(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 783 357 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
04.06.2008 Bulletin 2008/23

(51) Int Cl.:
F02M 55/00 *(2006.01)*

(21) Application number: **05256793.0**

(22) Date of filing: **02.11.2005**

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

Verbindungselement für die Kraftstoffhochdruckzufuhr eines Injektors

Structure de connexion pour l'alimentation haute pression en carburant pour un injecteur

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR

(43) Date of publication of application:
09.05.2007 Bulletin 2007/19

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(56) References cited:
EP-A- 0 387 504
DE-A1- 10 036 137
US-B1- 6 431 608
EP-A- 1 118 766
GB-A- 2 107 809

EP 1 783 357 B1

Printed by Jouve, 75001 PARIS (FR)

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] An example of such connecting structures is known from EP 0 387 504 A.

[0003] 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.

[0004] 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.

[0005] Greater attention to avoiding fuel leaks, particularly fuel vapour, is also required to meet ever stricter hydrocarbon emission limits for vehicles.

[0006] GB 2 107 809 discloses a fuel injector having a drain to prevent fuel from leaking to the exterior of the fuel pipe/connector assembly of the injector.

[0007] According to the present invention there is provided fuel injector having a connecting structure for a high pressure fuel supply of the fuel injector, the connecting structure comprising a connection member including an open ended tubular receiving portion 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 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, the first peripheral region being provided on a first region of the fuel supply inlet and the second peripheral region being provided on a second region of the fuel supply inlet, wherein a fuel return port is be provided in a side region of the fuel supply inlet at the juncture between first and second regions, said fuel return port communicating with a fuel return passage of the fuel injector, characterised in that the fuel return port opens into an annular recess between said first and second regions

[0008] Preferably the diameter of the second region is greater than the diameter of the first region.

[0009] In one embodiment the second sealing means comprises a further annular sealing ring.

[0010] 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.

[0011] 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.

[0012] 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.

[0013] 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.

[0014] A first fluorpolymer 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.

[0015] 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 passageway 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.

[0016] 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.

[0017] 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.

[0018] Such arrangement may be preferred where further securing means are required to hold the receiving cup 20 onto the injector body 10.

[0019] 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 fuel injector having a connecting structure for a high pressure fuel supply of the fuel injector, the connecting structure 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 (15) 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 (15) 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), the first peripheral region (16) being provided on a first region (12) of the fuel supply inlet and the second peripheral region (32) being provided on a second region (14) of the fuel supply inlet, wherein a fuel return port (41) is provided in a side region of the fuel supply inlet at the juncture between first and second regions (12,14), said fuel return port (41) communicating with a fuel return passage (42) of the fuel injector, **characterised in that** the fuel return port (41) opens into an annular recess (40) between said first and second regions (12,14).

2. A fuel injector as claimed in claim 1, wherein the drain port (36) communicates with a passageway (38) connectable to a collection vessel and/or return feed of a fuel pump.

3. A fuel injector as claimed in claim 1 or claim 2, wherein the diameter of the second region (14) is greater than the diameter of the first region (12).

4. A fuel injector as claimed in any preceding claim, wherein the second sealing means comprises a further annular sealing ring (30).

5. A fuel injector as claimed in any of claims 1 to 4, 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.

6. A fuel injector as claimed in claim 5, wherein a flat or conical metal to metal sealing abutment (54) is provided between cooperating faces formed respectively on the connection member (20) and the injector body (10).

Patentansprüche

1. Eine Brennstoffeinspritzdüse mit einer Verbindungskonstruktion für eine Hochdruckbrennstoffversorgung der Brennstoffeinspritzdüse, wobei die Verbin-

