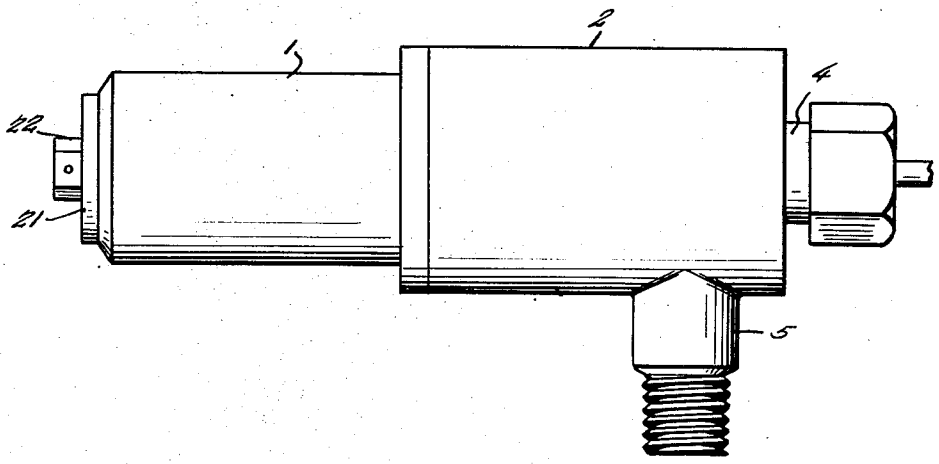
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INJECTOR NOZZLE

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Fig. 1.



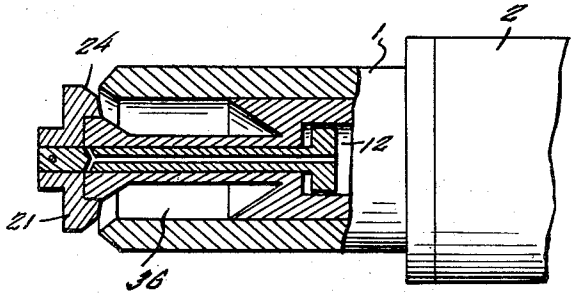


Fig. 4.

Fig. 5.

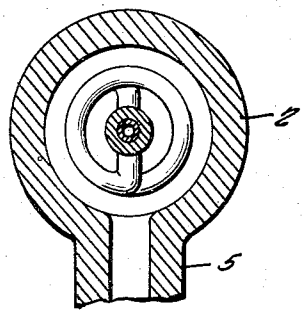
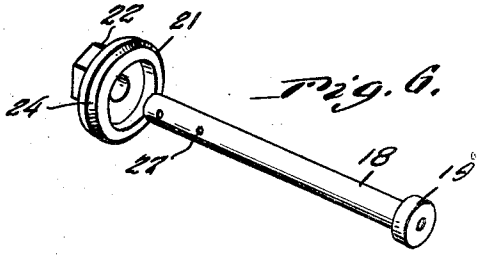


Fig. 6.



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Fig. 2.

