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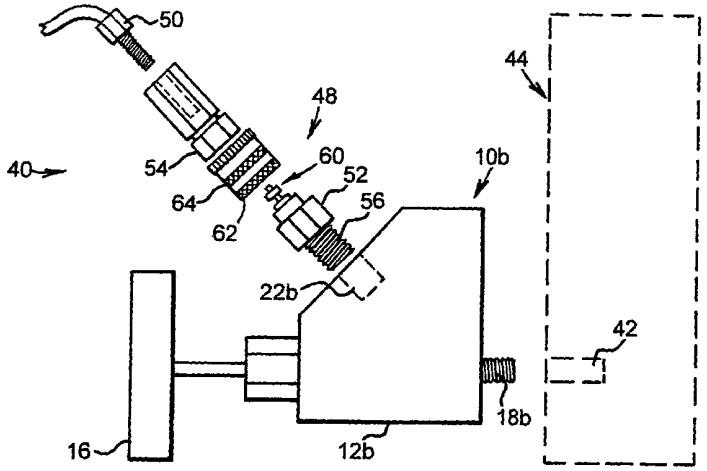
(54) Title: IMPROVED VALVE



(57) Abstract: An isolation valve (10b) for attachment to a fuel pump or fuel distribution block (44) of an engine is described. The valve (10b) comprises a valve and adaptor in a single body for direct attachment to a socket in the fuel pump or distribution block. A pressure sensor (50) can further be attached to the valve to provide fuel pressure measurement apparatus. In particular, the isolation valve can be used with large diesel engines e.g. 1000 kW engine power which operate with fuel pressures above 50 Mpa.

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IMPROVED VALVE

The present invention relates to an improved valve, and in particular, though not exclusively, to an isolation valve for use with engines, for example, diesel engines having a total engine power over 1000kW.

Current diesel engines having a total engine power over 1000kW are referred to as large diesel engines. Large diesel engines operate by injecting fuel at high pressure, for example, above 50MPa, into piston chambers where the fuel is compressed to a combustion point. At this point energy is released in a controlled explosion, driving the piston and thereby providing output power. Most combustion problems in diesel engines originate from the injection timing going out of balance. It is, therefore, advantageous to monitor high fuel pressure in a diesel engine.

Traditionally the fuel pressure is measured via an isolation valve connected to a high pressure fuel pump housing or on a line at a fuel distribution block. The isolation valve uses a needle which opens a line through the isolation valve to a sensing element in the form of a pressure transducer which senses the pressure in the line. The isolation valve is normally closed so as to protect the sensing element which has a limited life.

The isolation valve has to fit into a hole (blanked off with a plug) on the fuel pump housing or the fuel distribution block. This hole may have a range of diameters and threads - it is never standard as there are many licensees building large diesel engines. An adapter comprising an adapter pipe is therefore used to join the valve to the hole. However, there needs to be a specific adapter pipe to fit each hole type. This adapter pipe has to be very strong as it takes the pulsing pressure and the isolation valve itself is heavy. Vibration further worsens the load on the adapter pipe. The adapter pipe may be prone to fracture and indeed

ultimately potential breakage resulting in fuel spray fire risk.

It is an object of at least one aspect of the present invention to obviate or mitigate one or more of the aforementioned disadvantages in the prior art.

This object is addressed by the general solution of providing a valve and an adapter in a single body. The body may therefore, in use, be directly attached to a socket or aperture in the pump head outlet, in the fuel pump or block.

According to a first aspect of the present invention there is provided an isolation valve adapted for attachment to a fuel pump or fuel distribution block of an engine, the isolation valve comprising a valve body including valve means and coupling means for coupling the isolation valve to the fuel pump or fuel distribution block of the engine.

The engine may be a diesel engine, and may have a total engine power of over 1000kW.

The coupling means may be adapted to couple the isolation valve in the socket of a fuel pump or a line at a fuel distribution block of the engine.

Preferably the valve means may be a needle valve.

Preferably also the isolation valve may have a working pressure above 150MPa.

