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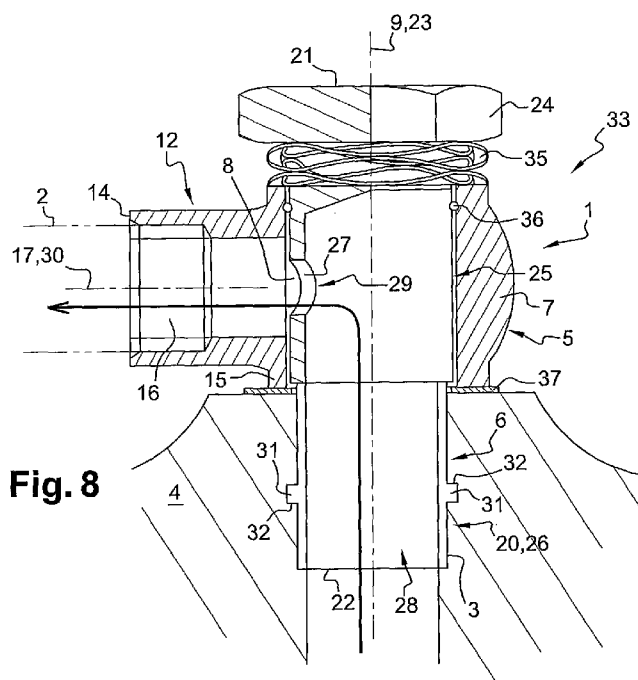
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- (54) **Title:** CONNECTING DEVICE FOR FLUID TRANSFER BETWEEN A PIPE AND A PORT PROVIDED IN A STRUCTURE



(57) **Abstract:** The connecting device (1) comprises: - a collar member (5) having a collar portion (7) forming a hole (8) and an coupling portion (12) connected to the pipe (2) and comprising an internal conduit (16); - an attachment member (6) comprising a body (20) having a transfer portion (25) inserted in the hole (8) and an attachment portion (26) secured in the port (3), an internal axial duct (28) arranged in the body opening laterally by at least one lateral hole (29) provided in the transfer portion. Angular indexing means (31, 32) allows the attachment member to be placed in a predetermined angular position with respect to the collar member in the operative position, in which one or the lateral hole of the attachment member substantially faces the conduit.

CONNECTING DEVICE FOR FLUID TRANSFER BETWEEN A PIPE AND A PORT PROVIDED IN A STRUCTURE

Field of the invention

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The present invention relates to a connecting device for fluid transfer between a pipe and a port provided in a structure such as an engine block, especially in an automotive vehicle.

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Technological background

Connecting devices are widely used to allow the transfer of a fluid, for example a coolant, between a rigid or flexible pipe and an engine block port.

A well-known type of connecting device is the so-called banjo connector, which is illustrated in figures 1 to 4. Such a connector 100 can typically comprise:

- a screw 101 ("banjo screw") which is designed to be screwed in the port 102 of the engine block 103. The screw 101 comprises an internal axial duct 104 which has an open axial end 105 – on the engine port side – and which opens on opposite side by several radial holes 106, generally four regularly angularly spaced holes;

- and a collar 107 ("banjo collar") through which the screw 101 is inserted and on which a pipe 108 is connected. The collar 107 defines an annular chamber 109 around the portion of the screw 101 having the radial holes 106, so that fluid coming from the holes is received in the annular chamber 109 and can flow toward the pipe 108 by an internal conduit 110. Generally, the collar 107 can take any position with respect to the screw, around the axis of the screw. Indeed, the position of the collar is in most cases adapted to the direction along which the pipe extends.

Furthermore, two sealing washers 111 are placed on either side of the collar 107.

With such a design, when the connector 100 is firmly screwed in the port 102 to prevent leaks, the radial holes 106 are randomly angularly placed with respect to the internal conduit 110, since it is not possible to predict the angular position of the screw 101 with respect to the engine bloc, and therefore also with respect to the collar 107. Thus, in practice, the radial holes

106 are generally angularly offset with respect to the internal conduit 110. As a result, the fluid coming from the engine block port 102 exits through all radial holes 106 and flows in the annular chamber 109 until it reaches the entrance of the internal conduit 110 by which it can escape towards the pipe 108.

5 Therefore, the fluid flow is not optimized, which induces great pressure drops.

This pressure drop issue is further exacerbated by the fact that, because several radial holes 106 are needed in the screw 101, their diameter is limited by the standard size of the screw 101 to a value that is lower than the
10 diameter of the duct 104. Typically, the conduit diameter can be around 10 mm while the holes diameter can be around 6 mm. This change in the flow cross sectional area is a further reason for pressure losses.

It therefore appears that, from several standpoints, there is room for improvement in connecting devices for fluid transfer.

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Summary

It is an object of the present invention to provide an improved connecting device for fluid transfer which can overcome the drawbacks of the
20 prior art, and more specifically which can reduce pressure losses.

According to a first aspect, the invention relates to a banjo-type connecting device which may be used for fluid transfer between a pipe and a port provided in a structure such as an engine block. The connecting device comprises:

25 - a collar member having a collar portion having a through hole and a pipe coupling portion comprising an internal conduit opening in the through hole of the collar portion;

- an attachment member comprising a body having a transfer portion adapted to be inserted in the through hole and an attachment portion
30 adapted to be secured in the port, wherein an internal axial duct arranged in the body opens laterally by at least one lateral hole provided in the transfer portion.

Angular indexing means are arranged on the attachment member so that, in an operative position, the attachment member can be placed in a predetermined angular position with respect to the structure.

35 Thereby, if the collar member has, in the operative position, a predetermined position with respect to the structure, then the angular indexing

means may be arranged so that, in the operative position, one or the lateral hole of the attachment member substantially faces the conduit of the collar member.

More precisely, the collar member may have:

- 5 - a collar portion having a substantially cylindrical through hole;
 - a coupling portion having a first end designed to be connected to the pipe and comprising an internal conduit, said conduit opening in the through hole.

The attachment member may comprise:

- 10 - a substantially cylindrical body having an axis and which, from a first end to a second end, has:
 * a transfer portion capable of being inserted substantially coaxially in the through hole of the collar portion of the collar member;
 * and an attachment portion capable of being secured in the
15 port, the attachment portion being designed to achieve securing of the attachment member onto the structure by a rotary movement of the attachment member around its body axis;
 - an internal duct which is open at the second end of the body and which opens laterally by at least one lateral hole arranged in the transfer
20 portion.

The attachment member may be capable of tightening the collar member against the structure in an operative position in which a fluid can flow from the structure port to the pipe, or inversely, through the duct of the attachment member, through one lateral hole and through the conduit of the
25 collar member.

