June 11, 1963 J. C. WAGNER 3,093,310

COMPRESSION PRESSURE FUEL INJECTOR

Filed Nov. 13, 1962

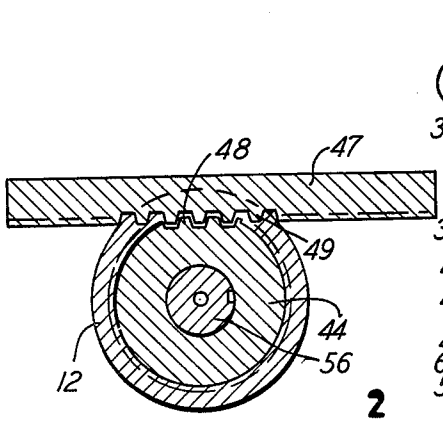


FIG. 2

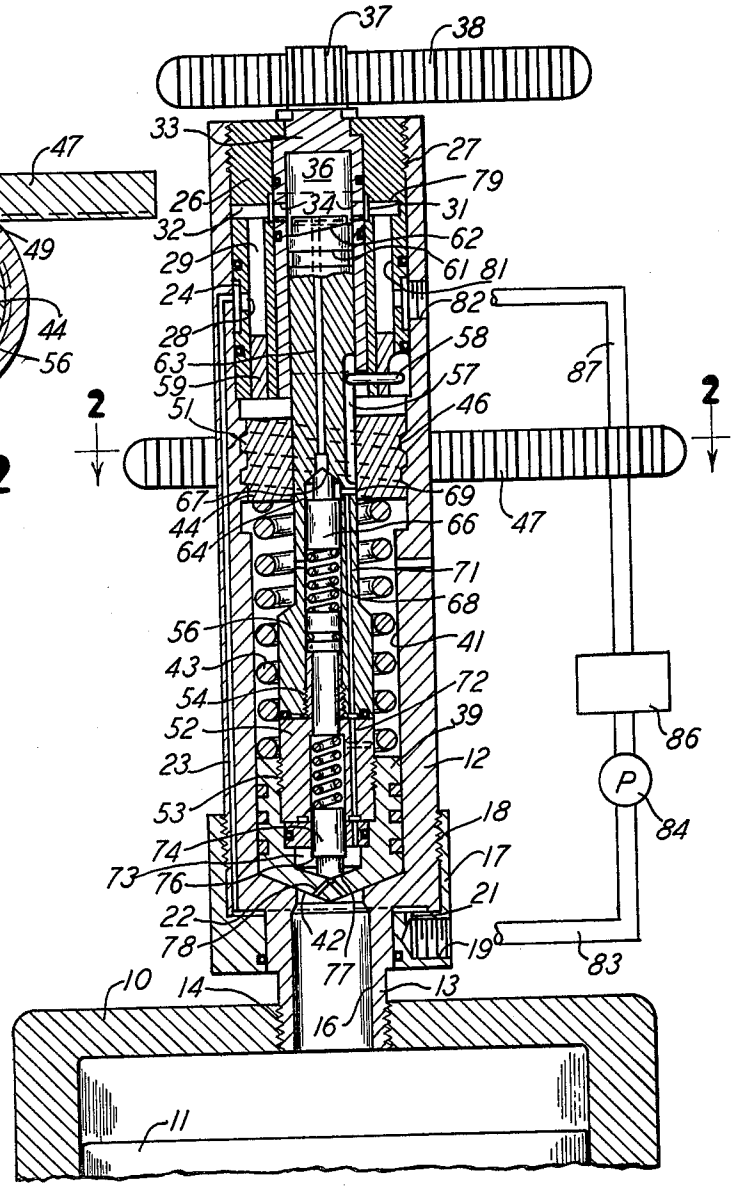


FIG. 1

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United States Patent Office 3,093,310 Patented June 11, 1963

3,093,310

COMPRESSION PRESSURE FUEL INJECTOR

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Filed Nov. 13, 1962, Ser. No. 237,164
5 Claims. (Cl. 239—87)

This invention relates to a fuel injector.

It is an object of this invention to provide a simple and inexpensive fuel injector which can be adjusted for both timing advance or delay, and for the injection of a wide variety of fuels, but to do so without the requirement of a cam means for adjusting the injector.

