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**(54) Connecting structure for a fuel injector high pressure fuel supply**

(57) A connecting structure for a high pressure fuel supply of a fuel injector comprises a connection member 20 including an open ended tubular receiving portion 24 having a diameter adapted to receive a fuel supply inlet of the fuel injector, an O-ring 15 being located around an end 12 of the fuel supply inlet, the O-ring 12 sealingly abutting an inner surface of the receiving portion 24, a

second sealing means 30 being provided around a second portion 14 of the fuel supply inlet, the second sealing means 30 cooperating with a further portion 26 of the connection member 20 to define an annular gallery 40, a low pressure drain port 36 being provided in a side wall of the receiving portion 20 whereby any fuel leaking past the O-ring 15 into the gallery 30 passes into the drain port 36.

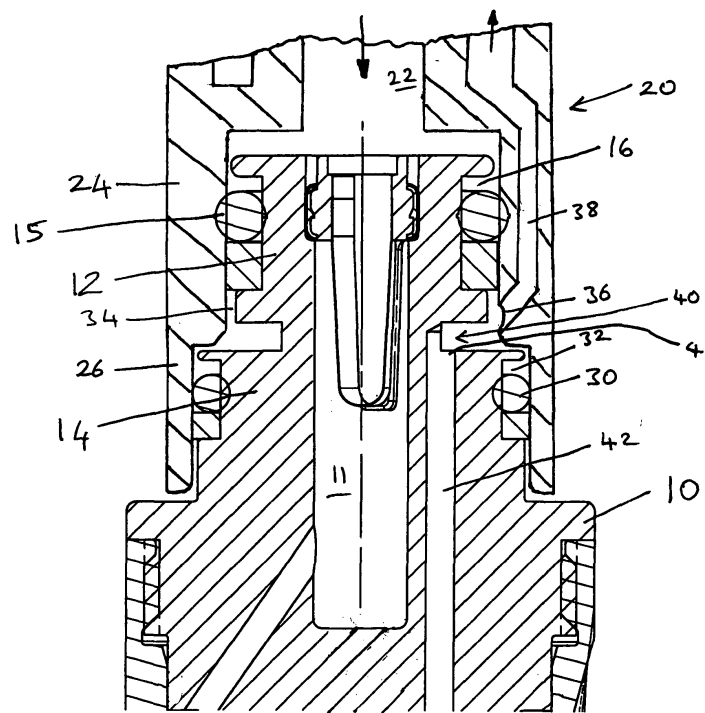


Fig. 2

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## Description

**[0001]** The present invention relates to a connecting structure for a high pressure fuel supply of a fuel injector and in particular to a connecting structure for preventing the leakage of high pressure fuel into the engine compartment.

**[0002]** As shown in Fig 1, separate fuel injectors are normally connected to a fuel supply, usually a common fuel supply rail, by means of receiving cups 1 connected to the fuel rail into which an inlet end 2 of the fuel injector 3 is inserted, a fluoropolymer O-ring 4 being provided in a seat 5 around said inlet end 2 of the injector 3 for sealing the gap between the receiving cup 1 and the injector. An axial fuel inlet 6 in the inlet end of the injector is thus connected to the fuel rail via the receiving cup 1. The fuel rail is usually bolted to the engine, trapping the injectors in their seats between the fuel rail and the engine and thus securing the receiving cups 1 mounted on the fuel rail onto the injectors 3.

**[0003]** Modern high pressure fuel injection systems typically have a fuel supply pressure of up to 200 bar. Thus any damage to the O-ring can lead to a leakage of fuel past the O-ring and out into the engine compartment due to the large pressure differential on either side of the O-ring.

**[0004]** Greater attention to avoiding fuel leaks, particularly fuel vapour, is also required to meet ever stricter hydrocarbon emission limits for vehicles.