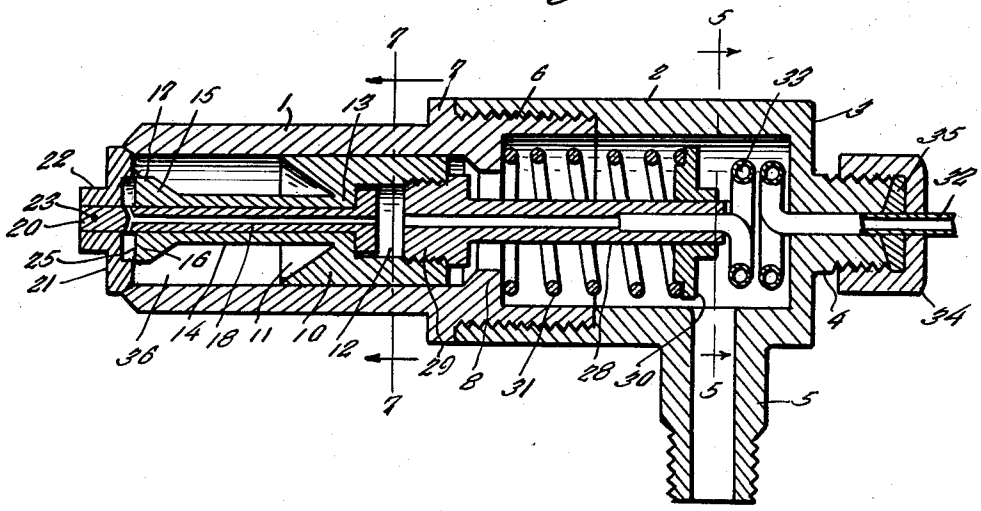
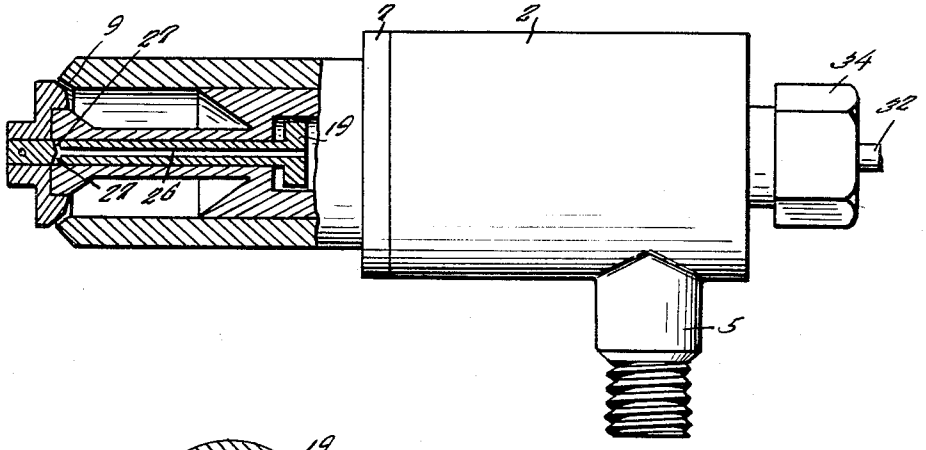


Fig. 3.



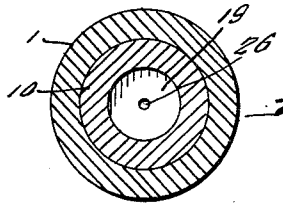


Fig. 7.

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Patented Jan. 3, 1939 2,142,973

UNITED STATES PATENT OFFICE

2,142,973

INJECTOR NOZZLE

Neal Draper, Albuquerque, N. Mex., assignor of one-half to J. W. Gaskill, Albuquerque, N. Mex.

Application February 3, 1938, Serial No. 188,570

3 Claims. (Cl. 299—107.2)

My invention relates to improvements in injector nozzles for Diesel type engines.

By way of explanation, it is well known that the Diesel type engine is still undesirable as an automobile power plant principally because of varying combustion efficiency and consequent variations in working pressure, or power, developed. This is due primarily to the fact that the spring loaded needle valve type of fuel injectors with which such engines are equipped vary in operation under different fuel pump speeds and to an extent resulting in varying spray velocities and frequently chattering of the valve with consequent pulsations in the feed of fuel. Another factor contributing to varying an inefficient combustion in such engines is that pump pressures in present day systems of fuel injection are relied upon solely to effect atomization of the fuel and such pressures are insufficient to effect complete vaporization essential to proper combustion in such engines.

Having the foregoing in mind, it is the principal object of my invention to provide an injector nozzle for Diesel type engines constructed for operation under control of energy obtained from pressure in the combustion chamber of the engine, thereby obviating the above disadvantages incident to varying pump speeds and utilizing the higher pressures obtainable in said chamber to obtain perfect vaporization of the fuel.

Other and subordinate objects are also comprehended by my invention all of which, together with the precise nature of my improvements, will be readily understood when the succeeding description and claims are read with reference to the drawings accompanying and forming part of this specification.

In said drawings:—

Figure 1 is a view in side elevation of my improved injector nozzle,

Figure 2 is a view in longitudinal vertical section, showing the parts in normal position,

Figure 3 is a view partly in side elevation and partly in longitudinal section illustrating the operation of the nozzle,

Figure 4 is a fragmentary view similar to Figure 3 further illustrating the operation of the nozzle,

Figure 5 is a view in vertical transverse section taken on the line 5—5 of Figure 2 looking in the direction indicated by the arrows,

Figure 6 is a view in perspective of the valve stem and valve the latter detached from the former, and

Figure 7 is a view in vertical transverse section taken on the line 7—7 of Figure 2 looking in the direction indicated by the arrows.

