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WO 1997/020136 A1 **JP 630061770 A**
JP 2002352183 A **US 6112720 A**

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INT CL **F02D, F02M**
Other:

(54) Abstract Title: **Fuel injection valve connector cover displaying valve operating data**

(57) An engine fuel injection valve 20 comprises a connector 3 with a cover 4, and data 5 concerning the operating characteristics of the valve are carried on the cover 4, to enable the information to be easily read when the injector 20 is assembled into an engine 6. The cover 4 may be located such that it is at the top of the injector 20 and can be read by a CCD camera 11 after the injector is installed in the engine. The data may then be supplied to the ECU which can modify the signal supplied in order to achieve predetermined performance. The data 5 may be in the form of a barcode or two dimensional code. The cover 4 may be temporary or permanent.

FIG. 4

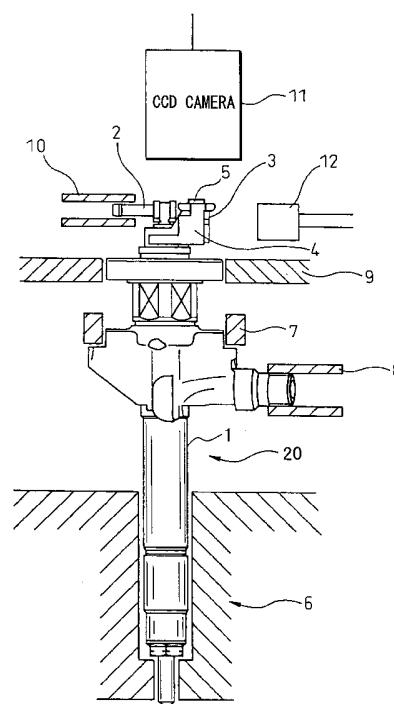


FIG. 1

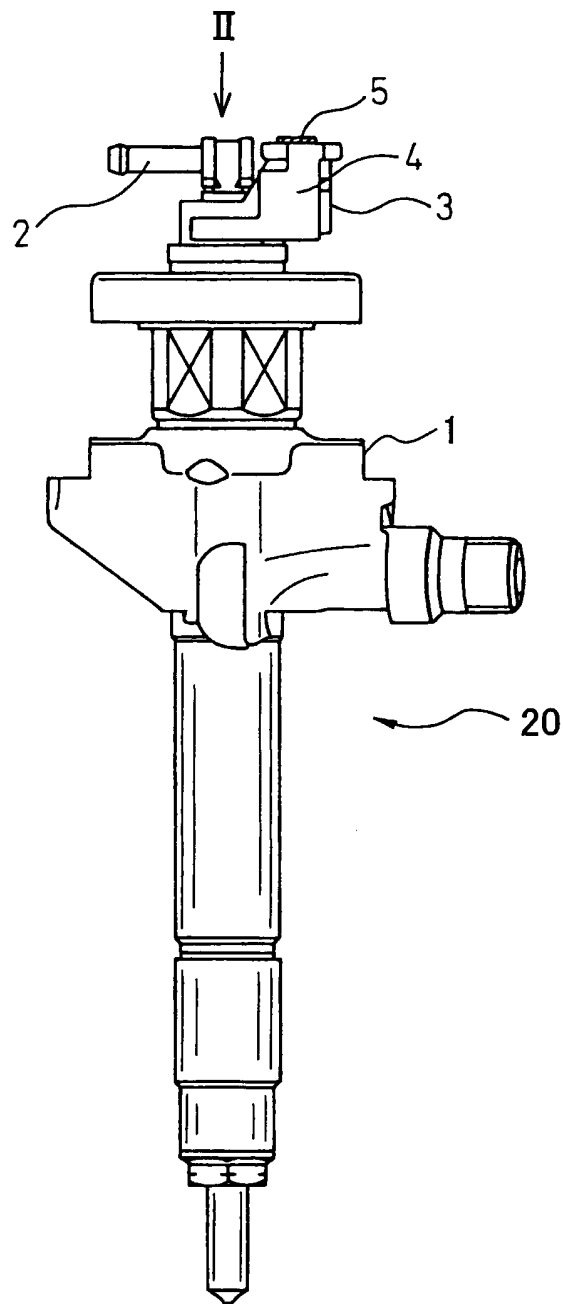


FIG. 2

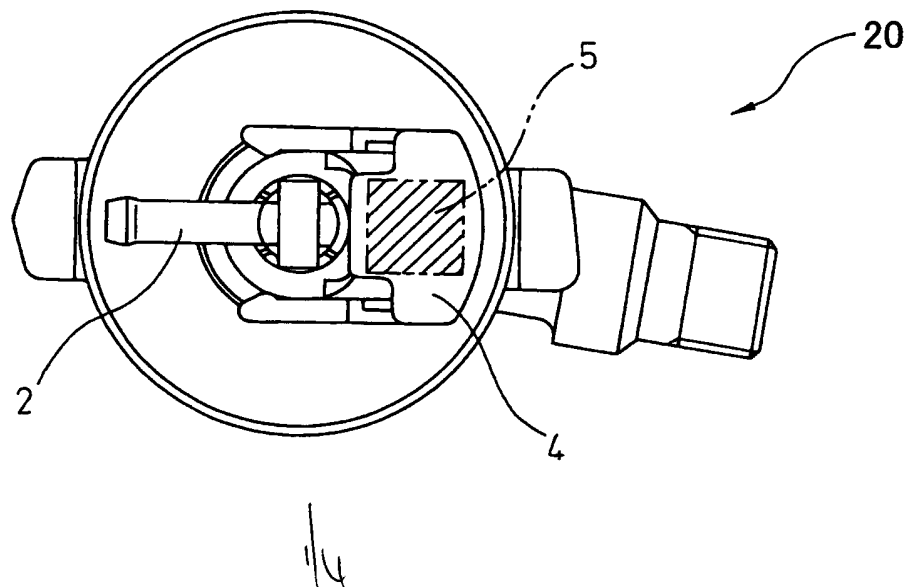


FIG. 3

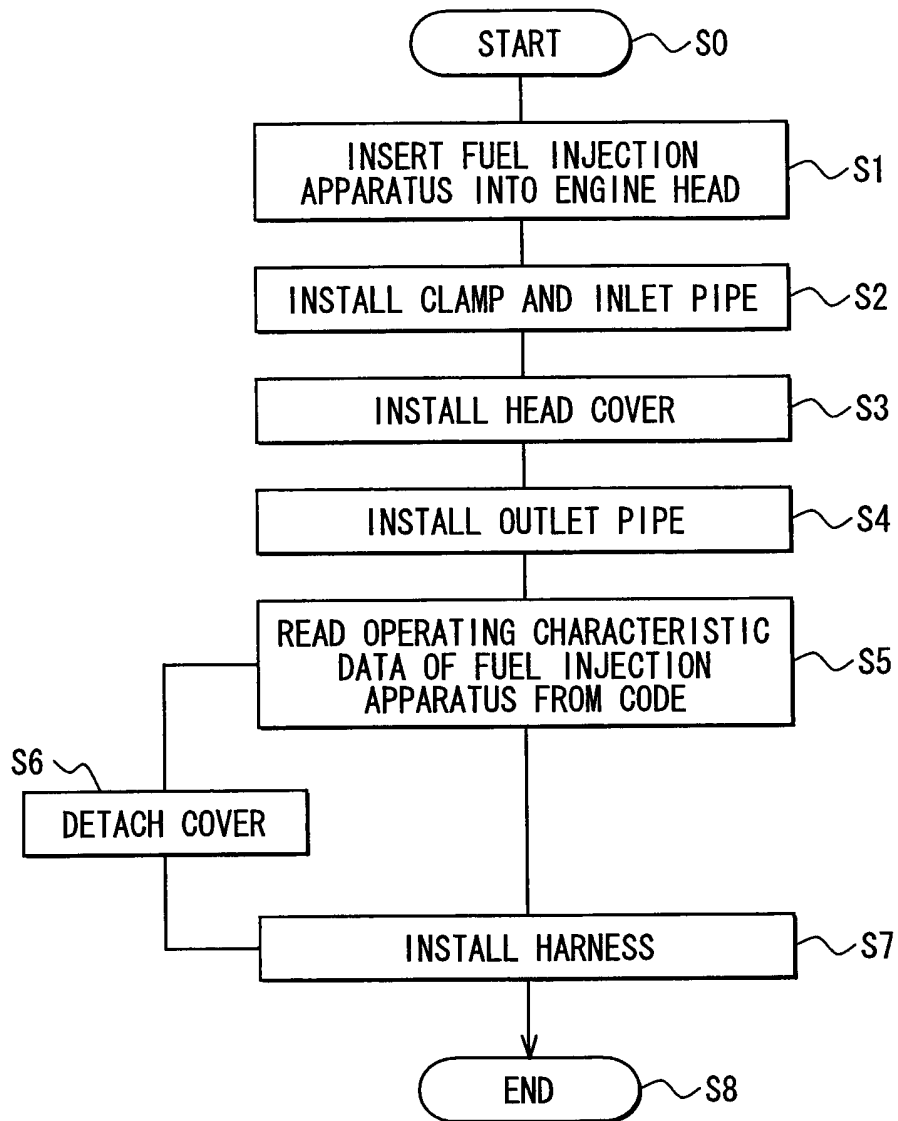


FIG. 4

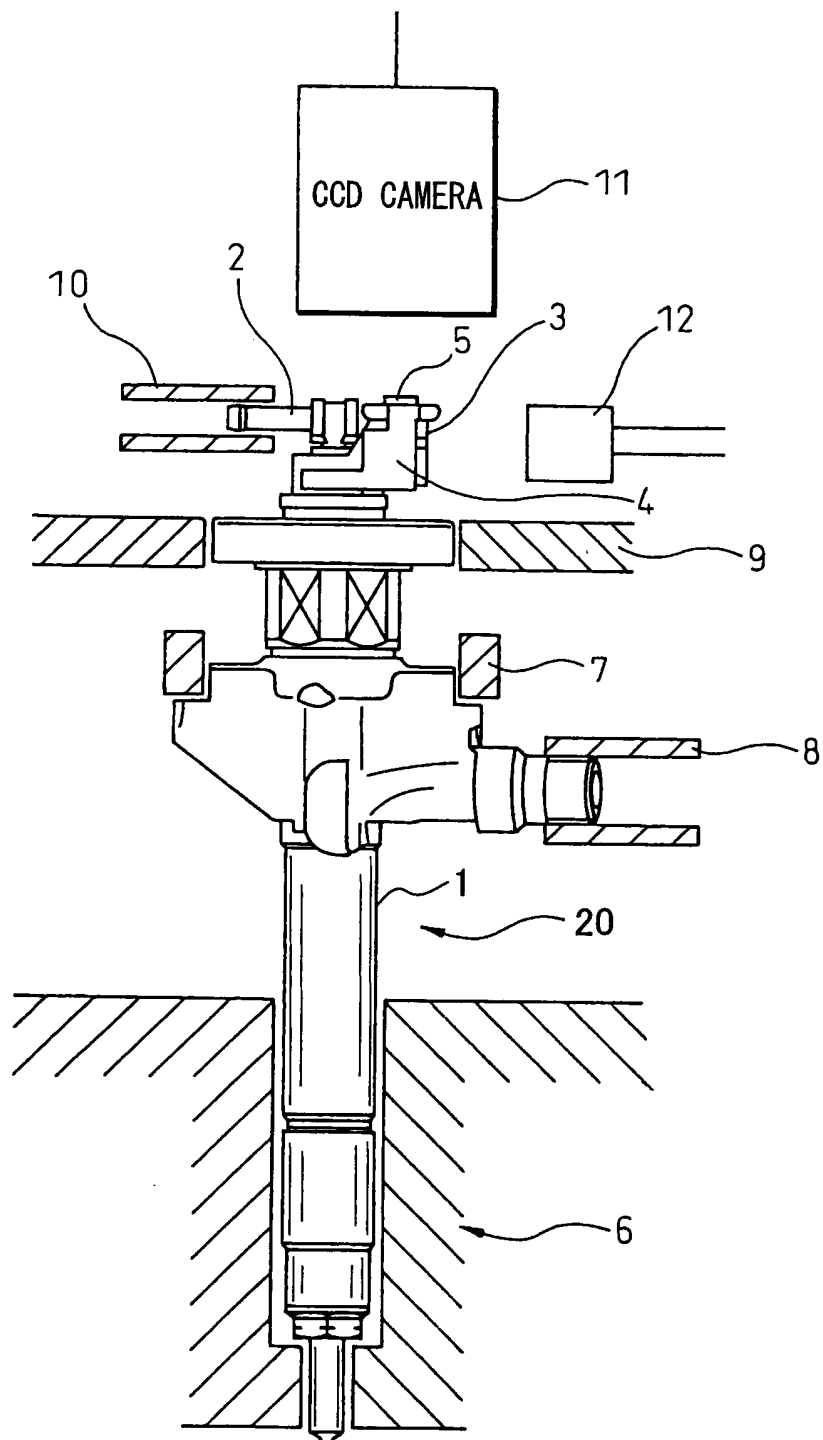


