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(71) Applicant: ROBERT BOSCH GMBH [DE/DE]; Postfach 30 02 20, 70442 Stuttgart (DE).

(72) Inventors: FRANK, Karsten; Auf Dem Geisenknopp 1, 66280 Sulzbach/Saar (DE). TORNESE, Federica; Via delle Ortensie 19, 70026 Modugno (IT). ROCCO, Silvia; Via delle Ortensie 19, 70026 Modugno (IT). GAEMLICH, Markus; Im Kaeppele 11, 73230 Kirchheim (DE). STENGELE, Michael; Hausertalstr. 24, 72477 Schwenningen

(DE). CECERE, Martino; Via delle Ortensie 19, 70026 Modugno (IT).

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(54) Title: METHOD FOR MANUFACTURING A HEAD-PIECE OF A PUMPING UNIT FOR FEEDING FUEL, PREFERABLY DIESEL FUEL, TO AN INTERNAL COMBUSTION ENGINE

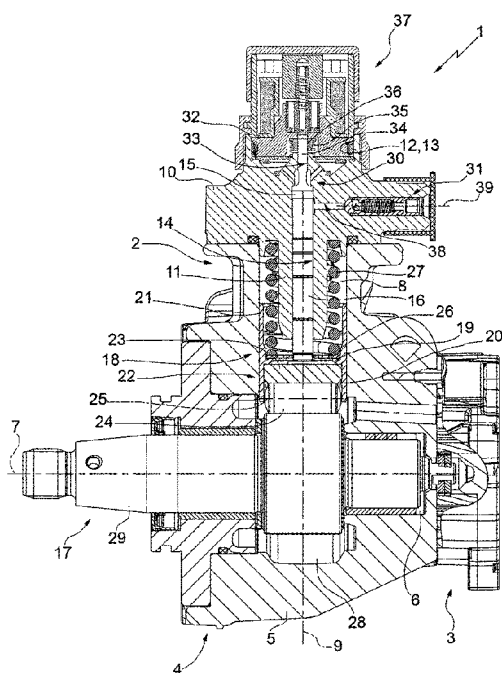


FIG. 1

(57) Abstract: Method for manufacturing a head-piece (10) of a pumping unit for feeding fuel, preferably diesel fuel, to an internal combustion engine, whereby the head-piece (10) is provided with a central hole (12) configured to define a cylinder (15) able to be slidably engaged by a piston (16) and a seat (33) designed to be slidably engaged by a closing member (34) of an intake valve (30) and is further provided with a delivery duct (38) connected to the cylinder (15) and the internal combustion engine; at least part of a surface of the central hole (12) and/or a surface of the delivery duct (38) being superficially compressed and plastically deformed by means of shot-blasting.

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5 Description

Title

10 METHOD FOR MANUFACTURING A HEAD-PIECE OF A PUMPING UNIT FOR
FEEDING FUEL, PREFERABLY DIESEL FUEL, TO AN INTERNAL
COMBUSTION ENGINE

The present invention relates to a method for manufacturing a head-piece of a pumping unit for feeding fuel, preferably diesel fuel, to an internal combustion engine.

15

In the sector of pumping units for feeding fuel to an internal combustion engine it is known to provide a pumping unit of the type comprising a high-pressure pump for feeding the fuel to an internal combustion engine; a pre-feed pump for feeding the fuel from a storage tank to the high-pressure pump; and a hydraulic circuit comprising, in turn, a first line for connecting together the storage tank and the pre-feed pump, a second line for connecting together the pre-feed pump and the high-pressure pump, and a third line for connecting together the high-pressure pump and the internal combustion engine.

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The high-pressure pump is a piston pump provided with a pump body comprising a support housing having a central hole and a side hole which are transverse to each other.

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The side hole is closed by a head-piece which is arranged in contact with the support housing and has a lug projecting inside said side hole.

The head-piece has a central hole comprising a wide portion and narrow portion which are arranged in succession along a longitudinal axis of said central hole.

