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(54) **Fuel injection system component.**

(57) In order to enhance fuel integrity, the fuel injectors 18 together with the associated fuel feed and return passages 22 and 24 are formed in a single block 10 which also includes the air feed passages 16 to the engine cylinders. The incorporation of all these elements into a single block means that the block can be pre-assembled and tested for fuel tightness before being built in to an engine.

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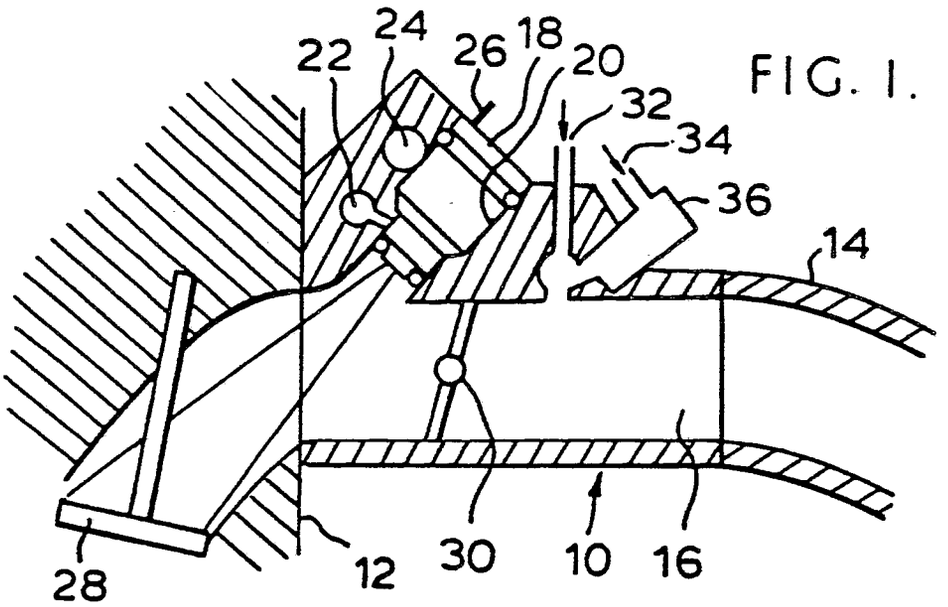


FIG. 1.

FUEL INJECTION SYSTEM COMPONENT

This invention relates to a component for a fuel injection system for use with an internal combustion engine.

It is of the utmost importance that fuel integrity (i.e. a complete absence of any leaks) is maintained in the fuel feed route to the engine combustion chambers in an internal combustion engine. Where fuel injectors are employed to introduce the fuel to the chambers, the connection of the fuel lines to the injectors needs to be carefully and effectively made. Conventionally, this connection is made through a fuel rail which carries injector cups each of which is connected to one of the injectors. The actual connection is made on the engine assembly line and then has to be tested for fuel tightness before the engine can be accepted.

It is an object of the present invention to avoid having to test the fuel line-to-injector joint for tightness during engine assembly. It is another object of the invention to reduce assembly time by preassembly of certain components.

According to the invention, there is provided a fuel injection system component adapted to interface at one side with an engine cylinder head and at another side with an air intake manifold, the component comprising a block in which a plurality of air passages extend from said one side to said another side, the block including at least one passage for each cylinder of the engine, a plurality of fuel injector seats, and fuel feed and return passages communicating with the injector seats.

The injector seats are preferably adapted to receive tip-feed injectors, and each seat may contain such an injector.

The use of tip-feed injectors is of benefit in the hot fuel handling operation of the system. This benefit is further enhanced by inclusion of the fuel inlet and return lines in the injection unit, thereby providing an efficient method of purging any gases or moisture from the system.

With this component, the fuel line connections to the individual injectors are made inside the block. The block can thus be put together off line and tested for fuel tightness before being assembled to the engine on the main assembly line. All that is then required on the assembly line is to connect fuel feed and fuel return lines to the block, and these connections can be made through connectors of a type which are simple to secure.

