

May 2, 1950

J. L. WEBB, JR., ET AL  
DIFFERENTIAL PRESSURE INJECTOR

2,506,528

Filed April 2, 1947

Fig. 1.

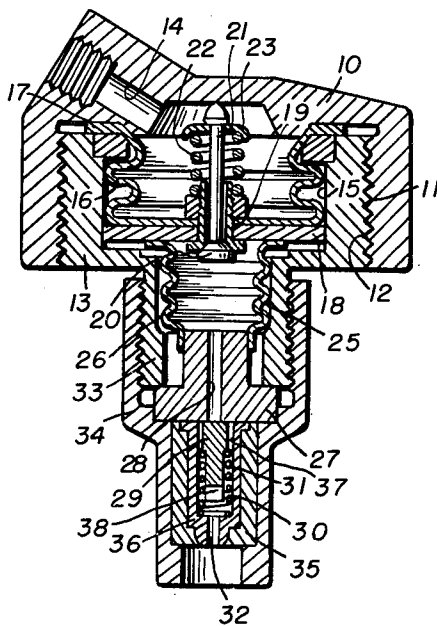


Fig. 2.

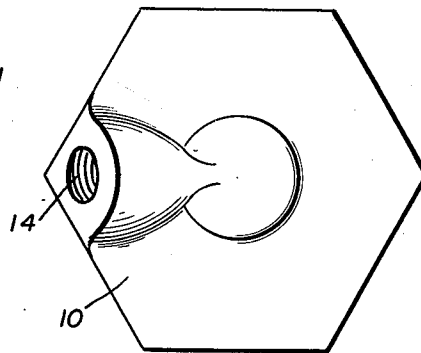
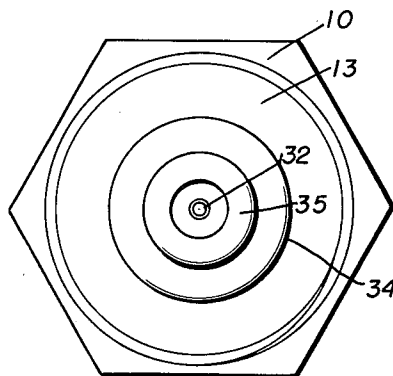


Fig. 3.



Inventors

James L. Webb, Jr.  
John J. Broderick  
Glenn E. Herz

By

*Clarence A. O'Brien*  
*and Harvey E. Jacobson*  
Attorneys

## UNITED STATES PATENT OFFICE

2,506,528

## DIFFERENTIAL PRESSURE INJECTOR

James L. Webb, Jr., Rochester, N. Y., John J. Broderick, Springfield, Mass., and Glenn E. Herz, Portland, Oreg.

Application April 2, 1947, Serial No. 738,996.

5 Claims. (Cl. 103—50)

1

This invention relates to a differential pressure injector, and more particularly to such a device adapted to be utilized in conjunction with an internal combustion engine or the like.

A primary object of this invention is the provision of an improved device for injecting a fuel charge, or water charge or the like, into the induction system, cylinders, or compression space of an internal combustion engine.

A further object of this invention is the provision of an improved device adapted to discharge a fluid under high pressure, under any circumstances where such a device is desirable.

Still another object is the provision of such a device which will be sturdy and durable in construction, reliable and efficient in operation, and relatively simple and inexpensive to manufacture and assemble.

Other objects reside in the combinations of elements, arrangements of parts, and features of construction, all as will be more fully pointed out hereinafter and disclosed in the accompanying drawings, wherein there is shown a preferred embodiment of this inventive concept.

In the drawings—

Figure 1 is a side sectional view of one form of device embodying the instant invention.

Figure 2 is a top plan view of the device shown in Figure 1, and

Figure 3 is a bottom plan view of the device in Figure 1.

Like reference numerals refer to like parts throughout the several views of the drawings.

Having reference now to the drawings, there is shown at 10 a cap or the like threaded as at 11 to engage corresponding threads 12 positioned about the periphery of a body portion 13. Cap 10 is provided with a fuel inlet 14, and the body portion 13 is provided with an interiorly positioned recess 15, within which is positioned an expansible and contractible bellows 16 having a peripheral flange 17 seated between the cap and the rim of the body 13. The bellows 17 is secured to stop member 18, which has a centrally positioned opening 19 therein within which is positioned a valve 20 provided with a valve stem 21 and surrounded by a coil spring 22 held in position by a cap 23 normally biasing the valve toward closed position. When the bellows 16 is not under pressure and is collapsed, the valve stem 21 engages the cap 10, the dimensions being properly proportional, and the valve is held thereby from its seat.

Positioned below the stop member 18 and within the body 13 is a second recess 25 of smaller

2

diameter than the recess 15, within which is positioned a second "sylphon" bellows 26, secured to stop member 18, and to the lower extremity of which is secured a plug or the like 27 having a bore 28 therethrough adapted to be closed by a valve member 29 having longitudinal peripheral grooves 37 or other means permitting passage of fluid thereby, and a valve stem 30 and normally biased into closed position as by means of a spring 31. An outlet 32 is positioned below the valve 29, and the lower end of the stem 30 is notched as at 38 to prevent closing of outlet 32 by the stem.