Advantageously the coupling means may comprise a male portion mateable with the hole.

The male portion may carry a threaded portion mateable with an internally threaded portion formed in the hole.

Preferably the threaded portion may be a B&W or RTA screw thread or the like.

Preferably the isolation valve further includes at least one and possibly a plurality of further coupling means.

Preferably the further coupling means comprises a female portion formed in the valve body. The female

portion formed in the valve body may include an internally threaded portion.

Preferably the first coupling means and the further coupling means are disposed on an inlet and an outlet of the isolation valve, respectively.

Additionally, the isolation valve may include transducer coupling means. The transducer coupling means may have a male or female portion and preferably is mateable, in use, to a fuel pressure sensor or transducer.

Preferably, the transducer coupling means provides access via a pressure sensor port to the inlet of the isolation valve.

Preferably, the pressure sensing port is disposed at an angle to the inlet. The angle selected preferably results in the needle of the isolation valve mates with the inlet at the shortest possible distance between the inlet and the needle. In the preferred embodiment, a minimum amount of valve body continuously endures the high stresses of the high pressure fuel line. Preferably also, in use, over 80% of the coupling means is enclosed in the body of the fuel pump or distribution block. This arrangement provides strengthening to the coupling means from the surrounding casing.

According to a second aspect of the present invention, there is provided apparatus for fuel pressure measurement in an engine, the test apparatus comprising an isolation valve and a pressure sensor, the isolation valve comprising a valve body including valve means, coupling means for coupling the isolation valve to a fuel pump or distribution block of the engine, and further coupling means for coupling the isolation valve to the pressure sensor.

The engine may be a diesel engine and may have a total engine power of over 1000kW.

The coupling means may be adapted to couple the isolation valve to a socket of a fuel pump or a line at a

fuel distribution block of the engine.

Preferably the valve means may be a needle valve.

Preferably also the isolation valve may have a working pressure above 150MPa.

Advantageously the coupling means may comprise a male portion mateable with the socket.

The male portion may carry a threaded portion mateable with an internally threaded portion formed in the socket.

Preferably the threaded portion may be a B&W or RTA screw thread or the like.

Preferably the isolation valve further includes further coupling means.

Preferably the further coupling means comprises a female portion formed in the valve body. The female portion formed in the valve body may include an internally threaded portion.

Preferably the first coupling means and the further coupling means are disposed on the inlet and an outlet of the isolation valve, respectively.

Additionally, the isolation valve may include transducer coupling means. The transducer coupling means may have a male or female portion and preferably is mateable, in use, to a fuel pressure sensor or transducer.

Preferably, the transducer coupling means provides access via a pressure sensor port to the inlet of the isolation valve.

Preferably, the pressure sensing port is disposed at an angle to the inlet. The angle selected preferably results in the needle of the isolation valve mating with the inlet at the shortest possible distance between the inlet and the needle. In the preferred embodiment, a minimum amount of valve body continuously endures the high stresses of the high pressure fuel line. Preferably also, in use, over 80% of the coupling means is enclosed in the body of the fuel pump or distribution

block. This arrangement provides strengthening to the coupling means from the surrounding casing.

Advantageously the test apparatus may include a quick release coupling.

The quick release coupling may be the transducer coupling means.

Preferably, the quick release coupling includes a nipple.

Preferably the nipple includes a check valve.

Preferably also, the nipple is attached to the isolation valve and the coupling is attached to the inlet of the pressure sensor.

According to a third aspect of the present invention there is provided a method of measuring fuel pressure in an engine by providing an isolation valve comprising a valve body including valve means and coupling means for coupling an inlet of the isolation valve to a fuel pump or distribution block of the engine, and a pressure sensor, said method comprising the steps of:

a) attaching the coupling means to the fuel pump or distribution block;

b) communicating an inlet of the pressure sensor with the inlet of the isolation valve, at an angle with respect to each other;

c) opening the isolation valve, and

d) measuring the fuel pressure via the pressure sensor.

