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LEAK-OFF FUEL COLLECTING SYSTEM FOR FUEL INJECTION ENGINES

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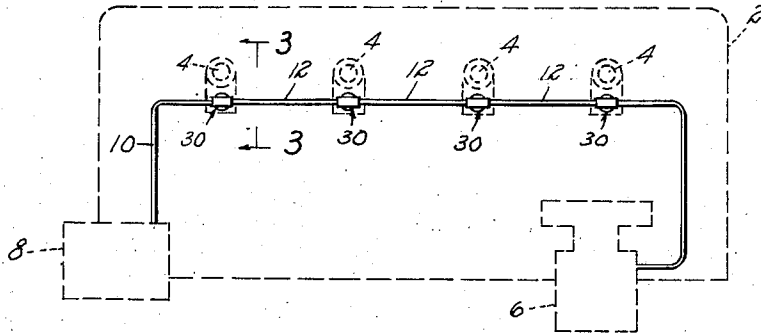


Fig. 1.

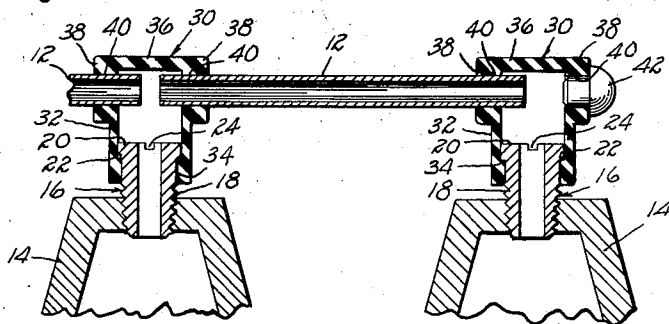


Fig. 2.

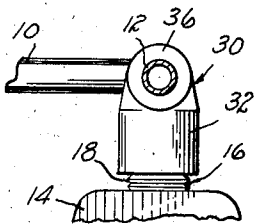


Fig. 3.

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LEAK-OFF FUEL COLLECTING SYSTEM FOR FUEL INJECTION ENGINES

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1 Claim. (Cl. 299—58)

This invention relates to improvements in fuel injection systems for internal combustion engines, and more particularly to an improved arrangement for collecting leak-off fuel from the fuel injectors and fuel pump of such injection systems.

One object of the invention is to provide a leakage fuel collection arrangement for fuel injection systems which is easy to install or remove without tools and which is adaptable for use with a variety of fuel injection systems.

Another object is to provide such a leak-off fuel collecting arrangement for fuel injection systems which is rugged and durable, yet simplified in construction and low in cost.

Another object is to provide an improved connector for use with such a leak-off fuel collecting arrangement which is cheap to make and easy to use, and which reduces the amount of metal tubing required.

Other objects will be in part obvious, and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application of which will be indicated in the appended claim.

In the drawing:

Figure 1 is a diagrammatic view of an engine and part of a fuel injection system thereof, illustrating the general arrangement of a leak-off fuel collecting system construction in accordance with the invention;

Figure 2 is an enlarged sectional view of a portion of a leak-off fuel collecting system similar to that shown in Figure 1; and

Figure 3 is a sectional view of the structure of Figure 1 taken on line 3—3 thereof.

Referring to the drawing, Figure 1 is a diagrammatic view of an engine and part of a fuel injection system of the type with which the present invention is concerned. The engine 2 has a plurality of fuel injectors 4, one for each cylinder, which are supplied with high pressure fuel by a fuel pump 6. The injectors are of the inwardly opening nozzle valve type which inherently operate with a small amount of internal leakage past the nozzle valve stem, and this leakage is collected and returned to the fuel tank 8 through a leak-off line 10 including a series of short lengths of metal tubing 12 extending between the injectors. The leak-off line 10 may also extend to the fuel pump 6 to serve as a drain and return to the fuel tank for any leakage fuel therefrom.

