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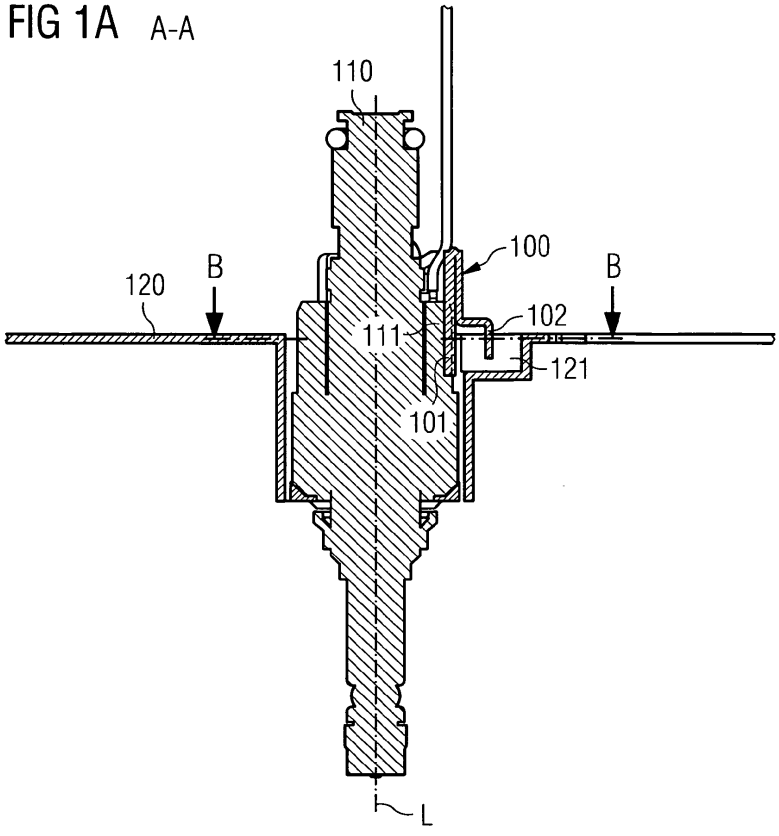
## (54) Indexing device and injector arrangement

(57) An indexing device for an injector (110) for injecting fluid, comprises:
- a first part (101) for coupling the indexing device (100) with the injector (110) such that the indexing device (100) and the injector (110) have a fixed defined orientation relative to each other, wherein the first part is designed such that the coupling between the first part (101) and the injector (102) is removable,
- a second part (102), the second part (102) projecting over the first part (101) to engage into a recess (121) of a basis (120) for holding the injector (110) to provide a fixed defined relative orientation between the indexing device (110) and the basis (120).

FIG 1A A-A

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## Description

**[0001]** The invention relates to an indexing device for an injector for injecting fluid and an injector arrangement that comprises such an indexing device.

**[0002]** Injectors are in widespread use, in particular for internal combustion engines where they may be arranged in order to dose the fluid into an intake manifold of the internal combustion engine or directly into the combustion chamber of a cylinder of the internal combustion engine.

**[0003]** Injectors are manufactured in various forms in order to satisfy the various needs for the various combustion engines. Therefore, for example, their length, their diameter and also various elements of the injector being responsible for the way the fluid is dosed may vary in a wide range. In addition to that, injectors may accommodate an actuator for actuating a valve needle of the injection valve, which may, for example, be an electromagnetic actuator.

**[0004]** In order to enhance the combustion process in view of the creation of unwanted emissions, the respective injector may be suited to dose fluids under very high pressures. The pressures may be in case of a gasoline engine, for example, in the range of up to 200 bar and in the case of diesel engines in the range of up to 2000 bar.

**[0005]** An object of the invention is to provide an indexing device for an injector that provides a reliable presetting of the orientation between the indexing device and a basis. It is a further object of the invention to provide an injector arrangement that can be oriented easily and reliably with respect to the basis.

**[0006]** According to an aspect, the invention is characterized by an indexing device for an injector for injecting fluid that comprises a first part for coupling the indexing device with the injector such that the indexing device and the injector have a fixed defined orientation relative to each other. The indexing device comprises a second part that projects over the first part to engage into a recess of the basis for holding the injector. The second part is designed to provide a fixed defined relative orientation between the indexing device and the basis. The first part is designed such that the coupling of the indexing device with the injector is removable. For example, the indexing device is put on the injector. The indexing device is easily mountable and demountable from the injector and, at the same time when the indexing device is coupled to the injector, a relative movement between the indexing device and the injector is prevented.