Preferably the method includes, between steps a) and b), the step of inserting a quick release coupling between the inlet of the isolation valve and the inlet of the pressure sensor to allow the pressure sensor and a coupling of the quick release coupling to be releasably disengaged from the isolation valve.

These and other aspects of the present invention will become apparent from the following description when taken in combination with the accompany drawings in which:

Fig. 1 is a schematic diagram of a perspective view

of an isolation valve in accordance with a first embodiment of the present invention;

Fig. 2 is a series of views of the valve of Fig. 1;

Fig. 3 is a series of views of an isolation valve in accordance with a preferred embodiment of the present invention, and

Fig. 4 is a schematic diagram of apparatus including an isolation valve according to Fig. 2 in accordance with an embodiment of the present invention.

Reference is first made to Fig. 1 of the drawings which depicts a perspective view, with hidden detail, of a first embodiment of the present invention. The first embodiment comprises an isolation valve 10 having a through port 26 for passage of fuel at high pressure from inlet 18 to outlet 30. Each end of the through port 26 is terminated with a connector 14,24. Screw threaded female connector 14 is for connection to the outlet of a fuel pump. Screw threaded male connector 24 is for connection to the high pressure fuel line. Incident with the through port 26 at a needle tip sealing point 28 is needle valve port 20. Needle valve port 20 is mounted parallel and perpendicular to the main faces of the valve body 12. However, the position of the needle (not shown) or its operating handle (not shown) relative to the through port 26 is irrelevant. Offset from the needle valve port 20 is an offset pressure sensor port 22. Port 22 is for connection to a fuel pressure sensor and is angled to allow freer finger movement around a quick release coupling when a quick release coupling is used to mate the fuel pressure sensor to the isolation valve 10.

In use, the needle is pulled free from the through port 26 and the offset pressure sensor port 22, allowing high pressure fuel to reach the fuel pressure sensor for measurement.

A clear view of the components of the isolation valve 10 of the first embodiment can be seen in the technical drawings used for the construction of the valve

10. Fig. 2(a) is a cross-sectional view of the valve 10 of Fig. 1, in fine detail. Male and female screw threaded connectors, 24 and 14 respectively, are located at either end of through port 26 and needle valve port 20 is mounted perpendicular to through port 26, impinging at needle tip sealing point 28. Fig. 2(b) is a plan view of Fig. 2(a) with hidden detail of the features of the valve 10. A cross-sectional view through the valve 10 of Fig. 1 is shown at Fig. 2(c) together with the corresponding plan view with hidden detail in Fig. 2(d). In Fig. 2c, the offset pressure sensor port 22 is now visible in relation to needle valve port 20. In this arrangement the offset pressure sensor port 22 meets the needle valve port 20 to the right of the needle tip sealing point 28 in the through port 26.

A preferred embodiment is shown in Fig. 3 of the drawings. This figure illustrates (a) front, (b) side, (c) plan views and (d) cross-sectional view through section A-A of Fig. 3(b) respectively. Like parts to the earlier figures are given the same reference numeral but are suffixed "a". Isolation valve 10a has three ports 30a,20a and 22a. Large diameter screw threaded male connector 30a is mounted clear of valve body 12a. Connector 30a is fitted into the body of the fuel pump or distribution block so that face 38 of the isolation valve 10a is close to the opposite face of the fuel pump or distribution block. The large diameter provides greater resistance to vibrations from the fuel pump line/ distribution block to which it is attached. In addition, connector 30a is mounted into the fuel pump or distribution block to minimise the amount of valve body continuously enduring the high stresses of the high pressure fuel line. Over 80% of the port at connector 30a is enclosed in the body of the fuel pump or distribution block, thereby gaining the strength of the surrounding casing. The offset pressure sensor port 22a is located on the valve body 12b and meets the needle

port 20a close to the needle tip sealing point 28a.

A quick release coupling is attached to the port 22a which, in turn, is connected to a fuel pressure sensor. The offset angle of port 22a provides ease of access to connect and disconnect the fuel pressure sensor and allows the needle to meet its mating surface nearer the inlet port 18a, as described hereinafter.