A conventional fuel rail includes a pressure regulator for controlling the fuel pressure in the rail. The pressure regulator may be incorporated in the block of the invention, either as a bolt-on unit, or the regulator body may be formed integrally in the block.

Where the air intake manifold has more than one tract to each cylinder, and a port deactivation system is desired to enable a tract to be connected into or out of the system, the port deactivation valve may be incorporated into the air passages through the component together with associated mechanical activation linkages.

The port deactivation valve may be in either tract of a twin inlet valve engine. There may be a single injector feeding either one or the other of the tracts, or mounted centrally between the tracts with a divided spray. The spray divider could be mounted on the injector itself, or formed as part of the block. Alternatively, there could be an injector for each tract, preferably with a balance passage between the tracts.

An idle air supply duct can be provided in the block to supply idle air to the engine independently of the air supply route employed when the engine is running under full or part load. This idle air can be supplied through an idle speed valve or motor functioning in a known manner, but the valve or motor itself can be built in to the block in the same manner as the pressure regulator. The block may also include a crankcase air inlet.

Passages are provided to communicate the idle air and crankcase emissions to the inlet port. The idle air passage and the crankcase emission passage may be independent or combined, and can be fed to primary or secondary inlet tracts. Non-return valves can be provided in the block to prevent pressure interaction between different intake ports.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic, sectional view through an injection system component in accordance with the present invention; and

Figure 2 is a plan view, partly in section, of the component of Figure 1.

The component shown comprises a block 10 which will normally be of cast metal, such as aluminium or an aluminium alloy machined to provide the necessary seats and mating faces which will be detailed later on. The block will replace the downstream end of the air intake tract 14.

The block 10 is attached to a cylinder head 12 in a conventional manner, with the interposition of a gasket which is not shown. Upstream the block is connected, again with the interposition of a gasket, to air inlet tracts 14. Tightness between the block and the cylinder head is essential to maintain fuel integrity. The joint between the block 10 and the tracts 14 will be made tight but is not crucial to the

fuel integrity, as fuel is only introduced downstream of this joint. It is however essential that the seal be air-tight to allow correct functioning of the complete inlet system.

An air passage 16 runs through the block 10. A fuel injector 18 is fitted in a seat 20 so as to communicate with a fuel feed passage 22 and a fuel return passage 24. The injector shown is a tip-feed injector which has a short overall length and can be completely housed in the seat 20 with the only projecting part being the necessary electrical connections 26. In this way, the injector can be fully sealed in the block. The injector will be positioned so as to direct injected fuel at the engine intake valve 28.

If a port deactivation system is used, the necessary valve 30 can be positioned in the passage 16. Port deactivation allows two or more tracts to be available to supply air to any one cylinder at times of peak demand, and for one or more of these tracts to be opened or closed as required for particular engine operating conditions.

A crankcase air inlet 32 (to cope with crankcase emissions) is provided in the block together with an idle air inlet 34 which is connected through an idle speed valve or motor 36. Additionally (see Figure 2), a pressure regulator for controlling the fuel pressure in the fuel return passage 24 is fitted in the passage 24. As can be seen in Figure 2, the pressure regulator comprises a housing which is formed directly in the block 10, by suitable casting or machining of a cavity in the block. A cap 38 is then fitted in the block 10 to complete the regulator. Similarly, the housing for the idle speed valve or motor 36 is formed directly in the block 10.

The block 10 can be of aluminium (or other metals) or of plastics. It is not exposed to great heat, but an insulating body should be fitted between the cylinder head 12 and the block 10 to prevent excessive heat transfer from the engine to the block 10. It may be possible for the gasket to provide this heat insulating function. The complete component can be used equally effectively with engines with one or more inlet valves per cylinder. The use of a single block allows complete preassembly and pretesting of the fuel supply connections. At the time of final engine assembly, it will only be necessary to fit fuel pipes to a block inlet 40 and a block outlet 42, and this can be done through conventional pipe unions which are unlikely to present any leakage problems. Electrical connections are required to the injectors, as are crankcase air and idle air bypass connections to the block, but none of these will interfere with fuel integrity.