In a first variant, the angular indexing means comprise a fastening mechanism of the bayonet type by which the attachment portion is secured to the structure port.

The bayonet fastening mechanism may comprise at least one pin, respectively one slot, provided on the attachment portion of the attachment member and designed to cooperate with at least one complementary slot, respectively pin, provided in the structure port.
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In a second variant, the attachment portion of the body has an external thread designed to cooperate with an internal thread of the structure port, and the attachment member further comprises a nut that is designed to be threaded on the transfer portion of the body and to tighten the collar member
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against the structure, and the angular indexing means comprise a marking provided on the body.

Owing to the provision of the angular indexing means, the invention makes it possible to position one lateral hole of the attachment member in an
5 optimized position with respect to the conduit of the collar member, thereby dramatically improving the fluid transfer by a great reduction in pressure losses.

Indeed, the connecting device can offer a substantially direct and preferably single path for the fluid which then does not have to follow a longer and diverted path to find its way towards the conduit of the collar member.

10 The optimized relative angular position between the collar member and attachment members is reached in the operative position. If the attachment member is designed to tighten or press the collar member against the structure, then, in the operative position, the attachment member firmly maintains the collar member against the structure without leaks. Fluid tightness can be
15 obtained also if the collar member is only held against the structure by the attachment member, with a different arrangement of seals.

In practice, for example, the attachment member can be forced to be placed in the optimized position by appropriate means, or there can be provided an indication allowing to adequately place the attachment member.

20 A significant advantage of the invention is that it provides angular indexing means that allow a repeatable relative angular positioning of the first and attachment members, to always ensure the optimization of the fluid path.

Furthermore, the design of the connecting device according to the invention does not require the provision of several lateral holes in the
25 attachment member nor of an annular chamber between the first and attachment members, which can be advantageous in terms of manufacturing simplicity and fluid transfer efficiency.

It has to be noted that, even if the fluid is considered as flowing from the attachment member towards the collar member, the invention is of
30 course also applicable for an inverted configuration where the fluid flows from the collar member towards the attachment member.

According to a another aspect, the invention relates to an engine arrangement comprising (i) an engine block having at least one internal canal opening in a port, and (ii) a pipe, the engine arrangement further comprising a
35 connecting device for fluid transfer between said pipe and said port as previously described.

According to a further aspect of the invention, the invention relates to an attachment member for a connecting device,

These and other features and advantages will become apparent upon reading the following description in view of the drawings attached hereto
5 representing, as non-limiting examples, embodiments of a connecting device according to the invention.

Brief description of the drawings

10 The following detailed description of several embodiments of the invention is better understood when read in conjunction with the appended drawings, it being however understood that the invention is not limited to the specific embodiments disclosed.

Figures 1 to 4 show a connecting device of the prior art comprising
15 a collar member and an attachment member, and more specifically: figure 1 is an exploded view of said connecting device; figure 2 is a cross section of the collar member; figure 3 is a cross section of the attachment member; and figure 4 is a schematic cross sectional view of the connecting device in the operative position for fluid transfer between a pipe and a port provided in a structure;

20 Figure 5 is a longitudinal cross section of a collar member pertaining to a connecting device according to a first embodiment of the invention;

Figures 6 and 7 are respectively a longitudinal and transverse cross section of an attachment member pertaining to a connecting device
25 according to a first embodiment of the invention;

Figure 8 is a longitudinal cross section of a connecting device comprising the first and attachment members of figures 5 to 7, mounted in a structure in the operative position;

30 Figure 9 is a schematic view of an insert that can be placed in a structure port;

Figures 10 and 11 are longitudinal cross sections of variants of the connecting device of figure 8, mounted in a structure in the operative position, by means of the insert of figure 9;

35 Figure 12 is a longitudinal cross section of a connecting device according to a second embodiment of the invention;

Figure 13 shows a variant of the embodiment of figure 12.

Detailed description of the invention

As this is illustrated in Figures 8 and 10-13, the invention concerns
5 a connecting device 1 for fluid transfer between a pipe 2 and a port 3 provided
in a structure 4 such as an engine block.

The connecting device 1 comprises a collar member 5 which is
designed to be connected to the pipe 2, and an attachment member 6 which is
designed to be inserted in the collar member 5 and secured in the port 3 of the
10 structure 4, while holding the collar member 5 against the structure 4 in an
operative position.

As shown in figure 5 for example, the collar member 5 comprises a
collar portion 7 having a substantially cylindrical through hole 8 having a first
axis 9 and an inner surface 10.

15 The collar member 5 also comprises a coupling portion 12 which is
to be connected directly or indirectly to the pipe. The coupling portion 12 can be
substantially tubular, i.e. can exhibit a substantially cylindrical outer surface 13.
The coupling portion 12, which is configured as a nipple, extends from the
collar portion and has a first end 14, on the pipe side, and a second end 15, on
20 the collar portion side. The coupling portion 12 comprises an internal conduit 16
extending along a second axis 17 which, as in the shown example can be
substantially orthogonal to the first axis 9, said conduit 16 having an inner
peripheral surface 18. This conduit 16 is open at the first end 14 of the coupling
portion 12 and opens in the through hole 8 at the second end 15 of the coupling
25 portion 12. The conduit 16 therefore opens in the inner surface 10 of the
through hole 8.

As shown in figure 6 for example, the attachment member 6 may
comprise a substantially cylindrical body 20 having a first end 21, opposite the
structure 4 in the operative position, and a second end 22, on the structure
30 side. The body 20, which has a longitudinal axis 23, can further comprise, on its
first end 21, an enlarged head portion 24 designed to allow the manual or
automatic handling of the body 20. In the shown example, the attachment
member 6 has the external shape of a screw.

From its first end 21 to its second end 22, the attachment member
35 6 comprises a transfer portion 25 capable of being inserted substantially
coaxially in the through hole 8 of the collar portion 7 of the collar member 5,

and an attachment portion 26 capable of being secured in the port 3 of the structure 4. In the operative position, the collar portion of the collar member encircles the transfer portion of the attachment member. In the shown embodiment, both portions are successive axial portions of the cylindrical body
5 20 which are axially offset.

In the shown embodiments, the attachment portion is designed to achieve securing of the attachment member onto the structure by a rotary movement of the attachment member around its body axis 23.