Referring to the drawings by numerals, the basic element of my improved nozzle is a tubular casing comprising a pair of relatively small and large front and rear sections 1 and 2, the latter having a closed rear end 3, an axially outwardly extending threaded nipple 4 at the rear end thereof, and a radially extending threaded nipple 5 adjacent said rear end all for a purpose presently seen.

The front section 1 is threaded at its rear end, as at 6, into the front end of the rear section 2 and provided with an external radial flange 7 adapted to bear against the front end of the rear section 2, and an internal similar flange 8 intermediate the flange 7 and the rear end of said section. The front end of the section 1 is ground to provide an internal conical valve seat 9 extending around said end.

Slidably mounted in the section 1, in front of the flange 8, is a short piston 10 having an inwardly tapering front end forming a similarly shaped chamber 11 therein, and a rear axial bore forming a rear chamber 12 therein, a central axially bored abutment wall 13 intermediate said chambers, and a small tubular axial plunger 14 extending forwardly from the wall 13 and piston 10 and terminating in an enlarged circular head 15 having a flat front face 16 and a cylindrical periphery 17. Slidably mounted in the plunger 14, and wall 13, is a tubular valve stem 18 having an enlarged circular rear end 19 loosely fitting in the chamber 12, a closed front end 20, and a disk like valve 21 fixed on said closed end 20 concentrically thereof as by a hub 22 on said valve and a pin 23 passing through said end and hub. The valve 21 has a bevelled inner edge 24 ground to fit the seat 9, and a flat bottomed, circular chamber 25 in its inner face concentric thereto and into which the head 15 of the plunger 14 is designed to fit with the outer face thereof flat against the bottom of the chamber. The valve stem 18 is bored axially from its inner end, as at 26, and provided in the chamber 25 with lateral discharge ports 27 leading from the bore 26 into said chamber.

Extending from the rear end of the piston 10, axially thereof and of the section 2, into the latter, is a tubular stem 28 having an enlarged front end 29 threaded into the chamber 12 and closing the rear end thereof and having fast on its rear end a circular follower 30 between which and the flange 8 a tension spring 31 is interposed in surrounding relation to the stem 28, said spring urg-

ing the follower 30, stem 28, piston 10, and plunger 14 rearwardly.

Suitably secured in the rear end of the stem 28 is one end of a tubular fuel feed line 32 extending slidably through the nipple 4 and having coils 33 formed therein between the stem 28 and the rear end of the section 2. A gland nut 34 threaded onto the nipple 4 with packing 35 therein forms a seal around said line for a purpose presently clear.

Referring now to the use and operation of the described invention, the nozzle is mounted in the usual manner in the engine with the valve 21 in the compression chamber of the latter, the nipple 5 is suitably connected to a hydraulic pump, and the fuel feed line 32 is suitably connected to a source of fuel supply under pressure.

In the normal position of the parts the stem 28, piston 10, plunger 14, and valve 21 are retracted by the spring 31 with the piston 10 in a position such that a chamber 36 is provided in the front end of the section 1. In this position of the piston 10 the valve 21 is seated against the seat 9 and held thereagainst by engagement of the wall 13 with the end 19 of the valve stem 18. The head 15 of the plunger 14 is withdrawn from the chamber 25 of the valve 21 sufficiently to just clear the edge of said chamber.

Before the compression stroke of the engine begins a metered quantity of fuel is passed into the chamber 25 by way of the fuel line 32, stem 28, chamber 12, valve stem 18 and ports 27. As the engine piston nearly reaches the top of the compression stroke hydraulic pressure is introduced into the section 2 by way of the nipple 5 and by action against the piston 10 causes the valve 21 to suddenly move off the seat 9 into opening position. In the meantime and prior to such opening of the valve 21 the head 15 of the plunger 14 has been driven into the chamber 25 thereby compressing the fuel in said chamber and ejecting the same around said head in the form of spray into the chamber 36. The sudden opening of the valve allows the highly compressed air in the combustion chamber to rush into the chamber 36 past the valve seat 9. This air rushing past the valve seat 9 picks up the fuel which is being sprayed out of the chamber 25, by the action of the plunger 14, and thoroughly atomizes the fuel. The rush of air into the chamber 36 causes a pressure wave within the chamber beginning at the valve seat and reaching to the back of the chamber 11, the pressure becoming greater and greater due to the impact of the air particles upon each other as they are suddenly stopped in chamber 11 where the pressure and temperature become so high that the fuel particles are instantly ignited. The pressure rises even higher after combustion begins, also the pressure wave reverses. The result is a surge of the fuel mixture toward the open end of the section 1.

