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(54) Title: MAGNETIC HIGH PRESSURE CONNECTOR

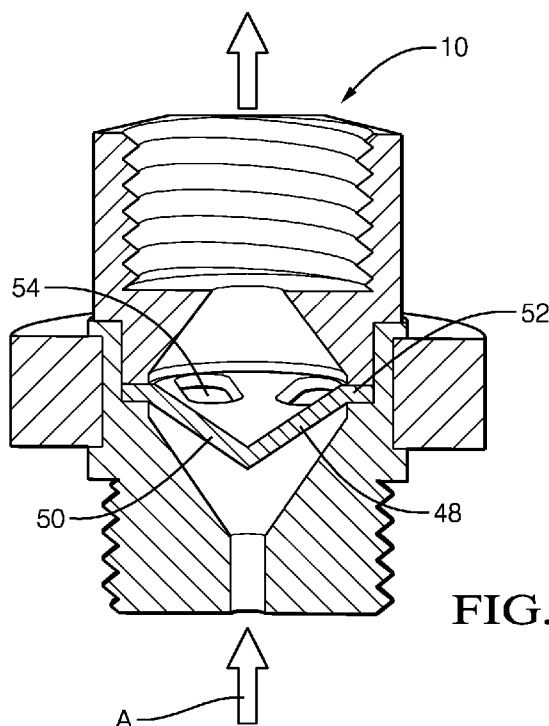


FIG. 3

(57) Abstract: A high pressure connector (10) adapted to be inserted between the outlet of a high pressure pump and the inlet of a fuel injector of a fuel injection equipment said high pressure connector (10) comprising an annular magnet member (40) defining a central opening for the fuel to flow through in use so that, metallic particles present in the fuel are trapped.

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MAGNETIC HIGH PRESSURE CONNECTOR

5 TECHNICAL FIELD

The present invention relates to a magnetic high pressure connector adapted to be arranged in a fuel injection equipment to retain metallic particles present in the flow.

10 BACKGROUND OF THE INVENTION

In fuel injection equipment, fuel is pressurised in a high pressure pump and is ultimately delivered to fuel injectors which spray said fuel in the cylinders of an internal combustion engine. Despite filters arranged in the equipment, some metallic particles present in the fuel flow find a way through and damage the fuel
15 injectors. A simple and efficient device retaining said particles is necessary.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to resolve the above mentioned problems in providing a high pressure connector adapted to be inserted
20 between the outlet of a high pressure pump and the inlet of a fuel injector of an fuel injection equipment of an internal combustion engine.

Advantageously, said high pressure connector comprises an annular magnet member defining a central opening for the fuel to flow through in use so that, metallic particles present in the fuel are trapped.

25 The high pressure connector further comprises a body, the annular magnetic member being arranged onto said body.

Also, an inner passage extends between the opposed opening ends of the body, said passage defining a slow-down chamber around which is arranged the magnet member so that, in use, the fuel flow entering said chamber slows down
30 for the magnetic member to attract and retain more easily the metallic particles.

Also, the body comprises an upstream member fixed to a downstream member, one of said upstream or downstream members defining connection means, for complementary fixing arrangement of said connector to the pump or the injector or another component of the fuel injection equipment.

Also, the other of one of said upstream or downstream members defines a holding means for holding the connector while fixing it onto said another component of the fuel injection equipment.

Also, the upstream member has a threaded outer face defining said
5 connection means and, the downstream member has a polygonal outer face defining said holding means.

Also, the high pressure connector further defines a narrow inlet conduit drilled in the upstream member and opening in said slow-down chamber wherein the flow section enlarges so that, in use, the flow speed decreases.

10 Also, the high pressure connector further comprises a chicane member arranged in said slow-down chamber so that, in use, fuel flow is forced toward the peripheral area of said chamber where in the magnetic field is stronger.

Also, said chicane member defines a cone portion which apex points to the inlet narrow conduit.

15 Also, the cone portion is provided with apertures through which fuel flows.

Also, said chicane member is fixed in place between the upstream member and the downstream member.

