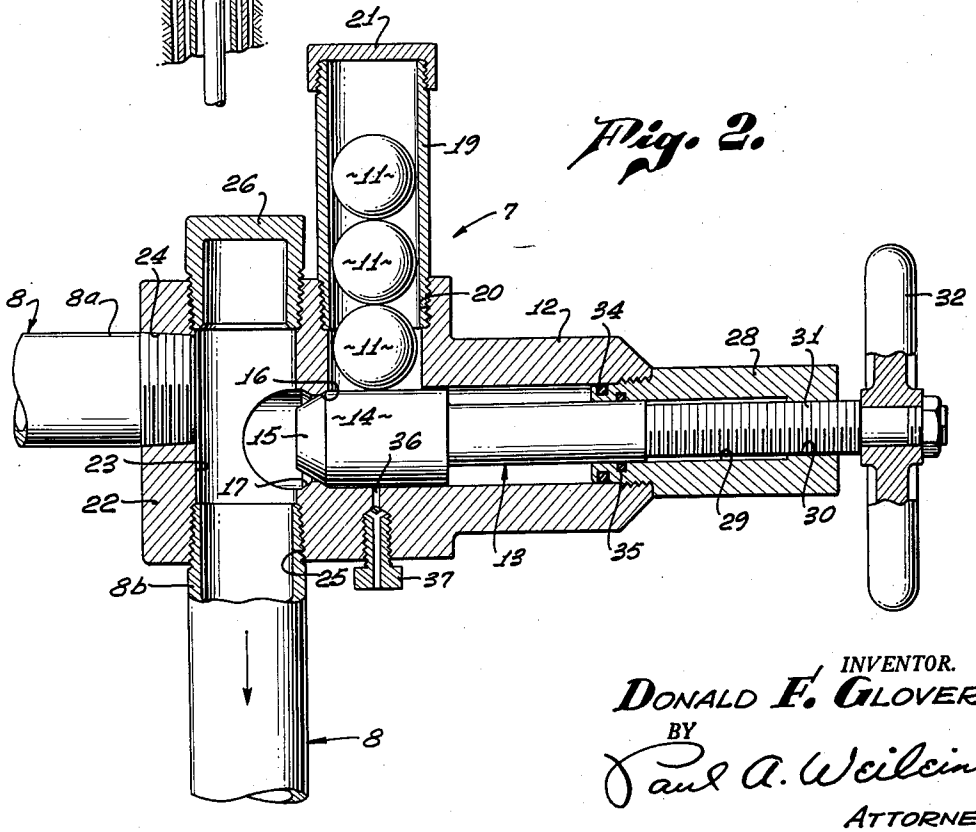


Fig. 2.



INVENTOR.
DONALD F. GLOVER,
BY
Paul A. Weilein
ATTORNEY.

Dec. 5, 1961 D. F. GLOVER 3,011,196

APPARATUS FOR INJECTING CLEAN-OUT MEMBERS INTO FLOW LINES

Filed May 31, 1955 2 Sheets-Sheet 2

Fig. 3.

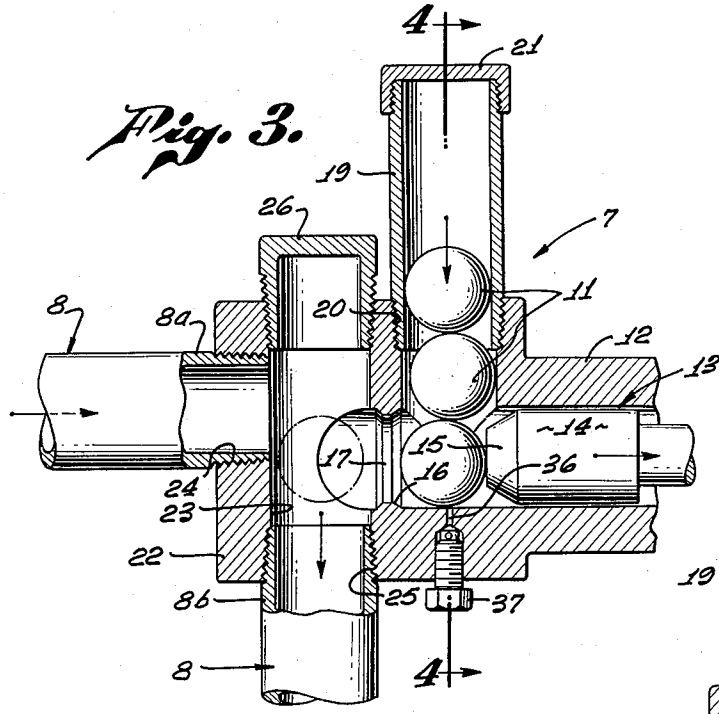


Fig. 4.