Needle valve port 20a directly faces the input in the line of through port 26a. However, the position of the needle tip sealing point 28a is arranged to be as close to the inlet port 18a as possible. This arrangement ensures that the valve body 12a is subjected to the minimum stresses from pressure in the line of the through port 26a.

Isolation valve 10a is designed to provide a small valve body 12a with a large connector 18 to be mounted in the fuel pump or distribution block or fuel line of an engine.

Reference is now made to Fig. 4 of the drawings which depicts a test apparatus, generally indicated by reference numeral 40, for fuel pressure measurement in, for example, a diesel engine having a total engine power over 1000kW according to an embodiment of the present invention. The apparatus 40 is connected to a hole 42 of a fuel pump or a fuel line at a fuel distribution block, generally designated 44. An isolation valve 10b, as described hereinbefore with like parts given the same numeral but now suffixed "b", is directly coupled to the hole 42 by mating to the screw threaded connector 18b which is part of the valve body 12b. A second screw threaded connector 22b of female type is located on an outlet of the isolation valve 10b.

A quick release coupling, generally indicated by reference numeral 48, is located between the isolation valve 10b and a pressure sensor 50. The quick release coupling 48 comprises a nipple 52 and coupling 54. Nipple end 56 is screwed into the screw threaded

connector 22b on the outlet of the isolation valve 10b. The releasable engagement of a quick release coupling 48 is operated by inserting an engaging portion 60 of the nipple 52 into a receiving aperture 62 of the coupling 54. Disengagement is achieved by twisting a knurled sleeve 64 on the coupling 54.

The quick release coupling 48 is a commercially available component as will be appreciated by persons skilled in the art. The use of the quick release coupling enables very rapid engaging and disengaging of the pressure sensor. The pressure sensor 50 connected to the coupling 54 is Model No. 6729 available from Kistler (trademark).

It will be appreciated that a principal advantage of one or more embodiments of the present invention is provision of an adapter and valve combined as a single unit, obviating the need for adapters and providing a strong connection point between valve and fuel pump/line which reduces maintenance repair and likelihood of failure with the associated risk of fire due to spraying high-pressure fuel oil.

CLAIMS

1. An isolation valve adapted for attachment to a fuel pump or fuel distribution block or fuel line of an engine, the isolation valve comprising a valve body including valve means and coupling means for coupling the isolation valve to the fuel pump, distribution block or fuel line of the engine.

2. An isolation valve as claimed in claim 1 wherein the valve means is a needle valve.

3. An isolation valve as claimed in claim 1 or 2 wherein the coupling means is a threaded coupling.

4. An isolation valve as claimed in any preceding claim wherein the isolation valve includes transducer coupling means.

5. An isolation valve as claimed in claim 4 wherein the transducer coupling means provides access via a pressure sensor port to the inlet of the isolation valve.

6. An isolation valve as claimed in claim 5 wherein the pressure sensing port is disposed at an angle to the inlet.

7. Apparatus for fuel pressure measurement in an engine, the apparatus comprising an isolation valve and a pressure sensor, the isolation valve comprising a valve body including valve means, coupling means for coupling the isolation valve to a fuel pump or distribution block or fuel line of the engine, and further coupling means for coupling the isolation valve to the pressure sensor.

8. Apparatus as claimed in claim 7 wherein the apparatus includes a quick release coupling.

9. Apparatus as claimed in claim 8 wherein the quick release coupling is a transducer coupling means.

10. A method of measure fuel pressure in an engine by providing an isolation valve comprising a valve body including valve means and coupling means for coupling an inlet of the isolation valve to a fuel pump or distribution block or fuel line of the engine, and a pressure sensor, said method comprising the steps of:

a) attaching the coupling means to the fuel pump or distribution block or fuel line;

b) communicating an inlet of the pressure sensor with the inlet of the isolation valve, at an angle with respect to each other;

c) opening the isolation valve, and

d) measuring the fuel pressure via the pressure sensor.

11. A method as claimed in claim 10 wherein the method includes, between steps a) and b), the step of inserting a quick release coupling between the pressure inlet of the isolation valve and the inlet of the pressure sensor.