**[0005]** According to the present invention there is provided a connecting structure for a high pressure fuel supply of a fuel injector comprising a connection member including an open ended tubular receiving portion communicating with source of high pressure fuel, preferably via a fuel rail and/or fuel supply pipe, the receiving portion being configured to receive a fuel supply inlet of the fuel injector, the fuel supply inlet having an axially arranged fuel inlet port communicating with a spray nozzle of the fuel injector via a selectively operable valve means, an annular sealing ring being locatable around a first peripheral region of the fuel supply inlet at or adjacent a distal end of the fuel supply inlet, the sealing ring being adapted to sealingly abut an inner surface of said receiving portion when the fuel supply inlet is inserted into the receiving portion, a second sealing means being provided around a second peripheral region of the fuel supply inlet axially spaced from said distal end of the fuel supply inlet, the second sealing means cooperating with a further portion of said connection member to define a closed annular space between said first and second peripheral regions, a low pressure return or drain port being provided in a side wall of the receiving portion, whereby any fuel leaking past the annular sealing ring into said closed annular space passes into the drain port.

**[0006]** Preferably the first peripheral portion is provided on a first region of the supply inlet and the second peripheral portion is provided on a second region of the supply inlet, the diameter of the second region being

greater than the diameter of the first region.

**[0007]** A fuel return port may be provided in a side region of the fuel supply inlet between said first and second peripheral regions communicating with a fuel return passage of the fuel injector. Preferably the fuel return port is provided at the juncture between first and second regions of the fuel supply inlet. Preferably the fuel return port opens into an annular recess between said first and second regions.

**[0008]** In one embodiment the second sealing means comprises a further annular sealing ring.

**[0009]** In an alternative embodiment the second sealing means comprises a threaded portion co-operable with a corresponding threaded portion on said second peripheral region of the fuel supply inlet.

**[0010]** The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig 2 is a sectional view of a connecting structure of a fuel injector assembly according to a first embodiment of the present invention, and;

Fig 3 is a sectional view of a connecting structure of a fuel injector assembly according to a second embodiment of the present invention.

**[0011]** In the first embodiment of the present invention, as illustrated in Fig 2, the fuel injector comprises an injector body 10 having a fuel supply inlet 11 connected to a fuel rail via a tubular receiving cup 20 having an axial fuel supply passageway 22 supplying fuel to an inlet port 11 of the fuel supply inlet.

**[0012]** The receiving cup 20 comprises a first receiving portion 24 having a first diameter for receiving a distal end portion 12 of the fuel supply inlet and a second or outer receiving portion 26 of a second diameter, greater than said first diameter, for receiving a further or inner portion 14 of the fuel supply inlet.

**[0013]** A first fluoropolymer O-ring 15 is located in an annular recessed seat 16 around the periphery of the end portion 12 of the fuel supply inlet. The first O-ring 15 is dimensioned to provide a fluid tight seal between the first receiving portion 24 and the end portion 12 of the injector to resist leakage of high pressure fuel between the injector body 10 and the receiving cup 20.

**[0014]** A further fluoropolymer O-ring 30 is provided in an annular recessed seat 32 around the periphery of the inner portion 14 of the fuel supply inlet, such further O-ring 30 being dimensioned to provide a fluid tight seal between the inner portion 14 of the fuel supply inlet and the second receiving portion 26 of the receiving cup 20. The first O-ring 15 and the further O-ring 30 define between them an annular space 34. A drain port 36 is provided in a side wall of the receiving cup 20, said drain port 36 communicating with said annular space 34 to provide a drain for any fuel that may leak past the first O-ring 15. The drain port 36 communicates with a pas-

sageway 38 that may be connected to a suitable collection vessel or to a return line to the inlet of the high pressure fuel pump. Thus any leakage of fuel from the high pressure side of the first O-ring 15 is prevented from escaping to the receiving cup 20 into the engine compartment.

**[0015]** An annular recess 40 is provided in the fuel supply inlet between the end portion 12 and inner portion 14 of the fuel supply inlet. A return line 42 of the injector communicates with the annular recess 40 via a port 41 to enable fuel from the return line 42 to pass into the drain port 26 and associated passageway 38 of the receiving cup 20.

**[0016]** A second embodiment of the present invention is shown in Fig. 3. Most of the components of the second embodiment are identical to those of the first embodiment and thus need not be described in more detail. However, in the second embodiment, the further O-ring has been replaced by a threaded portion 50 provided around the periphery of the inner portion 14 of the fuel supply inlet, said threaded portion 50 being cooperable with a corresponding threaded portion 52 on the outer receiving portion 26 of the receiving cup 20 to secure the receiving cup onto the injector body 10, and a flat or conical metal to metal sealing abutment 54 between cooperating faces formed respectively on the receiving cup 20 and the injector body 10. Another option is to use a nut pressing the receiving cup onto a metal to metal seal between receiving cup 20 and the injector body 10.