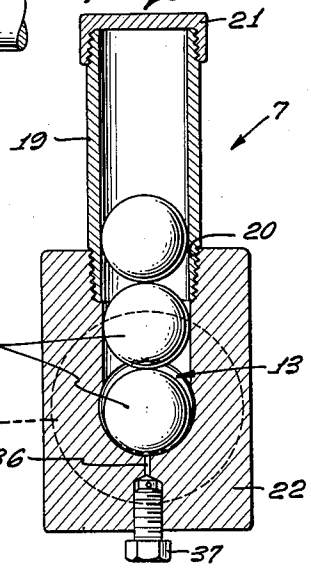
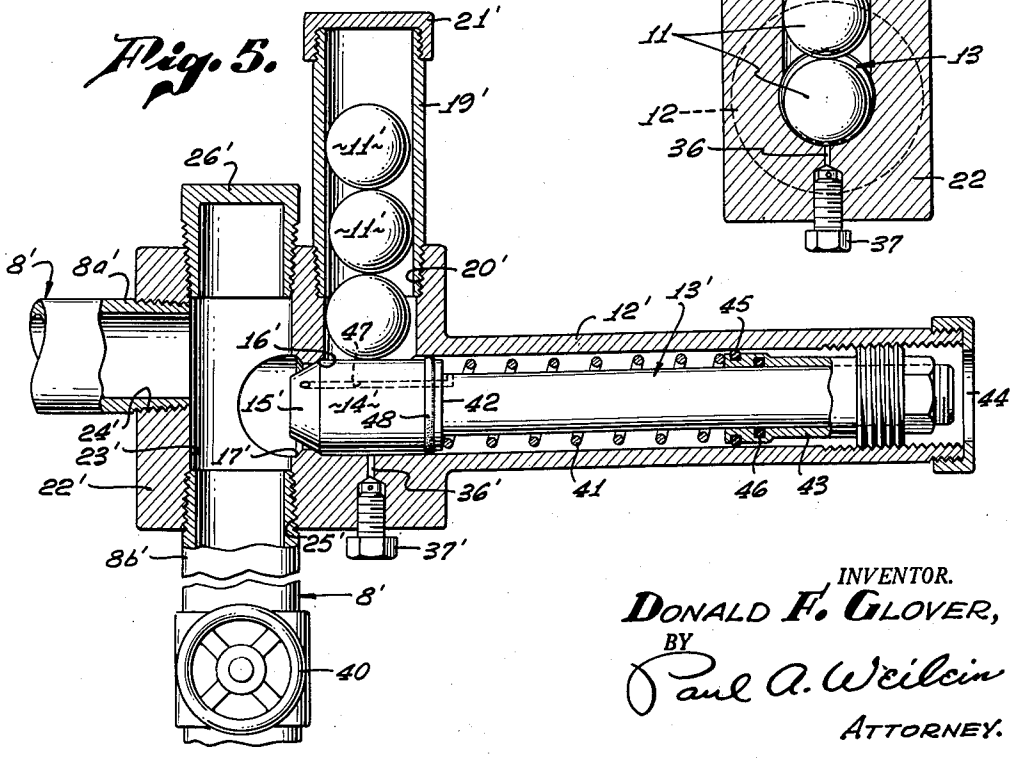


Fig. 5.



INVENTOR.
DONALD F. GLOVER,
BY
Paul A. Weilcin
ATTORNEY.

United States Patent Office

3,011,196
Patented Dec. 5, 1961

3,011,196

APPARATUS FOR INJECTING CLEAN-OUT MEMBERS INTO FLOW LINES

Donald F. Glover, 3806 Ocana, Long Beach 8, Calif.