Still another object of this invention is to provide a fuel injector which can be adjusted to operate at optimum efficiency and economy, and to provide such injector within a minimum of mechanism, both from the manufacture and operating standpoint.

Still a further object of this invention is to provide a fuel injector which has an improved provision for permitting the injector to operate at lower temperatures than those heretofore known, and thus the injector is self cooling and of course cooler operating.

Still another object of this invention is to provide a fuel injector with an improved means for metering the fuel dispensed into the engine, and in this particular instance, the means consists of the controlled jacket closing the pump plunger so that the plunger itself need not be directly adjusted.

Thus it will be recognized that an improved fuel injector is provided in this invention, and an important feature is that the injector is not limited to a cam element and thus it is not restricted by a cam profile, and therefore the injection can be advanced or delayed, and various fuels can be used since rate and time of fuel injection can be altered, and the best setting for injection can be found for any particular fuel, and also the setting can be altered according to the engine condition of temperature and wear or the like.

Other objects and advantages will become apparent upon reading the following description in light of the accompanying drawings wherein:

FIG. 1 is a longitudinal sectional view of a preferred embodiment of an injector mounted on a fragment of an engine cylinder and showing connecting lines and a pump and reservoir diagrammatically therewith.

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1.

The injector is shown mounted on an engine cylinder 10 having the usual piston 11 disposed therein and the injector has a housing 12 with a portion 13 secured to the cylinder 10 by any conventional means, such as being threaded along the line designated 14. Thus a chamber 16 is provided in the injector housing 12 to be in communication with the interior of the cylinder 10. A housing cap 17 is threaded at 18 to the housing, and the cap contains an inlet 19 and a drilled passage 21 which communicates the inlet 19 with a groove 22 in the housing 12. The groove 22 is circular and extends around the bottom of the housing 12 and is thus available for the flow of fluid around the housing and a port 23 extends upwardly in the housing and is in communication with the groove 22 to conduct fuel therefrom. Thus the incoming fuel is passed through the housing around the injection chamber 16 and up the housing along most of the length thereof so that the fuel actually cools the injector as the fuel flows therethrough.

The port or passageway 23 is in flow communication with a circular groove 24 formed between the housing 12 and a jacket housing 26 which is secured to the injector housing in any conventional manner such as being threaded thereto along the line designated 27. The housing 26 has fuel openings 28 for the flow of fuel therethrough and into the passageway 29, and from there into the annulus 31, all in the housing 26. Still further, it will be understood that the housing 26 has an opening 32 for providing the communication between the passageway 29 and the annular chamber 31.

A fuel injector jacket 33 is rotatably disposed in the housing 26 and has two diametrically opposite openings 34 which communicate with the annulus 31. Thus the fuel is pumped into the chamber designated 36 at the interior of the jacket 33. It will also be noted that the upper end of the jacket 33 has a gear 37 integral therewith and a rack 38 meshes with the gear 37 for rotating the latter and thus correspondingly rotating the jacket 33 for a purpose described later.

Referring again to the bottom of the housing 12, it will be noted that a piston 39 is reciprocably disposed in the housing chamber 41 and the lower face 42 of the piston 39 is exposed to the chamber 16. Also, a compression coil spring 43 is disposed within the housing chamber 41 and is in abutment with the piston 39 and a spring free-load adjuster 44, which is axially movably disposed in the housing chamber 41 on the threads 46 which are provided therein as indicated. Thus of course rotation of the adjuster 44 will vary the compression of the spring 43, and therefore in turn vary the force applied on the piston 39 and against the gas pressure in the chamber 16.

To accomplish the rotation and axial displacement of the adjuster 44, a toothed rack 47 is engaged with teeth 48 by means of the rack teeth 49, so that lateral displacement of the rack 47 will of course displace the teeth 48 which are formed on the teeth designated 51 on the adjuster 44, and thus the latter is rotated to be axially displaced as desired.