FIG. 5

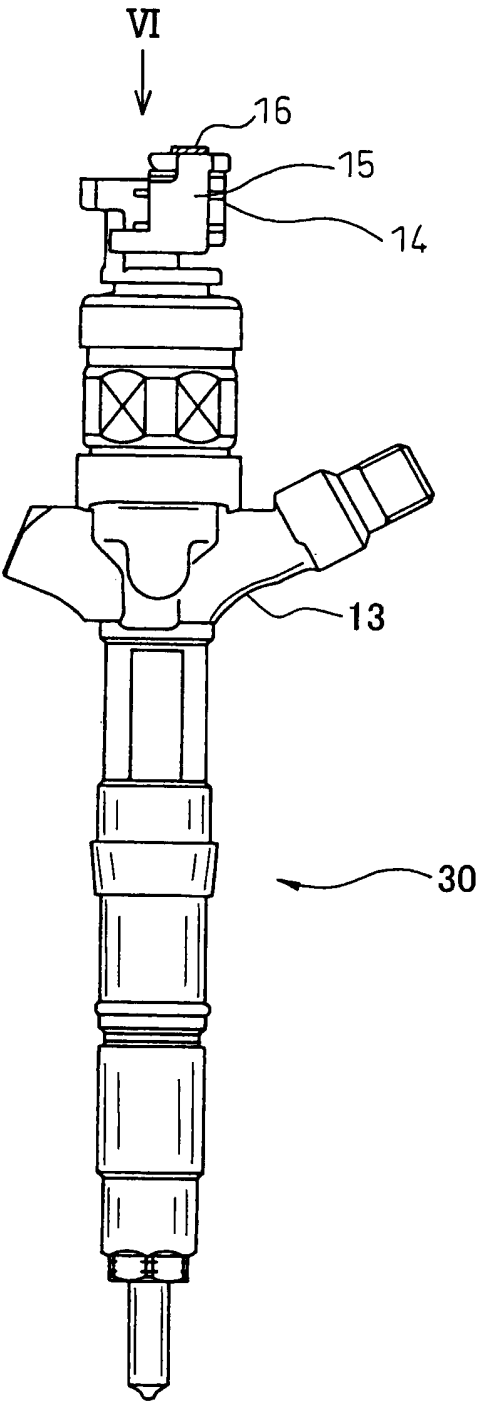
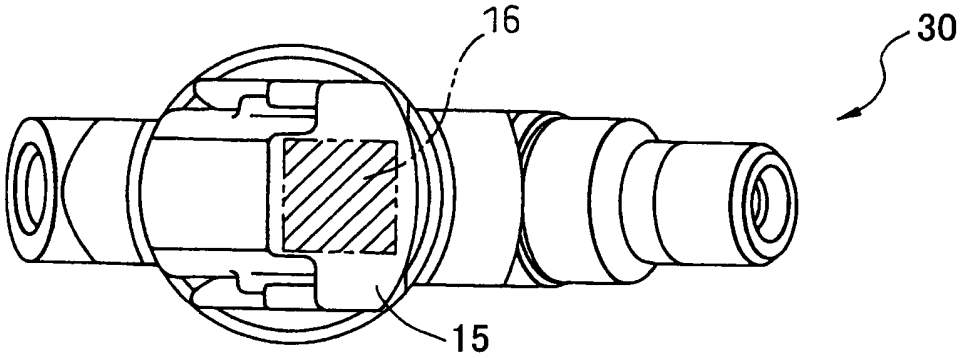


FIG. 6



**FUEL INJECTION VALVE, ASSEMBLING METHOD THEREOF
AND CAP THEREOF**

Description

5 This invention relates to an engine fuel injection valve, an assembling method thereof and a cap thereof, and specifically relates to a top-return-type engine fuel injection valve, and an assembling method thereof.