Filed May 31, 1955, Ser. No. 512,261
11 Claims. (Cl. 15—104.06)

This invention relates to apparatus for injecting clean-out members into flow lines, particularly oil flow lines, whereby such members will be propelled by the flow of fluid so as to dislodge paraffin, wax and other deposits from the walls of such lines.

It is an object of this invention to provide injection apparatus such as described, which constitutes an improvement in this art in point of its simplicity and inexpensiveness of construction, and its facility and reliability of operation at will to effect a cleaning out of the flow line to which it is attached.

It is an additional object of this invention to provide an improved injector of the character described, which may be operated at will to inject clean-out members into the flow line with which the injector is associated, without requiring that the normal flow through the line be shut-off.

It is another object of this invention to provide an injector such as described, in which a novel magazine arrangement makes possible the storage in the injector of a plurality of clean-out members subject to being introduced one at a time into a flow line in a particularly efficacious manner at the will of an operator, thereby eliminating the reloading of the apparatus for each introduction of a clean-out member.

Another object of the present invention is the provision in an injector such as described, of a novel plunger-valve member which has the three-fold function of controlling the feed of clean-out members from the magazine into an injector barrel, moving the feed-out member from the barrel into the flow line, and of acting as a valve to facilitate reloading the magazine.

Another object of this invention is the provision of an injector of the character described, which in one form, is operated in a novel manner by the pressure in the flow line to which the injector is connected, it only being necessary to momentarily close a valve in the flow line and then open this valve to cause a clean-out member to be introduced in the flow line.

This invention possesses many other advantages and has other objects which may be made more easily apparent from a consideration of several embodiments of the invention. For this purpose there is shown two forms in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

FIG. 1 is an elevational view of an injector embodying the present invention as installed in the flow line leading from the top of an oil well;

FIG. 2 is an enlarged vertical sectional view, partly in elevation of the injector, showing it closed but ready for operation to cause a clean-out member to gravitate into position from which it may be moved into the flow line;

FIG. 3 is a view corresponding to FIG. 2, showing the injector opened and a clean-out member in position to be moved into the flow line;

FIG. 4 is a vertical sectional view, taken on the line 4—4 of FIG. 3; and

FIG. 5 is a vertical sectional view, partly in elevation, of a modified form of the invention.

As shown in FIGS. 1–4, an injector apparatus 7 embodying the present invention is connected to a flow line 8 leading from the conventional valved head 9 of an oil well designated 10, whereby clean-out members 11, in this instance in the form of balls, may be injected at will into the flow line to remove paraffin, wax and other deposits from the walls of the flow line. This is a typical installation of the injector and it is to be understood that the injector may be used in connection with any flow line where it is desired to introduce a clean-out member for dislodging deposits from the walls of such a line.

The injector apparatus 7 includes an injector barrel 12 in the bore of which a combined plunger and valve member 13 is operable to move the clean-out members 11 into the flow line 8. The plunger 13 is provided with an enlarged piston-like head 14 having a bevelled outer end 15 adapted to seat against a valve seat 16 formed at the barrel outlet end 17, which latter opens into the line 8. The purpose of this valve action will be hereinafter fully described.

In order that a plurality of the clean-out members 11 may be stored in the apparatus 7, an upright tubular magazine 19 is connected with the barrel 12. The lower end of this magazine is screwed into an inlet opening 20 in the barrel 12. The clean-out members 11 contained in the magazine are arranged to gravitate through the opening 20, one at a time, into the bore of the barrel 12. The upper end of the magazine is closed by a cap 21 removably mounted thereon, whereby the magazine may be refilled when this is required.

It should be noted that the plunger 13 serves also as a feed control means for the members 11, as when it is retracted from the valve seat 16 to the position shown in FIG. 3, the head 14 thereof is disposed past the opening 20 and allows the lowermost member 11 to drop into the barrel 12. Thereafter, upon advancing the plunger toward the valve seat 16, the member 11 will be pushed through the end 17 into the flow line 8.

The pressure of the flowing fluid will cause the member 11 to travel through the flow line. Each member 11 is dimensioned so as to dislodge during such travel, the paraffin or other deposits on the walls of the line. The paraffin or other matter thus removed, will flow out through the line into a storage tank or sump, not shown.