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The narrow portion defines a cylinder which is slidably engaged by piston movable, by means of the thrusting action of an actuating device which is housed at least partly inside the central hole of the support housing, with an alternating rectilinear movement comprising an intake stroke for drawing the fuel into the cylinder and a compression stroke for compressing the fuel contained inside said cylinder.

The wide portion and the narrow portion of the central hole of the head-piece are connected together at an annular shoulder defining a seat slidably engaged by a closing member of an intake valve designed to control selectively feeding of fuel to the cylinder.

The head-piece also has a side hole defining a delivery duct which communicates hydraulically with the cylinder and houses inside it a delivery valve designed to control selectively the feeding of fuel to the internal combustion engine.

Since the transfer of the fuel from the second line to the third line of the hydraulic circuit by means of the piston pump causes oscillation of the pressure of the fuel inside the head-piece, the known pumping units of the type described above have a number of drawbacks due mainly to the fact that the head-piece is subject to tensile stresses which are relatively high and which may cause breakage of said head-piece due to wear.

The object of the present invention is to provide a method for manufacturing a head-piece of pumping unit for feeding fuel, preferably diesel fuel, to an internal combustion engine, which does not have the aforementioned drawbacks and is simple and inexpensive to produce.

According to the present invention a method for manufacturing a head-piece of a pumping unit for feeding fuel, preferably diesel fuel, to an internal combustion engine is provided, as claimed in the attached claims.

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The present invention will now be described with reference to the accompanying drawings which illustrate a non-limiting example of embodiment thereof, in which:

Figure 1 is a schematic cross-sectional view, with parts removed for greater clarity, of a preferred embodiment of the pumping unit according to the present invention;

Figure 2 is a schematic cross-sectional view, with parts removed for greater clarity, of the pumping unit according to Figure 1; and

Figure 3 is a schematic cross-sectional view of a head-piece of the pumping unit shown in Figures 1 and 2.

With reference to Figures 1 and 2, 1 denotes in its entirety, a pumping unit for feeding fuel, preferably diesel fuel, to an internal combustion engine (not shown).

The pumping unit 1 comprises a piston pump 2 for feeding the fuel to the said internal combustion engine (not shown); and a pre-feed pump 3, for example a gear pump, for feeding the fuel from a storage tank (not shown) to said pump 2.

The pump 2 has a pump body 4 comprising a support housing 5 which is provided with a central hole 6 having a longitudinal axis 7 and also has a side hole 8 which has a longitudinal axis 9 transverse to the axis 7 and extends radially towards the outside of the housing from said hole 6.

The hole 8 is closed by a head-piece 10 which is arranged in contact with the housing 5 and has a lug 11 projecting inside the hole 8 coaxially with the axis 9.

The head-piece 10 has a central hole 12 which is formed through the head-piece 10 coaxially with the axis 9 and comprises a wide portion 13 and a narrow portion 14 which are aligned with each other along said axis 9.

The portion 14 faces the hole 6 and defines a cylinder 15 which is slidably engaged by a piston 16 movable along the cylinder 15, by means of the thrusting

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action of an actuating device 17, with an alternating rectilinear movement comprising an intake stroke for drawing the fuel into the cylinder 15 and a compression stroke for compressing the fuel contained inside said cylinder 15.

5 The device 17 comprises a tubular sleeve 18 which is slidably engaged inside the hole 8 coaxially with the axis 9, extends around the cylinder 15 and has an inner annular flange 19 which projects radially from an inner surface of the sleeve 18 and divides said sleeve 18 into two cylindrical portions 20, 21, the portion 20 of which faces the hole 6.

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The device 17 has, moreover, a tappet system 22 comprising a coupling block with a substantially cylindrical shape, which is locked by means of interference inside the portion 20, is arranged in contact with the flange 19 and support a tappet system roller 24.

15

The roller 24 projects from the block 23 towards the hole 6 and is rotatably coupled with the block 23 so as to rotate, relative to said block 23, about its longitudinal axis 25 substantially perpendicular to the axis 9.

20

The flange 19 supports an annular disc 26 which extends around the around the piston 16, is inserted inside the portion 21 of the sleeve 18 coaxially with the axis 9 and has an outer perimeter edge axially facing the flange 19 and an inner perimeter edge axially facing a head of said piston 16.

