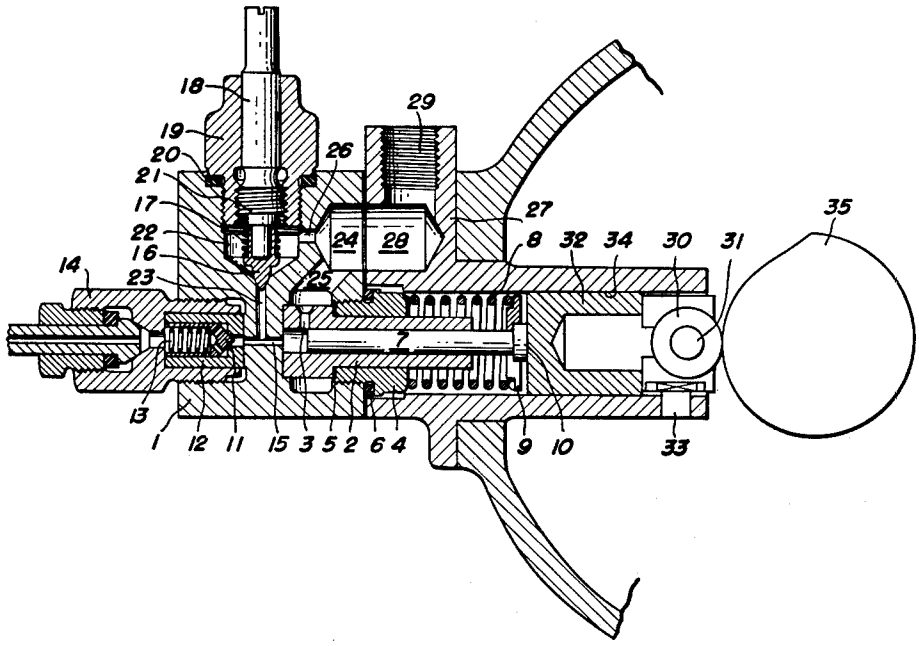
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FUEL INJECTION PUMP FOR DIESEL ENGINES

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FUEL INJECTION PUMP FOR DIESEL ENGINES

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The present invention relates to fuel injection pumps for diesel engines.

This application is a continuation-in-part of my earlier application, Serial No. 38,230 filed June 23, 1960 and now abandoned.

In conventional types of fuel injection pumps, there is provided a fuel suction valve wherein dust or dirt may be caught between the seat and the valve element rendering the fuel injection pump inoperative.

The present invention is intended to overcome such difficulty by eliminating the use of suction valves in fuel injection pumps. For this purpose, the present invention provides a fuel injection pump for a diesel engine having a barrel formed with a suction aperture so that fuel may be drawn into the barrel as the plunger moves to open said suction aperture. According to a further feature of the present invention, a control valve is provided through which excess oil is returned to a chamber provided on the suction side of the pump for the purpose of reducing pressure variations due to the excess oil returned.

The present invention is also advantageous in that it provides a fuel injection pump for a diesel engine which is simple in construction, economical in manufacture, and easy in handling.

Among the various features of the invention is the arrangement of excess fuel passages and the chambers which are provided for avoiding the transmission of pressure waves throughout the apparatus.

More particularly, as will be shown in greater detail hereinafter, there is provided a fuel delivery passageway extending from a bore in which a control rod is provided, there being further provided an excess fuel passageway extending perpendicularly away from the fuel delivery passageway and communicating with a control chamber in which is located a control valve as will be described. From this latter chamber extends a further passageway which is arranged in parallel with the fuel delivery passageway and which opens into a chamber having a cross-section and volumetric capacity such that the pressure of the excess fuel is abated. From the latter said chamber an inclined passageway leads to a fuel inlet passageway communicating at right angles with the bore of the aforesaid rod.

Other objects, features and advantages will become apparent from the following detailed description, reference being had to the accompanying drawing wherein the sole figure shows, in section, a preferred embodiment of the invention.

In the drawing which is a cross-section of a fuel injection pump according to the present invention, reference numeral 1 designates a body or casing of the fuel injection pump and numeral 2 a barrel in the casing having an aperture or freely open passageway 3 for fuel suction. Numeral 4 designates a threaded retainer for holding the barrel 2 in place within the pump casing 1 through the intermediary of packings 5 and 6. A plunger 7 is disposed for compression and suction strokes in the barrel

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2 and is provided with a collar 10. A coil spring 8 is provided to act upon the plunger 7 through a spring seat 9 resting against the collar 10 of the plunger 7.

Also provided is a fuel delivery valve 11 which in turn is provided with a valve seat member 12 and a valve spring 13. A threaded member 14 is provided for holding the seat member 12 in place on the valve casing. As shown, the delivery valve 11 with the spring 13 is accommodated in the valve seat member 12, which is mounted on the valve body 1 by the threaded member 14. A fuel oil delivery passageway 15 is provided in the valve body for communicating the fuel delivery valve 11 with a bore formed in the barrel and in which the plunger 7 operates.