 Recently, it has been demanded that high-pressurized fuel injection to an engine and an increased degree of accuracy in the adjustment of a fuel injection
10 quantity in relation to a tight regulation of exhaust gas emissions from the engine. When the high-pressurized fuel injection and the increased degree of accuracy of the fuel injection quantity are performed, for example, a degree of accuracy in the production of a component of a fuel injection system (e.g., a fuel injection pump or an injector) needs to be increased. However, in order to increase the degree of the
15 accuracy in the production, an increase in a component cost is inevitable, and also there is a limit in increasing the performance just by increasing the degree of the accuracy in the production. Thus, it is difficult to achieve the demanded high-pressure injection and the demanded highly accurate injection quantity even when the degree of accuracy in the production of the component is increased. Also,
20 even when the degree of accuracy in the production of the components is increased, there is a certain variation in the performance of the components. Therefore, in terms of the emission control regulation, it is demanded to perform an optimum operation of the component in relation to the variation in the performance.

 It has been discussed that the performance of the component is corrected
25 and optimized by electrically controlling the component. In this case, a portion of the component stores operating characteristic data, which includes inherent and different operating characteristics to each component. A control device, such as an

engine control unit (ECU), corrects the operating characteristics of the component based on the stored operating characteristic data to achieve a predetermined performance.

Japanese Unexamined Patent Publication No. 2000-501155 or Japanese
5 Unexamined Patent Publication No. 2002-352183 disclose a conventional technique that stores the operating characteristic data on a fuel injection valve itself in association with a fuel injection valve for a diesel engine. In a fuel injection valve disclosed in Japanese Unexamined Patent Publication No. 2000-501155, a bar code is directly provided on the fuel injection valve to store the operating
10 characteristic data of the fuel injection valve such that it is possible to read the operating characteristic data as needed. Also, Japanese Unexamined Patent Publication No. 2002-352183 discloses that a code, which stores the operating characteristic data, is provided on a connector portion of a fuel injection valve. Also, a difference between color tones of the code and the connector portion is set such
15 that readability of the code is improved.

However, in the fuel injection valve disclosed in Japanese Unexamined Patent Publication No. 2000-501155, the bar code may be covered by an engine head cover after the fuel injection valve is mounted (installed) on an engine when the bar code is provided in a certain position. Then, recorded data in the bar code
20 may not be read after the fuel injection valve is mounted on the engine. Even when the bar code may be provided in a certain position such that the bar code may not be covered by the engine head cover, accessibility to the recorded data in the bar code may not be very good because the bar code may be provided on a side face of the fuel injection valve. Therefore, it is difficult to automatically read the recorded data.
25 In contrast, in the fuel injection valve disclosed in Japanese Unexamined Patent Publication No. 2002-352183, it is difficult to have enough space for providing the code on the connector portion when the code is provided on a top-return-type fuel

injection valve. Here, the top-return-type fuel injection valve includes a return pipe on an opposite end of the top-return-type fuel injection valve, which is opposite from an injection nozzle of an operated valve thereof.

5 The present invention is made in view of the above disadvantages. It is an objective of the present invention to provide a method and a fuel injection valve, which facilitate reading and automatic reading of the operating characteristic data of the fuel injection valve after the fuel injection valve is mounted on the engine such that an operation of the fuel injection valve is optimized.

10 To achieve the objective of the present invention, there is provided an engine fuel injection valve, which includes an operated valve for controlling fuel injection of the engine fuel injection valve, wherein the engine fuel injection valve includes a casing, a connector and a cover. The casing includes the operated valve. The connector is installed on an opposite end portion of the casing, which is opposite from an injection nozzle of the operated valve. The cover is installed on the
15 connector and protects the connector. The cover carries information about the engine fuel injection valve.

To achieve the objective of the present invention, there is also provided an assembling method of an engine fuel injection valve, which includes an operated valve for controlling fuel injection of the engine fuel injection valve, wherein the
20 assembling method includes an installing step and a reading step. The installing step installs a cover, which carries information about the engine fuel injection valve, on a connector of the engine fuel injection valve. The reading step reads the information, which is carried by the cover.

25 To achieve the objective of the present invention, there is also provided a cover arrangement of an engine fuel injection valve, which includes an operated valve for controlling fuel injection of the engine fuel injection valve, wherein the cover includes an information indicator. The information indicator carries

information about the engine fuel injection valve.