20 BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is now described by way of example with reference to the accompanying drawings in which:

Figure 1 is a 3D view of a magnetic high pressure connector as per the invention.

25 Figure 2 is an axial section of the connector of figure 1.

Figures 3 and 4 are axial sections of an alternative embodiment of the connector of figure 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

30 In reference to the figures is described a high pressure (HP) magnetic connector 10 adapted to be inserted in the high pressure circuit of a fuel injection equipment arranged on an internal combustion engine. More precisely, such injection equipment comprises a HP pump delivering, in use, pressurised fuel to a

common rail which distributes said pressurised fuel to fuel injectors, ultimately spraying the fuel in the cylinders of the engine. The connector 10 is placed on the fuel flow circuit, between the outlet of the HP pump and the inlet of an injector in order to prevent some particles present in the fuel to enter the injector.

5 More precisely, the HP connector 10 comprises a generally cylindrical tubular body 12 which, in consideration of the fuel flow direction indicated with arrow A, extends along a main axis X from an upstream end 14, to a downstream end 16. The body 12 itself comprises an upstream member 18 fixed to a downstream member 20. Said two complementary members may be welded
10 together or fixed with other known means.

The body 12 defines an inner through passage 22 extending between the said ends 14, 16 in said passage 22, in following the general flow direction, comprises a first upstream narrow conduit 24, a chamber 26 and a cylindrical downstream recess 28 establishing together a permanent fluid communication
15 between the upstream end 14 and the downstream end 16.

The chamber 26 has a section that enlarges in a first conical portion 30 from the opening of the narrow conduit 24 to a large central section 32, from which, said chamber section restricts in a second conical portion 34 ending in an outlet 36 that centrally opens in the bottom face of the cylindrical downstream
20 recess 28.

In an alternative shown on the figures, between the first 30 and the second 34 conical portions, the chamber 26 is provided with a short cylindrical central portion 38 wherein is defined said large central section 32. Said first conical portion 30 is machined in the upstream member 18 of the body and, the
25 second conical portion 34 is provided in the downstream member 20 of the body. The parting line shown on the figures indicating the faces of said upstream 18 and downstream 20 members in contact against one another.

Also, an annular magnet member 40 arranged on the external face of the body 12 at substantially equal distances between the upstream 14 and the
30 downstream 16 ends surrounds said central portion 38 and the large central section 32. As it is visible on figure 2, said annular magnet member 40 is arranged in an annular external groove provided in body. To enable such arrangement, the

magnetic member comprises several portions that are arranged one by one in said groove.

In use, a pressurised fuel flow enters the HP connector 10 via the narrow conduit 20 wherein said flow has an inlet speed $S1$ then, the fuel enters the chamber 22 wherein the speed reduces down to a central speed $S2$ because the section enlarges and, finally, the flow exits the chamber 22 and continues in the downstream recess 24 flowing toward an injector. As an illustration, test have shown that flow having a maximum value of 150 L/hour resulting in a inlet velocity $S1$ close to 1m/s slows down to a central speed $S2$ of around 0.8m/s at the widest section. When entering the chamber 22 and flowing at its lowest speed, the central speed $S2$, metallic particles present in the fuel are attracted by the magnetic field of said annular magnet member 34 toward the lateral face of the chamber, and preferably by the largest central section 28 where said field is the strongest.

Externally, the connector 10 is designed to sealingly interconnect components of the fuel equipment. In the embodiment presented on the figures the external face of the upstream end 14 is threaded 42 for complementary tightening for instance in the outlet of the HP pump and, the downstream end 16 is externally shaped with an hexagon 44 for complementary engagement of a tightening tool, a spanner or a wrench and, the lateral face of the recess 28 is internally threaded 46 for complementary connection of the end of a HP pipe. Other connection means than threads can be utilised such as clips or flanges. Also other tools can be used requiring other complementary shapes than an hexagon such as simple flats or any type of polygons or other means.

In an alternative presented on figures 3 and 4, the connector 10 further comprises a chicane member 48 arranged within the inner through passage 22, said chicane 48 disrupting and slowing the fuel flow and forcing it to an external path for enabling easier trap by the magnet member 34 of said metallic particles.