Numeral 16 designates an excess oil control valve carrying a valve spring 17. The control valve 16 is provided as shown with a control rod 18 having a threaded portion 21. A control rod holder 19 has an internally threaded portion to engage with the threaded portion 21 of the control rod to hold the latter in an adjustable manner. A control valve chamber 22 is defined in the pump casing 1 around the control valve body 16, which is mounted on the control rod with the spring 17 arranged therebetween as illustrated. The control rod holder 19 is threadably fitted in the control valve chamber 22 with a packing 20 interposed between a shouldered portion of the control rod holder 19 and an adjacent portion of the pump casing 1. An excess fuel oil passageway 23 extends perpendicular from passageway 15 to communicate the oil passageway 15 as described above with the control valve 16.

Provided in the pump body 1 is a part of a chamber 24 for reducing pressure variations in communication with the suction aperture 3 formed in the barrel 2 through an inclined oil passageway 25 formed in the pump body 1. A return oil passageway 26, parallel with passageway 15, connects the control valve chamber 22 with the pressure variation reducing chamber 24.

Reference numeral 27 designates a base for mounting the fuel injection pump thereon and having formed therein the remainder of the pressure variation reducing chamber as indicated at 28. The pump base 27 has a threaded portion or fuel inlet passageway 29 for receiving a fuel suction tube (not shown) in communication with the pressure variation reducing chamber 28.

Also provided in the pump base 27 is a bore 34 in which a slider 32 is movable. The slider 32 carries a cam follower roller 30 mounted on a pin 31 carried by the slider 32. The entire slider assembly is fitted in the bore 34 in the pump base as shown. A stud 33 is provided on the pump base 27 to hold the slider 32 against rotation. A fuel cam 35 is arranged to cooperate with the follower roller 30.

In operation, as the fuel cam 35 rotates, the cam follower roller 30 is actuated by the raised portion of the cam to advance the plunger 7 through the intermediary of the slider 32 so that the suction aperture 3 in the barrel 2 is closed. Continued advance of the plunger 7 acts to compress the fuel oil confined in the delivery oil passageway 15 and the excess oil passageway 23 to drive the delivery valve 11 open thereby to feed oil to the fuel injection valve, not shown.

The control rod 18 is rotated by means of a speed governor, not shown, to move slightly upward due to threaded formation 21 on the control rod, thereby releasing the

control valve 16. As a result, the fuel oil pressure in the delivery oil passageway 15 and the excess oil passageway 23, acting on the control valve 16, causes the valve to open to allow an excess of fuel oil to flow into the control valve chamber 22 and further through the return oil passageway 26, perpendicularly connected to chamber 22, back into the pressure variation reducing chamber 24–28 coaxial with passageway 26 and at least several times greater in cross-section or diameter than the same. Since the pressure variation reducing chamber 24–28 has a cross-section at least several times greater than that of passageways 3 and 23 and a volumetric capacity far larger than the volume of the excess oil returned, the pressure of the latter is reduced and fuel is delivered at reduced pressure to the base on which plunger 7 slides.

With further continued rotation of the fuel cam 35, the plunger 7 is retracted by the force of the spring 8 through the spring seat 9 carried on the plunger 7 to open the suction aperture 3 in the barrel 2 to allow fuel oil to be drawn into the barrel.

It will be appreciated that, according to the present invention, a fuel injection pump is provided which avoids the need for a suction valve, and which is thus simple in construction, and economical in manufacture with the fuel oil pressure around the suction aperture in the barrel 2 remaining substantially at a predetermined level by the provision of a pressure variation reducing chamber irrespective of the pressure of the excess oil being returned.

Having fully described one embodiment of the invention, it will be evident that various changes in the construction and arrangement of parts may be made without exceeding the scope of the invention.

What is claimed is:

1. A fuel injection pump for a diesel engine comprising a pump body, a barrel supported in said body, said barrel being provided with a bore, a plunger slidably supported in said bore for providing suction and compression strokes in said bore, a freely open passageway being provided in the wall of said barrel at a location at which the plunger passes beyond said passageway during said suction stroke to open said passageway while during said compression stroke the plunger closes said passageway, said passageway being in communication with said bore for permitting fuel to flow into said bore during the suction stroke of said plunger, said pump body being provided with a fuel delivery passageway which extends from said bore, valve means in the fuel delivery passageway for controlling discharge of fuel from said fuel delivery passageway, said plunger, during said compression stroke, exerting pressure on fuel in said bore and said fuel delivery passage to open said valve means to permit discharge of said fuel from said fuel delivery passageway, said body being provided with an excess fuel passageway coupled to said fuel delivery passageway and with a chamber in communication with said excess fuel passageway to permit excess fuel in said fuel delivery passageway to be delivered to said chamber, said body being provided with a fuel inlet passageway opening into said chamber, said chamber being of substantial size relative to the freely open and excess fuel passageways to reduce the pressure of said excess fuel delivered to said chamber, said chamber being in communication with the first said passageway whereby said excess fuel is delivered at reduced pressure to said bore during said suction stroke, and a control valve operatively disposed between said chamber and said excess fuel passageway for regulating communication therebetween, said excess fuel passageway extending perpendicularly away from said fuel delivery passageway, said body being provided with a further chamber and further passage connecting the excess fuel passageway to the first said chamber, said control valve being located in said further chamber, said further passage being parallel to said fuel delivery passageway.