The attachment member 6 also comprises an internal axial duct 28
10 which is open at the second end 22 of the body 20 and which opens laterally by at least one lateral hole 29 arranged in the transfer portion 25. The lateral hole 29 has an inner peripheral surface 27. In the embodiment illustrated in figure 6, the lateral hole 29 is a radial cylindrical hole having an axis 30 which is substantially orthogonal to the body axis 23, but other embodiments can be
15 envisaged. In particular, the hole(s) 29 is (are) not necessarily radially oriented.

In the operative position, as shown in any of figures 8 and 10 to 13, the attachment member 6 preferably tightens the collar member 5 without leaks against the structure 4. A fluid can then flow from the structure port 3 through the duct 28 of the attachment member 6, and exit by one or the lateral hole 29,
20 towards the conduit 16 of the collar member 5 and towards the pipe 2.

In this operative position, the body axis 23, which is also the axis of the conduit 28, is substantially coincident with the through hole axis 9.

The connecting device 1 further comprises angular indexing means arranged so that, in the operative position, the attachment member 6 can be
25 placed in a predetermined angular position with respect to the structure 4,

In the operative position, the collar member has in many cases a predetermined position with respect to the structure 4, for example due to the orientation of the pipe to which it is connected. Indeed the pipe has in most cases certain rigidity and is routed in a certain direction. In such a case, the
30 angular indexing means are arranged so that, in the operative position, one or the lateral hole (29) of the attachment member (6) substantially faces the conduit (16) of the collar member. Thereby, the angular indexing means are arranged so that, in the operative position, the attachment member 6 is indirectly placed in a predetermined angular position with respect to the collar
35 member. In that predetermined angular position, one or the lateral hole 29 of

the attachment member 6 substantially faces the conduit 16 of the collar member 5.

Thus, the angular position of the attachment member 6 when the connecting device 1 is operatively fitted on the structure 4 is predetermined, and corresponds to an optimized position where there is provided a preferred direct route for the fluid flow, or even a single route.

With this arrangement, the invention makes it possible to greatly reduce pressure drops in the connecting device 1 when compared to the conventional connecting devices of the banjo type.

Because of this angular position adjustment which makes one lateral hole 29 coincide with the conduit 16, it may be envisaged that the transfer portion 25 of the attachment member body 20 comprises one single lateral hole. Indeed, because of the alignment of this hole 29 with the conduit 16, no other lateral hole is required on the attachment member 6 for the fluid transfer. This disposition forces the fluid to follow the best way from the attachment member 6 to the collar member 5 – or the reverse.

According to an implementation of the invention, the diameter D8 of the through hole 8 of the collar member collar portion 7 can be substantially identical to the external diameter D25 of the transfer portion 25 of the attachment member body 20 – with the appropriate assembly clearance. As a result, the connecting device is devoid of an annular chamber provided between the collar member 5 and the attachment member 6.

This implementation is possible because the invention provides a repeatable solution for ensuring that one lateral hole 29 substantially faces the conduit 16. Therefore, there is no need for such an annular chamber in which the fluid, which has passed through a lateral hole 29 angularly offset from the opening of the conduit 16, can flow until it finds its way towards the conduit 16.

This implementation is advantageous since it makes it possible to avoid undesirable fluid flow around the attachment member 6 whilst there exists a direct way which should preferably be used by the fluid. It therefore further reduces pressure drops.

It has to be noted that, if no annular chamber exists, then more than one lateral hole 29 can be provided without significantly impairing the fluid transfer efficiency. Indeed, the lateral holes that do not face the conduit 16 are not active for the fluid flow since the fluid cannot exit by these lateral holes. For example, for manufacturing issues, there may be provided two diametrically

opposed lateral holes 29, as shown for example in figure 10, typically radial holes made by a single drilling step. In this case, there exists only one active exit way for the fluid, through the hole 29 that faces the conduit 16, while the other hole(s) are inactive since the fluid will not flow through it (them).

5 One particularly advantageous implementation of the invention would be to provide both a single lateral hole 29 and no annular chamber, thereby avoiding undesirable alternate flow paths and creating a single, direct and optimized fluid flow.

In an embodiment, for example as shown in figure 12, the lateral
10 hole diameter D29 can be substantially identical to the conduit diameter D16, in order to further reduce pressure drop. Specifically, this arrangement is possible when only one lateral hole 29 is provided (or two diametrically opposed holes), because its diameter can be larger than in a conventional connecting device having four holes. For example, in a standard connecting device 1 in which the
15 external diameter D20 of the second connecting device 6 is 16 mm and the diameter D16 of the conduit 16 is 10 mm, the hole diameter D29 can be around 10 mm as opposed to around 6 mm in the prior art. In a further preferred embodiment, the internal duct 28 can also have a diameter D28 substantially identical to the hole diameter D29, and the diameter D16 of the conduit 16.

20 Besides, in an implementation of the invention, the internal gallery of the connecting device 1, formed by the successive duct 28 and conduit 16, can have an optimized shape to reduce pressure drop.

Several possible embodiments of the invention will now be described.

25 A first embodiment of the invention is illustrated in figures 5 to 8.

In this first embodiment, the radial indexing means comprise a fastening mechanism of the bayonet type.

For example, the fastening mechanism may comprise at least one pin 31 provided on the attachment portion 26 of the attachment member 6 and
30 designed to cooperate with at least one complementary slot 32 provided in the structure port 3, to form a fastening mechanism of the bayonet type. Alternatively, in a variant not shown, the pin(s) could be provided on the structure port 3 and the slot(s) could be provided on the attachment portion 26 of the attachment member 6.

35 In practice, two, three or more pin-slot sets can be provided.

With this arrangement, the attachment member 6 is forced to be placed in the optimized predetermined angular position with respect to the collar member 5, in the operative position, by the appropriate positioning of the pins 31 and slots 32 in the connecting device 1 and with respect to surrounding parts, such as the pipe 2.

This connecting device 1 is quicker to assemble than a device comprising a threaded part, since the mounting process only necessitates to push the attachment member 6 and to turn it by a predefined angle, which can be in the order of 90°.

Another advantage of this implementation is that there is no obligation to provide axial indexing means, since the pin(s) and slot(s) of the bayonet fastening mechanism can be designed so that, in the operative position, the attachment member 6 is placed in a predetermined axial position with respect to the collar member 5, in which one or the lateral hole 29 of the attachment member 6 substantially faces the conduit 16.

Furthermore, there is no need for anti-rotation means, as compared with conventional banjo connecting devices.

In an engine arrangement 33 in which the structure 4 is an engine block having at least one internal duct opening in a port 3, the bayonet fastening mechanism can be designed in different ways.

In a first variant, shown in figure 8, the complementary slot 32 (or alternatively the complementary pin) can be provided directly in the engine block port 3.