In the embodiment presented said chicane member 48 is a circular plate having a central conical portion 50 and a peripheral annular area 52. The central conical portion 50 is oriented toward the upstream end 14 so pointing against the flow direction, and the peripheral annular area 52 is tightened between the upstream 18 and downstream 20 members of the body. As shown, the central

conical portion 50 extends in the largest part of the first conical portion 30 of the chamber 26 and, said central portion 50 is provided with apertures 54 opening a fluid communication between the first 30 and second 32 conical portions of the chamber. Said apertures 54 are arranged in the largest part of the cone, close to the peripheral area 52 and in use, the fuel flow entering the chamber 26 slows down because of the enlarging section of the chamber, and also because of the chicane member 48 which disturbs the flow and laterally orients it toward the largest area of the chamber 22, where the wall thickness of the connector body is the thinnest, the magnetic field being the strongest so having a maximum influence to retain the metallic particles.

LIST OF REFERENCES

	A	flow direction
	X	main axis
15	10	connector
	12	body
	14	upstream end
	16	downstream end
	18	upstream member of the body
20	20	downstream member of the body
	22	inner through passage
	24	first upstream narrow conduit
	26	chamber
	28	downstream recess
25	30	first conical portion
	32	large central section
	34	second conical portion
	36	outlet of the chamber
	38	central portion
30	40	annular magnet member
	42	external thread of the upstream end
	44	hexagon
	46	internal thread of the downstream end
	48	chicane member
35	50	central cone portion
	52	annular area
	54	apertures

CLAIMS:

1. High pressure connector (10) adapted to be inserted between the outlet of a high pressure pump and the inlet of a fuel injector of an fuel injection equipment
5 of an internal combustion engine said high pressure connector (10) comprising an annular magnet member (40) defining a central opening for the fuel to flow through in use so that, metallic particles present in the fuel are trapped and wherein,
the high pressure connector (10) comprises a body (12) extending from
10 an upstream end (14) to a downstream end (16), the annular magnetic member (40) being arranged onto said body (12) and wherein,
an inner passage (22) extends between said opposed opening ends (14, 16) of the body, said passage (22) defining a slow-down chamber (26) around which is arranged the magnet member (40) so that, in use, the fuel flow entering
15 said chamber (26) slows down for the magnetic member to attract and retain more easily the metallic particles.
2. High pressure connector (10) as claimed in claim 1 wherein the body (12) comprises an upstream member (18) fixed to a downstream member (20), one
20 of said upstream or downstream members defining connection means (42, 46) for complementary fixing arrangement of said connector (10) to the pump or the injector or another component of the fuel injection equipment.
3. High pressure connector (10) as claimed in claim 2 wherein the other of
25 one of said upstream (18) or downstream (20) members defines a holding means (44) for holding the connector (10) while fixing it onto said another component of the fuel injection equipment.
4. High pressure connector (10) as claimed in claim 3 wherein the upstream
30 member (18) has a threaded outer face (42) defining said connection means and, the downstream member (20) has a polygonal outer face (44) defining said holding means.

5. High pressure connector (10) as claimed in any of the claims 2 to 4 further defining a narrow inlet conduit (24) drilled in the upstream member (18) and opening in said slow-down chamber (26) wherein the flow section enlarges so that, in use, the flow speed decreases.