**[0007]** The indexing device provides an interface between the injector and the basis that defines the angular position of the injector relative to the basis. The indexing device and the injector are separate parts. The indexing device and the injector are arranged to be coupled and decoupled. According to further aspects, the injector is a pigtail injector. The injector is a stand-alone injector. The injector has no overmolded housing over the metal body. Further, the connection between the injector and the basis is independent from a fuel rail that is coupelable with the injector.

**[0008]** According to further aspects, the indexing device is in direct contact to the metal body of the injector. The indexing device is made of plastic or material, for example.

**[0009]** According to further aspects, the fixed defined orientation between the indexing device and the injector is provided by at least one axial projecting part that is arranged at the first part. Due to the projecting part a rotational movement of the indexing device relative to the injector can be prevented.

**[0010]** According to further aspects, the indexing device comprises at least one flat surface arranged at the second part to provide the fixed defined orientation between the indexing device and the injector. A rotational movement between the indexing device and the injector is prevented by an abutment of the flat surface and an accordant counterpart at the metal body of the injector.

**[0011]** According to further aspects, the indexing device comprises at least one guiding surface arranged at the second part to provide the fixed defined orientation between the indexing device and the basis. A relative rotational movement between the indexing device and the basis can be prevented by an abutment of the guiding surface and a stop surface of the basis.

**[0012]** According to further aspects, the indexing device comprises at least one axial projecting part arranged at the second part to provide the fixed defined orientation between the indexing device and the basis. A relative rotational movement between the indexing device and the basis is prevented by the projecting part that engages into the recess of the basis.

**[0013]** According to an embodiment, an injector arrangement comprises an injector for injecting fluid. The injector arrangement further comprises an indexing device as described above. The indexing device and the injector are coupled such that the indexing device is easily mountable and demountable and this can be done without destroying or damaging either the indexing device or the injector.

**[0014]** According to aspects of the invention, the injector is a pigtail injector that does not comprise a fixed housing over the metal body of the injector.

**[0015]** In the following, embodiments of the invention are illustrated by reference to the schematic drawings.

**[0016]** Elements of the same construction or function are provided with the same reference sign throughout the figures.

Figures 1A and 1B schematically show an injector with an indexing device according to an embodiment,

Figure 2 schematically shows an injector and an indexing device according to an embodiment,

Figure 3 schematically shows the injector and the indexing device of Figure 2 in an installation situation

according to an embodiment.

Figure 4 schematically shows an injector and an indexing device according to an embodiment, and

Figure 5 schematically shows the injector and the indexing device of Figure 4 in an installation situation according to an embodiment.

Figure 1A schematically shows an injector 110 for injecting fluid. Figure 1A shows a cross-section of the injector 110 and Figure 1B shows a top view of the injector 110.

**[0017]** Particularly, the injector is designed for injecting fuel into a cylinder of an internal combustion engine of, for example, a vehicle and particularly an automobile. The fluid injector 110 has a longitudinal axis L and further comprises a metal body 111. The metal body 111 of the fuel injector 110 surrounds a cavity in which a valve needle is arranged. In a closed position of the injector 110 a fuel flow through the injector is prevented. In an open position fuel can flow through the injector into the combustion chamber of the internal combustion engine. The fuel flows through the metal body 111. For example, the fuel injector is coupled with a common rail in which the fuel is stored under high pressure.

**[0018]** The injector 110 is arranged at a basis 120. For example, the basis is a cylinder head of the combustion engine.

**[0019]** An indexing device 100 is coupled with a first part 110 of the indexing device 100 with the injector 110. The indexing device 100 comprises a projecting second part 102 that engages a recess 121 of the basis 120.

**[0020]** For example, the first part 101 of the indexing device 100 has a ring-shaped form. The first part 101 is designed such that it can be put on the injector easily. For example the first part 101 has an open side and can be clipped on the injector.

**[0021]** The injector 110 and the indexing device 100 are two separate parts that are mountable and demountable without destroying or damaging the indexing device 100 or the injector 110. The indexing device 100 is removable from the metal body 111 of the injector 110.

**[0022]** A relative rotational around the axis L movement between the indexing device 100 and the injector 110 is prevented by the structure of the first part 101. The first part 101 is coupled to the metal body 111, such that the indexing device and the injector have a fixed defined orientation relative to each other.

**[0023]** For example, a relative rotational movement of more than +-5° is prohibited due to the shape of the first part 101 and the corresponding part of the metal body 111. The first part 101 and the part of the injector 110 that are in direct contact with each other are designed such that the fixed defined orientation is provided reliably.