The barrel 12 may be connected to the flow line 8 in any suitable manner, providing the end 17 of the barrel opens into the line 8 for discharging the members 11 into the line. As here shown, an attaching head 22 integral with the barrel, has a through bore 23 therein and ports 24 and 25 in one side and at one end of the bore, respectively, for connection with sections 8*a* and 8*b* of the line 8. The other end of the bore 23 is closed by a plug 26, whereby this bore becomes in effect, a part of the flow line 8 with the open end 17 of the barrel communicated therewith.

The outer end of the bore of the barrel 12 is closed by means of a tubular plug 28, the bore 29 of which is screw threaded as at 30 for cooperation with a screw threaded portion 31 of the plunger 13. The plunger extends outwardly beyond the plug 28 and has a hand wheel 32 fixed thereto. With this arrangement, it is apparent that the hand wheel 32 is rotated to advance and retract the plunger, and that when the plunger head 14 seats against the valve seat 16 it will remain in this position until intentionally retracted. In other words, the screw threaded connection between the plunger and the plug 28 assures that the plunger will remain in any position into which it is moved in the barrel.

A sealing ring 34 is provided between the plug 28 and the barrel 12. A similar sealing ring 35 is disposed between the plunger 13 and the plug 28.

It is now apparent that it is only necessary to retract

the plunger head 14 from the valve seat 16 to a position beyond the magazine opening 20, to permit a member 11 to drop into the bore of the barrel 12 ahead of the plunger, as shown in FIG. 4. When the plunger is retracted in this manner, the fluid pressure enters the barrel 12 and magazine, as the diameter of the head 14 of the plunger is such that the fluid will flow past the head in either direction. However, the screw threaded connection between the plunger and the plug 28 makes it possible readily to advance the plunger against the pressure in the line 8 so that the member 11 will be pushed through the open end 17 of the barrel into the flow line 8. Further advance of the plunger will cause the head 14 thereof to seat against the seat 16.

When it is desired to reload the magazine 19, the plunger head 14 must be seated, as above noted, against the seat 16 to exclude flow into the barrel 12 and magazine, as the cap 21 must be removed to reload the magazine. Before removing the cap 21, any liquid trapped in the magazine and barrel is relieved to the atmosphere through a bleed port 36 in the barrel 12 controlled by a valve 37. Following this bleeding operation the cap 21 is removed and the clean-out members are dropped into the magazine, after which the cap 21 is replaced to close and seal the upper end of the magazine.

It should be noted that the members 11 are here shown as balls and as having a diameter such that each ball upon being carried along by the flowing liquid through the flow line, will dislodge deposits from the walls of the flow line. However, these members may be of any suitable shape and of any suitable material, provided they may be fed from the magazine into the barrel and may be moved into the flow line in the manner here shown, to dislodge the deposits from the walls of the flow line.

A modified form of this invention, as shown in FIG. 5, is identical in part, with the apparatus shown in FIGS. 1–4, and for this reason like parts are identified by the same reference numerals with the addition of the prime character.

This form of the invention is automatic in operation responsive to momentarily closing a valve 40 located downstream from the apparatus in the line 8', and then closing this valve, as will be hereinafter described.

The plunger 13' in the barrel 12' is arranged to be moved from seated engagement with the valve seat 16' by fluid pressure building up in the line 8' when the line valve 40 is closed. Consequently, in order to maintain the head 14' of the plunger 13' in position preventing a member 11' from dropping into the barrel 12' during normal flow through the line 8', also in order to move the plunger for forcing one of the clean out members 11' into the flow line, a spring 41 is mounted in the barrel 12'. This spring also maintains the plunger head 14' in seated position while reloading the magazine 19'. As here shown, the spring 41 is confined on the plunger between an annular shoulder 42 formed at the inner end of the head 14' of the plunger and one end of a tubular member 43 screwed into the bore of the barrel. The plunger 13' is slidable through the member 43 so that one end will extend out through the open outer end 44 of the barrel when the plunger moves away from the seat 16'. The force of the spring may be regulated by adjusting the member 43 axially in the bore of the barrel 12'. Sealing rings 45 and 46 form seals between the member 43 and the barrel and between the plunger and the member 43, respectively.