Additional features which can conveniently be incorporated in the component are:

1. A potentiometer mounted as part of the port deactivation system so that the angular position of the port deactivation throttles can be used as an input to an engine management computer;

2. A temperature sensor or switch to give a fuel inlet temperature input to the engine management system.

3. A Schrader valve in the fuel inlet or return system to enable fuel pressure to be monitored for engine servicing and fault-finding.

Claims

1. A fuel injection system component adapted to interface at one side with an engine cylinder head (12) and at another side with an air intake manifold (14), characterised in that the component comprises a block (10) in which a plurality of air (16) passages extend from said one side to said another side, the block (10) including at least one passage for each cylinder of the engine, a plurality of fuel injector seats (20), and fuel feed and return passages (22,24) communicating with the injector seats (20).

2. A fuel injection system component as claimed in Claim 1, wherein the injector seats (20) are adapted to receive tip-feed injectors.

3. A fuel injection system component as claimed in Claim 2, wherein each seat (20) contains an injector.

4. A fuel injection system component as claimed in any preceding claim including a pressure regulator for controlling the pressure in the fuel return passage (24)

5. A fuel injection system component as claimed in Claim 4, wherein the pressure regulator is a bolt-on unit.

6. A fuel injection system component as claimed in Claim 4, wherein the pressure regulator has a regulator body formed integrally in the block.

7. A fuel injection system component as claimed in any preceding claim, for use in an engine installation where the air intake manifold has more than one tract, wherein a port deactivation valve (30) is incorporated into the air passages (16) through the component.

8. A fuel injection system component as claimed in any preceding claim, wherein an idle air supply duct (34) is provided in the block (10) to supply idle air to the engine independently of the air supply route employed when the engine is running under load.

9. A fuel injection system component as claimed in Claim 8, wherein the idle air is supplied through an idle speed motor (36).

10. A fuel injection system component as claimed in Claim 9, wherein the motor (36) has a housing formed integrally in the block (10)

11. A fuel injection system component as claimed in any preceding claim, wherein the block (10) also includes a crankcase air inlet (32).

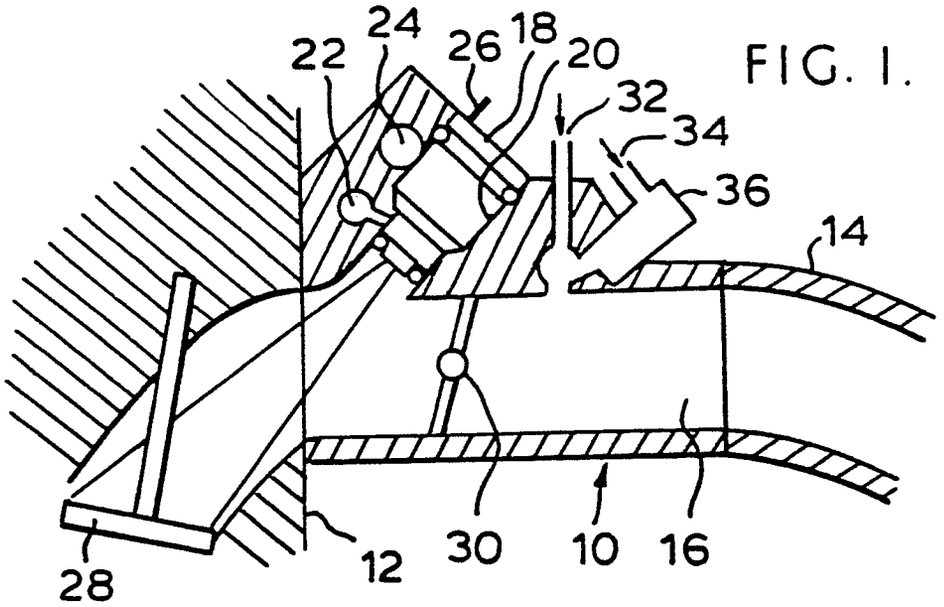

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FIG. 1.