**[0024]** The projecting second part 102 and the recess 121 are designed to provide a fixed defined orientation relative to each other. Therefore, the indexing device 110 has a fixed defined orientation relative to the basis 120. Rotational movement between the indexing device 100 and the basis 120 is prevented due to the shape of the second part 102 and the recess 121. Since a relative rotational movement between the indexing device 100 and the basis 120 is prevented and a relative rotational movement between the indexing device 100 and the injector 110 is prevented, a rotational movement between the injector 10 and the basis 120 is also prevented. The injector 110 has a fixed defined orientation with respect to the basis 120 due to the fixed defined orientation between the first part 101 and the injector 110 and the fixed defined orientation between the second part 102 and the basis 120.

**[0025]** Due to the indexing device 100 an indexing of the pigtail injector 110 that has no overmolded housing is easy and reliable when the injector is sent to the customer as a stand-alone injector. The indexing, as well as the relative angular position between the injector 110 and the basis 120, is achieved by the indexing device 100 automatically after mounting the injector 110 into the cylinder head. When the angular position between the injector 110 and the cylinder head is optimized, the combustion in the combustion chamber is optimized too. For example, the spray layout of the fuel has minimum interference so that most of it participates in the combustion.

**[0026]** The vertical movement of the injector 110 is limited from one side by the shape of the basis 120 that prevents downward movement in the direction of the combustion chamber. From the other side the movement of the injector is prevented by a component that should have a function similar to the fuel rail (not shown). The rotational movement is avoided by the indexing device 100. For example, a relative rotational movement between the injector 110 and the basis 120 has a tolerance of maximum +-5°.

**[0027]** Figure 2 shows the indexing device 100 and the injector 110 according to further embodiments.

**[0028]** The first part 110 of the indexing device 100 surrounds the upper part of the metal body 111 of the injector 110. The relative rotational movement of the indexing device 100 with respect to the injector 110 is prevented by a flat surface 103 that is arranged at the second part 102 of the indexing device 100. The flat surface 103 abuts with a part of the injector 110 from which the connection cables exit. The connection cables are for electronically controlling the injector 110. In this case the shape of the indexing device 100 is designed dependent on the shape of the metal 111 of the injector 110 to provide the fixed defined orientation between the indexing device 100 and the injector 110.

**[0029]** To prevent the rotational movement between the indexing device 100 and the basis 120 the second part 102 comprises a projecting part 105. The projecting part 105 is, for example, a nose that projects in the axial direction of the longitudinal axis L.

**[0030]** In an installation situation as schematically

shown in Figure 3, the nose 105 engages into the recess 121 of the basis 120. Relative rotational movement between the indexing device 100 and the basis 120 is prevented by an abutment of the projecting part 105 and the walls surrounding the recess 121. According to embodiments, the recess 121 is specifically created in the basis 120 for coupling with the projecting part 105.

**[0031]** Figure 4 schematically shows the indexing device 100 and the injector 110 according to further embodiments.

**[0032]** To prevent a relative rotational movement between the indexing device 100 and the injector 110, the indexing device 100 comprises projecting parts 104 that are arranged at the first part 110. The projecting parts 104 project into the axial direction of the longitudinal axis L. The projecting parts 104 are designed such that they have a contact surface with the metal body 111 of the injector 110. The first part 110 surrounds the metal body 111 partly and has an open end such that the indexing device 100 may be clipped sideways on the injector 110.

**[0033]** Relative rotational movement between the indexing device 100 and the basis 120 is prevented by a guiding surface 106 that is arranged at the second part 102.

**[0034]** As shown in Figure 5 that schematically shows an installation situation of the arrangement of Figure 4, the guiding surface 6 abuts with the walls of the basis 120 that surround the recess 121. The shape of the second part is designed dependent on the shape of the cylinder head, in particular the shape of the recess 121.

**[0035]** The way of defining the fixed orientation between the injector 110 and the indexing device 100 as well as between the indexing device 100 and the basis 120 may be replaced between the embodiments of Figures 2 and 3 and the embodiments of Figures 4 and 5. For example, according to further embodiments the indexing device 100 comprises the projecting part 105 (Figures 2 and 3) at the second part 102 and the projecting part 104 (Figures 4 and 5) at the first part 101.

**[0036]** The indexing device 100 could be made of several materials, for example metal or plastic, in particular steel. The material for the indexing device 100 is chosen dependent on given rigidity requirements for each application.