dungskonstruktion ein Verbindungselement (20) beinhaltet, das einen röhrenförmigen empfangenden Abschnitt (24) mit offenem Ende umfasst, der mit der Quelle des Hochdruckbrennstoffs in Verbindung steht und konfiguriert ist, um einen Brennstoffversorgungseinlass der Brennstoffeinspritzdüse zu empfangen, wobei der Brennstoffversorgungseinlass einen axial angeordneten Brennstoffeinlasskanal (11), der mit einem Sprühkopf der Brennstoffeinspritzdüse über ein wahlweise betriebsbereites Ventilmittel in Verbindung steht, einen ringförmigen Dichtungsring (15), der um einen ersten peripheren Bereich (16) des Brennstoffversorgungseinlasses an einem distalen Ende oder angrenzend an ein distales Ende des Brennstoffversorgungseinlasses lokalisierbar ist, wobei der Dichtungsring (15) angepasst ist, um dichtend an eine innere Oberfläche des empfangenden Abschnitts (24) anzugrenzen, wenn der Brennstoffversorgungseinlass in den empfangenden Abschnitt eingeführt wird, ein zweites Dichtungsmittel (30,50), das um einen zweiten peripheren Bereich (32) des Brennstoffversorgungseinlasses von dem distalen Ende des Brennstoffversorgungseinlasses axial mit Abstand angeordnet bereitgestellt ist, wobei das zweite Dichtungsmittel (30, 50) mit einem weiteren Abschnitt (26) des Verbindungselements (20) kooperiert, um einen geschlossenen ringförmigen Raum (40) zwischen dem ersten und dem zweiten peripheren Bereich zu definieren, aufweist, wobei ein Rücklaufanschluss oder Ablaufkanal (36) mit Niederdruck in einer Seitenwand des empfangenden Abschnitts (24) bereitgestellt ist, wodurch jeglicher Brennstoff, der an dem ringförmigen Dichtungsring vorbei in den geschlossenen ringförmigen Raum durchsickert, in den Ablaufkanal (36) geht, wobei der erste periphere Bereich (16) auf einem ersten Bereich (12) des Brennstoffversorgungseinlasses bereitgestellt ist und der zweite periphere Bereich (32) auf einem zweiten Bereich (14) des Brennstoffversorgungseinlasses bereitgestellt ist, wobei ein Brennstoffrücklaufanschluss (41) in einem Seitenbereich des Brennstoffversorgungseinlasses an der Verbindungsstelle zwischen dem ersten und dem zweiten Bereich (12, 14) bereitgestellt ist, wobei der Brennstoffrücklaufanschluss (41) mit einem Brennstoffrücklaufdurchgang (42) der Brennstoffeinspritzdüse in Verbindung steht, **dadurch gekennzeichnet, dass** sich der Brennstoffrücklaufanschluss (41) in eine ringförmige Aussparung (40) zwischen dem ersten und dem zweiten Bereich (12, 14) öffnet.

2. Brennstoffeinspritzdüse gemäß Anspruch 1, wobei der Ablaufkanal (36) mit einem Durchgang (38) in Verbindung steht, der mit einem Sammelbehälter und/oder einer Rückführung einer Brennstoffpumpe verbindbar ist.

3. Brennstoffeinspritzdüse gemäß Anspruch 1 oder Anspruch 2, wobei der Durchmesser des zweiten Bereichs (14) größer ist als der Durchmesser des ersten Bereichs (12).

4. Brennstoffeinspritzdüse gemäß einem der vorhergehenden Ansprüche, wobei das zweite Dichtungsmittel einen weiteren ringförmigen Dichtungsring (30) beinhaltet.

5. Brennstoffeinspritzdüse gemäß einem der Ansprüche 1 bis 4, wobei das zweite Dichtungsmittel einen gewindeten Abschnitt (50) beinhaltet, der mit einem entsprechenden gewindeten Abschnitt (52) auf dem zweiten peripheren Bereich des Brennstoffversorgungseinlasses zusammenwirken kann.

6. Brennstoffeinspritzdüse gemäß Anspruch 5, wobei eine flache oder abgeschrägte Metall-zu-Metall-Dichtungsangrenzung (54) zwischen zusammenwirkenden Flächen, die jeweils auf dem Verbindungselement (20) und dem Einspritzdüsenkörper (10) gebildet sind, bereitgestellt ist.