Turning now to the details of the leakage-collecting system, as best shown in Figure 2, the leakage in each injector 4 or in the fuel pump 6 is collected within its casing 14 and led off through a centrally bored adaptor or nipple 16. The nipple 16 has a hollow cylindrical body 18 threaded into casing 14 at one end and provided at its outer end with a centrally apertured head 20 of slightly enlarged diameter forming with the body 18

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an annular radial shoulder 22. The head of the nipple has a screw-driver slot 24 or alternatively may have wrench-engaging flats or a wrench-receiving socket to facilitate threading of the nipple into the injector or fuel pump casing 14.

Mounted on the outer end of each nipple 16 is a one-piece T-shaped connector 30 of resilient material through which the leakage fuel from the nipple may flow to the leak-off line 10. The T-connector includes a centrally bored cylindrical stem 32 dimensioned to be slipped over the head of the nipple 16 with a tight leakproof fit, and having an internal cylindrical bead or flange 34 at its lower end which tightly engages the cylindrical body 18 of the nipple and hooks under the radial shoulder 22 to prevent the connector from being inadvertently pulled off the nipple. At the top of the stem the connector is formed with a laterally extending, generally cylindrical head 36 having thickened end walls 38. The end walls have coaxial cylindrical bores 40, each dimensioned to receive with a tight sliding leakproof fit a length of metal tubing 12 forming a portion of the leak-off line 10. The connector may be made of any suitable elastomer such as Buna N base neoprene which is impervious to the fuel and capable of withstanding the temperatures encountered on the exterior of the engine, and which will not stick to the metal of the nipple or tubing.

With this arrangement all that is required to connect up the leak-off system once the nipples 16 are installed is to slide the stem 32 of a connector 30 over the head of each nipple, and then slide the ends of connecting lengths of tubing 12 into the cylindrical bores 40 of the several connectors. Conveniently the unused bore 40 of the last connector in line 10 may be closed by inserting therein a plug 42 dimensioned for a tight sliding leakproof fit. Since the resilience of each connector 30 enables it to grip the nipple and tubing with a tight sliding leakproof fit, there is no threading required in installing either the connectors or the tubing, and no flanging of the tubing is required. Thus the system may be connected up or entirely detached by hand without using any tools. Moreover, each connector may be readily twisted or bent back to facilitate inserting the ends of the lengths of tubing 12 into the bores 40 without bending the tubing, and hence relatively stiff straight pieces of tubing, of minimum length sufficient to reach from one connector to the next, may be conveniently used to form the leak-off line 10 without danger of breakage or loss of fuel.

Thus it may be seen that a leak-off fuel connecting system constructed as described may be quickly and easily installed or detached without tools, and is adaptable to a variety of engine installations. Furthermore, the system provides substantial economies both in the reduced amounts of tubing required and in the inexpensiveness of the connectors 30 themselves, and hence is substantially cheaper than prior art systems.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claim is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim:

In a leak-off fuel collecting arrangement for the fuel injection system of an internal combustion engine, a

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short projecting nipple on each fuel injector having a cylindrical body terminating at its outer end in an enlarged head forming with the cylindrical body an annular radial shoulder, said nipple having a central bore forming an outlet for leak-off fuel, a one-piece resilient T-connector having an integral cylindrical stem provided with an axial bore dimensioned to be slipped over the head of each nipple with a tight sliding leakproof fit and terminating in an inturned cylindrical bead hooked under said radial shoulder and engaging said cylindrical nipple body, said T-connector having an integral laterally extending head provided with lateral cylindrical bores at its opposite ends communicating with the bore of said

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stem, and straight sections of metal tubing joining said connectors having a greater length than the distance between the heads of the T-connectors and being dimensioned to be pushed into said lateral bores with a tight sliding leakproof fit, said T-connectors being sufficiently resilient to permit lateral flexing thereof to facilitate insertion of the ends of said tubing.

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