**[0037]** The connection between the injector 110 and the basis 120 is independent from a fuel rail so that the injector 110 together with the indexing device 100 that are sent to the customer automatically satisfy the indexing requirements and are forced to stay in the optimized spray configuration when coupled with the basis 120. In particular, according to aspects of the invention, the indexing is available without any variation on the shape of given cylinder heads.

## Claims

**1.** Indexing device for an injector (110) for injecting fluid, comprising:

- a first part (101) for coupling the indexing device (100) with the injector (110) such that the indexing device (100) and the injector (110) have a fixed defined orientation relative to each other, wherein the first part is designed such that the coupling between the first part (101) and the injector (102) is removable,
- a second part (102), the second part (102) projecting over the first part (101) to engage into a recess (121) of a basis (120) for holding the injector (110) to provide a fixed defined relative orientation between the indexing device (110) and the basis (120) .

**2.** Indexing device according to claim 1, wherein the first part (101) is in direct contact to a metal body (111) of the injector (110).

**3.** Indexing device according one of the preceding claims, being made of plastic or metal.

**4.** Indexing device according one of the preceding claims, comprising: at least one axial projecting part (104) arranged at the first part (101) to provide the fixed defined orientation between the indexing device (100) and the injector (110).

**5.** Indexing device according one of the preceding claims, comprising: at least one flat surface (103) arranged at the second part (102) to provide the fixed defined orientation between the indexing device (100) and the injector (110).

**6.** Indexing device according one of the preceding claims, comprising: at least one guiding surface (106) arranged at the second part (102) to provide the fixed defined orientation between the indexing device (100) and the basis (120).

**7.** Indexing device according one of the preceding claims, comprising: at least one axial projecting part (105) arranged at the second part (102) to provide the fixed defined orientation between the indexing device (100) and the basis (120).

**8.** Injector arrangement, comprising:

- an injector (110) for injecting fluid,
- an indexing device (100) according one of the preceding claims, the first part (101) of the indexing device being coupled with the injector (110) removably.