Revendications

1. Un injecteur de carburant ayant une structure de raccordement destinée à une alimentation en carburant haute pression de l'injecteur de carburant, la structure de raccordement comprenant un organe de raccordement (20) incluant une portion de réception tubulaire à extrémité ouverte (24) communiquant avec la source de carburant haute pression et configurée pour recevoir une entrée d'alimentation en carburant de l'injecteur de carburant, l'entrée d'alimentation en carburant ayant un orifice d'admission de carburant arrangé de façon axiale (11) communiquant avec un ajutage de pulvérisation de l'injecteur de carburant par le biais d'un moyen formant clapet pouvant être commandé de façon sélective, une rondelle d'étanchéité annulaire (15) pouvant être placée autour d'une première région périphérique (16) de l'entrée d'alimentation en carburant au niveau de ou adjacent à une extrémité distale de l'entrée d'alimentation en carburant, la rondelle d'étanchéité (15) étant adaptée pour abouter de façon étanche contre une surface interne de ladite portion de réception (24) lorsque l'entrée d'alimentation en carburant est insérée dans la portion de réception, un deuxième moyen d'étanchéité (30, 50) étant prévu autour d'une deuxième région périphérique (32) de l'entrée d'alimentation en carburant espacée de façon axiale de ladite extrémité distale de l'entrée d'alimentation en carburant, le deuxième moyen d'étanchéité (30, 50) coopérant avec une portion supplémentaire (26) dudit organe de raccordement (20) afin de définir un espace annulaire fermé (40) entre lesdites première

et deuxième régions périphériques, un orifice de retour ou de purge basse pression (36) étant prévu dans une paroi latérale de la portion de réception (24), grâce auquel tout carburant fuyant au-delà de la rondelle d'étanchéité annulaire et s'écoulant dans ledit espace annulaire fermé passe dans l'orifice de purge (36), la première région périphérique (16) étant prévue sur une première région (12) de l'entrée d'alimentation en carburant et la deuxième région périphérique (32) étant prévue sur une deuxième région (14) de l'entrée d'alimentation en carburant, dans lequel un orifice de retour de carburant (41) est prévu dans une région latérale de l'entrée d'alimentation en carburant à la jonction entre la première et la deuxième région (12, 14), ledit orifice de retour de carburant (41) communiquant avec un passage de retour de carburant (42) de l'injecteur de carburant, **caractérisé en ce que** l'orifice de retour de carburant (41) donne dans un renfoncement annulaire (40) entre lesdites première et deuxième régions (12,14).

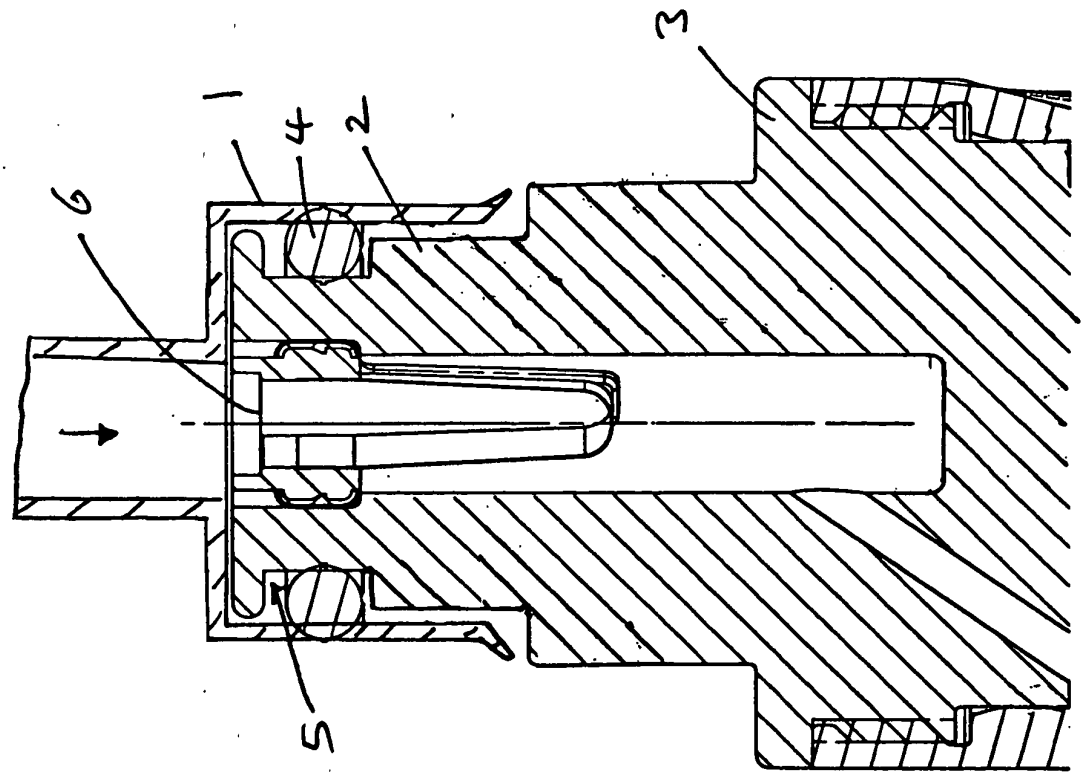
2. Un injecteur de carburant tel que revendiqué dans la revendication 1, dans lequel l'orifice de purge (36) communique avec une voie de passage (38) pouvant être raccordée à un bac collecteur et/ou un approvisionnement en retour d'une pompe à carburant.