2. A fuel injection pump for a diesel engine comprising a pump body, a barrel supported in said body, said barrel being provided with a bore, a plunger slidably supported in said bore for providing suction and compression strokes in said bore, a freely open passageway being provided in the wall of said barrel at a location at which the plunger passes beyond said passageway during said suction stroke to open said passageway while during said compression stroke the plunger closes said passageway, said passageway being in communication with said bore for permitting fuel to flow into said bore during the suction stroke of said plunger, said pump body being provided with a fuel delivery passageway which extends from said bore, valve means in the fuel delivery passageway for controlling discharge of fuel from said fuel delivery passageway, said plunger, during said compression stroke, exerting pressure on fuel in said bore and said fuel delivery passage to open said valve means to permit discharge of said fuel from said fuel delivery passageway, said body being provided with an excess fuel passageway coupled to said fuel delivery passageway and with a chamber in communication with said excess fuel passageway to permit excess fuel in said fuel delivery passageway to be delivered to said chamber, said body being provided with a fuel inlet passageway opening into said chamber, said chamber being of substantial size relative to the freely open and excess fuel passageways to reduce the pressure of said excess fuel delivered to said chamber, said chamber being in communication with the first said passageway whereby said excess fuel is delivered at reduced pressure to said bore during said suction stroke, and a control valve operatively disposed between said chamber and said excess fuel passageway for regulating communication therebetween, said excess fuel passageway extending perpendicularly away from said fuel delivery passageway, said body being provided with a further chamber and further passage connecting the excess fuel passageway to the first said chamber, said control valve being located in said further chamber, said further passage being parallel to said fuel delivery passageway, the first said chamber being coaxial with said further passage and of substantially greater diameter than the same, said fuel inlet passageway extending perpendicularly into the first said chamber.

3. A fuel injection pump for a diesel engine comprising a pump body, a barrel supported in said body, said barrel being provided with a bore, a plunger slidably supported in said bore for providing suction and compression strokes in said bore, a freely open passageway being provided in the wall of said barrel at a location at which the plunger passes beyond said passageway during said suction stroke to open said passageway while during said compression stroke the plunger closes said passageway, said passageway being in communication with said bore for permitting fuel to flow into said bore during the suction stroke of said plunger, said pump body being provided with a fuel delivery passageway which extends from said bore, valve means in the fuel delivery passageway for controlling discharge of fuel from said fuel delivery passageway, said plunger, during said compression stroke, exerting pressure on fuel in said bore and said fuel delivery passage to open said valve means to permit discharge of said fuel from said fuel delivery passageway, said body being provided with an excess fuel passageway coupled to said fuel delivery passageway and with a chamber in communication with said excess fuel passageway to permit excess fuel in said fuel delivery passageway to be delivered to said chamber, said body being provided with a fuel inlet passageway opening into said chamber, said chamber being of substantial size relative to the freely open and excess fuel passageways to reduce the pressure of said excess fuel delivered to said chamber, said chamber being in communication with the first said passageway whereby said excess fuel is delivered at reduced pressure to said bore during said suction stroke, and a control valve operatively disposed between said chamber and said excess fuel passageway for regulating

communication therebetween, said excess fuel passageway extending perpendicularly away from said fuel delivery passageway, said body being provided with a further chamber and further passage connecting the excess fuel passageway to the first said chamber, said control valve being located in said further chamber, said further passage being parallel to said fuel delivery passageway, the first said chamber being coaxial with said further passage and of substantially greater diameter than the same, said fuel inlet passageway extending perpendicularly into the first

said chamber, said body being further provided with an inclined passage extending between the first said chamber and said freely open passageway.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,139,830 July 7, 1964

Toshi Umezawa

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 1 and 12, in the heading to the printed specification, line 3, for "Toshio Umezawa", each occurrence, read -- Toshi Umezawa --; in the sheet of drawing, line 1, for "TOSHIO UMEZAWA" read -- TOSHI UMEZAWA --.

Signed and sealed this 24th day of November 1964.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents