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(54) **Fuel injector with improved spring arrangement**

Einspritzdüse mit verbesserter Federanordnung

Injecteur avec agencement de ressort ameliore

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EP 1 586 763 B1

Description

[0001] The present invention relates to a fuel injector with an improved spring guide and spring calibration adjusting feature. The invention is particularly, but not exclusively, useful in solenoid actuated fuel injectors.

[0002] A solenoid actuated fuel injector for automotive engines is required to operate with a small and precise stroke in order to provide a fuel flow rate within a desired minimal tolerance level. The fuel injector commonly involves a spring to bias the valve closed. Line production of fuel injector parts and springs naturally leads to the need for adjustment of the precise bias effect of each spring to a defined requirement.

[0003] Figure 1 is a diagrammatic and very simplified view of a fuel injector in the art, showing a central pintle 2 having a spring 4 around its upper part. The spring 4 acts against a top flange 3 of the pintle 2 to close its bottom flange against the outflow seat 6 of the fuel injector. A solenoid actuator 5 acts on an armature 8 secured to the pintle to move the pintle 2 against the bias force of the spring 4 during injection.

[0004] Figure 2 is a more detailed cross-sectional view of an upper part of a fuel injector, showing in more detail a spring 16, pintle 12, and the top flange (20) of the pintle 12. The equivalent of the top flange 3 of Fig. 1 is provided by an adjusting washer 18 and a locking screw 14 engaged with a screw threaded portion of the pintle 12.

[0005] Figure 2 further shows the location of a filter 22 and filter housing 24 in the inlet part of the fuel injector, so as to filter incoming fuel.

[0006] To adjust the force of the spring 16, the filter 22 and filter housing 24 must be removed. The adjusting washer 18 is then turned to achieve the desired spring force and then locked in position by tightening the locking screw 14, suitably accompanied by the application of a suitable adhesive. The filter 22 and filter housing 24 are then replaced.

[0007] A similar arrangment is disclosed in United States Patent No. 5,944,262 to Akutagawa et al.

[0008] These overall arrangements have at least three disadvantages. Firstly, contamination of the inside of the fuel injector following removal of the filter and filter housing. Secondly, the actual difficulty of carrying out the adjustment, due to the lack of access within the tube and the small parts involved. It will be appreciated that fuel injectors are generally small components, and whilst individual adjustment deep within the injector housing is manageable on a small scale, it does not suit mass production.

[0009] Thirdly, and as can be seen from Figure 2, it is possible for the spring 16 to flex away from its absolute co-axial direction with the pintle 12. Any such flexing will upset the delicacy of the spring force being adjusted.

[0010] It is an object of the present invention to obviate or mitigate these disadvantages.

[0011] The present invention, which is defined in claim 1, facilitates the adjustment of biasing means of a fuel injector. The adjustment may be effected without removing an inlet fuel filter, by using a fuel filter housing to effect adjustment. Further, preferred forms of the invention use a coil spring as biasing means and a sleeve provided for effecting adjustment also acts as a guide to prevent lateral movement of the spring.

[0012] Other preferred features and advantages of the invention will be apparent from the following description and the claims.

[0013] An embodiment of the present invention will now be described by way of example only, and with reference to the accompanying diagrammatic drawings in which:

Figure 1 is a simple cross-sectional drawing of a prior art fuel injector as discussed above;
Figure 2 is a cross-sectional part view of a prior art fuel injector as discussed above;
Figure 3 is a cross-sectional part view of a fuel injector according to one embodiment of the present invention;
Figure 4 is a plan view of a sleeve forming part of Figure 3; and
Figure 5 is a partial end view of the sleeve.

[0014] Figure 3 shows a detailed view of the upper portion of a fuel injector according to one embodiment of the present invention. A tubular body 30 contains a central pintle 32, around which is a biasing spring 34. The pintle 32 has a top flange 36 which may be formed by welding a disc-shaped extension to the top of the pintle 32. At the top of the tubular body 30 there is a filter 38 and filter housing 40 similar to those of Figure 2.

[0015] A sleeve 42 extends from a threaded portion (44) at its lower end to a level near the top of an inner lining 46 of the body 30. The threaded portion 44 engages with a threaded portion of a fixed part 48 of the fuel injector.

[0016] As seen in Figures 4 and 5, the top of the sleeve 42 is castellated. The periphery of the filter housing 40 is formed with a cooperating shape, thus providing a rotary driving connection between these parts.

[0017] In use, the sleeve 42 can be rotated within the tube 30 and inner lining 46 either directly, as access to the top of the sleeve 42 is significantly better than access to the adjusting washer 18 of Figure 2, or preferably by turning the filter housing 40 which engages directly with the top of the sleeve 42.

[0018] By turning the sleeve 42, the distance between the lower end of the spring 34 and the pintle flange 36 is changeable because of the degree of extension of the threaded portion 44 into the fixed part 48. The sleeve movement may be upward or downward, thus increasing and decreasing the spring tension as desired.

[0019] Once the length and hence biasing force of the spring 34 is as desired, the filter housing 40 can be welded to the inner lining 46 to lock the position of the sleeve 42.

[0020] The sleeve 42 also provides a close or snug guide to the spring 34, so as to resist lateral flexing of the spring 34.

[0021] The present invention provides a simple and effective way to adjust the biasing force on a fuel injector valve member, whilst overcoming problems known in the art. Although described with reference to a pintle-type, solenoid actuated fuel injector, the invention may also be applied to other forms of valve member and other forms of actuation in fuel injectors.

Claims

1. A fuel injector for use in an engine, comprising:

   a body (30) having a fuel inlet and a fuel outlet; a valve seat in the outlet and including a discharge opening;
   a valve member (32) moveable in the valve seat between open and closed positions;
   biasing means (34) to bias the valve member (32) towards its closed position; a sleeve (42) which is adjustable between linear positions by way of rotation in order to adjust the force of the biasing means (34) against the valve member (32); and a filter housing (40) at the inlet **characterised in that** the filter housing is correspondingly shaped with the sleeve in order to provide rotational driving connection with said sleeve (42) such that rotation of said filter housing (40) results in rotation of said sleeve (42).

2. A fuel injector as claimed in Claim 1 wherein the sleeve (42) extends wholly or substantially to the fuel inlet end of the body (30).

3. A fuel injector as claimed in Claim 1 or Claim 2 wherein the sleeve (42) has a threaded portion (44) at its lower end engageable with a fixed part of the injector whereby rotation of the sleeve (42) causes axial movement of the sleeve (42) with respect to the body (30).

4. A fuel injector as claimed in claim 3 wherein the biasing means comprises a coil spring (34) trapped between the sleeve (42) and a flange (36) secured to the valve member (32).

5. A fuel injector as claimed in claim 4 wherein the sleeve (42) has an inner diameter close to the outer diameter of the coil spring (34) to act as a guide for the latter.

6. A fuel injector as claimed in any of the preceding claims wherein the valve member (32) is a pintle.

7. A method of adjusting the biasing force of a biasing means (34) on a valve member (32) in a fuel injector according to any of Claims 1-6, wherein the sleeve (42) is moved by way of rotation of a filter housing at the inlet in order to adjust the biasing force.

Patentansprüche

1. Eine Brennstoffeinspritzvorrichtung zur Verwendung in einem Motor, die Folgendes beinhaltet:

   einen Körper (30) mit einem Brennstoffeinlass und einem Brennstoffauslass;
   einen Ventilsitz in dem Auslass einschließlich einer Ablassöffnung;
   ein Ventilelement (32), das in dem Ventilsitz zwischen einer offenen Stellung und einer geschlossenen Stellung bewegbar ist;
   Vorspannmittel (34) zum Vorspannen des Ventilelements (32) in Richtung seiner geschlossenen Stellung; eine Muffe (42), die durch Drehung zwischen den linearen Stellungen einstellbar ist, um die Kraft des Vorspannmittels (34) gegen das Ventilelement (32) einzustellen; und ein Filtergehäuse (40) an dem Einlass, **dadurch gekennzeichnet, dass** das Filtergehäuse mit der Muffe entsprechend geformt ist, um mit der Muffe (42) eine Drehantriebsverbindung bereitzustellen, so dass die Drehung des Filtergehäuses (40) in der Drehung der Muffe (42) resultiert.

2. Brennstoffeinspritzvorrichtung gemäß Anspruch 1, wobei sich die Muffe (42) im Ganzen oder im Wesentlichen zu dem Brennstoffeinlassende des Körpers (30) erstreckt.

3. Brennstoffeinspritzvorrichtung gemäß Anspruch 1 oder Anspruch 2, wobei die Muffe (42) an ihrem unteren Ende einen Gewindeabschnitt (44) aufweist, der in einen fixierten Teil der Einspritzvorrichtung eingreifen kann, wobei die Drehung der Muffe (42) axiale Bewegung der Muffe (42) bezüglich des Körpers (30) verursacht.

4. Brennstoffeinspritzvorrichtung gemäß Anspruch 3, wobei das Vorspannmittel eine Schraubenfeder (34) beinhaltet, die **zwischen der Muffe (42) und einem Flansch (36), der an dem Ventilelement (32) gesichert ist, eingefasst ist.**

5. Brennstoffeinspritzvorrichtung gemäß Anspruch 4, wobei die Muffe (42) einen inneren Durchmesser nahe an dem äußeren Durchmesser der Schraubenfeder (34) aufweist, um als eine Führung für letztere zu wirken.

6. Brennstoffeinspritzvorrichtung gemäß einem der vorhergehenden Ansprüche, wobei das Ventilele-

ment (32) ein Drehzapfen ist.

7. Ein Verfahren zum Einstellen der Vorspannkraft eines Vorspannmittels (34) auf einem Ventilelement (32) in einer Brennstoffeinspritzvorrichtung gemäß einem der Ansprüche 1-6, wobei die Muffe (42) durch Drehung eines Filtergehäuses an dem Einlass bewegt wird, um die Vorspannkraft einzustellen.

Revendications

1. Un injecteur de carburant destiné à être utilisé dans un moteur, comprenant :

un corps (30) ayant une entrée de carburant et une sortie de carburant ;
un siège de soupape dans la sortie et incluant une ouverture de décharge ;
un élément de soupape (32) pouvant se déplacer dans le siège de soupape entre une position ouverte et une position fermée ;
un moyen de décalage (34) pour décaler l'élément de soupape (32) en direction de sa position fermée ; un manchon (42) qui peut être ajusté entre des positions linéaires au moyen d'une rotation afin d'ajuster la force du moyen de décalage (34) contre l'élément de soupape (32) ; et un boîtier de filtre (40) au niveau de l'entrée **caractérisé en ce que** le boîtier de filtre est formé de façon correspondante avec le manchon afin de fournir une connexion d'entraînement en rotation avec ledit manchon (42) de telle sorte que la rotation dudit boîtier de filtre (40) ait pour résultat la rotation dudit manchon (42).

2. Un injecteur de carburant tel que revendiqué dans la revendication 1 dans lequel le manchon (42) s'étend complètement ou substantiellement jusqu'à l'extrémité d'entrée de carburant du corps (30).

3. Un injecteur de carburant tel que revendiqué dans la revendication 1 ou la revendication 2 dans lequel le manchon (42) a une portion filetée (44) au niveau de son extrémité inférieure pouvant se mettre en prise avec une partie fixe de l'injecteur grâce à quoi la rotation du manchon (42) amène un déplacement axial du manchon (42) par rapport au corps (30).

4. Un injecteur de carburant tel que revendiqué dans la revendication 3 dans lequel le moyen de décalage comprend un ressort hélicoïdal (34) enfermé entre le manchon (42) et un flasque (36) assujetti à l'élément de soupape (32).

5. Un injecteur de carburant tel que revendiqué dans la revendication 4 dans lequel le manchon (42) a un diamètre interne proche du diamètre externe du ressort hélicoïdal (34) pour faire office de guide pour ce dernier.

6. Un injecteur de carburant tel que revendiqué dans n'importe lesquelles des revendications précédentes dans lequel l'élément de soupape (32) est une aiguille.

7. Une méthode pour ajuster la force de décalage d'un moyen de décalage (34) sur un élément de soupape (32) dans un injecteur de carburant selon n'importe lesquelles des revendications 1 à 6, dans laquelle le manchon (42) est déplacé au moyen d'une rotation d'un boîtier de filtre au niveau de l'entrée afin d'ajuster la force de décalage.

Fig 1

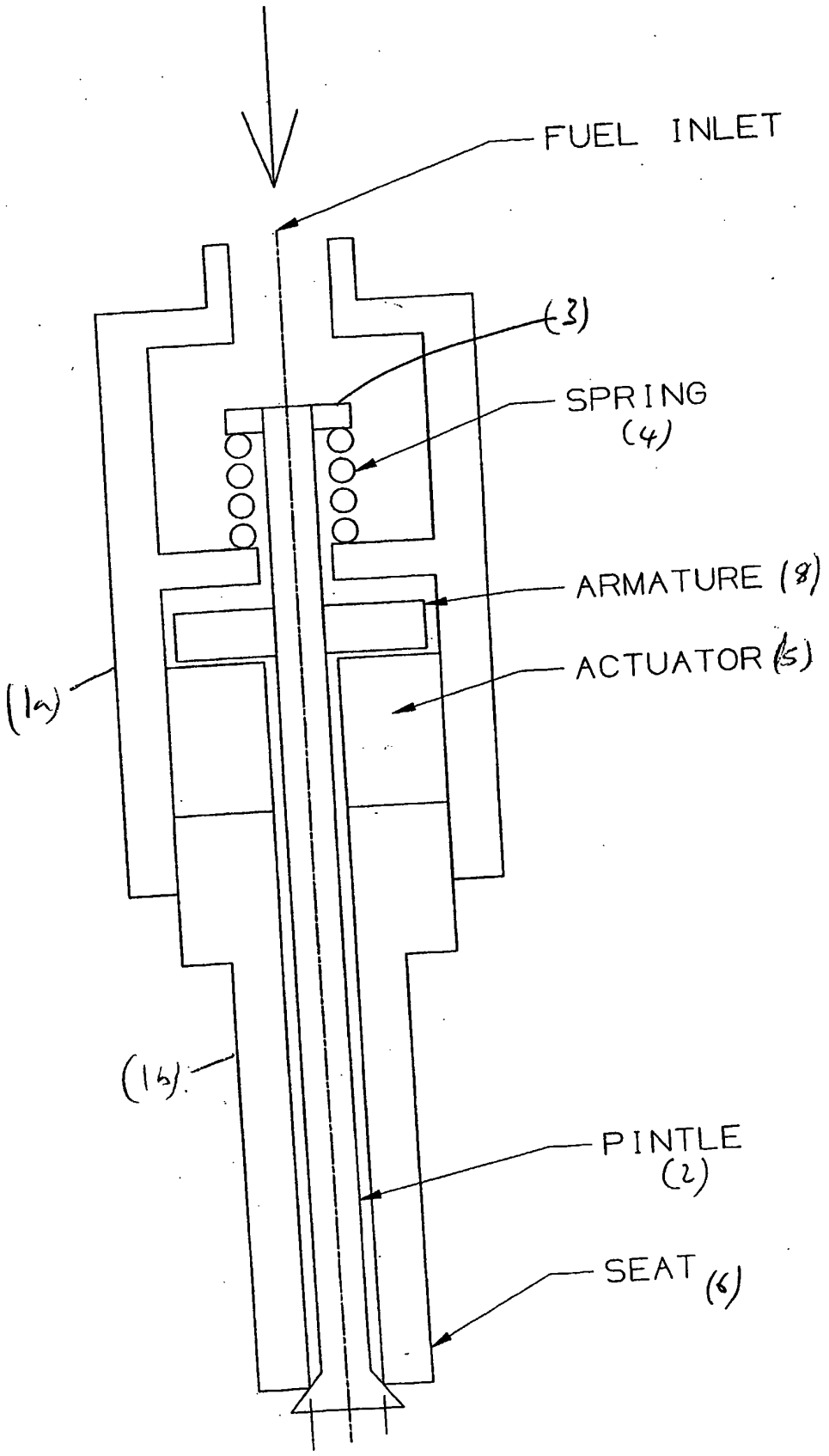

FUEL INLET
(3)
SPRING
(4)
ARMATURE (8)
ACTUATOR (5)
(1a)
(1b)
PINTLE
(2)
SEAT (6)

Fig 2

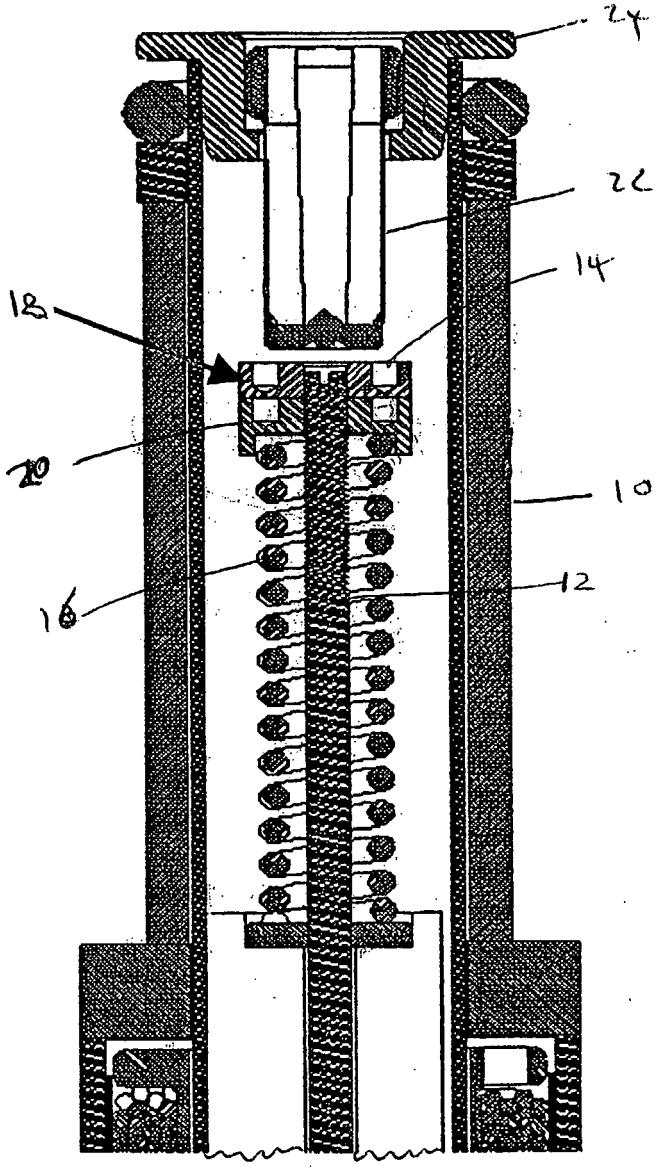


Fig.4

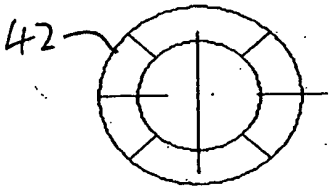
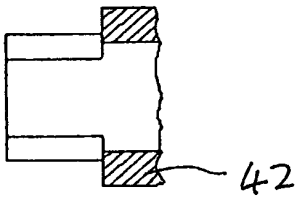


Fig.5



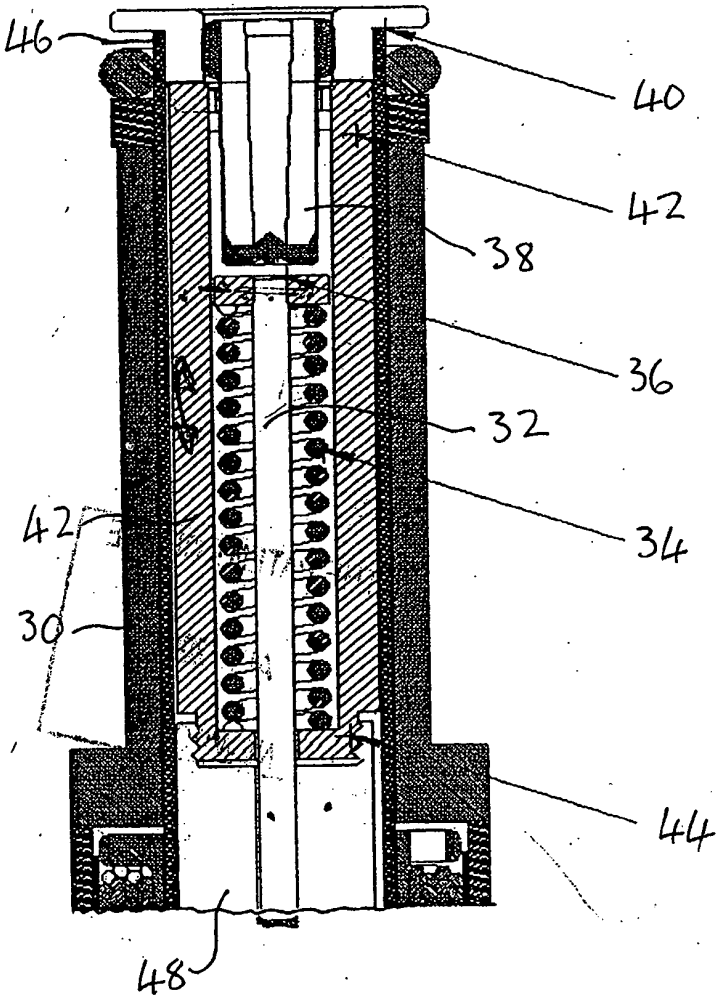


Fig.3