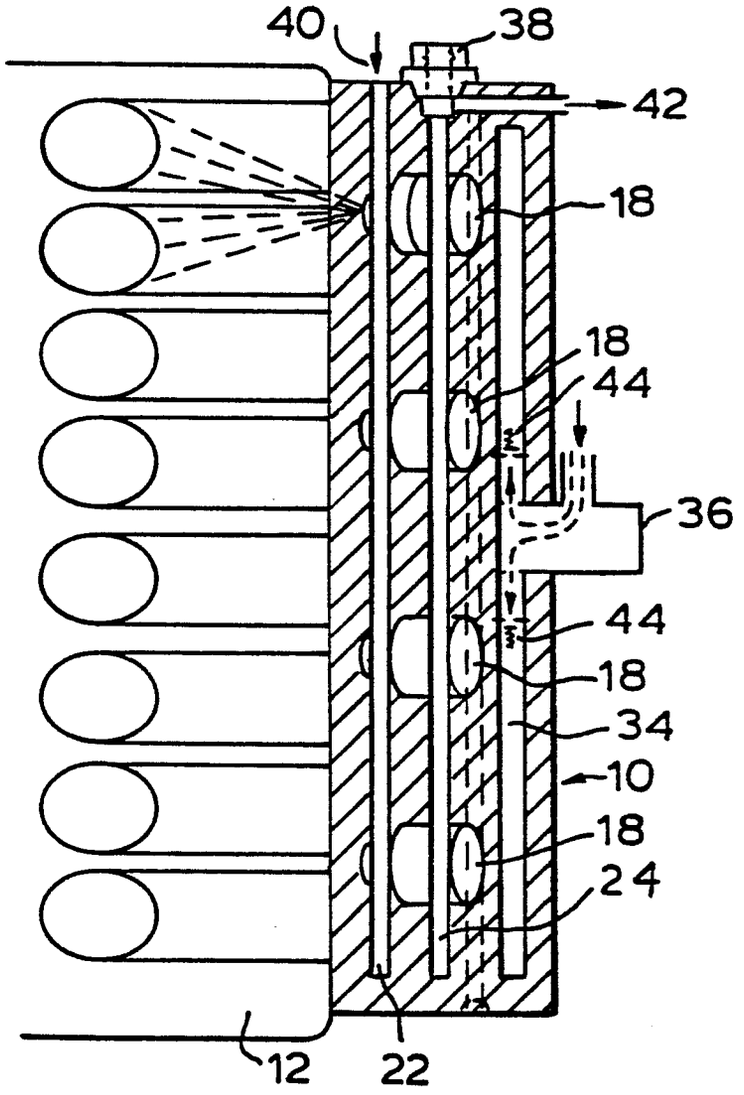

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FIG. 2.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 87 30 8114

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
P,X	EP-A-0 233 697 (GENERAL MOTORS) * page 4, line 22 - page 10, line 14; figures 1-13 *	1-5	F 02 M 55/02 F 02 D 9/02 F 02 M 61/14 F 02 M 69/00 F 02 M 69/04
A	EP-A-0 134 024 (HITACHI) * page 4, line 20 - page 5, line 15; figures 1,2,4 *	1-3,7	
A	US-A-4 512 311 (SUGIYAMA) * column 2, line 37 - column 4, line 19; figures 1-3 *	1-3,7	
A	EP-A-0 182 473 (FORD) * page 3, line 18 - page 4, line 13; figures 1-3 *	1-3,7,8	
A	DE-A-3 326 408 (GENERAL MOTORS) * page 4, line 23 - page 6, line 22; figures 1-3 *	1-5	
A	GB-A-2 074 233 (BENDIX) * page 2, lines 29-78; figures 1-4 *	1-5	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	EP-A-0 098 549 (HITACHI) * page 11, line 25 - page 12, line 22; figures 1,2,5 *	1,2,6	F 02 D 9/00 F 02 M 55/00 F 02 M 61/00 F 02 M 69/00
A	DE-A-2 940 754 (NISSAN) * page 10, line 24 - page 16, line 5; figures 5-7 *	8-10	
A	DE-A-2 543 242 (IRMSCHER) * page 3, line 1 - page 5, line 13; figures 1,2 *	1,7	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	22-11-1987	NORDSTROEM U.L.N.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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