The invention, together with additional objectives, features and advantages thereof, will be best understood from the following description, the appended claims and the accompanying drawings in which:

5 FIG. 1 is a schematic diagram of a top-return-type fuel injection valve for a diesel engine according to a first embodiment of the present invention;

 FIG. 2 is a top view of the fuel injection valve shown in FIG. 1 viewed from a direction II;

 FIG. 3 is a flowchart showing an assembling process of reading a code after
10 the fuel injection valve is mounted on an engine according to the first embodiment of the present embodiment;

 FIG. 4 is a schematic diagram for explaining the assembling process shown in FIG. 3;

 FIG. 5 is a side view of a side-return-type fuel injection valve for the diesel
15 engine according to a second embodiment of the present invention; and

 FIG. 6 is a top view of the fuel injection valve shown in FIG. 5 viewed from a direction VI.

(First Embodiment)

20 The first embodiment of a fuel injection valve and an assembling method thereof will be described with reference to accompanying drawings.

 As shown in FIG. 1, the fuel injection valve 20 in the first embodiment is a top-return-type fuel injection valve used for a diesel engine. Here, the top-return-type fuel injection valve includes a return pipe 2 on an opposite end of a casing of the top-return-type fuel injection valve, which is opposite from an injection
25 nozzle of an operated valve thereof. The fuel injection valve 20 in the first embodiment is mounted on an engine head 6 (shown in FIG. 4) of the diesel engine

and injects fuel into a cylinder. The fuel injection valve 20 internally includes a solenoid valve (not shown) and rapidly controls fuel injection (injecting fuel or stopping injection of the fuel) by opening and closing the solenoid valve. The fuel injection valve 20 in the present embodiment includes an injection casing 1, the return pipe 2, a connector 3 and a cover 4. The injection casing 1 includes the operated valve. The fuel injection valve 20 recovers leak fuel by use of the return pipe 2 mounted on a top portion of the fuel injection valve 20. The connector 3 supplies power to the solenoid valve, and the cover 4, which is mounted on the connector 3, protects the connector 3. The cover 4 includes a code 5 (information indicator), which is printed on the cover 4, for storing operating characteristics of the fuel injection valve 20, such as manufacturing information thereof and injection performance information thereof. Here, the code 5 may be a linear bar code or may be a two-dimensional symbology, such as a quick response code (QR code). As shown in FIG. 2, the code 5 is located on a certain place of the fuel injection valve 20 such that the code 5 can be easily recognized when seen from the above of the fuel injection valve 20 (seen from direction II in FIG. 1). The code 5 may be, for example, well-known various information storage media, such as a bar code. It is preferable that the cover 4 is removably (detachably) mounted on the connector 3.

As shown in FIG. 3, assembly of the fuel injection valve 20 with the engine is started at step 0 (S0). Firstly at step 1 (S1), the fuel injection valve 20, which is an assembled apparatus, is inserted into the engine head 6. Next at step 2 (S2), the inserted fuel injection valve 20 is fixed to the engine head 6 by assembling a clamp 7 and an inlet pipe 8 (shown in FIG. 4). At this time, the inlet pipe 8 is connected with a fuel supply nozzle of the fuel injection valve 20. Then at step 3 (S3), a head cover 9 is assembled from above of the fuel injection valve 20. The head cover 9 protects the engine head 6 and the fuel injection valve 20 from an external force.

After the head cover 9 is assembled, the return pipe 2, the connector 3 and

the cover 4 projects from the fuel injection valve 20 above the head cover 9. At step 4 (S4), the return pipe 2, which projects above the head cover 9, is connected with an outlet pipe 10. After this assembly, at step 5 (S5) in this state, a charge coupled device (CCD) camera 11 reads the code 5, which is printed on the cover 4. The read
5 data of the code 5 is transmitted to a control device, such as an engine control unit (ECU). After the data of the code 5 is read, the cover 4 is removed from the connector 3 at step 6 (S6). Then, at step 7 (S7), the connector 3 is connected with a harness 12, which is connected with the ECU. At step 8, the assembly of the fuel injection valve 20 with the engine head 6 is ended.