As it is desired to maintain the head 14' of the plunger 13' in a position preventing a member 11 from being fed into the barrel 12' during flow of fluid through the line 8', also to seat this head against the seat 16' during the reloading of the magazine 19', the spring 41 must have sufficient strength to resist pressure surges in the line 8'. In some instances a relatively heavy and large spring may be required due to a high flow pressure in the line 8.

The use of an extremely heavy and large spring however, may be avoided by forming a passage 47 through the plunger head 14' so that the fluid pressure will be effective against both ends of the plunger head. In such case, a sealing ring 48 is employed to form a seal between the rear end of the plunger head 14' and the wall of the bore of the barrel 12' at a point rearward of the magazine opening 20'. As here shown, the ring 48 is carried by the plunger head 14' so that in all positions of the plunger, it will form a seal between the plunger head and that portion of the wall of the bore of the barrel 12' between the opening 20' and the outer end of the barrel.

If the passage 47 and sealing ring 48 are omitted in this form of the invention, it will be seen that upon closing the valve 40, the pressure in the line 8' will build up against the free end of the plunger head 14' sufficient to overcome the force of the spring 41, thereby unseating the plunger head and moving the plunger away from the valve seat. The plunger head 14' then moves under this pressure, past the opening 20 whereby the lowermost member 11' will drop through the opening 20 into the bore of the barrel 12' ahead of the plunger head. When the plunger head 14' is unseated in this manner, the liquid under pressure will flow, due to clearance between the plunger head and the barrel, past the head and into the barrel behind the plunger head. However, this liquid will be displaced and flow out from behind the head as the plunger is forced away from the seat 16' and thus will not interfere with the desired movement of the plunger, due to the smaller effective area of the head at the annular shoulder 42 than the effective area at the outer end of the head.

After the plunger has been moved to a position permitting a member 11' to drop into the barrel, this requiring but a short time, the valve 40 is opened. The normal flow is thus resumed through the line 8 and this reduces the pressure against the plunger which therefore is urged by the spring 41 so as to move the member 11' out of the barrel into the line 8'. Following this movement of the plunger, the head 14' thereof seats against the seat 16' thereby shutting off the flow of liquid into the barrel. The spring 41 maintains the plunger head seated against the valve seat. When the plunger is seated in this manner the bleed valve 37' may be operated to relieve the pressure in the magazine 19' and barrel 12', if it is desired to reload the magazine.

When this modified form of the apparatus is provided with the passage 47 and the sealing ring 48, as shown in FIG. 5, the line pressure is developed at both ends of the plunger head 14' so that the pressure effective against the annular shoulder 42 aids the spring 41 in holding the end 15' of the head 14' against the seat 16'. Consequently, an exceptionally large and strong spring need not be used to maintain the plunger seated.

When the valve 40 is closed, the line pressure will build up against both ends of the head due to the presence of the passage 47 and sealing ring 48. However, as the effective area of the shoulder 42 on the head 14' is less than that of the outer end of the head, it is seen that the pressure building up against the outer end of the plunger will overcome the force of the spring and the pressure against the shoulder 42, thereby causing the plunger head to be unseated and move past the opening 20' so that a member 11' will drop into the barrel 12' ahead of the plunger head. The fluid behind the head 14' is displaced through the passage 47 when the plunger is moved in this manner away from the seat 16'. Upon now closing the valve 40 the pressure against the plunger head is reduced as flow through the line 8' commences, and the spring 41 becomes effective to move the plunger so that the member 11' is pushed into the flow line 8', after which the plunger head 14' seats against the valve seat 16'. When the head 14' is thus seated, the sealing ring 48 seals against the wall of the bore of the barrel 12, as shown in FIG. 5, thereby preventing the liquid which will flow through the passage 47 from pass-

ing this seal. Any fluid trapped in the magazine 19' and part of the barrel between the seal 16' and the sealing ring 48, may be relieved through the port 36' and valve 37' when it is desired to reload the magazine.