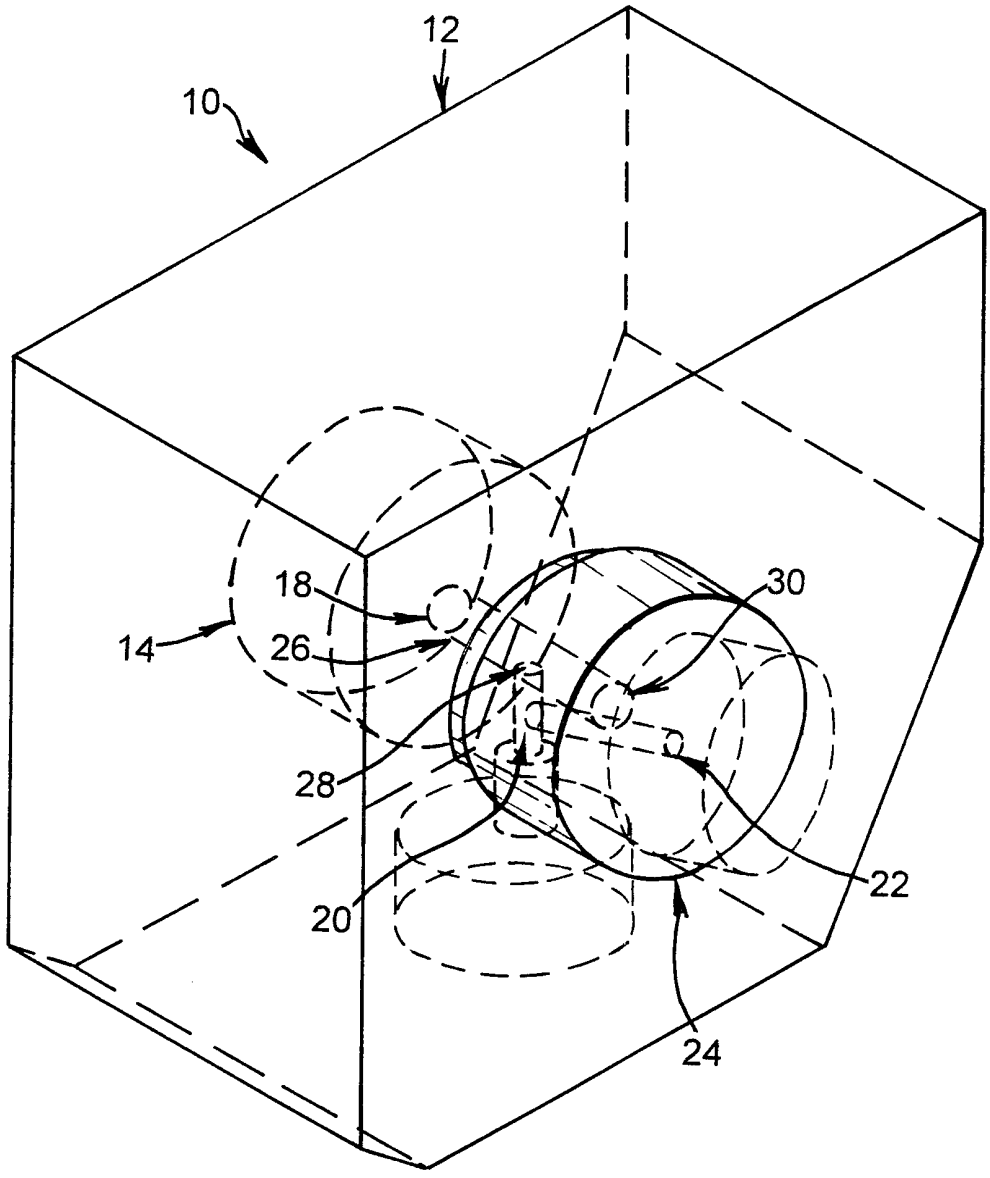