10 In the above assembly process, the cover 4 is removed from the connector 3 such that the connector 3 is easily connected with the harness 12. However, the cover 4 may not be removed from the connector 3 when the connector 3 is connected with the harness 12. Specifically, step 7 may be performed after step 5 by bypassing step 6. Therefore, the cover 4 may serve as a permanent cover for the
15 connector 3 of the fuel injection valve 20 and also may serve as a temporal cover, which is eventually removed. The cover 4 may includes a groove in an inner peripheral surface, into which a projection portion of the connector 3 is inserted such that the assembly of the cover 4 with the connector 3 is facilitated.

(Second Embodiment)

20 As shown in FIGS. 5 and 6, a fuel injection valve in the second embodiment is a side-return-type fuel injection valve for the diesel engine. Here, the side-return-type fuel injection apparatus includes a return pipe on an outer peripheral surface of a casing of the top-return-type fuel injection apparatus. FIGS. 5 and 6 correspond to FIGS. 1 and 2. Similar components of the fuel injection
25 apparatus of the second embodiment shown in FIGS. 5 and 6, which are similar to the components of the fuel injection apparatus of the first embodiment shown in FIGS. 1 and 2, will be indicated by the same numerals. The side-return-type fuel

injection valve 30 in the second embodiment includes an injection casing 13. Similarly to the top-return-type fuel injection valve 20, a cover 15, which is printed with a code 16, can be assembled with a connector 14 in the case of the side-return-type fuel injection valve 30 in the second embodiment. Thus, information, which is stored in the code 16, about operating characteristics of the fuel injection valve 30 can be read. An assembling process of the fuel injection valve 30 with the engine head 6 in the present embodiment is similar to that in the first embodiment. Portions, which are not described above, are similar to the first embodiment. Thus, the explanation thereof is omitted.

The following effects can be expected by the fuel injection valve and the assembling method thereof in the first embodiment.

In the case of the top-return-type fuel injection valve, the code, which stores the operating characteristics of the fuel injection valve, is provided on the separated cover, and the cover is assembled with the connector in a position such that the code can be read from above of the fuel injection valve. Thus, even after the fuel injection valve is mounted on the engine, the reading of the code and the automatic reading of the code are facilitated. Therefore, the operation of the fuel injection valve may be adjusted to be optimized such that pollutants in the engine exhaust gas may be minimized.

The following effects can be expected by the fuel injection valve and the assembling method thereof in the second embodiment.

The similar effects, which are achieved by the top-return-type fuel injection valve in the first embodiment, can be achieved by the side-return-type fuel injection valve.

In the above description, the fuel injection valve and the assembling method thereof in the present invention are used for the diesel engine. However, fuel injection valve and the assembling method thereof may be used for other internal

combustion engines except for the diesel engine, such as a gasoline engine.

In the above description, the fuel injection valve includes the solenoid valve. However, the solenoid valve may be other operated valves, such as a piezo actuated valve.

5 Additional advantages and modifications will readily occur to those skilled in the art. The invention in its broader terms is therefore not limited to the specific details, representative apparatus, and illustrative examples shown and described.

Claims

1. An engine fuel injection valve, which includes an operated valve for controlling fuel injection of the engine fuel injection valve, the engine fuel injection valve comprising:
 - a casing (1, 13), which includes the operated valve;
 - a connector (3, 14) that is installed on an opposite end portion of the casing (1, 13), which is opposite from an injection nozzle of the operated valve; and
 - a cover (4, 15) that is installed on the connector (3, 14) and protects the connector (3, 14), wherein the cover (4, 15) carries information about the engine fuel injection valve.
2. The engine fuel injection valve according to claim 1, wherein the cover (4, 15) includes an information indicator (5, 16), which carries the information about the engine fuel injection valve.
3. The engine fuel injection valve according to claim 1 or 2, wherein the information indicator (5, 16) of the cover (4, 15) is one of a linear bar code and a two-dimensional symbology.
4. The engine fuel injection valve according to any one of claims 1 through 3, wherein:
 - the connector (3, 14) includes a projecting portion; and
 - the cover (4, 15) includes a groove portion in an inner peripheral surface of the cover (4, 15) such that the groove portion receives the projecting portion of the connector (3, 14).