3. Un injecteur de carburant tel que revendiqué dans la revendication 1 ou la revendication 2, dans lequel le diamètre de la deuxième région (14) est supérieur au diamètre de la première région (12).

4. Un injecteur de carburant tel que revendiqué dans n'importe quelle revendication précédente, dans lequel le deuxième moyen d'étanchéité comprend une rondelle d'étanchéité annulaire supplémentaire (30).

5. Un injecteur de carburant tel que revendiqué dans n'importe lesquelles des revendications 1 à 4, dans lequel le deuxième moyen d'étanchéité comprend une portion à filet (50) pouvant coopérer avec une portion à filet correspondante (52) sur ladite deuxième région périphérique de l'entrée d'alimentation en carburant.

6. Un injecteur de carburant tel que revendiqué dans la revendication 5, dans lequel un aboutement d'étanchéité métal sur métal plat ou conique (54) est prévu entre des faces correspondantes formées respectivement sur l'organe de raccordement (20) et le corps d'injecteur (10).



PRIOR ART

Fig. 1

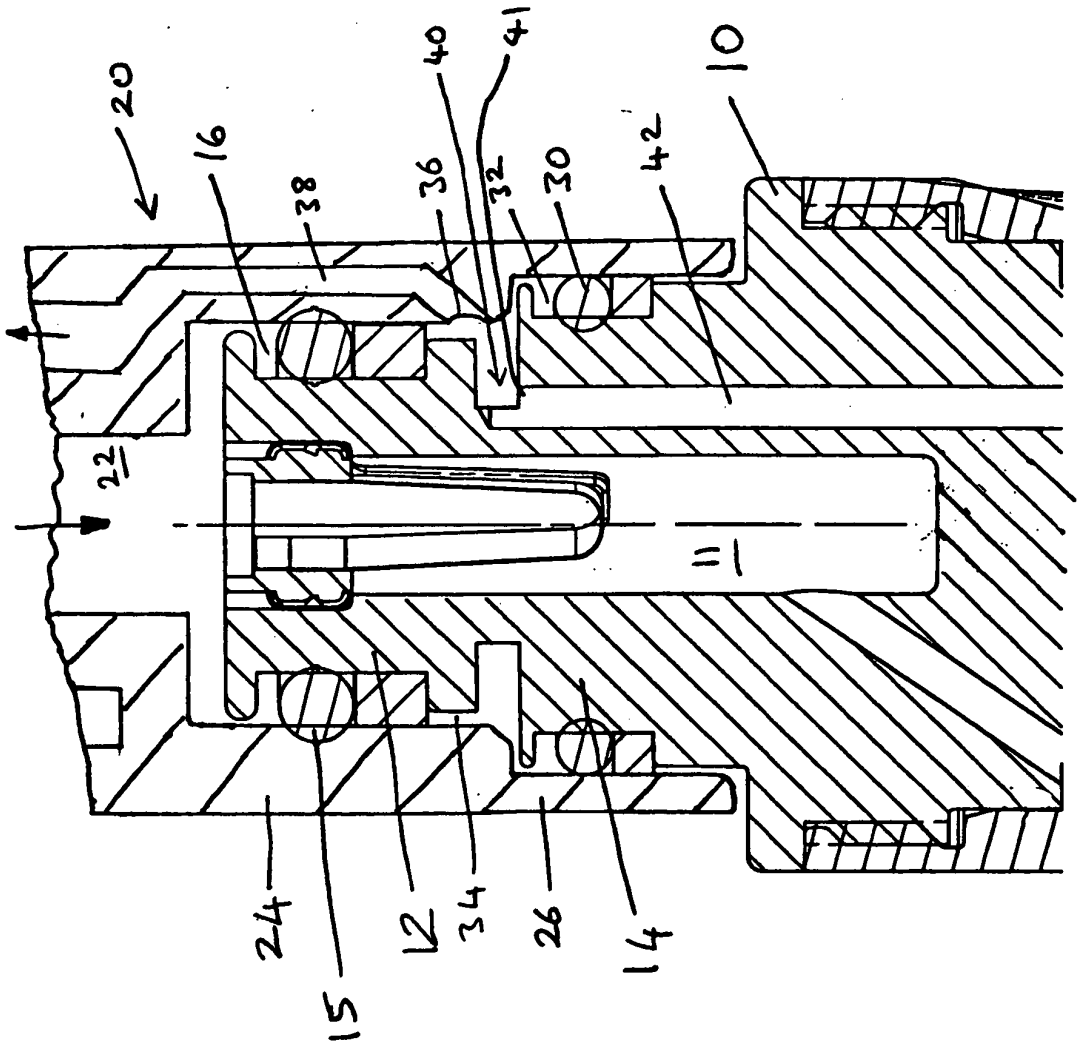


Fig. 2

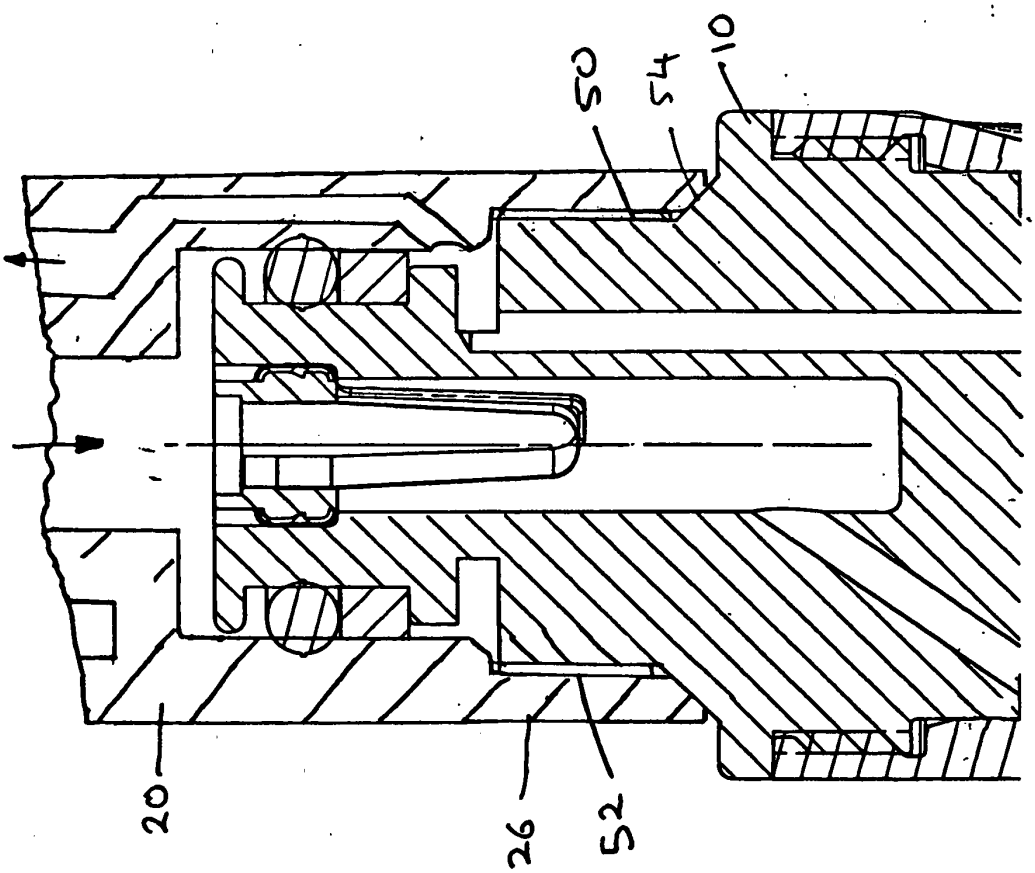


Fig.3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0387504 A **[0002]**
- GB 2107809 A **[0006]**