I claim:

1. Apparatus for injecting clean-out members into a flow line comprising: a barrel having means thereon providing for connection of the barrel to a flow line with one end of the barrel opening into said line; a plunger reciprocable in said barrel; means adjacent the other end of said barrel providing a fluid-tight seal with said barrel and said plunger, respectively; said barrel having an opening adjacent said one end through which a clean-out member may be introduced into the barrel between said plunger and said one end; said barrel having a valve seat at said one end; said plunger being operable to push a clean-out member through said valve seat and said one end of the barrel into said flow line and then engage said valve seat to exclude flow from the line into said barrel; said barrel having a bleed port for venting fluid to the atmosphere; and a valve controlling said bleed port.

2. Apparatus for injecting clean-out members into a flow line comprising: a barrel having means for connecting one end thereof with the flow line; a valve seat at said end of said barrel; said seat being of smaller diameter than the bore of said barrel; a plunger movable in said barrel into and from engagement with said seat; said plunger having a reduced end portion projecting beyond said seat toward the flow line when said plunger is engaged with said seat; means on the barrel providing for the introduction of a clean-out member into the barrel between said plunger and said seat; said plunger being movable to push a clean-out member through said seat and said one end preliminary to seating said reduced end portion against said seat, said barrel having a vent port for venting fluid to the atmosphere; and valve means controlling said port.

3. Apparatus for injecting clean-out members into a flow line comprising: a barrel; an attaching head integral with said barrel; said head having a through bore therein and provided with means for connecting said head to a flow line so that said bore becomes a part of said flow line; said barrel having one end opening directly into said bore; a magazine for clean-out members carried by said head and opening into said barrel; said barrel having an annular valve seat therein where said one end of the barrel opens into said bore; said seat being of less diameter than the bore of said barrel; a plunger movable in said barrel into and from engagement with said seat; said plunger having a reduced end projecting toward said bore from said seat when engaged with said seat and being operable to push a clean-out member through said seat and said one end into said bore and to then engage said seat; said barrel having a vent port from said barrel and magazine for venting fluid to the atmosphere; and valve means controlling said port.

4. Apparatus for injecting clean-out members into a flow line comprising: a barrel; an attaching head integral with said barrel; said head having a through bore therein and provided with means for connecting said head to a flow line so that said bore becomes a part of said flow line; said barrel having one end opening directly into said bore; a magazine for clean-out members carried by said head and opening into said barrel; said barrel having a valve seat therein where said one end of the barrel opens into said bore; said valve seat being of less diameter than the bore of said barrel; a plunger movable in said barrel into and from engagement with said seat; said plunger projecting toward said bore from said seat when engaged with said seat and being operable to push a clean-out member through said seat and said end into said bore and to then engage said seat; said barrel having a vent port for venting fluid to the atmosphere; valve means controlling said port; and means adjacent the other end of said barrel for forming seals with said plunger and said barrel, respectively.

5. Apparatus for injecting clean-out members into a flow line comprising: a barrel for connection to a flow line with one end of the bore of the barrel in communication with said flow line; means connected with said barrel operable for introducing a clean-out member into the bore of said barrel; a plunger movable in one direction in said bore for effecting the introduction of a clean-out member into said bore; said plunger being movable in the opposite direction for ejecting said clean-out member from said bore into said line; said plunger being movable in said one direction responsive to a fluid pressure in said line greater than the pressure developed during flow of fluid through said line; and means operable to move said plunger in said opposite direction responsive to reduction of said greater pressure in said line.

6. Apparatus for injecting clean-out members into a flow line comprising: a barrel for connection to a flow line with one end of the bore of said barrel in communication with said flow line; means connected with said barrel operable for introducing a clean-out member into the bore of said barrel; a plunger movable in one direction in said bore for effecting the introduction of a clean-out member into said bore; said plunger being movable in the opposite direction for ejecting a clean-out member from said bore into said line; said plunger being movable in said one direction responsive to a fluid pressure in said line greater than the pressure developed during flow of fluid through said line; said barrel having a valve seat in said bore adjacent said end of said bore; means operable to move said plunger in said opposite direction and against said seat responsive to reduction of said greater pressure in said line.