The portion 13 has an axial depending extension 33 upon which is screw-threaded a tubular member 34 which detachably receives in its shouldered bore an apertured nozzle supporting sleeve 35 for supporting the nozzle 36, apertured at 32.

It should be here noted that as a result of the different areas of bellows 16 and 26, a relatively low actuating pressure applied to 16 will result in a high pressure being applied to sylphon 26. It will be understood that flexible diaphragms or the like might be employed in place of the bellows shown.

The operation of the device should now be readily understandable. Fuel or other liquid charge is delivered to the fuel inlet by a suitable auxiliary pump (not shown) at suitably timed intervals in the cycle of the engine operation. This charge is delivered at relatively low pressure, into the interior of the "sylphon" bellows 16, which it may be here pointed out, is normally open to the interior of bellows 26, by reason of the fact that in contracted position the abutment of the extremity of valve stem 21 with the cap 10 serves to hold the valve 20 in open position.

As the fuel passes in to the bellows 16 and the bellows 26, the bellows 16 is expanded by the increased pressure therein, which expansion gradually closes the valve 20 and correspondingly contracts the bellows 26. Such contraction of the bellows 26 increases the pressure of the fluid charge therein, until such point that the pressure thereof is sufficient to overcome the bias of the spring 31, whereupon the valve 29 is opened and the fuel or the like permitted to pass through the outlet 32 into the cylinder or compression space of the engine.

The sequence of operations is thus as follows. At rest, or in the idle position, "sylphons" 16 and 26 are filled with a charge, with the valve 20 unseated because of the collapsed position of "sylphon" 16 (and the expanded position of bel-

3

lows 26). When a fluid is forced into bellows 16 by way of inlet 14, the bellows expands, first closing the valve 20; continued expansion now covers a contraction of bellows 26 until the resultant pressure rise therein causes valve 29 to open and the contents of 26 are thus discharged until the release of the pressure applied to bellows 16. At that time, valve 29 is closed by spring 30, siphon 26 expands and bellows 16 contracts until the idle position is reached, whereupon valve 20 is opened and fluid again flows from 16 into 26.

From the foregoing it will now be seen that there is herein provided a device which provides for a compressed high pressure discharge of a fluid, at suitably spaced intervals, the operation of which is substantially automatic, and which is adapted to recycle in such manner as to be receptive to an additional charge as the fuel is fed thereto by the pump.

It will also be seen that there is herein provided a device accomplishing all the objects of this invention and others including many advantages of great practical utility and commercial importance.

As many embodiments may be made of this inventive concept, and as many modifications may be made in the embodiment hereinbefore shown and described, it is to be understood that all matter herein is to be interpreted merely as illustrative and not in a limiting sense.

We claim:

1. An injector comprising an intake chamber, a first bellows in said chamber, an injection chamber, a second bellows in said injection chamber, a discharge valve connected to said injection chamber and adapted to receive fuel therefrom, said second bellows being of lesser diameter than said first bellows, passage means for allowing flow of fuel from said intake chamber to said injection chamber, and valve means responsive to the contraction of said first bellows for opening said passage means and responsive to the expansion of said first bellows for closing said passage means, said valve means including an apertured stop member secured to said first bellows, a valve stem in said first bellows having a portion extending through the aperture pro-

4

vided in said stop, and a valve on said extended portion.

2. The combination of claim 1 wherein said intake chamber includes a cap abutting the opposite portion of said valve stem.

3. The combination of claim 2 and a coil spring about said valve stem interposed between said cap and said stop normally biasing said valve toward a closed position.

4. An injector comprising a body having an upper recess and a lower recess in longitudinal alignment therewith, a cap closing said upper recess and having a fuel inlet therein, a first bellows in said upper recess, a second bellows in said lower recess, said second bellows being of lesser diameter than said first bellows, a discharge valve connected to said body and communicative with said lower recess, a passage interconnecting said first and second bellows, and valve means responsive to the contraction of said first bellows for opening said passage and responsive to the expansion of said first bellows for closing said passage, said valve means including an apertured stop member secured to said first bellows having a portion extending through the aperture provided in said stop, the opposite end of said stem abutting said cap, and a valve on said extended portion.

5. The combination of claim 4 and a coil spring about said valve stem interposed between said cap and said stop normally biasing said valve toward a closed position.

JAMES L. WEBB, JR.  
JOHN J. BRODERICK.  
GLENN E. HERZ.

#### REFERENCES CITED

The following references are of record in the file of this patent:

#### UNITED STATES PATENTS

| Number    | Name         | Date          |
|-----------|--------------|---------------|
| 1,580,479 | Frankenfield | Apr. 13, 1926 |

#### FOREIGN PATENTS

| Number | Country | Date         |
|--------|---------|--------------|
| 58,424 | Norway  | July 4, 1938 |