

Dec. 18, 1934.

G. M. NELL

1,984,422

LIQUID INJECTING AND EJECTING APPARATUS

Filed July 11, 1931

2 Sheets-Sheet 1

Fig. 1

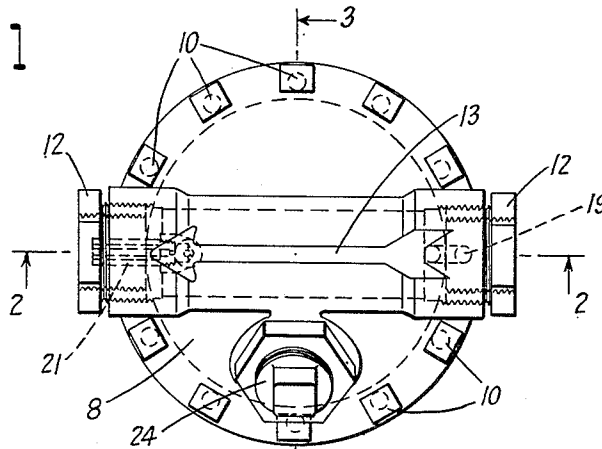


Fig. 2

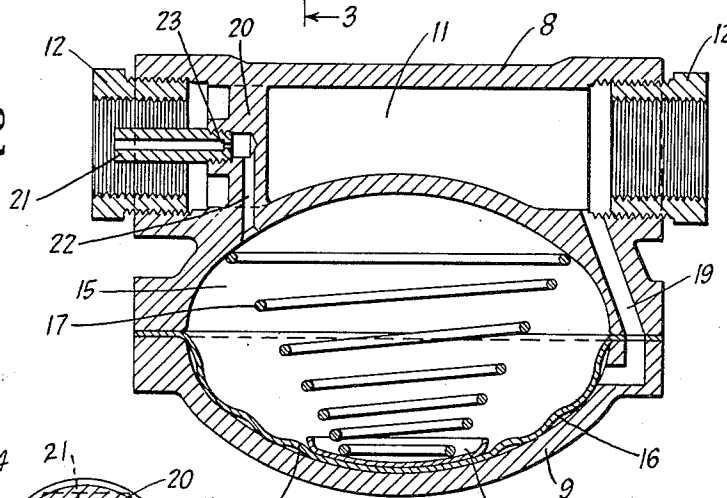
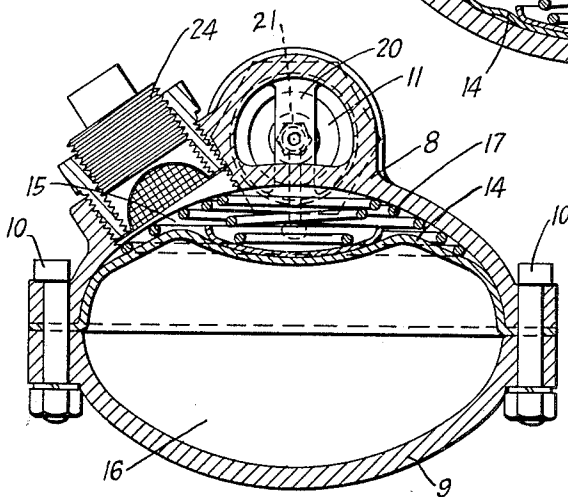


Fig. 3

INVENTOR.
Gustave M. Nell

BY

Ira L. Nickerson
ATTORNEY.

Dec. 18, 1934.