In a second variant, shown in figures 10 and 11, the complementary slot 32 (or alternatively the complementary pin) can be provided on an insert 34 which is fastened into the engine block port 3. Such an insert 34 can be a tubular shaped metal element provided with the slots 32 – or pins – as shown in figure 9.

The insert 34 can be devoid of external threads and maintained in the port 3 by means of a clip 35, as shown in figures 10 and 11. Alternatively, the insert could be provided with an external thread designed to cooperate with an internal thread of the port 3. The insert could alternatively be press-fitted.

Especially in the case the angular indexing means are designed as a bayonet fastening mechanism, but not exclusively, the connecting device 1 may further comprise spring 35, here embodied as an elastic metal structure, arranged between the collar portion 7 of the collar member 5 and an enlarged

head portion 24 of the body 20 so as to push said collar portion 7 towards the structure 4 in the operative position. The spring could also be a conventional coil spring.

Moreover, in such a case it can be provided an annular sealing ring 36 between the collar member collar portion 7 and the attachment member transfer portion 25 on the first end side of the body 20, as well as a sealing washer 37 arranged between the collar portion 7 of the collar member 5 and the structure 4 in the operative position.

Thus, the connecting device 1 provides an efficient sealing.

10 In a variant, the spring may be embodied as elastomeric washer instead of as an elastic metal structure. In such a case, it is possible to dispense with the sealing ring 36.

Turning more specifically to figure 8, the connecting device 1 comprises a bayonet fastening mechanism forming the angular indexing means, with the pins 31 being provided on the body 20 and the slot being arranged directly in the port 3. Furthermore, the attachment member 6 comprises a single radial hole 29 and the connecting device 1 has no annular chamber. Besides, the inner peripheral surface 18 of the conduit 16 is substantially cylindrical.

20 In the variant of figure 10, the slots 32 of the bayonet fastening mechanism are provided on the insert 34 inserted in the port 3. Besides, two diametrically opposed radial holes 29 are provided, a single one being an active exit way for the fluid.

In the variant of figure 11, the internal gallery of the connecting device 1, formed by the successive duct 28 and conduit 16, have an optimized shape to reduce pressure drop.

To that end, the following dispositions are possible, taken alone or in combination:

- at the second end 15 of the collar member coupling portion 12, the part 40 of the peripheral surface 18 of the conduit 16 that is located on the second end 22 side of the body 20 in the operative position is inclined towards the first axis 9 and towards the body second end 22. Said part 40 can for example have a flaring shape;

- the part 41 of the peripheral surface 27 of the attachment member lateral hole 29 that is located on the second end 22 side of the

body 20 is inclined towards the duct axis 23 and towards the body second end 22.

Owing to any one of these dispositions, in the operative position, the inside surface of the turn of the fluid path, between the first and the attachment members 5, 6, can be substantially devoid of sharp angles or can even approach the shape of a bended pipe, on its inside surface. This smoother and optimized shape makes it possible to further reduce pressure drops.

In a preferred embodiment, such as the specific embodiment of figure 11, said inclined parts 40, 41 of the peripheral surfaces 18, 27 of the collar member 5 and the attachment member 6 can furthermore form a substantially continuous smooth surface. In other words, the inside surface of the turn of the fluid path, between the first and the attachment members 5, 6, can be devoid of sharp angles and steps. For example, as shown in figure 11, said inclined parts 40, 41 are substantially flush.

Of course, other combinations of the above described alternatives can be envisaged in other variants of the first embodiment of the invention.

A second embodiment of the invention is illustrated in figures 12 and 13.

In this second embodiment, the attachment portion 26 of the body 20 has an external thread 43 designed to cooperate with an internal thread 44 of the structure port 3. The attachment member 6 further comprises a nut 45 that is designed to be threaded on a portion of the body which is on the first end side of the transfer portion 25 of the body 20 and to tighten the collar member 5 axially against the structure 4. Moreover, the angular indexing means comprise a marking 46 provided on the body.

With this arrangement, the angular indexing means comprise an indication, namely the marking 46, allowing to adequately place the attachment member 6, in the operative position, in the optimized predetermined angular position with respect to the structure 4, and thus indirectly with collar member 5 if the latter has also a predetermined position with respect to the structure.

The marking 46 can be a visual marking, for example detectable by a vision camera during the mounting process. It can for example be an indentation arranged in the first end 21 of the body 20. Typically, the marking 46 can be axially aligned with one or the lateral hole 29.

An advantage of this second embodiment is that it makes it possible to separate the elements providing angular indexing – here the body 20 and its marking 16 – and the parts providing tightening – here the nut 45. This avoids the prior art problems where the exact angular position of the holes 29 when the connecting device 1 is firmly screwed in the port 3 cannot be predetermined.

The internal thread 44 of the structure port 3 can be realized directly in the port inside surface or, alternatively, can be realized on an insert mounted in said port 3.

10 In this second embodiment, the body 20 can be devoid of enlarged head portion.

It may be envisaged that the connecting device 1 further comprises axial indexing means arranged so that, in the operative position, the attachment member 6 can be placed in a predetermined axial position with respect to the collar member 5, in which one or the lateral hole 29 of the attachment member 6 substantially faces the conduit 16.

Although the precise adjustment of the axial position of the hole 29 with respect to the conduit 16 is less important than the angular adjustment, this makes it possible to further improve the fluid transfer by further reducing pressure drop.

With such a decoupled system in which the threaded body 20 is not used to provided tightening, it is advantageous to have axial indexing means capable of indicating how many turns of threading the body has to be screwed to achieve a substantial alignment between the hole 29 and the conduit 16.

25 The connecting device 1 may be designed so that the axial alignment can be substantially obtained when the appropriate tightening is achieved. However, providing axial indexing means makes it possible to optimize the relative positioning between the hole 29 and the conduit 16.

In the embodiment illustrated in figure 12, the conduit diameter D16, the lateral hole diameter D29 and the internal duct diameter D28 are substantially identical, so as to improve fluid transfer between the collar member 5 and the attachment member 6. Besides, in the embodiment shown, the attachment member 6 comprises a single radial hole 29 and the connecting device 1 has no annular chamber. However, other implementations are possible.

Furthermore, the internal gallery of the connecting device 1, formed by the successive duct 28 and conduit 16, can have an optimized shape to reduce pressure drop. To that end, in the embodiment shown, the part 41 of the peripheral surface 27 of the attachment member lateral hole 29 that is located on the second end 22 side of the body 20 can be inclined towards the duct axis 23 and towards the body second end 22.

As shown in figure 12, this forms a chamfer at the junction between the duct 28 and the conduit 16.