**[0017]** Such arrangement may be preferred where further securing means are required to hold the receiving cup 20 onto the injector body 10.

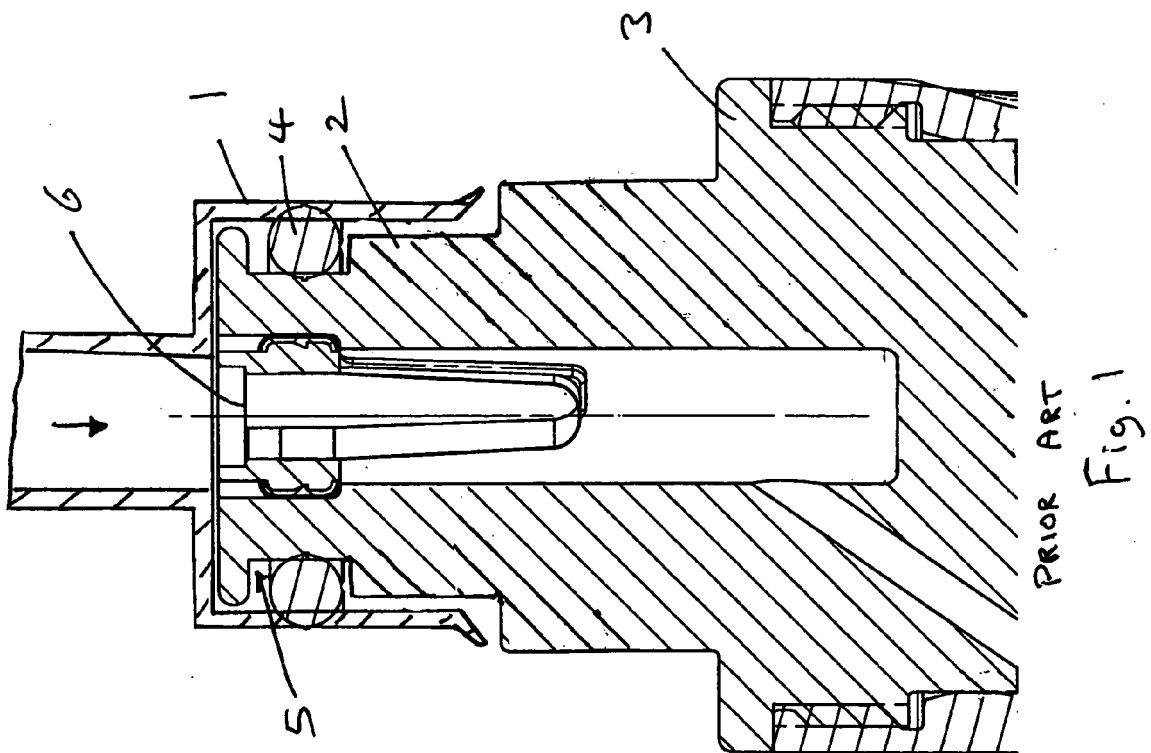
**[0018]** Whilst the above described embodiments show injectors having fuel return lines, it is envisaged that the invention may be equally applicable to fuel injectors which do not include fuel return passageways, the drain port 36 and associated passageway 38 merely being used to collect any fuel or fuel vapour that may escape past the first O-ring 15.

## Claims

1. A connecting structure for a high pressure fuel supply of a fuel injector comprising a connection member (20) including an open ended tubular receiving portion (24) communicating with source of high pressure fuel and being configured to receive a fuel supply inlet of the fuel injector, the fuel supply inlet having an axially arranged fuel inlet port (11) communicating with a spray nozzle of the fuel injector via a selectively operable valve means, an annular sealing ring (12) being locatable around a first peripheral region (16) of the fuel supply inlet at or adjacent a distal end of the fuel supply inlet, the sealing ring (16) being adapted to sealingly abut an inner surface of said receiving portion (24) when the fuel supply inlet is inserted into the receiving portion, a second sealing

means (30,50) being provided around a second peripheral region (32) of the fuel supply inlet axially spaced from said distal end of the fuel supply inlet, the second sealing means (30,50) cooperating with a further portion (26) of said connection member (20) to define a closed annular space (40) between said first and second peripheral regions, a low pressure return or drain port (36) being provided in a side wall of the receiving portion (24), whereby any fuel leaking past the annular sealing ring into said closed annular space passes into the drain port (36).