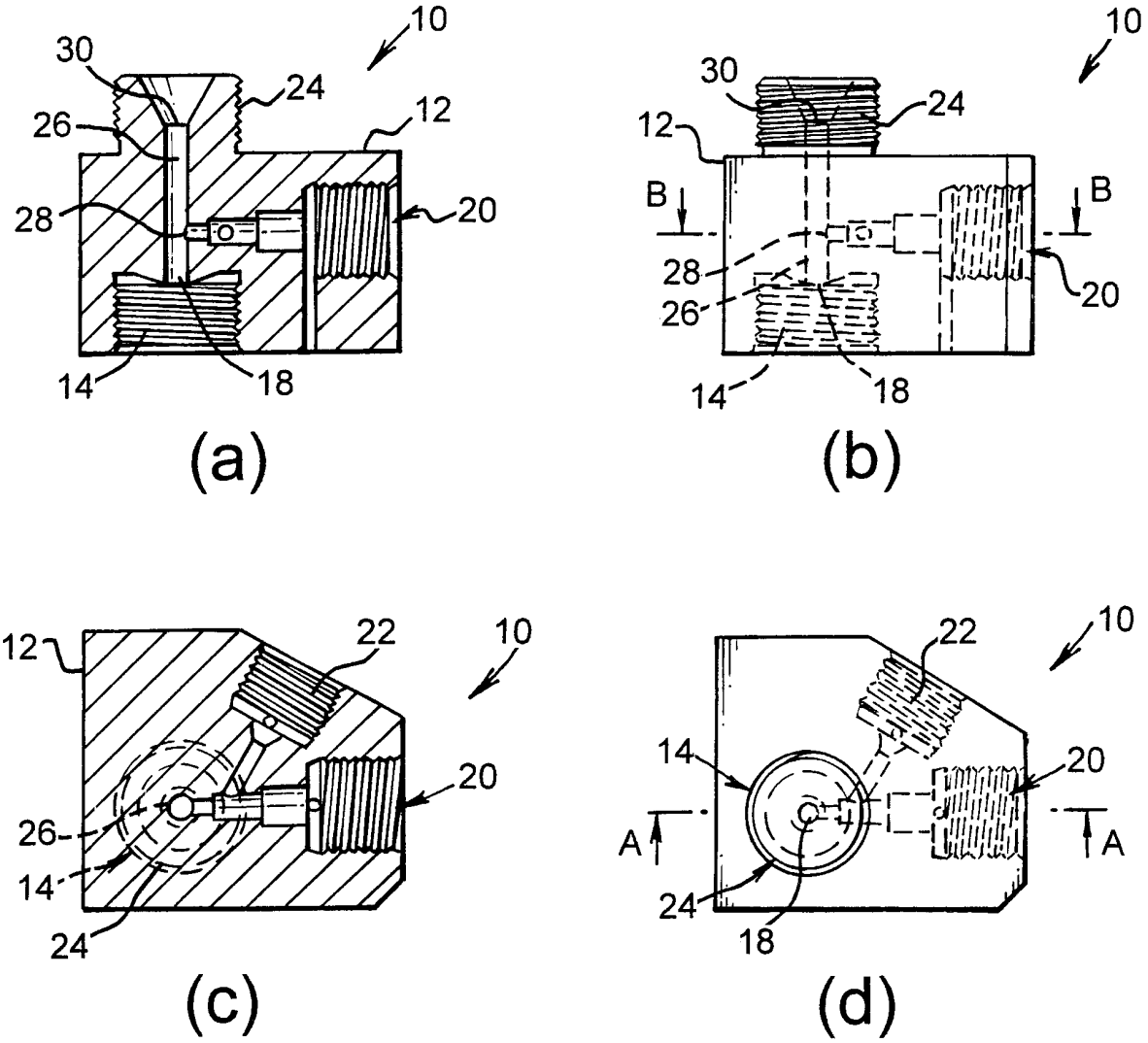