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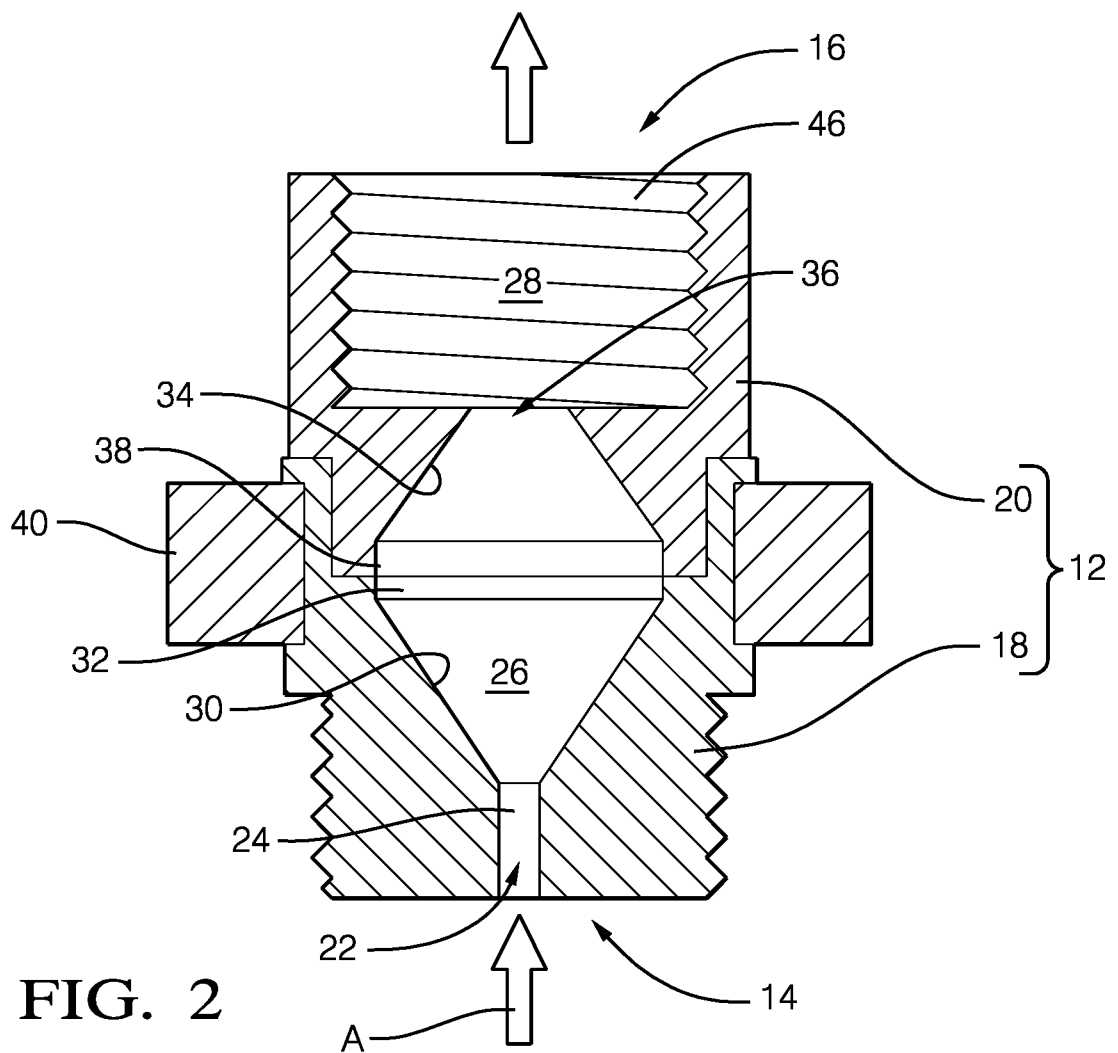
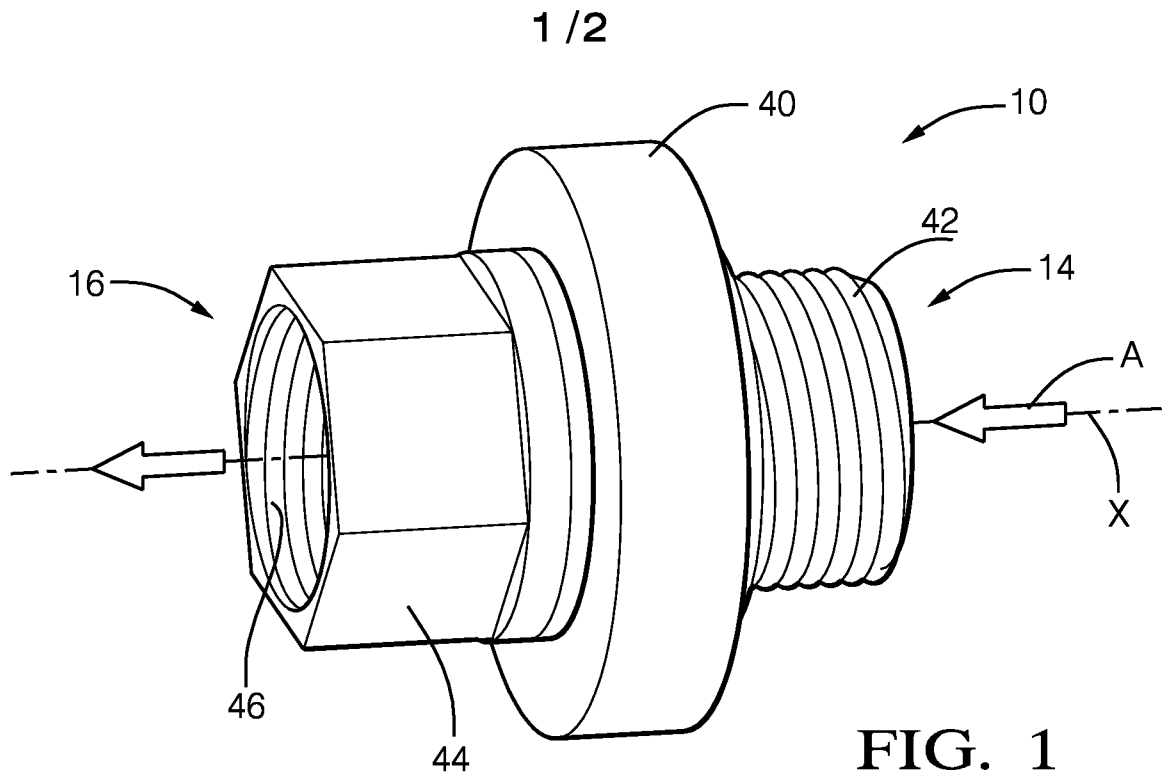
6. High pressure connector (10) as claimed in any of the claims 2 to 5 further comprising a chicane member (48) arranged in said slow-down chamber (26) so that, in use, fuel flow is forced toward the peripheral area of said chamber where in the magnetic field is stronger.