The hydraulic pressure in the section 2 is now interrupted whereupon the parts are returned to normal position partially under action of the spring 31 and partially under action of pressure within the combustion chamber, said pressure acting to seat the valve 21 and force the plunger 14, piston 10 and stem 28 into retracted position until the valve is seated at which point the spring 31 completes the retraction of said plunger, piston and stem. At this point it should be explained that during forward movement of the piston 10 and plunger 14 the valve 21 is picked up by the plunger head 15 after the fuel has been ejected from the chamber 25 by said head, in the manner previously described, and opened in opposition to pressure exerted thereagainst by compression in the combustion chamber of the engine.

The invention will, it is believed, be clearly understood from the foregoing without further explanation.

Manifestly the invention, as described, is susceptible of modification without departing from the inventive concept and right is herein reserved to all such modifications falling within the scope of the subjoined claims.

What I claim is:—

1. In an injector nozzle of the class described, a cylindrical casing having a closed rear end and a circular seat in the front end thereof, a cylindrical piston dividing the casing into front and rear compartments and having a closed front end and a chambered rear end, a tubular plunger integral with the piston and extending forwardly and axially thereof, a valve stem slidably mounted in the plunger with its ends extending therefrom and having an enlarged rear end loosely fitting in the piston chamber and an axial bore therein opening into the piston chamber and terminating adjacent the front end of the stem in lateral discharge ports, a disk valve fast on the front end of the stem adapted for cooperation with the seat to close the front end of the casing and having a chambered inner face fitting around the front end of the piston plunger, means to introduce fluid into the rear compartment of the casing from a source of supply under pressure, means to tension the piston against forward movement, and means to admit fuel through the rear end of the casing into the piston chamber.

2. In an injector nozzle of the class described, a cylindrical casing having a closed rear end and a circular seat in the front end thereof, a cylindrical piston dividing the casing into front and rear compartments and having a closed front end and a chambered rear end, a tubular plunger integral with the piston and extending forwardly and axially thereof, a valve stem slidably mounted in the plunger with its ends extending therefrom and having an enlarged rear end loosely fitting in the piston chamber and an axial bore therein opening into the piston chamber and terminating adjacent the front end of the stem in lateral discharge ports, a disk valve fast on the front end of the stem adapted for cooperation with the seat to close the front end of the casing and having a chambered inner face fitting around the front end of the piston plunger, means to introduce fluid into the rear compartment of the casing from a source of supply under pressure, means to tension the piston against forward movement, and means to admit fuel through the rear end of the casing into the piston chamber, including a tubular fuel conducting stem threaded into the rear end of the piston, and a pipe line extending from said stem through said rear end and slidable therein.

3. In an injector nozzle of the class described, a cylindrical casing having a closed rear end and a circular seat in the front end thereof, a cylindrical piston dividing the casing into front and rear compartments and having a closed front end and a chambered rear end, a tubular plunger integral with the piston and extending forwardly and axially thereof, a valve stem slidably mounted in the plunger with its ends extending therefrom and having an enlarged rear end loosely fitting in the piston chamber, and an axial bore therein opening into said piston chamber and terminating adjacent the front end of the stem in lateral dis-

charge ports, a disk valve fast on the front end of the stem adapted for cooperation with the seat to close the front end of the casing and having a chambered inner face fitting around the front end of the plunger and into which said ports discharge, means to introduce fluid into the rear compartment of the casing from a source of supply under pressure, means to admit fuel to the rear end of the casing into the piston chamber including a tubular fuel conducting stem threaded into the rear end of the piston, and a pipe line extending from said stem through said rear end and slidable therein, and means to tension the piston against forward movement including a follower on the rear end of the fuel conducting stem, a flange in the casing, and a tension spring surrounding said fuel conducting stem and interposed between the follower and flange.

NEAL DRAPER.