A piston stem 52 is connected to the interior of the piston 39 by means of being threaded along the line 53, and the stem in turn is threaded along the line 54 to a fuel injector stem 56, which extends upwardly through the housing chamber 41. It will of course also be noted that the injector stem 56 has a keyway slot 57 which receives a pin 58 extending through the jacket housing 26, but extending through a retaining cylinder 59 which is fixed with respect to the jacket housing 26, such that the pin 58 will permit axial movement of the stem 56 and guide same, and it will also permit rotation of the jacket 33, since the latter is undercut as indicated to rotate over the fixed pin 58.

The upper end of the injector stem 56 has a groove 61 and a helix 62 provided thereon, and the latter of course extends to the internal diameter of the jacket chamber 36 as shown. It will of course also be understood that the stems 52 and 56 are axially displaceable along with the piston 39 as they are threaded thereto, and thus the helix portion 62 is slidable over the two ports 34 for governing the flow of fuel from the one port 34 or the other port 34. Further, it will be noted that an axial passageway 63 extends through the upper end of the stem 56 to a chamber 64 where a plunger 66 is disposed to seat with the lower end of the opening 63 on the line indicated 67. Also, a compression spring 68 is disposed within the stem 56 to urge the plunger 66 against the seat 67.

A passageway 69 and a port 71 extend through the lower end of the stem 56 in communication with the chamber 64, and they extend into communication with a port 72 in the stem 52. The latter in turn extends to a chamber 73, which is defined on the interior of the piston 39, and a plunger 74 is reciprocal in the stem 52, and a shoulder 76 on the plunger 74 is exposed to the fuel in the

chamber 73 and thus the plunger 74 can be raised off its seat 77 by the fuel pressure acting on the shoulder 76.

Finally, the piston 39 has ports 78 extending therethrough from the chamber 73 to permit fuel to be injected into the chamber 16.

Referring again to the upper end of the injector, it will also be noted that there is a passageway 79 extending from the annulus 31, and another passageway 81 communicates with the passageway 79, and extends into the outlet 82. Thus fuel can of course flow through the entire injector from the inlet 19 and through the port 23 and out the outlet 82, and thereby cool the injector. Still further, when the injector stem 56 is raised to where the helix portion 62 is obstructing the diametrically opposite ports 34, then the fuel will flow around the jacket 33 in the annulus 31 and thereby flow through the injector as desired.

To create the continuous flow described, it will also be noted that a fuel inlet line 83 is shown and can be connected to the inlet 19 to provide the fuel through a pump 84 and a reservoir 86, which are of course connected to the inlet line 83. Also an outlet line 87 is connected to the outlet 82 to provide the continuous circuit of flow described.

In the operation of the injector, it will therefore be understood that pressure within the cylinder 10 will unseat the piston 39 and accordingly displace the injector stem 56 which will create pressure on the fuel in the upper chamber 36. Thus the fuel will be forced downwardly through the port 63 and into the port 71 and ultimately into the chamber 73 where the plunger 74 will be unseated by the fuel and the latter will then be injected through the port 78 and into the cylinder 10 as desired. To control the timing and quantity of fuel injected, the injector adjuster 44 will of course be regulated to control the action of the piston 39 by the pressure in the cylinder 10. Also, the injector jacket 33 can be rotated to dispose the diametrically opposite openings 34 with respect to the helix 62, and thus again, the quantity of fuel forced into the port 63 will be controlled in the usual manner of fuel injector operation as far as the utilization of the helix 62 is concerned. However, the employment of the rotating jacket 33 is deemed to be novel.

While a specific embodiment of this invention has been shown and described, it will be understood that certain changes can be made in the embodiment and the invention therefore should be determined only by the scope of the appended claims.

What is claimed is:

1. A fuel injector comprising a housing having a bore therein with one side of said bore being open for admitting gas therein, a piston movably disposed in said bore and having one end seating on the opening in said one side for controlling gas flow therethrough, the other end of said piston including a circular helix surface and defining a pressure chamber in said bore, said piston having a fuel passageway extending from said pressure chamber to said opening, check valve means in said passageway for controlling fuel flow therethrough, said housing having a fuel inlet port and a fuel outlet port both in fuel-flow communication with said pressure chamber, a jacket rotatably mounted in said bore and fluid tightly disposed on said helix surface and having a port in fuel-flow communication with said pressure chamber and in the path of movement of said helix surface for altering the flow of fuel with respect to said chamber according to the rotative position of said jacket, and positive engaging means for rotating said jacket.