10

7. High pressure connector (10) as claimed in the combination of claims 5 and 6 wherein said chicane member (48) defines a cone portion (50) which apex points to the inlet narrow conduit (24).

15 8. High pressure connector (10) as claimed in claim 7 wherein the cone portion (50) is provided with apertures (54) through which fuel flows.

9. High pressure connector (10) as claimed in claim 6 wherein said chicane member (48) is fixed in place between the upstream member (18) and the
20 downstream member (20).



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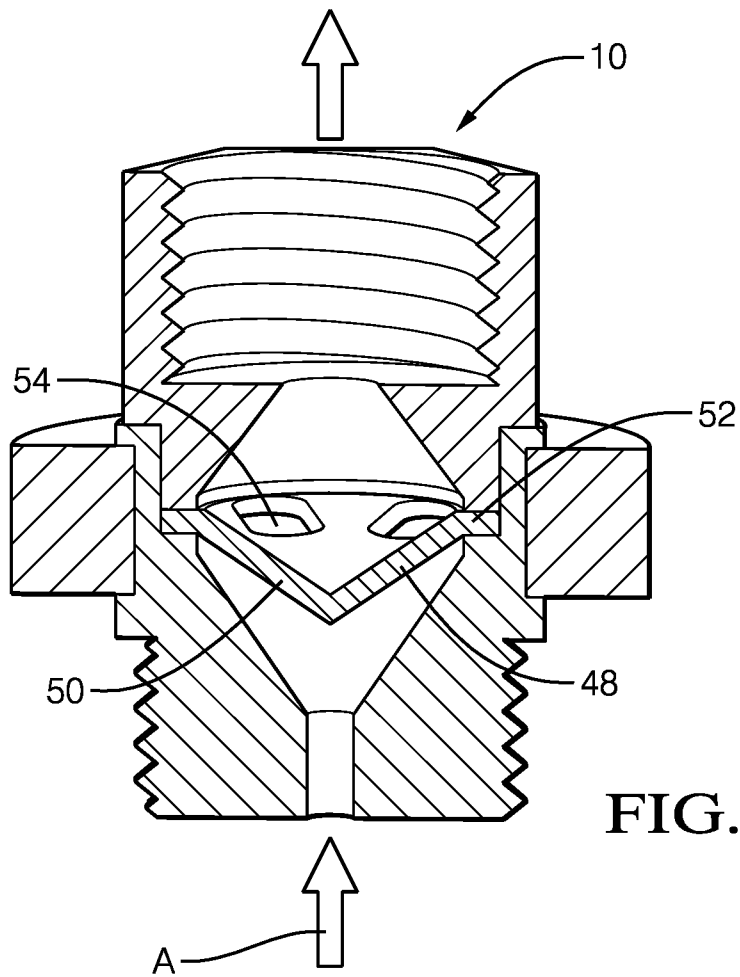