7. Apparatus for injecting clean-out members into a flow line comprising: a barrel for connection to a flow line with one end of the bore of said barrel in communication with said flow line; a plunger reciprocable in said bore; means operable responsive to movement of said plunger in one direction for effecting the introduction of a clean-out member into said bore; said plunger being exposed to pressure in said line and moving in said one direction responsive to a line pressure greater than that developed during flow of fluid in said line; movement of said plunger in the opposite direction causing said clean-out member to be moved out of said bore into said line; and spring means urging said plunger in said opposite direction responsive to reduction of said greater pressure in said line.

8. Apparatus for injecting clean-out members into a flow line comprising: a barrel for connection to a flow line with one end of the bore of said barrel in communication with said flow line; a plunger reciprocable in said bore; means operable responsive to movement of said plunger in one direction for effecting the introduction of a clean-out member into said bore; said plunger being exposed to pressure in said line and movable in said one direction responsive to a line pressure greater than that developed during flow of fluid in said line; movement of said plunger in the opposite direction causing said clean-out member to be moved out of said bore into said line; spring means urging said plunger in said opposite direction responsive to reduction of said greater pressure in said line; said plunger having an enlarged head; said head having a larger area exposed to line pressure on the outer end thereof than on the inner end thereof; said barrel having a valve seat in said bore adjacent said end of said bore engageable by said head; means providing for communication of said line with the portion of said bore between the inner end of said head and the outer end of said barrel; and means forming a seal between said head and the wall of said portion of said bore.

9. Apparatus for injecting clean-out members into a flow line comprising: a barrel for connection to a flow line with one end of the bore of said barrel in communi-

cation with said flow line; a plunger reciprocable in said bore; said barrel having an opening through which a clean-out member may be introduced into said bore between said plunger and said end of said bore; a magazine for containing a plurality of clean-out members; said magazine being connected with said opening for gravitationally introducing said members one at a time into said bore responsive to movement of said plunger in one direction; said plunger being movable in said one direction responsive to a fluid pressure in said line greater than the pressure developed during flow through the line; said barrel having a valve seat in said bore adjacent said end of said bore; said plunger having an enlarged head; said head having an outer end of greater area than the inner end of the head; said outer end of said head being engageable with said seat; said head having a passage therethrough for conducting fluid under pressure between said line and the portion of said bore between the inner end of said head and the outer end of said barrel; spring means in said bore for urging said plunger toward said seat responsive to reduction of said greater pressure in said line; and a sealing ring on said head for forming a seal between said head and said portion of said bore in all positions of said plunger.

10. Apparatus for injecting clean-out members into a flow line comprising: a barrel for connection to a flow line with one end of the bore of the barrel in communication with said flow line; said barrel having an opening between its ends through which a clean-out member may be introduced into the bore of the barrel; a plunger reciprocable in said bore past said opening whereby a clean-out member may be introduced into said bore and expelled from said bore into said line, respectively; said plunger being movable past said opening in one direction responsive to a fluid pressure in said line greater than the pressure developed during flow through said line; and means operable to move said plunger in the opposite direction past said opening responsive to reduction of said greater pressure.

11. Apparatus for injecting clean-out members into a flow line comprising: a barrel for connection to a flow line with one end of the bore of the barrel in communication with said flow line; said barrel having an opening between its ends through which a clean-out member may be introduced into the bore of the barrel; said barrel having a valve seat adjacent said one end of said bore; a plunger reciprocable in said bore past said opening into and from engagement with said seat to close and open said one end of said bore, respectively; said plunger when engaged with said seat being movable away from said seat past said opening responsive to a fluid pressure in said line in excess of the fluid pressure developed during flow of fluid through said line, whereby a clean-out member may be introduced through said opening into said bore; and means operable to move said plunger toward said seat so as to move said clean-out member from said bore into said line and then seat said plunger against said seat responsive to reduction of said excess pressure.

References Cited in the file of this patent

UNITED STATES PATENTS

228,950	Spencer	June 15, 1880
334,475	Shaw	Jan. 19, 1886
1,184,271	Ten Eyck	May 23, 1916
1,814,766	Oberhuber	July 14, 1931
2,278,799	Riccardi	Apr. 7, 1942
2,790,500	Jones	Apr. 30, 1957

FOREIGN PATENTS

309,344	Great Britain	June 21, 1928