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The device 17 also comprises a compression spring 27 which is mounted between the lug 11 and the sleeve 18 coaxially with the axis 9 and is arranged between the head-piece 10 and the disc 26 so as to displace, and normally keep, the disk 26 in contact with the flange 19 and the roller 24 in contact with a cam 28 formed on an outer surface of an intermediate portion of a transmission shaft 29 mounted through the hole 6 so as to rotate, relative to the housing 5, about the axis 7.

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The head-piece 10 supports an intake valve 30 for drawing the fuel into the cylinder 15 and a delivery valve 31 for supplying the fuel to the internal combustion engine (not shown).

5 The portions 13 and 14 of the hole 12 are connected together at an annular shoulder 32 defining a central seat 33 slidably engaged by a closing member 34 of the valve 30.

10 The closing member 34 is displaced, and normally kept, in a closing position (Figures 1 and 2) by a spring 35 arranged between the shoulder 32 and a disc 36 mounted on said closing member 34.

15 The closing member 34 is moreover displaced from its closing position into an opening position (not shown) against the thrust of the spring 35 by an electromagnetic actuator 37 of the known type.

20 The valve 31 is housed inside a delivery duct 38, which has a longitudinal axis 39 transverse to the axis 9, communicates with the cylinder 15 and is connected in a known manner to the internal combustion engine (not shown).

25 At least the seat 33, the narrow portion 14 of the hole 12 and the duct 38 are subject to a surface compression and plastic deformation treatment designed to generate in the head-piece 10 compression stresses which compensate for the tensile stresses generated inside the head-piece 10 by oscillation of the fuel pressure inside said head-piece 10.

30 In the case in question the surface compression and plastic deformation treatment used is shot-blasting where a stream of particles, in particular, glass-fibre particles, is directed against the surface of the seat 33, the narrow portion 14 of the hole 12 and the duct 38 by means of a compressed air flow or by means of ultrasound.

35 With the shot-blasting treatment it is possible to limit the risk of breakage of the head-piece 10 due to fatigue

5 Claims

- 10 1. Method for manufacturing a head-piece (10) of a pumping unit for feeding fuel, preferably diesel fuel, to an internal combustion engine, the head-piece (10) being provided with a central hole (12) configured to define a cylinder (15) designed to be slidably engaged by a piston (16) of the pumping unit and a coupling seat (33) designed to be slidably engaged by a closing member (34) of an intake valve (30) of said pumping unit, the head-piece (10) being provided moreover with a delivery duct (38) connected to the cylinder (15) and the internal combustion engine; the method being characterized in that it
- 15 comprises the step of:
performing a surface compression and plastic deformation of at least part of the surface of the central hole (12) and/or of a surface of the delivery duct (38).
- 20 2. Method according to Claim 1, wherein the surface compression and plastic deformation are performed by means of shot-blasting where a stream of particles, in particular glass-fibre particles, is directed against at least part of the surface of the central hole (12) and/or the surface of the delivery duct (38) by means of a compressed air flow.
- 25 3. Method according to Claim 1, wherein the surface compression and plastic deformation are performed by means of shot-blasting, a stream of particles, in particular glass-fibre particles, being directed against at least part of the surface of the central hole (12) and/or the surface of the delivery duct (38) by
- 30 means of ultrasound.