Fig.1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(a)
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(b)
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Fig.2

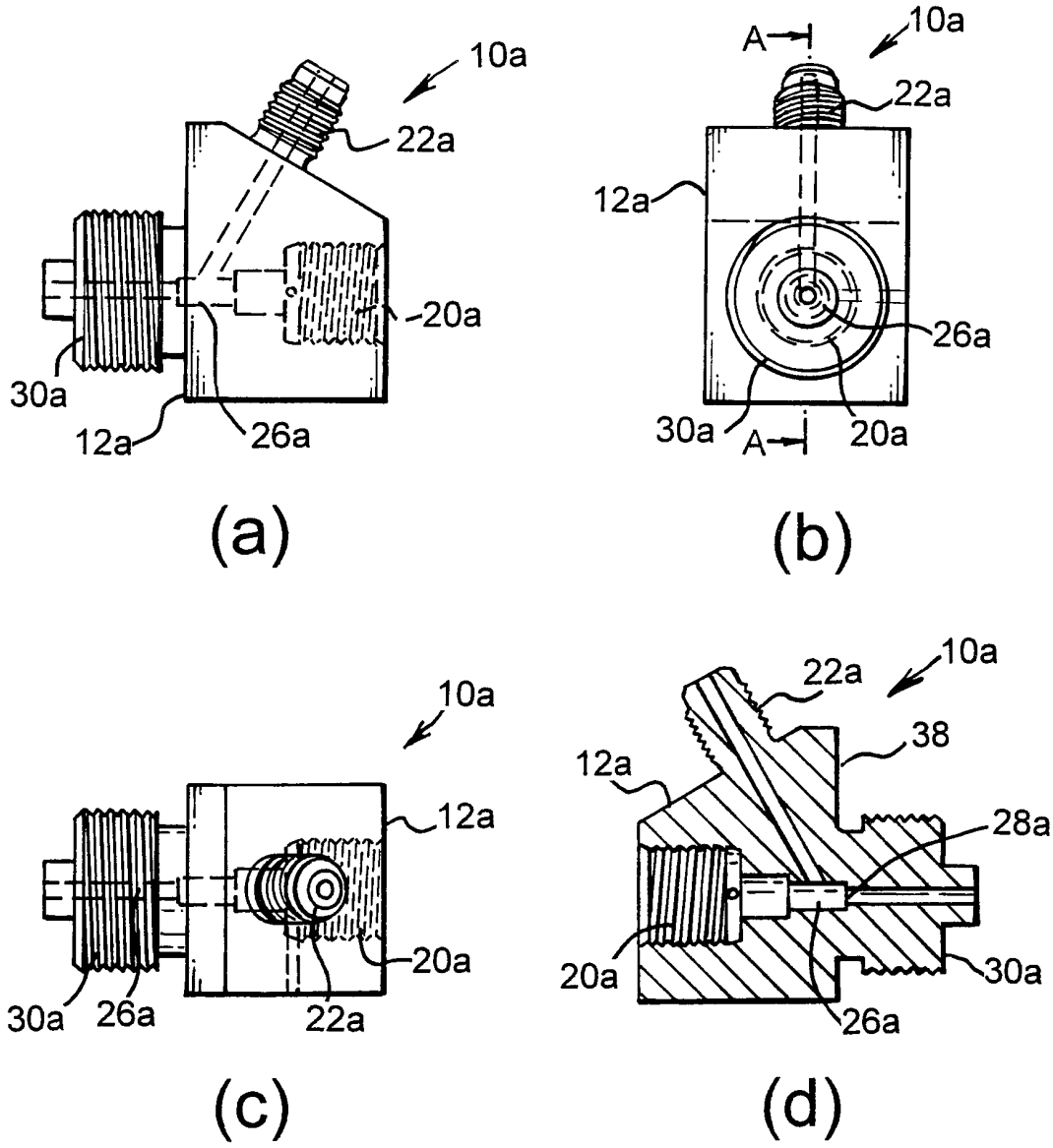
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Fig.3