5. The engine fuel injection valve according to any one of claims 1 through 4, further comprising a return pipe (2) that is installed on the opposite end portion of the casing (1, 13), which is opposite from the injection nozzle of the operated valve.
6. The engine fuel injection valve according to any one of claims 1 through 5, wherein the connector (3, 14) that is detachably installed on the opposite end portion of the casing (1, 13).
7. The engine fuel injection valve according to any one of claims 1 through 6, wherein the information, which is stored in the cover (4, 15), includes operating characteristic data of the engine fuel injection valve.
8. The engine fuel injection valve according to claim 7, wherein the operating characteristic data includes at least one of the followings:
- manufacturing information; and
 - injection performance information.
9. An assembling method of an engine fuel injection valve (20, 30), which includes an operated valve for controlling fuel injection of the engine fuel injection valve (20, 30), the assembling method comprising:
- installing a cover (4, 15), which carries information about the engine fuel injection valve (20, 30), on a connector (3, 14) of the engine fuel injection valve (20, 30); and
 - reading the information, which is carried by the cover (4, 15).
10. The assembling method according to claim 9, wherein the cover (4, 15) includes an information indicator (5, 16), which carries the information about the

engine fuel injection valve (20, 30).

11. The assembling method according to claim 9 or 10, wherein the information indicator (5, 16) of the cover (4, 15) is one of a linear bar code and a two-dimensional symbology.

12. The assembling method according to any one of claims 9 through 11, further comprising:

installing the engine fuel injection valve (20, 30) on an engine before the reading of the information.

13. The assembling method according to any one of claims 9 through 12, wherein the installing of the cover (4, 15) on the connector (3, 14) includes installing the cover (4, 15) detachably on the connector (3, 14).

14. The assembling method according to claim 13, further comprising:

demounting the cover (4, 15) and connecting a harness (12), which is connected to an engine control unit, with the connector (3, 14) after the reading of the information.

15. The assembling method according to any one of claims 9 through 14, wherein:

the engine fuel injection valve (20, 30) includes a return pipe (2) on an opposite end portion of the engine fuel injection valve (20, 30), which is opposite from an injection nozzle of the operated valve.

16. The assembling method according to any one of claims 9 through 15,

wherein: the information, which is stored in the cover (4, 15), includes operating characteristic data of the engine fuel injection valve.

17. The assembling method according to claim 16, wherein the operating characteristic data includes at least one of the followings:

manufacturing information; and
injection performance information.

18. A cover arrangement of an engine fuel injection valve (20, 30), which includes an operated valve for controlling fuel injection of the engine fuel injection valve (20, 30), the cover comprising:

an information indicator (5, 16) that carries information about the engine fuel injection valve (20, 30).

19. The cover arrangement according to claim 18, wherein:

the information indicator (5, 16) of the cover (4, 15) is one of a linear bar code and a two-dimensional symbology.

20. The cover arrangement according to claim 18 or 19, wherein:

the cover arrangement is detachably installed on a connector (3, 14) of the engine fuel injection valve (20, 30) such that the cover arrangement protects the connector (3, 14).

21. An engine fuel injection valve substantially as herein described with reference to and as illustrated in the accompanying drawings.

22. An assembly method of an engine fuel injection valve, the assembly method being substantially as herein described with reference to and as illustrated in the accompanying drawings.

23. A cover arrangement of an engine fuel injection valve, the cover arrangement being substantially as herein described with reference to and as illustrated in the accompanying drawings.

Application No: GB0607865.3

Examiner: Peter Middleton

Claims searched: 1-23

Date of search: 18 August 2006

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-3 5-20	US6112720 A (CATERPILLAR) see abstract and figures 2 and 3: data carried on top cover of injector
X	1--3, 5-20	WO97/20136 A1 (SIEMENS) see abstract and figures: injector with data stored on surface
X	1-3, 5-20	JP2002352183 A (DENSO) see figures and WPI abstract accession number 2003-113610 [11]: information displayed on upper end of injector
A	1, 9, 18	JP63061770 A (DENSO) see figures and EPODOC abstract: figure shows cover for electrical connector of fuel injector

Categories:

X Document indicating lack of novelty or inventive step	A Document indicating technological background and/or state of the art.
Y Document indicating lack of inventive step if combined with one or more other documents of same category.	P Document published on or after the declared priority date but before the filing date of this invention.
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Field of Search:

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The following online and other databases have been used in the preparation of this search report

Online: WPI, EPODOC