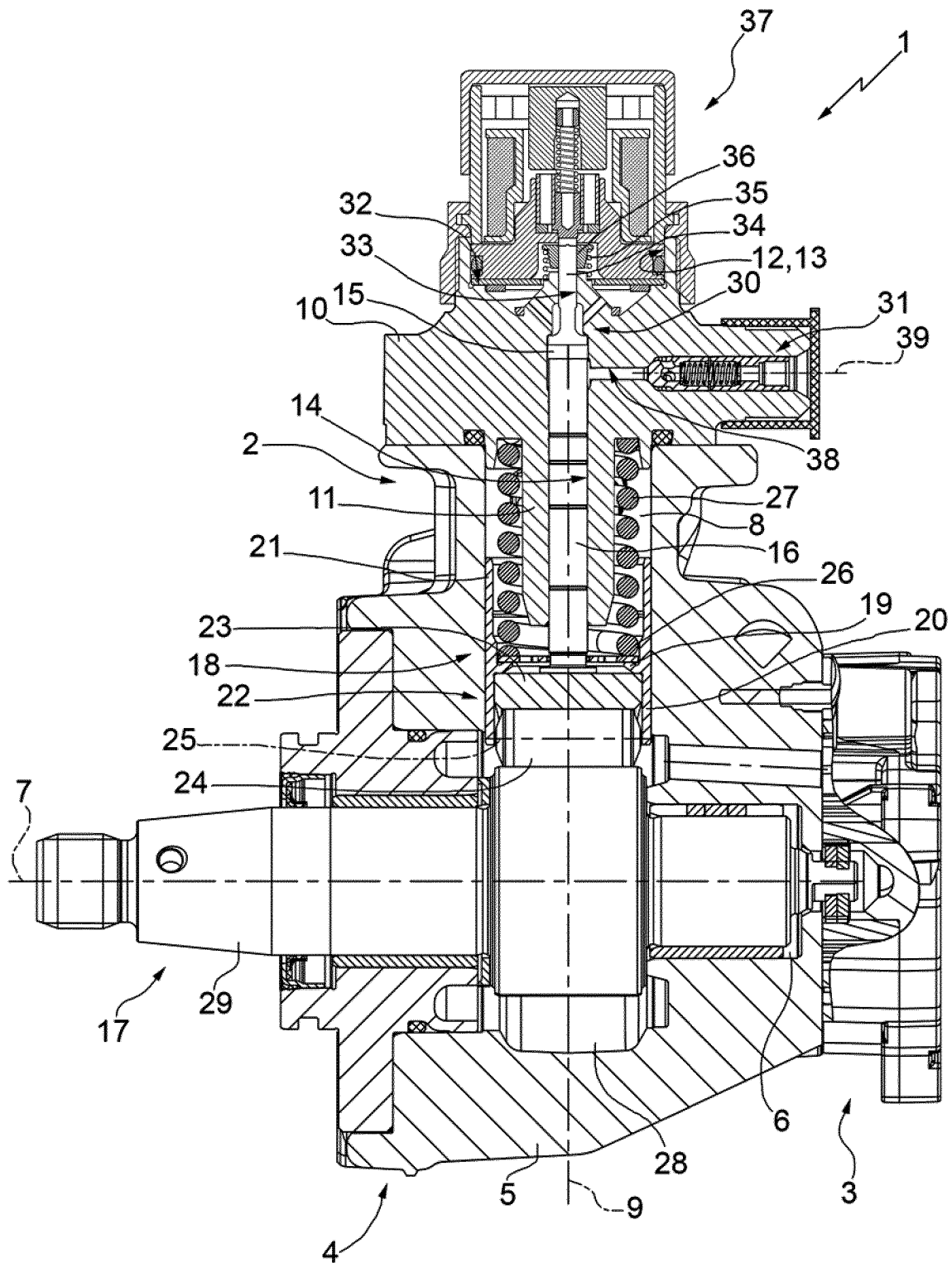


FIG.1

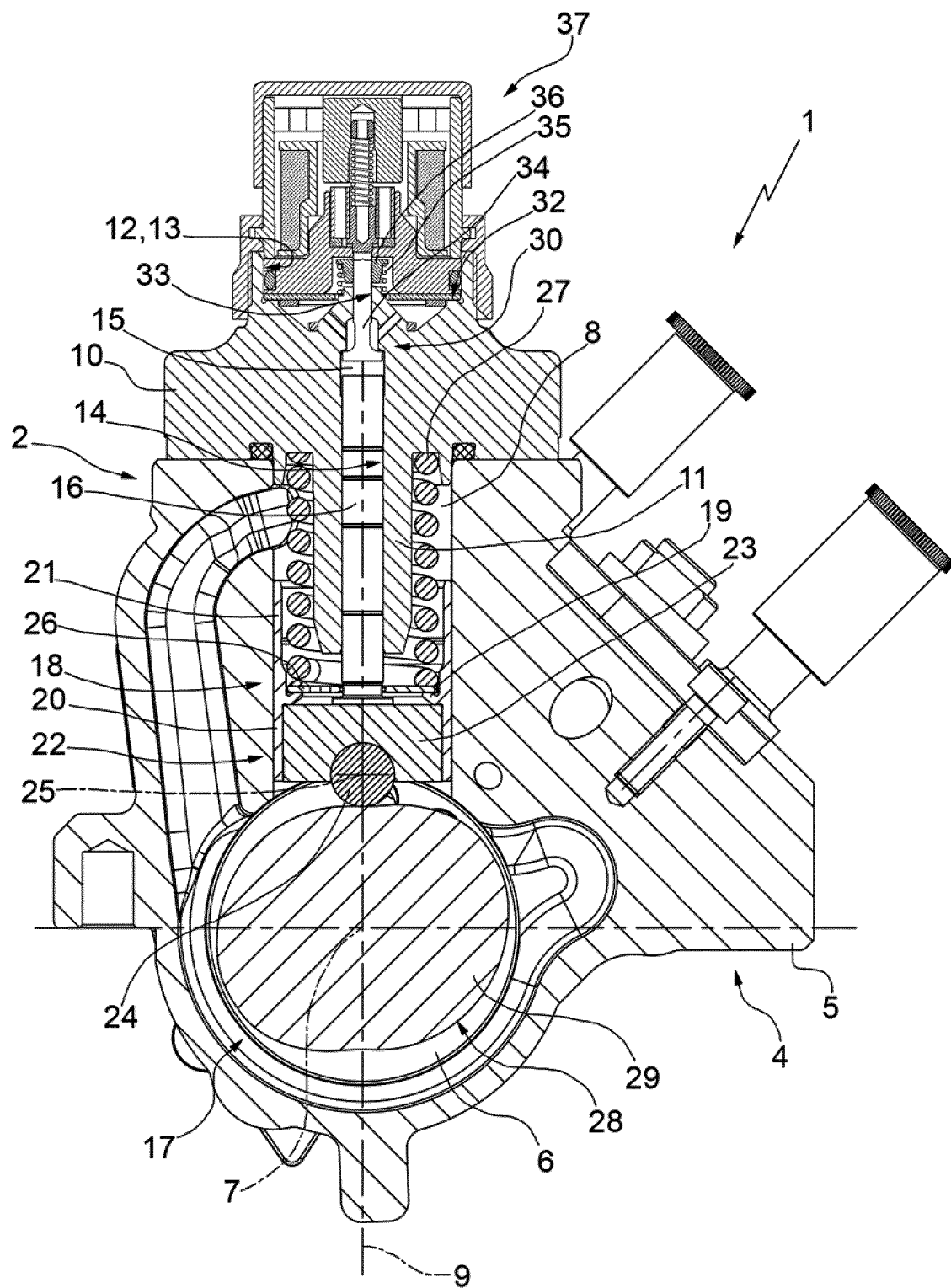


FIG. 2

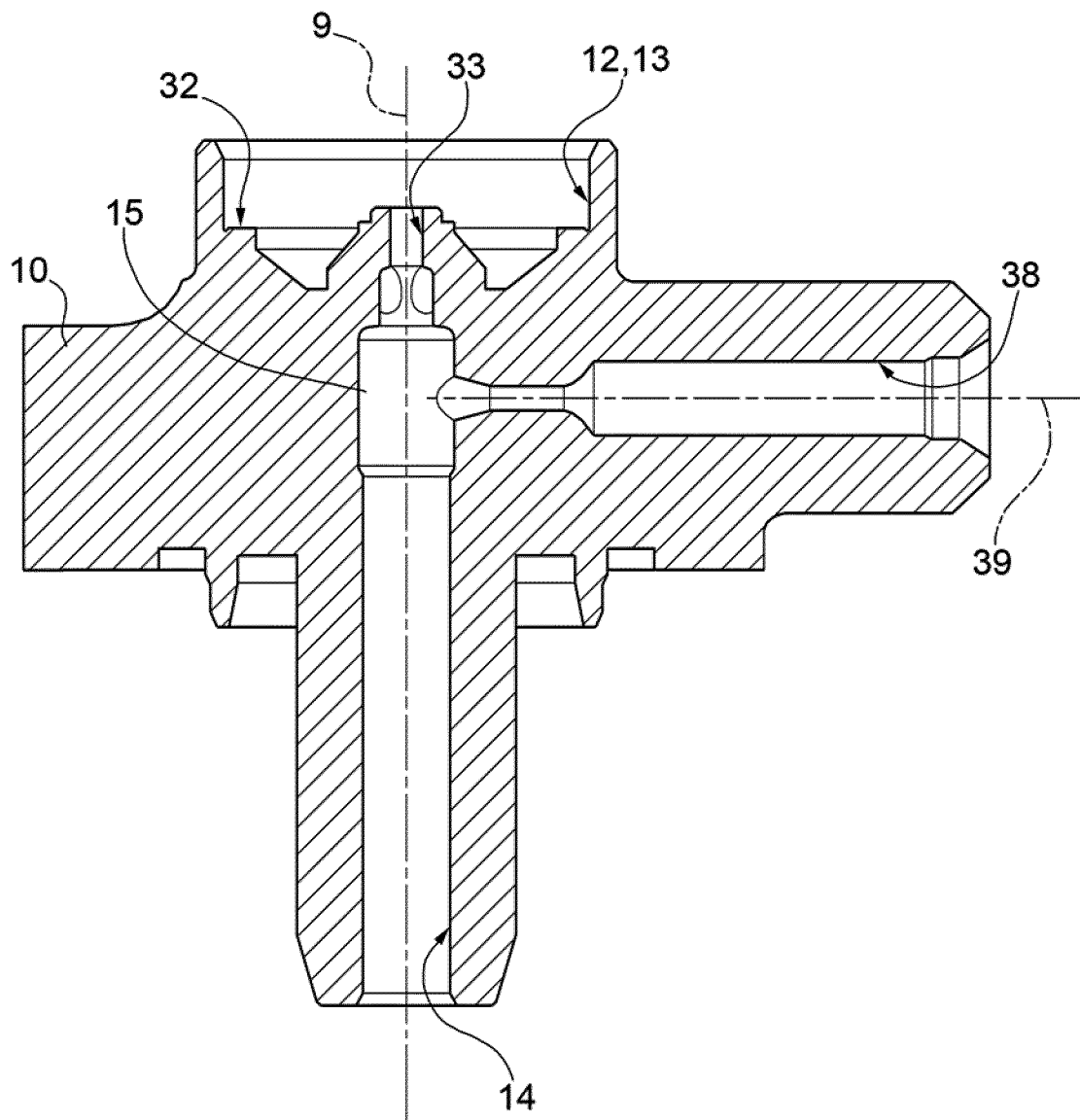


FIG.3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/057410

A. CLASSIFICATION OF SUBJECT MATTER		
INV.	F04B1/04 F04B1/053	F02M59/06 F04B7/00
	F02M59/44 F04B9/04	F04B53/00 F04B53/16
ADD.		
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) F04B 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 practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2017/348826 A1 (SPINNER DANIEL [US] ET AL) 7 December 2017 (2017-12-07) paragraph [0014] - paragraph [0029]; figures 1,2a,3a -----	1,2
X	US 2016/130679 A1 (COBER WILLIAM J [US] ET AL) 12 May 2016 (2016-05-12) paragraphs [0042] - [0082]; figures 9-14 -----	1,3
X	CN 205 663 608 U (BAOSHI MACHINERY CHENGDU EQUIPMENT MFG BRANCH) 26 October 2016 (2016-10-26) paragraphs [0002] - [0039]; figures 1,2 -----	1
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
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Date of the actual completion of the international search 13 May 2019		Date of mailing of the international search report 22/05/2019
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Jurado Orenes, A

INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 2016130679	A1	12-05-2016	NONE
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