FIG 1A A-A

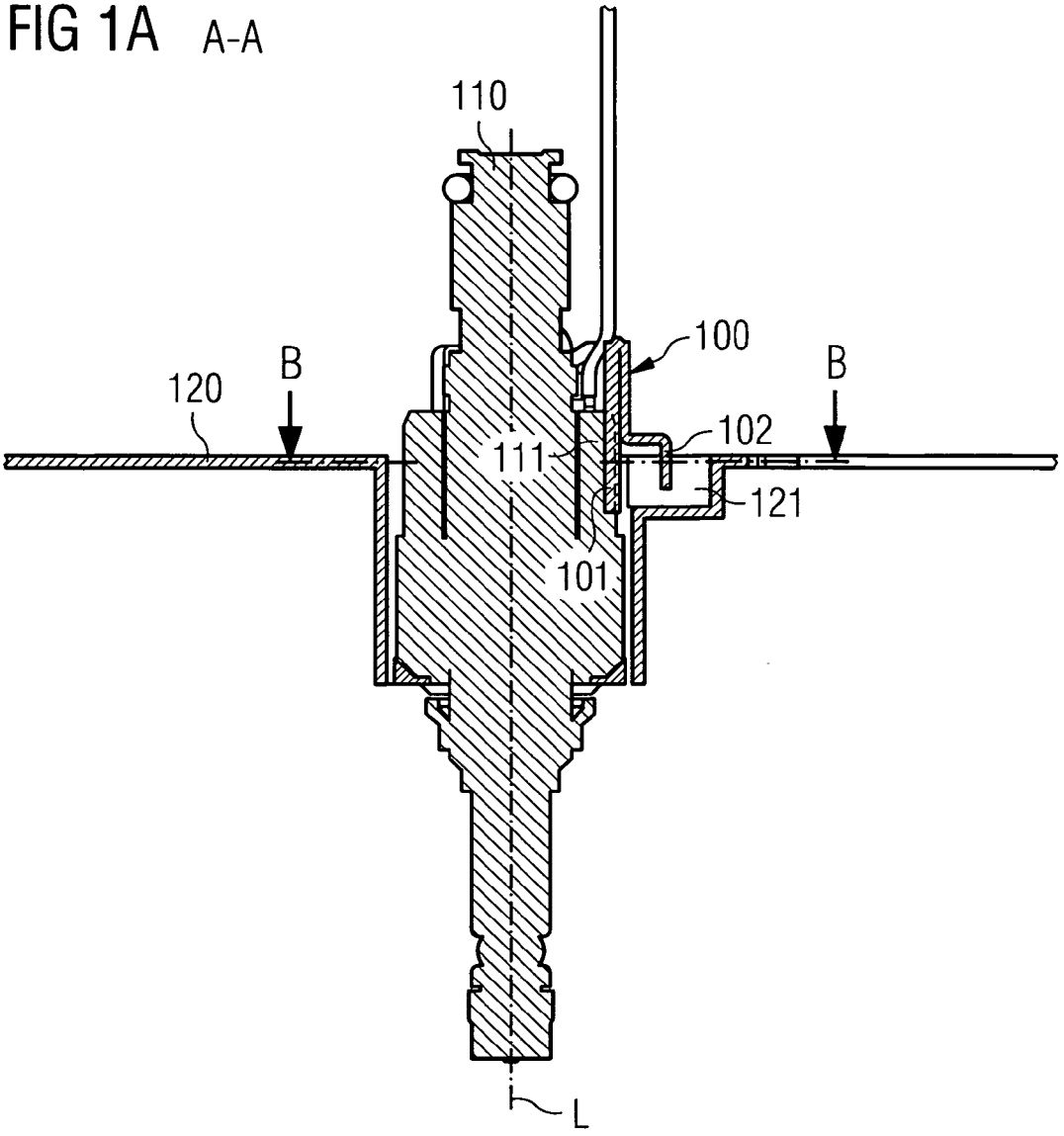



FIG 1B B-B

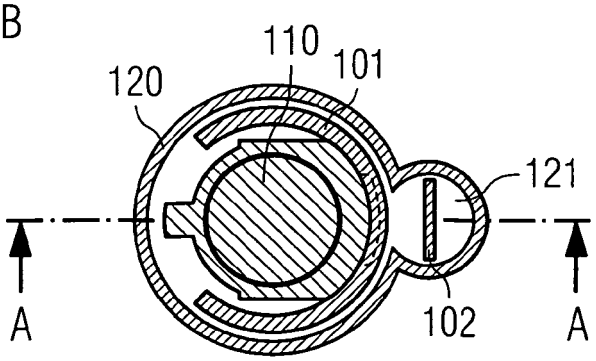


FIG 2

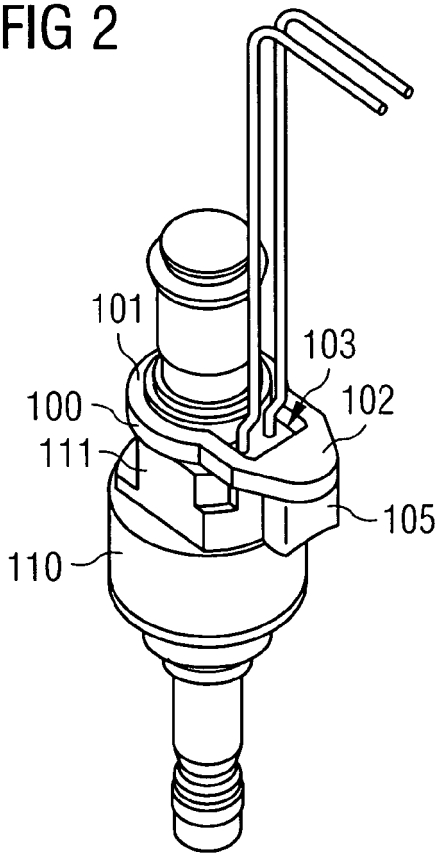



FIG 3

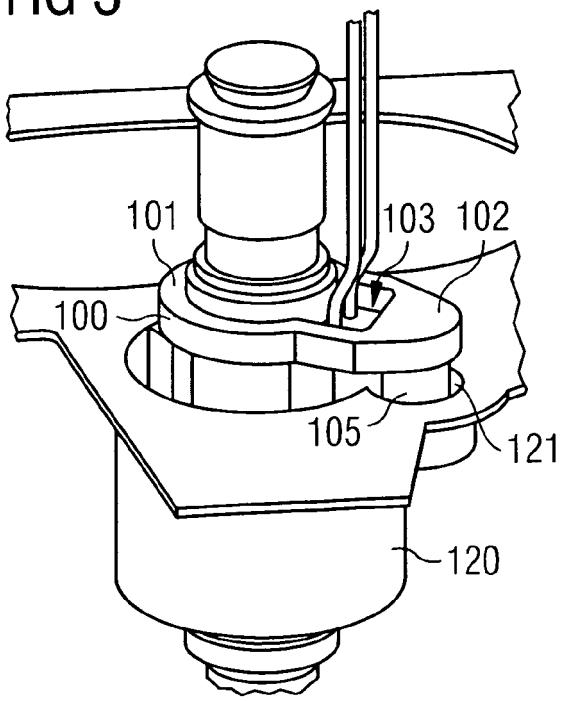


FIG 4

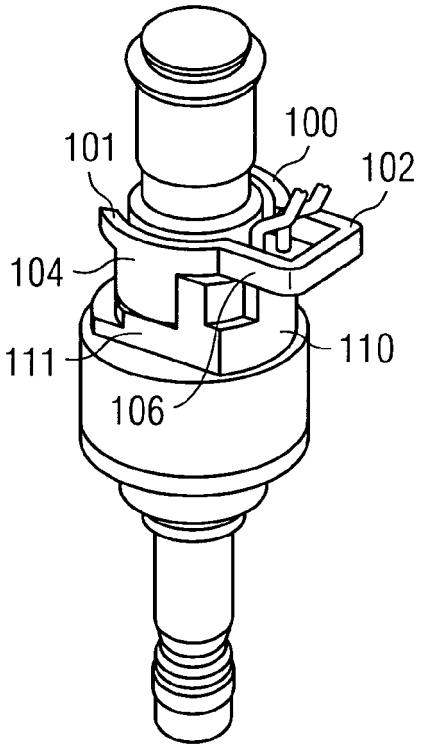
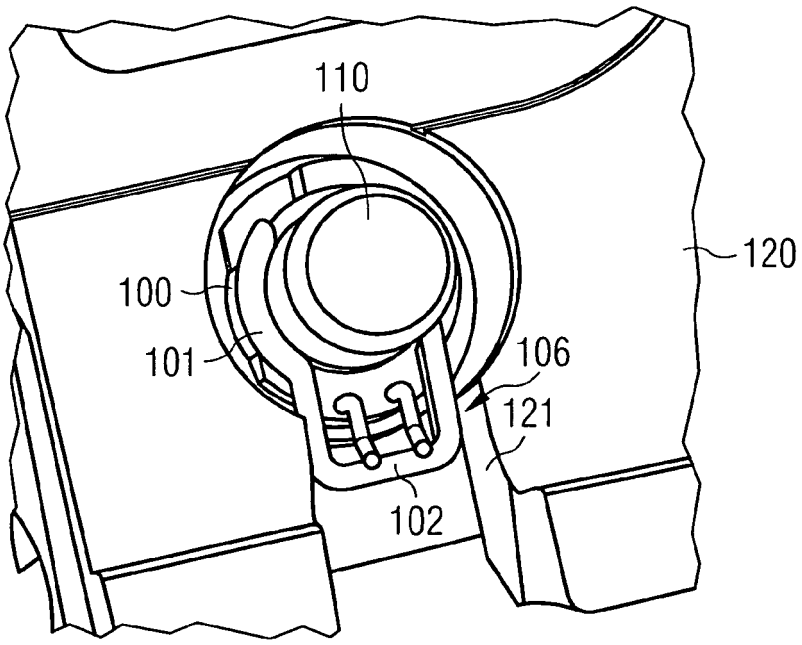



FIG 5



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# EUROPEAN SEARCH REPORT

Application Number
EP 11 18 6863

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| X | EP 1 482 168 A1 (BOSCH GMBH ROBERT [DE]) 1 December 2004 (2004-12-01) * paragraphs [0023], [0024], [0039], [0040]; figures 1,4,5 * | 1-4,6-8 | INV. F02M61/14 ADD. F02M63/00 |
| X | US 2004/069280 A1 (EVANCIK MICHAEL JOSEPH [US] ET AL) 15 April 2004 (2004-04-15) * paragraphs [0022], [0025]; figures 1-3 * | 1-4,6-8 | |
| X | US 5 520 151 A (GRAS JUERGEN [DE] ET AL) 28 May 1996 (1996-05-28) * column 3, lines 53-65; figures 1,2,3,4,7,8,9,12 * * column 5, lines 8-17,46-50 * | 1,3,6-8 | |
| X | US 4 894 900 A (RAUSFEISEN ROBERT [US] ET AL) 23 January 1990 (1990-01-23) * column 5, lines 18-22; figures 2,3, * | 1-4,6-8 | |

TECHNICAL FIELDS SEARCHED (IPC)
F02M

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 17 February 2012 | Godrie, Pierre |

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