FUEL SUPPLY INSTALLATION FOR INJECTION-TYPE INTERNAL COMBUSTION ENGINES

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ABSTRACT OF THE DISCLOSURE

A fuel supply installation for an injection-type internal combustion engine in which the fuel tank is connected with the fuel injection unit by way of a fuel supply line including a fuel filter, and in which the suction space of the injection unit is connected by way of an overflow valve with the fuel return line leading back to the tank, whereby a fuel pump supplies fuel from the fuel tank to the injection unit by way of the fuel supply line; the leakage-fuel collecting line which is connected with the injection valves for the working cylinders, in turn, is operatively connected with the fuel return line by way of a connecting piece which includes an injector pump so that the fuel flowing back from the suction space of the injection pump into the tank creates a suction effect taking along the fuel in the leakage-fuel collecting line. The connecting piece itself may be formed as an integral part of the housing of the fuel filter whereby the connection for the fuel return line at the outlet side of the filter is connected with the filter space by way of a venting line.

BACKGROUND OF THE INVENTION

The present invention relates to a fuel supply installation for injection-type internal combustion engines provided with a fuel supply line between fuel tank and injection unit as well as with a fuel return line connected to the suction space of the injection pump and leading back to the fuel tank, a connecting piece for a common leakage-fuel collecting line which is arranged in the fuel return line being communication or connection with the injection valves of the working cylinders.

Such types of fuel supply installations may be equipped in an advantageous manner with only one separable connection each for the fuel supply and the fuel return between the fuel tank and the internal combustion engine and are particularly suitable therefore for the installation into driving engines for vehicles in which the assembly and disassembly of the drive unit is necessarily relatively frequently.

SUMMARY OF THE INVENTION

The aim underlying the present invention essentially resides in improving the fuel supply installation of the aforementioned type.

For this purpose, provision is made according to the present invention that the connecting piece is provided with a pump—especially with a jet or injector pump—arranged in the fuel-return line, to the suction space of which is connected the common leakage-fuel collecting line.

Significant advantages are achieved by the present invention. Fuel can no longer escape at the leakage places from the leakage-fuel collecting line in case of occurring leaks as the vacuum in the suction space of the pump counteracts this escape. The leakage-fuel lines are located in part in the cylinder head unshielded with respect to the oil spaces.
larged scale, through the fuel filter of FIGURE 1; and FIGURE 3 is a partial cross-sectional view (on a still further enlarged scale) through the connecting piece at the housing of the fuel filter provided with an injector pump in accordance with the present invention.

Referring now to the drawing wherein like reference numerals are used throughout the various views to designate like parts, reference numeral 10 designates in FIGURE 1 an injection-type internal combustion engine serving for the drive of a vehicle while reference numeral 11 designates a fuel tank secured at the vehicle frame or any suitable part of the vehicle in a conventional manner (not illustrated). Only one fuel supply line generally designated by reference numeral 12 and one fuel return line generally designated by reference numeral 13 is provided between the internal combustion engine 10 and the tank 11. Both fuel lines 12 and 13 are provided with a separable connection 12c and 13b, respectively for the installation and disassembly of the injection-type internal combustion engine 10. A fuel pump 15 of conventional construction which is arranged in the section 12a at the engine side of the fuel supply line 12 supplies the fuel through a fuel filter generally designated by reference numeral 16 to the injection equipment of conventional construction of the internal combustion engine 10. Injection lines 17 to 24 lead from the injection pump 25 to the injection valves (not shown) for the combustion spaces of the eight working cylinders of the injection-type internal combustion engine 10. Each of the injection valves is connected with a common leakage-fuel collecting line generally designated by reference numeral 26. The connecting pieces 27 to 30 in the leakage-fuel collecting line 26 for the four injection valves of one of the two cylinder rows mutually arranged in V-shape of the internal combustion engine 10 are provided with a separable connection.

The injection pump 25 is provided with a conventional fuel overflow valve 31 in communication with its suction space to which is connected the section 13a of the fuel return line 13 at the engine side.

The section of the fuel supply line 12 connecting the fuel filter 16 with the injection pump 25 is designated in FIGURE 1 by reference numeral 12a.

The fuel filter 16 is provided for purposes of connection with the fuel supply line 12 with a housing connection 32 and 33 at the inlet and outlet side thereof, respectively. As is shown in particular in FIGURE 2 and 3, the housing 34 of the fuel filter 16 is provided with a distance connecting piece 34a for the fuel return line 13 and the leakage-fuel collecting line 26. The connecting piece 34a is equipped on the one hand, with a housing connection 35 at the inlet side as well as with a housing connection 36 at the outlet side for the fuel return line 13 and, on the other with a further housing connection 37 at the inlet side for the leakage-fuel collecting line 26.

A housing channel 38 which is in communication with a venting bore 39 within the housing cover 40 of the fuel filter 16, terminates in the housing connection 36 at the outlet side for the fuel return line 13.