2. A structure as claimed in claim 1, wherein the drain port (36) communicates with a passageway 36 connectable to a collection vessel and/or return feed of a fuel pump.
3. A structure as claimed in claim 1 or claim 2, wherein the first peripheral portion (36) is provided on a first region (12) of the fuel supply inlet and the second peripheral portion (32) is provided on a second region (14) of the fuel supply inlet, the diameter of the second region (14) being greater than the diameter of the first region (12).
4. A structure as claimed in claim 3, wherein a fuel return port (41) is provided in a side region of the fuel supply inlet between said first and second regions (12,14) communicating with a fuel return passage (42) of the fuel injector.
5. A structure as claimed in claim 4, wherein the fuel return port (41) is provided at the juncture between first and second regions (12,14) of the fuel supply inlet.
6. A structure as claimed in claim 5, wherein the fuel return port (41) opens into an annular recess (40) between said first and second regions (12,14).
7. A structure as claimed in any preceding claim, wherein the second sealing means comprises a further annular sealing ring (30).
8. A structure as claimed in any of claims 1 to 6, wherein the second sealing means comprises a threaded portion (50) co-operable with a corresponding threaded portion (52) on said second peripheral region of the fuel supply inlet.
9. A structure as claimed in claim 8, wherein a flat or conical metal to metal sealing abutment (54) is provided between cooperating faces formed respectively on the receiving cup 20 and the injector body 10