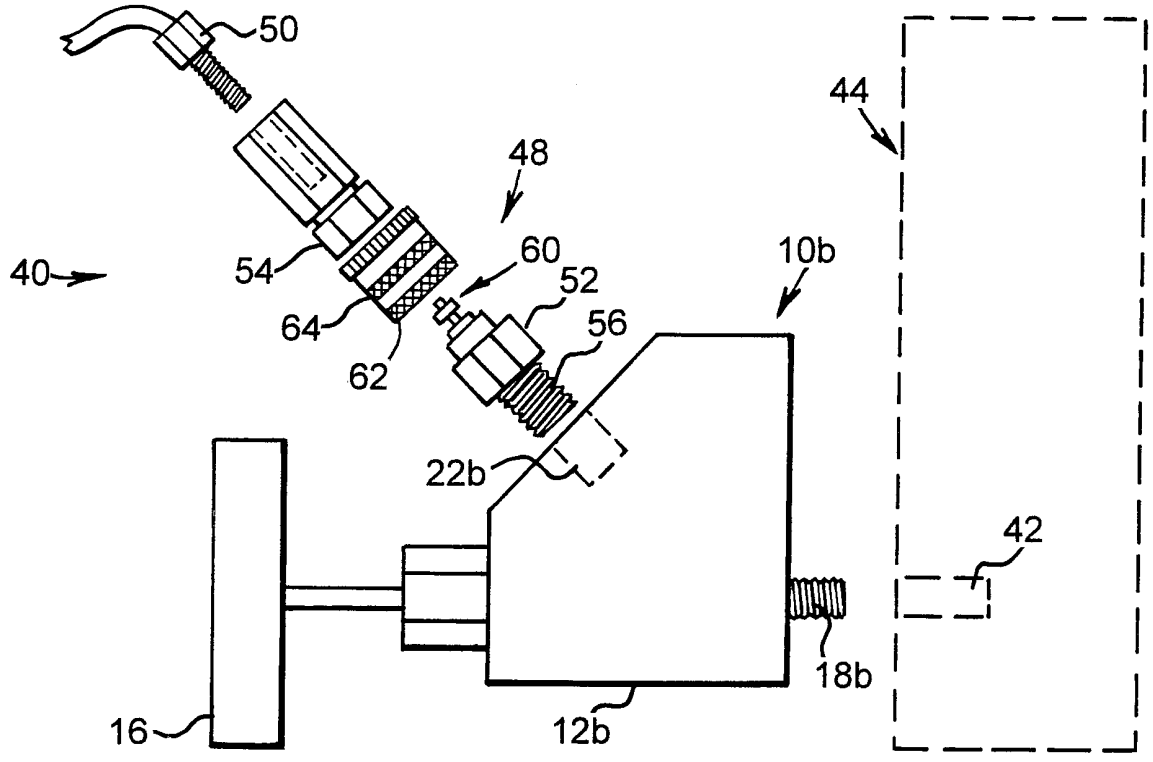

Fig.4

INTERNATIONAL SEARCH REPORT

Inte ional Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F02M65/00 F02M55/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 1 017 779 A (CHANSON) 17 December 1952 (1952-12-17) the whole document	1,3-7,10
X	GB 2 243 432 A (FORD MOTOR CO) 30 October 1991 (1991-10-30)	1,3-7,10
Y	page 4, line 20 -page 5, line 26; figures	2,8,9
Y	GB 2 333 323 A (FORD MOTOR CO) 21 July 1999 (1999-07-21) abstract; figures	2,8,9
X	US 4 598 581 A (BREKKE CARROLL E) 8 July 1986 (1986-07-08)	1-5,7-9
A	column 3, line 37 -column 8, line 43; figures 1,2,6,7	11

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
29 November 2000	07/12/2000

Name and mailing address of the ISA	Authorized officer
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PCT/EP 00/07577

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	DE 21 43 476 A (LIST HANS) 13 April 1972 (1972-04-13) figure -----	1

2

INTERNATIONAL SEARCH REPORT

information on patent family members

Inte .onal Application No
PCT/EP 00/07577

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 1017779 A	17-12-1952	NONE	
GB 2243432 A	30-10-1991	NONE	
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