The housing connections 35 and 36 for the fuel return line 13 in the connecting piece 34a are connected with each other by a jet or injector pump generally designated by reference numeral 41 (FIG. 3). The mixing chamber 42 of the injector pump 41 is constituted by a housing bore 43 within the connecting piece 34a, into which projects in an injector nozzle 44. The mixing chamber 42 is in communication, on the one hand, by way of the injector nozzle 44 with the housing connection 35 at the inlet side as well as by way of a connecting channel 45 arranged coaxially to the injector nozzle 44 with the housing connection 36 at the outlet side for the fuel return line 13. On the other hand, a fuel supply line generally designated by reference numeral 46 which is disposed perpendicularly to the axis of the injector nozzle 44, terminates in the mixing chamber 42 and leads to the housing connection 37 at the inlet side for the leakage-fuel collector line 13.

OPERATION

The operation of the described fuel supply installation is as follows:

With a running injection-type internal combustion engine 10 the fuel is supplied by the pump 15 from the tank 11 by way of the fuel filter 16 to the injection pump 25. The fuel reaches the injection valves from the injection pump 25 through the injection lines 17 to 24. The excess fuel in the suction space of the injection pump 25 flows by way of the overflow valve 31 and an outlet of the connecting piece 13c to the housing connection 35 of the connecting piece 34a at the fuel filter 16.

The leakage fuel from the injection valves reaches the mixing chamber 42 by way of the connections (27 to 30) of the leakage-fuel collecting line 26 and the housing connection 37 in the connecting piece 34c. The leakage fuel is thereby taken along by the fuel flowing back into the fuel tank 11 by way of the injector nozzle 44 into the section of the return line 13 connected at 36.

Due to the sub-atmospheric pressure prevailing within the mixing chamber 42, no fuel can escape from those places where leakage might otherwise occur in the leakage-fuel collecting line 26.

With specially constructed fuel supply circulation systems, the overflow valve 31 can be omitted. The fuel pressure in the suction space of the injection pump 25 is then determined by the throttling effect of the injector pump 41. A higher pressure drop thereby occurs at the latter and the suction effect is further improved as regards line 26.

While I have shown and described one embodiment, it is understood that the same is not limited thereto but is susceptible to changes and modifications of reasonable scope without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A fuel supply installation for injection-type internal combustion engines having a fuel supply line between a fuel tank and an injection unit as well as a fuel return line connected to the suction space of the injection pump and leading back to the fuel tank, and a connecting means provided in the fuel return line for a leakage-fuel collecting line operatively connected with the injection valves of the working cylinders, wherein the improvement comprises pump means providing a sub-atmospheric pressure in the leakage-fuel collecting line for preventing escape of leakage fuel therefrom which would dilute the lubricating oil, said pump means being arranged in the fuel return line and having a suction space, the leakage-fuel collecting line being operatively connected with the suction space of said pump means, wherein said pump means is arranged within said connecting means and is an injector-type pump having a nozzle conducting the fuel from the injection pump through the motive fluid, said suction space surrounding said nozzle and being in fluid communication with said connecting line.

2. A fuel supply line according to claim 1 wherein said connecting means is in the form of a connecting piece.

3. A fuel supply line according to claim 2, further comprising fuel filter means in the fuel supply line, venting line means operatively connected with the fuel return line by way of the connecting piece of said connecting means, said filter means having a housing constructed in one piece with said connecting means.

4. A fuel supply installation according to claim 3, wherein the housing of the filter means is provided with housing connection means at the fuel return line and the inlet and outlet side, said housing connection means being operatively connected with each other by way of an injector nozzle.
5. A fuel supply installation according to claim 4, wherein a housing channel of the fuel filter means forms said venting line means, said housing channel terminating in the housing connection means for the fuel return line at the outlet side.

6. A fuel supply installation for injection-type internal combustion engines having a fuel supply line between a fuel tank and an injection unit as well as a fuel return line connected to the suction space of the injection pump and leading back to the fuel tank, and a connecting means provided in the fuel return line for a leakage-fuel collecting line operatively connected with the injection valves of the working cylinders, wherein the improvement comprises pump means arranged within said connecting means and providing a sub-atmospheric pressure in the leakage-fuel collecting line for preventing escape of leakage-fuel therefrom which would dilute the lubricating oil, said pump means being arranged in the fuel return line and having a suction space, the leakage-fuel collecting line being operatively connected with said suction space of said pump means, further comprising fuel filter means in the fuel supply line, venting line means operatively connecting said filter means with the fuel return line by way of said connecting means, said filter means having a housing constructed in one piece with said connecting means.

7. A fuel supply installation according to claim 6, wherein the housing of the filter means is provided with housing connection means for the fuel return line at the inlet and outlet side, said housing connection means being operatively connected with each other by way of an injector nozzle.

8. A fuel supply installation according to claim 7, wherein a housing channel of the fuel filter means forms said venting line means, said housing channel terminating in the housing connection means for the fuel return line at the outlet side.

9. A fuel supply installation according to claim 6, wherein a housing channel of the fuel filter means forms said venting line means, said housing channel terminating in the housing connection means for the fuel return line at the outlet side.

10. A fuel supply installation according to claim 6, wherein said pump means is arranged in said connecting means.

11. A fuel supply line according to claim 10, wherein said connecting means is in the form of a connecting piece.

12. A fuel supply line according to claim 7, wherein said pump means is an injector-type pump.

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