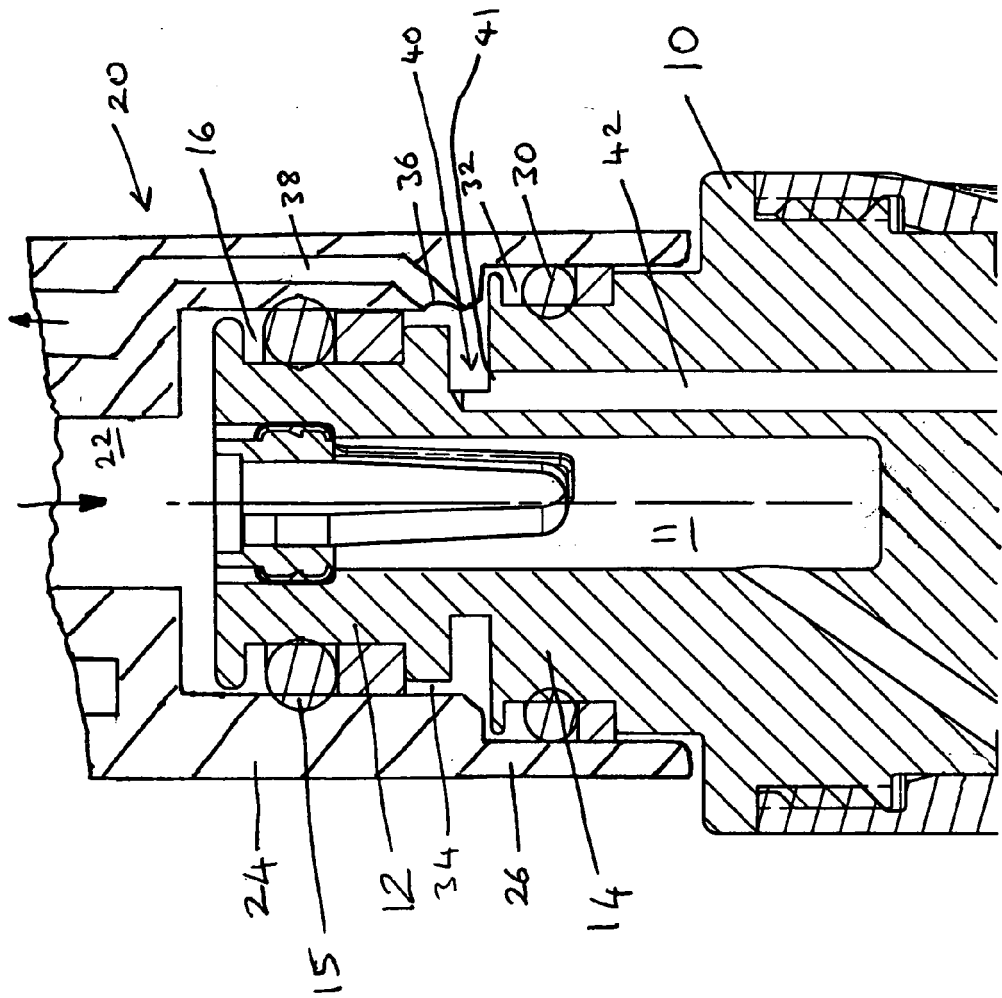


Fig. 2

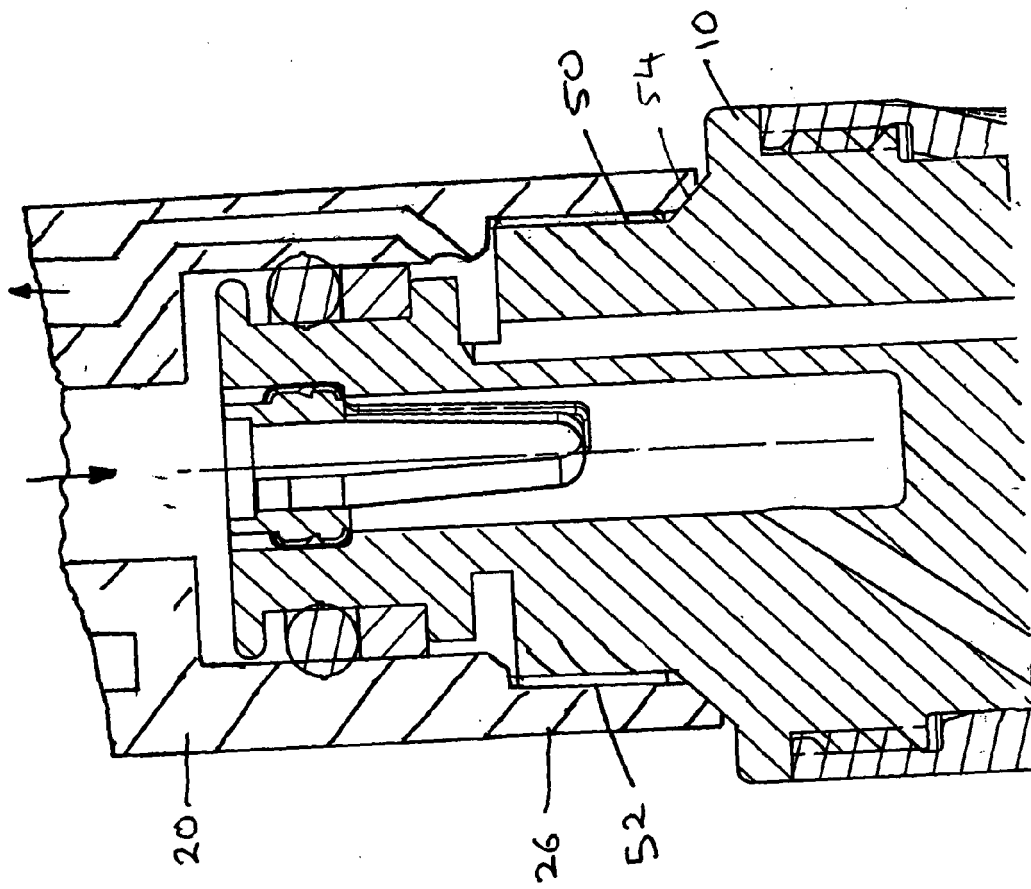


Fig. 3



European Patent  
Office

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Application Number  
EP 05 25 6793

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                               |                                                  |                                         |
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| Place of search<br>Munich                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                               | Date of completion of the search<br>5 April 2006 | Examiner<br>Landriscina, V              |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>&amp; : member of the same patent family, corresponding document</p> |                                                                                                               |                                                  |                                         |

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