G. M. NELL

1,984,422

LIQUID INJECTING AND EJECTING APPARATUS

Filed July 11, 1931

2 Sheets-Sheet 2

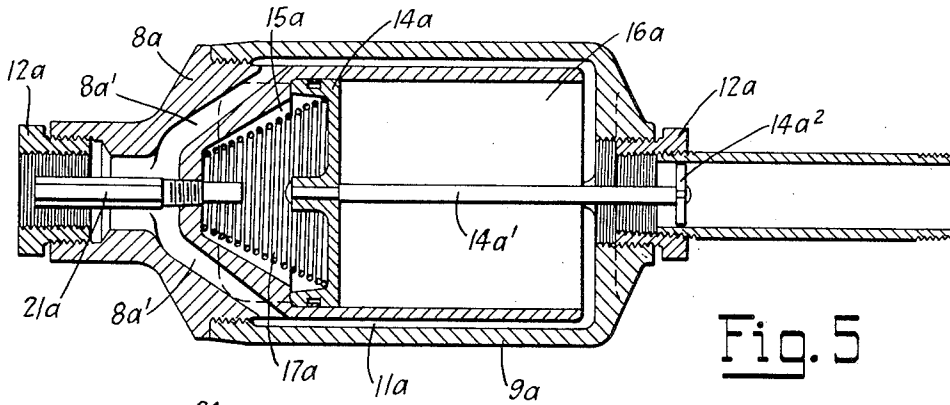


Fig. 5

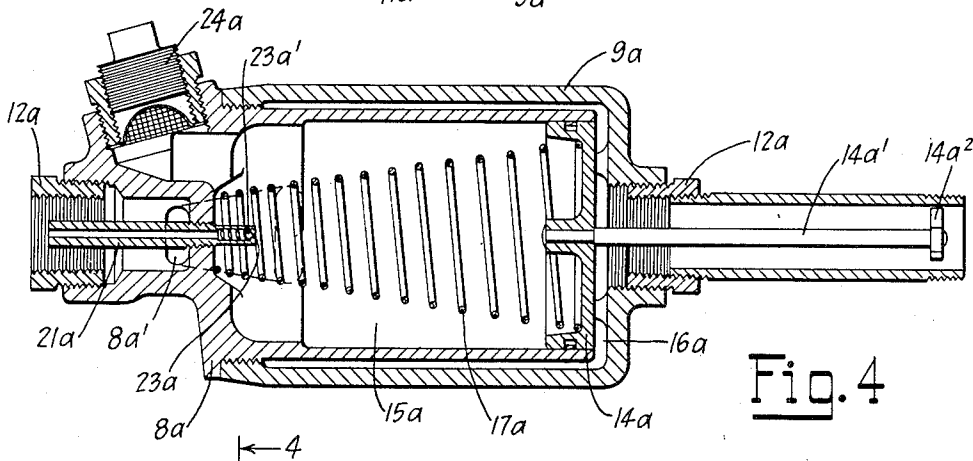


Fig. 4

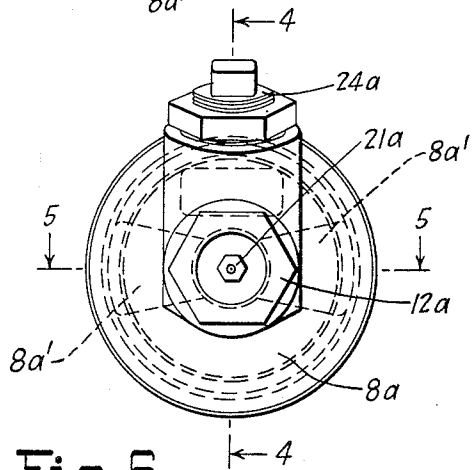
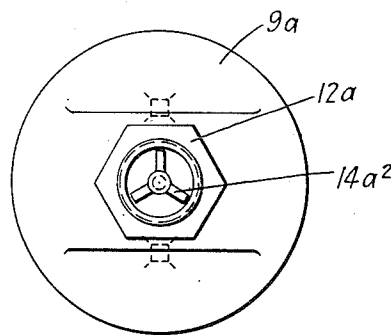


Fig. 6

Fig. 7



INVENTOR.
Gustave M. Nell

BY

Ira L. Nickerson
ATTORNEY.

UNITED STATES PATENT OFFICE

1,984,422

LIQUID INJECTING AND EJECTING
APPARATUSGustave M. Nell, Detroit, Mich., assignor to Chi-
cago Pneumatic Tool Company, New York,
N. Y., a corporation of New Jersey

Application July 11, 1931, Serial No. 550,080

8 Claims. (Cl. 184—55)

This invention relates to apparatus for effect-
ing movement of a fluid, as the injecting of a
liquid into a fluid stream under the action of the
latter. While capable of many uses and with
5 various fluids, it has been developed in its appli-
cation to the lubrication of fluid pressure oper-
ated motors, especially line oilers for rock drills.

One object of the invention is to provide fluid
injecting or ejecting apparatus and devices
10 which will function in any position. Another
object is to feed or eject the fluid in proportion
to the movement of a fluid stream. Another ob-
ject is to provide devices from which the fluid
will not leak by gravity and in general to improve
15 prior devices of the described character in the
interest of more satisfactory and efficient service.

In order to illustrate the invention concrete
embodiments thereof are disclosed in the accom-
panying drawings, in which:

20 Fig. 1 is a plan view of a line oiler;

Figs. 2 and 3 are sectional views on a slightly
enlarged scale of the line oiler shown in Fig.
1, the sections being taken on the lines 2—2 and
3—3 respectively of Fig. 1;

25 Figs. 4 and 5 are longitudinal sectional views
at right angles to one another of a modified
form of the invention, the sections being taken
on the lines 4—4 and 5—5 respectively of Fig. 6;

30 Fig. 6 is a right end elevational view of the
line oiler shown in Figs. 4 and 5; and

Fig. 7 is a right end elevational view of the
same device.

The embodiment of the invention shown in
Figs. 1 to 3 inclusive comprises a line oiler for
35 pneumatic tools made up of parts 8 and 9
generally circular in form and having flanged
portions in abutting relation clamped together
as by a series of bolts 10. Part 8 provides a mo-
tive fluid conduit 11 having connections 12 by
40 which the oiler may be connected into the
motive fluid line at any desired point. Suitable
indicia, such as arrow 13, may be applied to the
exterior of the conduit to indicate the direction
in which the motive fluid should flow. The mat-
45 ing portions of parts 8 and 9 are recessed, as
indicated in Figs. 2 and 3, to form a chamber.
A movable member, in the present instance a
flexible diaphragm 14, is disposed within the
chamber as a partition or separator to divide
50 the same into a reservoir chamber 15 and a
pressure chamber 16. Diaphragm 14 may extend
as a gasket between the flanged portions
of parts 8 and 9 and be secured in place by
bolts 10. Resilient means, such as a tapered
55 coiled spring 17, is disposed in reservoir cham-

ber 15 yieldingly to urge diaphragm member 14
to one limit of its movement. A plate 18 is
preferably interposed between spring 17 and
diaphragm 14 to protect the latter from in-
jury by the spring. Free communication be-
tween pressure chamber 16 and motive fluid
conduit 11 is established by a passage 19. To
assist the motive fluid thus admitted to pres-
sure chamber 16 to overcome spring 17 and
move diaphragm 14 to eject liquid, such as lu-
10 bricant, from reservoir chamber 15, suitable
means are provided for reducing the pressure
in the reservoir chamber. This may be accom-
plished by utilizing the principle of the Venturi
tube and of a reversed Pitot tube. To this end
15 conduit 11 is restricted at one point, as by a
cross member 20 inserted in or integral with
part 8. A nozzle 21 extends from cross mem-
ber 20 into the zone of reduced pressure created
by the latter when motive fluid is flowing
20 through conduit 11. A passage 22 extending
into cross member 20 serves to connect reser-
voir chamber 15 with nozzle 21 and the passage
is restricted at one point, as at 23, to produce
any desired regulation of the flow of lubricant
25 from chamber 15.

To put the device into operation, reservoir
chamber 15 is filled with oil by removing filler
plug 24, Figs. 1 and 3. The device is connected
into the air line so that the motive fluid will
30 flow through conduit 11 in the direction of ar-
row 13. When the throttle valve of the pneu-
matic tool to which the air line is connected is
then opened, motive fluid will flow through con-
duit 11 producing a locality or zone of reduced
35 pressure at the end of nozzle 21 as compared
with the pressure obtaining at the locality or
zone into which passage 19 opens for admitting
motive fluid to pressure chamber 16. Thus a
reduced pressure, or suction, is created in reser-
40 voir chamber 15 while a positive pressure is
created in pressure chamber 16 with the result
that the force exerted by spring 17 is overcome
and diaphragm 14 is moved upwardly reducing
the volume of reservoir chamber 15 and forcing
45 lubricant out through the connection 22, 23 lead-
ing to nozzle 21. The flow of the lubricant is
regulated by the restriction at 23, and the oil
which is forced into the motive fluid stream
50 will be carried to the pneumatic tool to lubricate
the same. When the throttle valve is closed,
the flow of motive fluid will cease and the pres-
sures in chambers 15 and 16 will become equal-
ized. Spring 17 will then force diaphragm 14 to
55 its lowermost position and movement of lubri-

cant into conduit 11 will cease. When the throttle valve is again opened motive fluid which has entered through nozzle 21 into reservoir chamber 15 will be forced back through the nozzle 5 relatively faster than the oil will move there-through mainly on account of its lesser friction. Movement of air into reservoir chamber 15 during shut-down periods may be entirely prevented, if desired, by a check valve, such as disclosed in the modification of the invention shown in Figs. 4-7 but it has been found in practice 10 in most cases that motive fluid or air leaves the chamber so rapidly that a check valve is not absolutely essential.

15 The spring 17 cooperates with the diaphragm 16 to prevent the flow of lubricant from the reservoir 15 through the nozzle 21 due to gravity alone, when the motive fluid is not flowing through the conduit. If the device shown in 20 Fig. 2 were turned upside down, or in any other position, oil could not flow through the restriction 23 unless it were forced by fluid pressure resulting from a flow of fluid through the conduit 11. As long as the air in this conduit is 25 stationary, pressures will be substantially equal at all points in the device, a slight pressure difference only resulting from gravity. If the spring 17 were omitted, then oil would leak from the reservoir through the restriction 23 and into 30 line 11 due to gravity head. Applicant's spring, however, is made strong enough to counteract the gravity head. Hence, when oil starts to flow, it will tend to produce a partial vacuum or a zone of relatively lower pressure between the oil and 35 the diaphragm as compared to the pressure in line 11 as applied at the hole 23. It will be understood that diaphragm 14, while flexible, will not stretch a great amount. Again, assuming the position of the parts to be as shown in 40 Fig. 3 and pressures equalized when air stream in 11 is stationary, it seems obvious that the spring pressure if sufficiently great will now actually suck in air at nozzle hole 23.

45 The principle employed to prevent flow of oil due to gravity head alone is generally the same as that involved in the barometer. If a bottle partially full of liquid, with a stopper having a hole of the order of, say two millimeters or less is turned upside-down the liquid 50 will stop flowing when the unit pressure above the liquid plus gravity head is approximately equal to the air pressure or unit pressure of air on the hole. When the hole is of the order of two millimeters surface tension and superficial viscosity will prevent flow even though 55 the pressure external to the hole is slightly less than that above the liquid. If for the glass bottom of the bottle we substitute a flexible diaphragm then external pressures would be 60 equalized and liquid would flow out of the hole. However by supporting the diaphragm in such manner that it cannot flex inward we would then have the same general performance as with the glass bottom. In order to be able to cause 65 oil to flow when desired, applicant makes the spring only strong enough to overcome the gravity head. Hence, while there is an approximate balance with no air flowing in the conduit, the flow of air produces sufficient difference in pressures to destroy this balance and oil flows. 70

75 In the form of the invention shown in Figs. 4-7 inclusive, the lubricator casing is formed of tubular parts 8a and 9a in telescoping relation, part 9a providing the inlet for the motive fluid and part 8a the outlet. The two parts

cooperate to provide a chamber with an open end toward the motive fluid inlet and a movable partition member, in this instance a piston 14a slidably engaging the interior of part 8a, divides the chamber into a reservoir chamber 15a and a pressure chamber 16a, the latter communicating directly and unrestrictedly with the motive fluid inlet. The telescoping portions of members 8a and 9a are in spaced relation to provide a passage 11a surrounding chambers 15a 5 and 16a, and passages 8a' in member 8a on either side of a transverse portion corresponding to cross member 20 in the first form of the invention establish a restricted connection to the outlet. Nozzle 21a projects into the zone of 15 reduced pressure in the outlet and communicates with reservoir chamber 15a through a restriction at 23a having a check valve 23a' to prevent movement of fluid therethrough into chamber 15a. A coil spring 17a yieldingly urges 20 piston 14a to the right to maintain reservoir 15a at its maximum volume and pressure chamber 16a at its minimum. To reduce the weight of the device piston 14a may be made quite short and have an extension 14a' with a three 25 point contact head 14a' engaging the rigid motive fluid conduit extending from coupling 12a to prevent angular displacement of piston 14a. Piston 14a must have a rather close fit with the interior of part 8a and the space between 30 the telescoping portions of parts 8a and 9a serves an additional purpose in preventing the chamber wall with which piston 14a has sliding contact from being dented or distorted from the shocks encountered in service. Reservoir chamber 15a is filled through an inlet opening closed 35 by a plug 24a. Although the structural arrangement is somewhat different from the form shown in Figs. 1-3, the manner of operation is identical save that on shutting down motive fluid there is no leakage of the latter back into 40 reservoir chamber 15a by reason of check valve 23a' but equalization is established by the action of spring 17a against the fluid pressure in chamber 16a.

45 From the above it will be apparent that both forms of the device will function in all positions from horizontal to upside down and in any vertical or angular position and that the differential pressure, which is made of sufficient 50 force to counteract the gravity head, will prevent the oil from running or leaking into the motive fluid line in any position in which the device is standing without motive fluid thereon or when the pneumatic tool is not running and 55 all the air pressures are equalized. In addition both forms of the device will cause oil to flow into the motive fluid line in amounts approximately proportional to the amount of air flow.

While the invention has been herein shown 60 and disclosed in what are now considered to be preferred forms, it is to be understood that the invention is not limited to the specific details thereof, but covers all changes, modifications, and adaptations within the scope of the ap- 65 pended claims.

I claim as my invention:

1. A line oiler for fluid pressure tools comprising a conduit for motive fluid, a chamber 70 adjacent said conduit, a flexible diaphragm dividing said chamber into a lubricant reservoir chamber and a motive fluid pressure chamber and sealing said chambers from each other, passages leading from the lubricant and pressure chambers respectively to spaced points 75

along said conduit adapted to have different pressures when motive fluid is flowing through said conduit, the lubricant passage being restricted, thereby requiring the application of pressure to said diaphragm for effecting egress of fluid from said reservoir into the conduit, and resilient means in said lubricant chamber and engaging the diaphragm for yieldingly urging the latter in a position of maximum size for said lubricant chamber, whereby to prevent gravity flow of lubricant through said restricted passage when motive fluid is not flowing through the conduit.

2. A liquid ejecting device having a conduit for motive fluid, means including a member extending across said conduit for providing localities of differing pressure when motive fluid is flowing therethrough, a chamber, a movable member in said chamber dividing the same into a reservoir chamber and a pressure chamber, connections from said chambers to said conduit at said localities of differing pressures to effect movement of said movable member in one direction, one of said connections comprising a restricted outlet for the liquid, and means for effecting reverse movement of said member when motive fluid is not flowing in said conduit, whereby to prevent flow of liquid through said outlet due to gravity.

3. A liquid ejecting device having a conduit for motive fluid, means including a restriction in said conduit for providing localities of differing pressure when motive fluid is flowing therethrough, a chamber, a movable member in said chamber dividing the same into a reservoir chamber and a pressure chamber, connections from said chambers to said conduit at said localities of differing pressures to effect movement of said movable member in one direction one of said connections comprising a restricted outlet for the liquid, and a spring engaging said member for effecting reverse movement of the same when motive fluid is not flowing in said conduit, whereby to prevent leakage of liquid through said outlet due to gravity.

4. In a liquid ejecting device, a casing providing a chamber, a movable separator member in said chamber dividing the same into a chamber for liquid and a chamber for pressure fluid, means urging said member in a direction to increase the volume of said liquid chamber and proportionately to decrease said pressure chamber, said casing providing a motive fluid passageway, a cross member in said passageway forming a restriction, a nozzle protruding from said member into a zone of reduced pressure when motive fluid is flowing through said passageway, a restricted connection from said nozzle to said liquid chamber, and a connection from said passageway to said pressure chamber for supplying motive fluid at substantially full pressure to the latter.

5. A liquid ejecting device comprising open ended tubular members in telescoping engage-

ment providing a chamber open at one end, the inner of said members having a portion in spaced relation to the outer of said members to provide a passage exteriorly of said chamber from the open end thereof to the opposite end of said device, a piston slidably mounted in said chamber and having a guide extension projecting through said open end, a coil spring engaging the opposite or inner side of said piston, a nozzle extending into a zone of reduced pressure in said passage at a point remote from said open end, a restricted connection from said nozzle to the closed end of said chamber, and a check valve in said connection.

6. A liquid ejecting device comprising open ended tubular members in telescoping engagement providing a chamber open at one end, the inner of said members having a portion in spaced relation to the outer of said members to provide a passage exteriorly of said chamber from the open end thereof to the opposite end of said device, a piston slidably mounted in said chamber and having a guide extension projecting through said open end, a coil spring engaging the opposite or inner side of said piston, a nozzle extending into a zone of reduced pressure in said passage at a point remote from said open end, and a restricted connection from said nozzle to the closed end of said chamber.

7. A line oiler comprising two telescoping tubular members, spaced to provide an annular passage therebetween, the inner member having an end wall closed except for a nozzle extending therethrough, the outer member having an end wall apertured to receive an inlet conduit for motive fluid, an outlet conduit surrounding the nozzle, said conduits communicating with each other through said annular passage, a piston slidable in said inner member and providing a lubricant chamber between the piston and the end wall of the inner member, said piston and inlet conduit being coaxial, and a guide secured to said piston and extending into said inlet conduit.

8. An air line oiler comprising two telescoping tubular members spaced to provide a passage therebetween, the inner member having an end wall defining one end of a lubricant chamber, the other end being defined by a piston movable in said chamber, a restricted nozzle extending from the lubricant chamber through the first-named wall and projecting into a continuation of said passage, an inlet conduit for motive fluid leading to said passage and to the piston for forcing the latter in the direction to contract the lubricant chamber as long as motive fluid is flowing through said conduit and passageway, and a spring in said lubricant chamber acting against the piston to enlarge the chamber, whereby to prevent gravity flow of lubricant through the nozzle after the motive fluid has stopped flowing.

GUSTAVE M. NEILL.