2. A fuel injector comprising a housing having a bore therein with one side of said bore being open for admitting gas therein, a piston movably disposed in said bore and having one end seating on the opening in said one side for controlling gas flow through said opening and being unseated by the gas pressure, means for yieldingly seating said piston, the other end of said piston including a stem and defining a pressure chamber in said bore, said stem having a bore extending therethrough in fuel-flow communication with said pressure chamber and including a check valve seat in said bore, check valve means on said valve seat for controlling fuel flow, said housing having a fuel inlet port and a fuel outlet port both in fuel-flow communication with said pressure chamber, said stem having a fuel passageway in fuel-flow communication with said bore adjacent said valve seat and by-passing a portion of said bore, said piston having a chamber and said passageway being in fuel-flow communication with said chamber, said piston having a fuel-injector opening in fuel-flow communication with said chamber, and a check valve responsive to pressure in said chamber and seating on said opening for controlling flow therethrough.

3. A fuel injector comprising a housing having a bore therein with one side of said bore being open for admitting gas therein, a piston movably disposed in said bore and having one end seating on the opening in said one side for controlling gas flow therethrough and being exposed to said gas to be unseated thereby, means in said bore for yieldingly seating said piston, the other end of said piston including an exterior helix surface and defining a pressure chamber in said bore, said piston having a fuel passageway extending from said pressure chamber to said opening, check valve means in said passageway for controlling fuel flow therethrough, said housing having a fuel inlet port and a fuel outlet port both in fuel-flow communication with said pressure chamber and with one thereof extending through said housing and having an annulus around said opening in said housing for cooling said housing by the fuel flow therethrough, a jacket rotatably mounted in said bore and fluid tightly disposed on said helix surface and having a port in fuel-flow communication with said pressure chamber and in the path of movement of said helix surface for altering the flow of fuel with respect to said chamber according to the rotative position of said jacket, and positive engaging means for rotating said jacket.

4. A fuel injector comprising a housing having a bore therein with one side of said bore being open for admitting gas therein, a piston movably disposed in said bore and having one end seating on the opening in said one side for controlling gas flow therethrough, the other end of said piston including an inclined surface on the circumference thereof and defining a pressure chamber in said bore, said piston having a fuel passageway extending from said pressure chamber to said opening, adjustable means movably disposed in said housing for yieldingly seating said piston at varying pressures, control means engaged with said adjustable means for setting the latter, check valve means in said passageway for controlling fuel flow therethrough, said housing having a fuel inlet port and a fuel outlet port both in fuel-flow communication with said pressure chamber, a jacket rotatably mounted in said bore and fluid tightly disposed on said helix surface and having a port in fuel-flow communication with said pressure chamber and in the path of movement of said helix surface for altering the flow of fuel with respect to said chamber according to the rotative position of said jacket, and gear means engaged with said jacket and exteriorly of said housing for rotating said jacket.

5. A fuel injector comprising a housing having a bore therein with one side of said bore being open for admitting gas therein, a piston movably disposed in said bore and having one end seating on the opening in said one side for controlling gas flow through said opening and being unseated by the gas pressure, adjustable means for yieldingly seating said piston, means exterior of said housing for setting said adjustable means, the other end of said piston including a stem and defining a pressure chamber in said bore, an exterior helix surface on said stem adjacent said pressure chamber, said stem having a bore extending therethrough in fuel-flow communication with said pressure chamber and including a check valve seat in said bore, check valve means on said valve seat for controlling fuel flow, said housing having a fuel inlet

port and fuel outlet port both in fuel-flow communication with said pressure chamber, a jacket rotatably mounted around said helix surface and having a fuel port in the path of movement of said surface to be controlled by said surface in fuel flow therethrough, means exterior of said housing for rotating said jacket, said stem having a fuel passageway in fuel-flow communication with said bore adjacent said valve seat and by-passing a portion of said bore, said piston having a chamber and said passageway being in fuel-flow communication with said chamber,

said piston having a fuel-injector opening in fuel-flow communication with said chamber, and a check valve responsive to pressure in said chamber and seating on said opening for controlling fuel flow therethrough.

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