FIG. 3

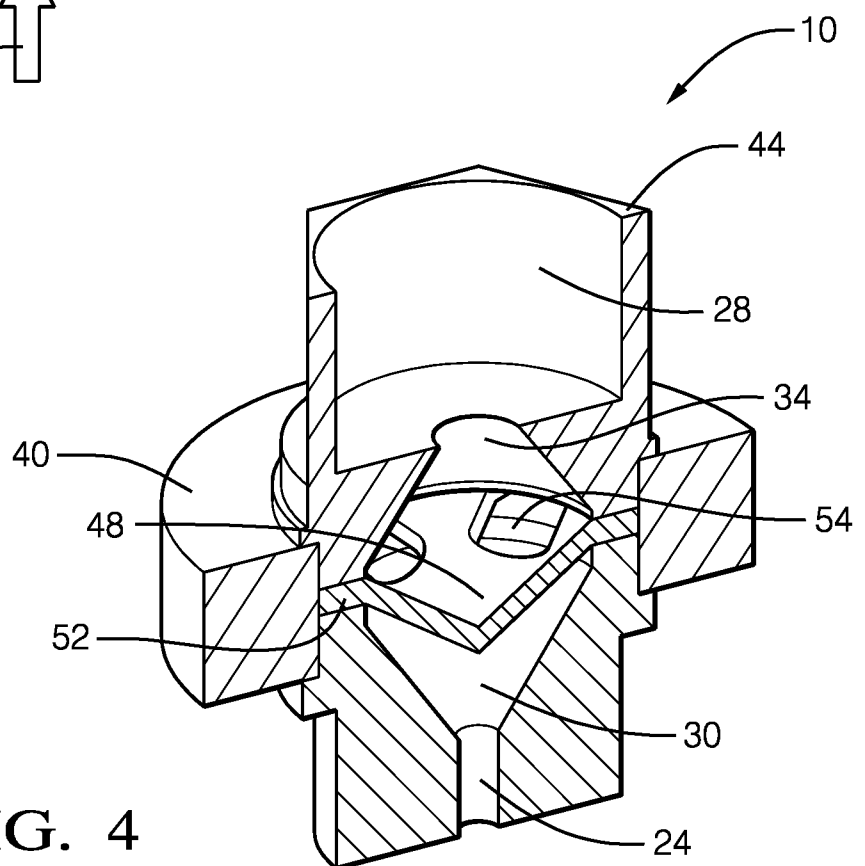


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. F02M27/04 F02M37/22 F02M61/16 B03C1/033
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)
F02M B03C

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

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X	US 2009/308360 A1 (ISTRATI DUMITRU [MD] ET AL) 17 December 2009 (2009-12-17) paragraphs [0002], [0026] - [0028], [0035]; figures 2, 3 -----	1-9
X	EP 2 745 000 A1 (BUONINSEGNI ANSELMO [IT]; MAGNINI TONINO [IT]) 25 June 2014 (2014-06-25) paragraphs [0017] - [0021]; figure 1 ----- -/--	1-9



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

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2018/064547

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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