Alternatively or in addition, at the second end 15 of the collar member coupling portion 12, the part of the peripheral surface 18 of the conduit 16 that is located on the second end 22 side of the body 20 in the operative position could be inclined towards the first axis 9 and towards the coupling portion outer surface 13.

Said inclined parts 41 of the peripheral surfaces 18, 27 of the collar member 5 and the attachment member 6 can furthermore form a substantially continuous smooth surface.

Owing to any one of these variants, in the operative position, the inside surface of the turn of the fluid path, between the first and the attachment members 5, 6, can be substantially devoid of sharp angles or can even approach the bended pipe shape, on its inside surface. This smoother and optimized shape makes it possible to further reduce pressure drops.

In the variant of figure 13, the connecting device 1 is provided with both inclined surfaces 40, 41 of the peripheral surfaces 18, 27 of the collar member 5 and the attachment member 6. Said inclined surfaces 40, 41 form a substantially continuous smooth surface, here by being substantially flush and forming a single chamfer at the junction between the duct 28 and the conduit 16.

Furthermore, in this variant, the – or at least one – lateral hole 29 has a substantially cylindrical shape having an axis 30 which is inclined with respect to the duct axis 23 by an angle α comprised between 30° and 60° , preferably between 40° and 50° , for example around 45° .

As a result, the part 47 of the peripheral surface 27 of the attachment member lateral hole 29 that is located on the first end 21 side of the body 20 is inclined towards the duct axis 23 and towards the body second end 22, like the part 41 of the peripheral surface 27.

Typically, this can be obtained by drilling the hole 29 obliquely in the body 20.

Then, the internal gallery of the connecting device 1, formed by the successive duct 28 and conduit 16, has a shape close to that of a bended pipe
5 on its entire periphery, leading to a fluid transfer optimization.

Of course, other combinations of the above described alternatives can be envisaged in other variants of the second embodiment of the invention.

Thus, the invention provides a connecting device that is easy and quick to mount between a structure port and a pipe, that makes it possible to
10 dramatically decrease the pressure drop, possibly similarly to a bended pipe if an optimized design for fluid transfer is used.

The invention is of course not limited to the embodiments described above as examples, but encompasses all technical equivalents and alternatives of the means described as well as combinations thereof.

CLAIMS

1. A connecting device for fluid transfer between a pipe (2) and a port (3) provided in a structure (4) such as an engine block, the connecting device (1) comprising:

- a collar member (5) having a collar portion (7) having a through hole (8) and a pipe coupling portion (12) comprising an internal conduit (16) opening in the through (8) hole of the collar portion (7);
- an attachment member (6) comprising an axially extending body (20) having a transfer portion (25) adapted to be inserted in the through hole (8) and an attachment portion (26) adapted to be secured in the port (3), wherein an internal axial duct (28) arranged in the body opens laterally by at least one lateral hole (29) provided in the transfer portion (25).

the attachment member (6) being capable of holding the collar member (5) against the structure (4) in an operative position in which a fluid can flow from the structure port (3) to the pipe (2), or inversely, through the duct (28) of the attachment member (6), through one lateral hole (29) and through the conduit (16) of the collar member (5);

characterized in that the connecting device (1) further comprises angular indexing means (31, 32, 46) arranged so that, in the operative position, the attachment member (6) can be placed in a predetermined angular position with respect to the structure (4).

2. The connecting device according to claim 1, characterized in that, in the operative position, the collar member (5) has a predetermined position with respect to the structure (4), and in that the angular indexing means are arranged so that, in the operative position, one or the lateral hole (29) of the attachment member (6) substantially faces the conduit (16) of the collar member.

30

3. The connecting device according to claim 1 or 2, characterized in that the attachment portion (26) of the attachment member (6) is designed to achieve securing of the attachment member onto the structure by a rotary movement of the attachment member around its body axis (23).

35

4. The connecting device according to any preceding claim, characterized in that the attachment member (6) is capable of tightening the collar member (5) against the structure (4) in the operative position.

5 5. The connecting device according to any preceding claim, characterized in that the transfer portion (25) of the attachment member body (20) comprises one single lateral hole (29).

10 6. The connecting device according to any preceding claim, characterized in that the through hole is substantially cylindrical and in that the diameter (D8) of the through hole (8) of the collar member collar portion (7) is substantially identical to the external diameter (D25) of the transfer portion (25) of the attachment member body (20), the connecting device (1) being devoid of an annular chamber provided between the first and attachment members (5, 6).

15

20 7. The connecting device according to any preceding claim, characterized in that, at where the conduit (16) of collar member coupling portion (12) opens in the through hole (8), the part (40) of the peripheral surface (18) of the conduit (16) that is located on the side of the attachment portion (26) in the operative position is inclined towards the axis (9) of the through hole (8) and towards the body end (22) on the side of the attachment portion (26).

25 8. The connecting device according to any preceding claim, characterized in that the part (41) of the peripheral surface (27) of the attachment member lateral hole (29) that is located on the side of the attachment portion (26) is inclined towards the duct axis (23) and towards the body end (22) on the side of the attachment portion (26).

30 9. The connecting device according to claim 8, characterized in that the or at least one lateral hole (29) has a substantially cylindrical shape having an axis (30) which is inclined with respect to the duct axis (23) by an angle (α) comprised between 30° and 60°, preferably between 40° and 50°, for example around 45°.

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10. The connecting device according to claim 7 in combination with claim 8 or 9, characterized in that said inclined parts (40, 41) of the peripheral surfaces (18, 27) of the collar member (5) and of the attachment members (6) form a substantially continuous smooth surface.

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11. The connecting device according to any preceding claim, characterized in that the angular indexing means comprise a fastening mechanism of the bayonet type by which the attachment portion (26) is secured to the structure port (3).

10

12. The connecting device according to claim 11, characterized in that the bayonet fastening mechanism comprises at least one pin (31), respectively one slot, provided on the attachment portion (26) of the attachment member (6) and designed to cooperate with at least one complementary slot (32), respectively pin, provided in the structure port (3).

15

13. The connecting device according to any one of claims 1 to 10, characterized in that the attachment portion (26) of the body (20) has an external thread (43) designed to cooperate with an internal thread (44) of the structure port (3), in that the attachment member (6) further comprises a nut (45) that is designed to be threaded on the body (20) and to tighten the collar member (5) against the structure (4), and in that the angular indexing means comprise a marking (46) provided on the body (20).

20

14. The connecting device according to any one of claims 1 to 13, characterized in that the connecting device (1) further comprises axial indexing means arranged so that, in the operative position, the attachment member (6) can be placed in a predetermined axial position with respect to the collar member (5), in which one or the lateral hole (29) of the attachment member (6) substantially faces the conduit (16).

25

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15. The connecting device according to any one preceding claim, characterized in that the lateral hole diameter (D29) is substantially identical to the conduit diameter (D16).

35

16. The connecting device according to any preceding claim, characterized in that it further comprises a spring (35) arranged between the collar portion (7) of the collar member (5) and an enlarged head portion (24) of the body (20) so as to push said collar portion (7) towards the structure (4) in the operative position.

17. An engine arrangement comprising: (i) an engine block (4) having at least one internal canal opening in a port (3), and (ii) a pipe (2), characterized in that it further comprises a connecting device (1) for fluid transfer between said pipe (2) and said port (3) according to any one of claims 1 to 16.

18. The engine arrangement according to claim 17, the connecting device (1) being according to claim 12, characterized in that the complementary slot (32), respectively pin, is provided directly in the engine block port (3).

19. The engine arrangement according to claim 17, the connecting device (1) being according to claim 12, characterized in that the complementary slot (32), respectively pin, is provided on an insert (34) which is fastened into the engine block port (3).

20. An attachment member for a connecting device comprising a collar member (5) and an attachment member (6), wherein the attachment member (6) comprises a body (20) having an axis (23) and which, from a first end (21) to a second end (22), has a transfer portion (25) and an attachment portion (26) for securing the attachment member to a structure port (3), and wherein an internal axial duct (28) is arranged in the body such that the duct (28) is open at the second end (22) of the body (20) and is open laterally by at least one lateral hole (29) provided in the transfer portion, characterized in that angular indexing means are arranged on the attachment member (6) so that, in an operative position, the attachment member (6) can be placed in a predetermined angular position with respect to the structure port (3).

21. The attachment member according to claim 20, characterized in that the angular indexing means comprise a fastening mechanism of the

bayonet type by which the attachment portion (26) is secured to the structure (4).

22. The attachment member according to claim 20, characterized
5 in that the attachment portion (26) of the body (20) has an external thread (43) designed to cooperate with an internal thread (44) of the structure port (3), in that the attachment member (6) further comprises a nut (45) that is designed to be threaded on the transfer portion (25) of the body (20) and to tighten the collar member (5) against the structure (4), and in that the angular indexing
10 means comprise a marking (46) provided on the body (20).

23. The attachment member according to any of claims 20 to 22, characterized in that the part (41) of the peripheral surface (27) of the attachment member lateral hole (29) that is located on the body second end
15 side is inclined towards the duct axis (23) and towards the body second end (22).

1/4

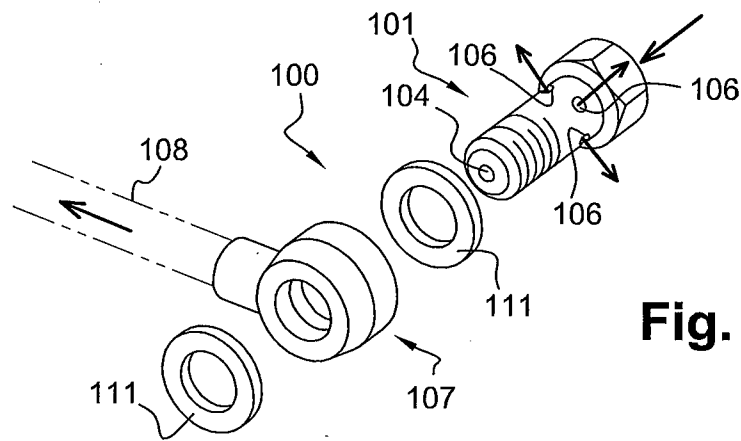


Fig. 1

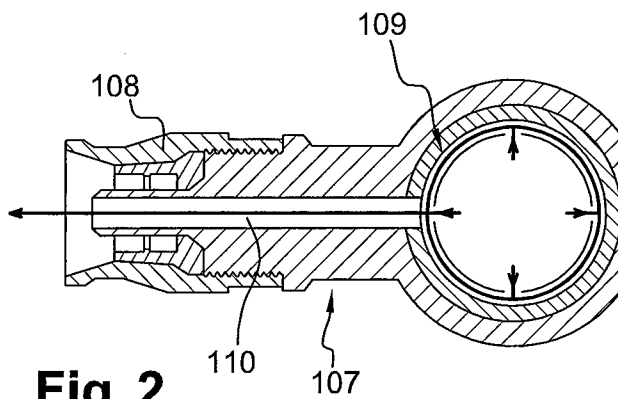


Fig. 2

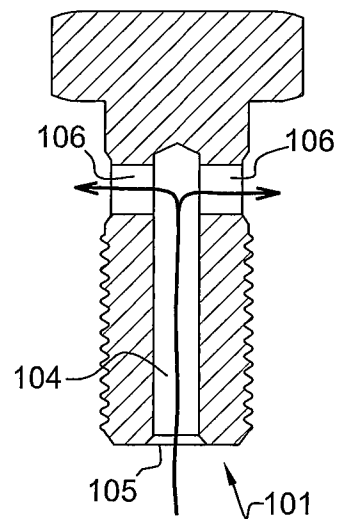


Fig. 3

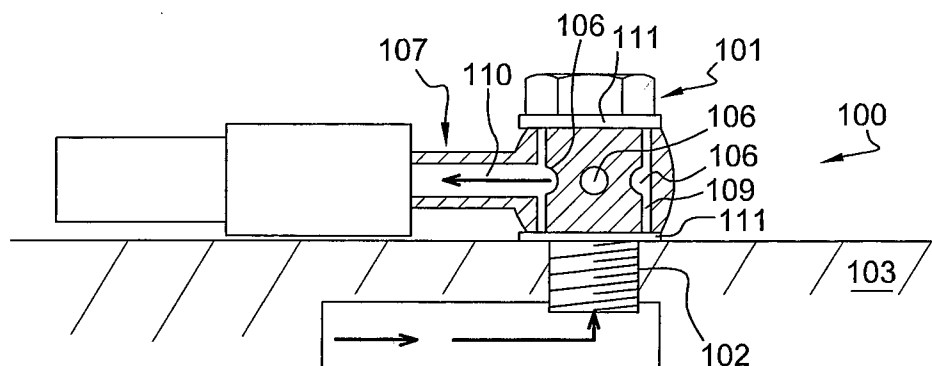


Fig. 4

2 / 4

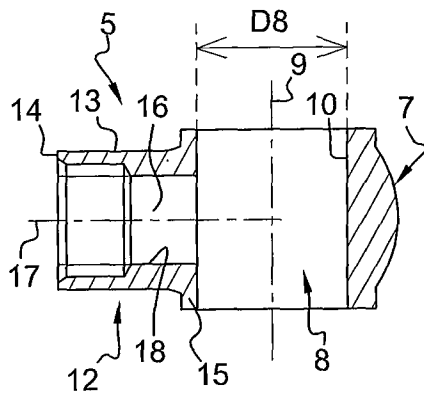


Fig. 5

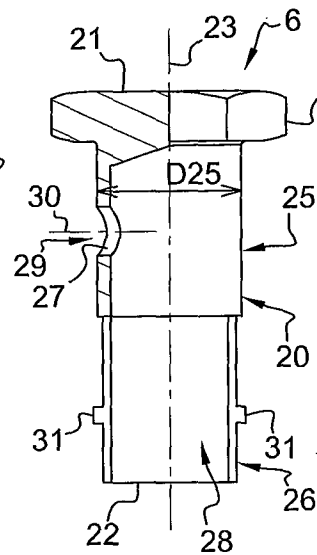


Fig. 6

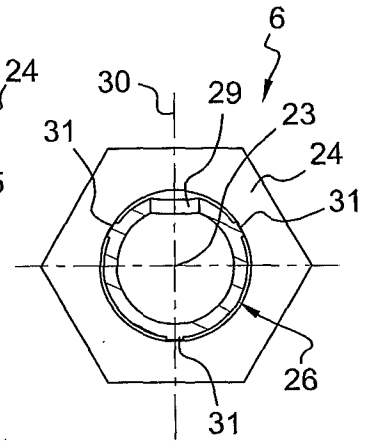


Fig. 7

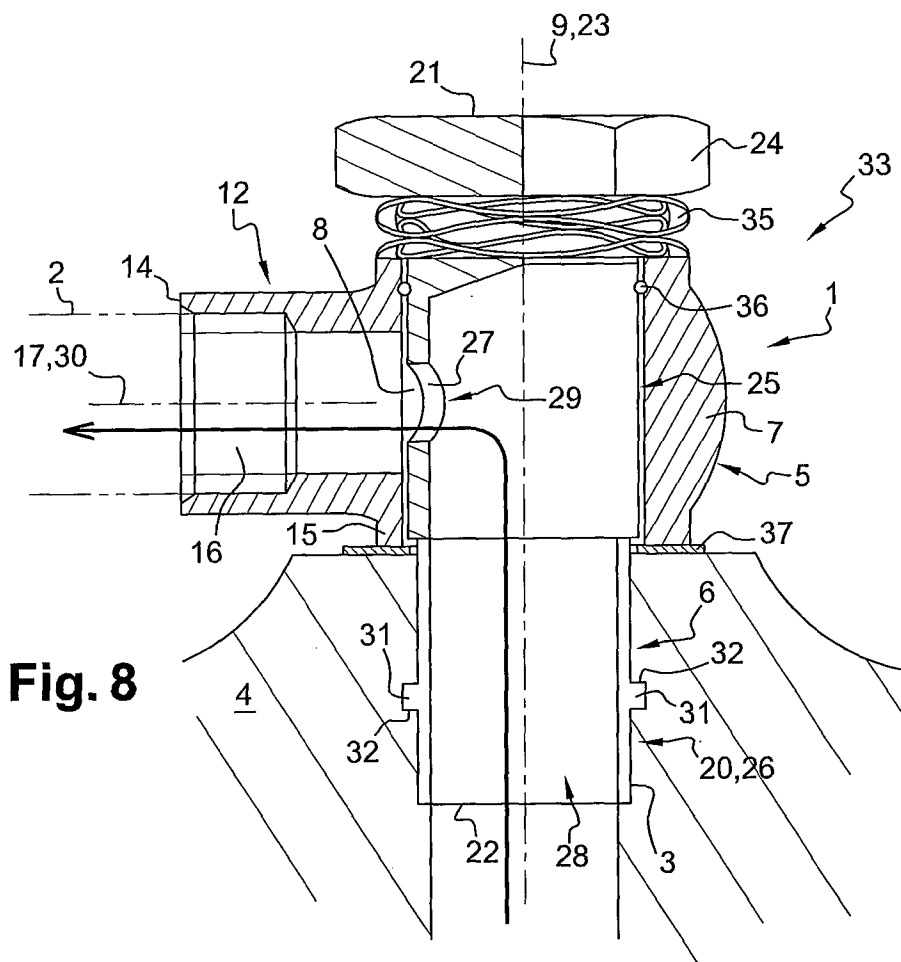


Fig. 8

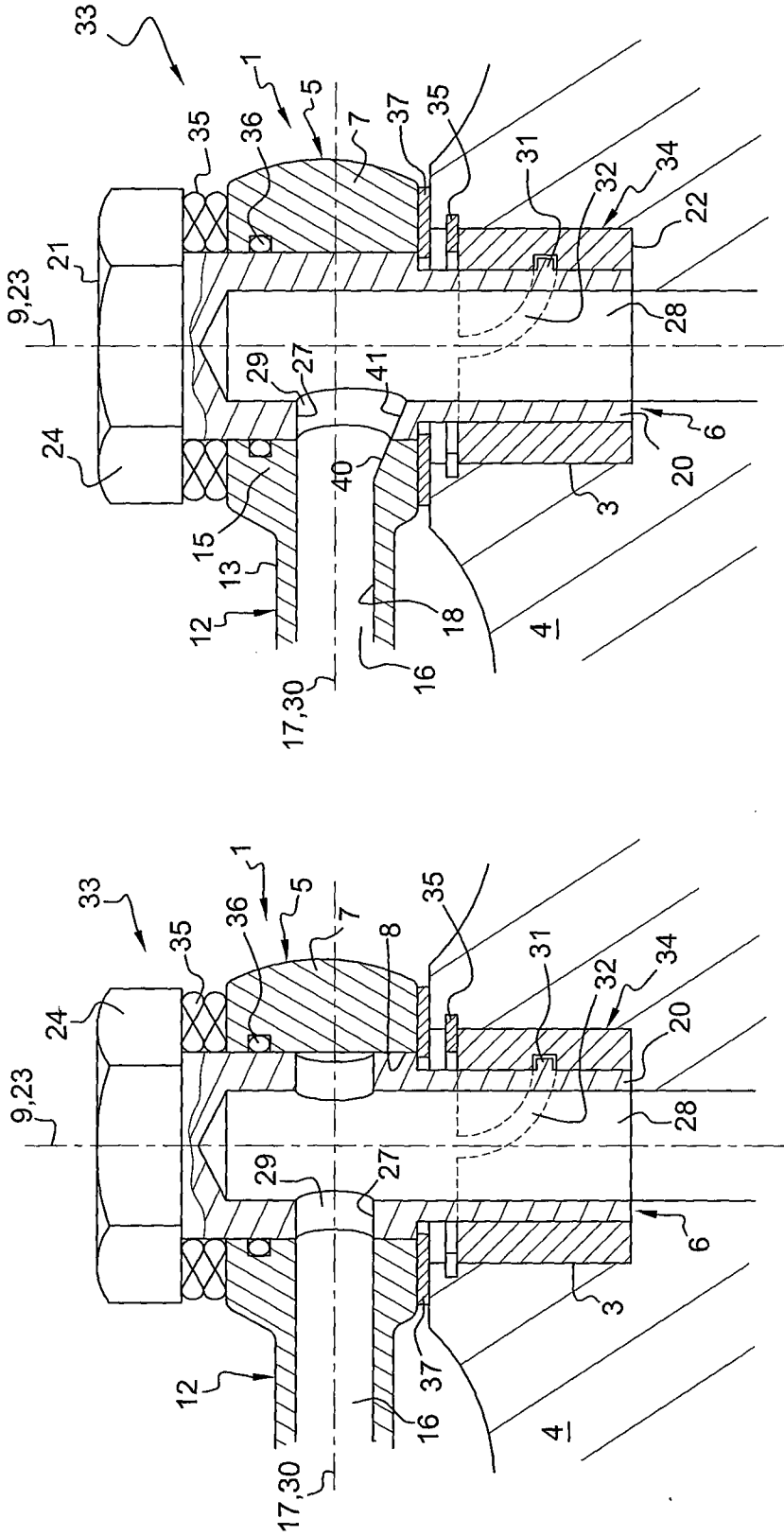


Fig. 11

Fig. 10

4 / 4

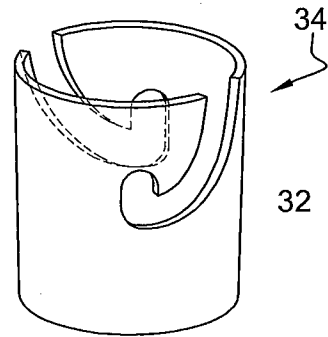


Fig. 9

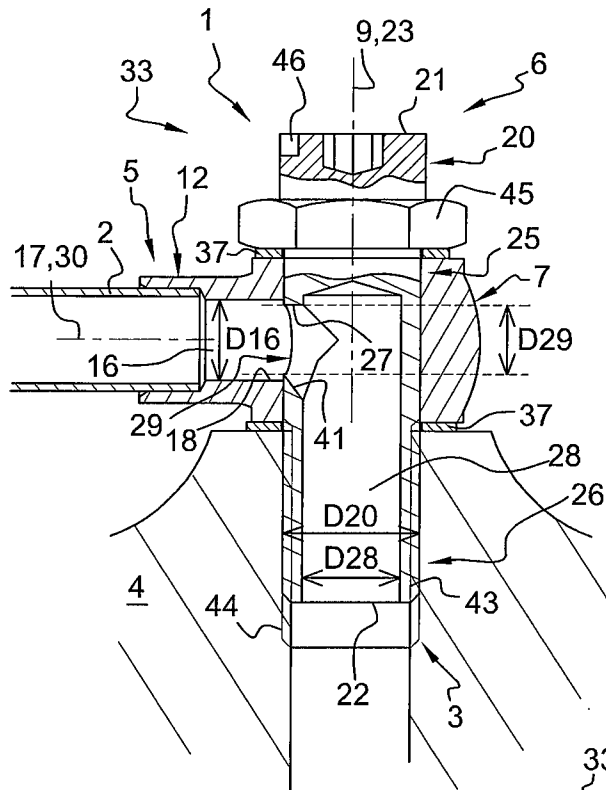


Fig. 12

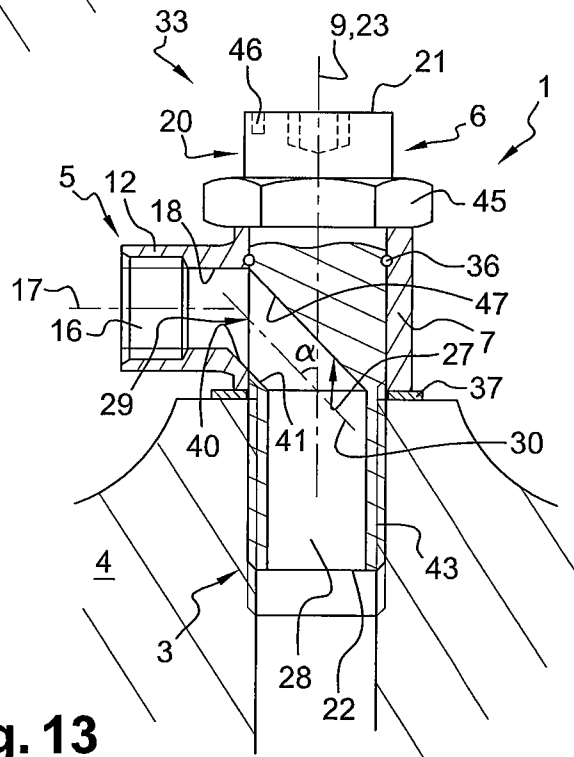


Fig. 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2012/002896

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16L27/093 F16L41/00
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)
F16L A01G

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)

EP0-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	FR 1 308 499 A (EDM GRESSEL A G) 3 November 1962 (1962-11-03)	1-6, 13-20,22
Y	page 2, column 1, line 11 - line 55; figures	7,10-12
Y	----- US 2 915 324 A (JACKSON WILLIAM M) 1 December 1959 (1959-12-01) figure 4	7,10
X	----- DE 20 2011 102730 U1 (ARCO ARMATUREN [DE]) 5 December 2011 (2011-12-05) abstract; figures	1,8,9, 20,22,23
X	----- DE 20 2008 004528 U1 (HAWLE ARMATUREN GMBH [DE]) 10 July 2008 (2008-07-10)	21
Y	abstract; figure 3 ----- -/--	11,12

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

28 August 2013

Date of mailing of the international search report

04/09/2013

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2012/002896

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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X	----- FR 2 963 077 A1 (PEUGEOT CITROEN AUTOMOBILES SA [FR]) 27 January 2012 (2012-01-27) abstract; figures -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2012/002896

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