

(19)



(11)

EP 1 892 408 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
27.02.2008 Bulletin 2008/09

(51) Int Cl.:
F02M 55/00 (2006.01) F02M 61/14 (2006.01)
F02M 61/16 (2006.01)

(21) Application number: **06017359.8**

(22) Date of filing: **21.08.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

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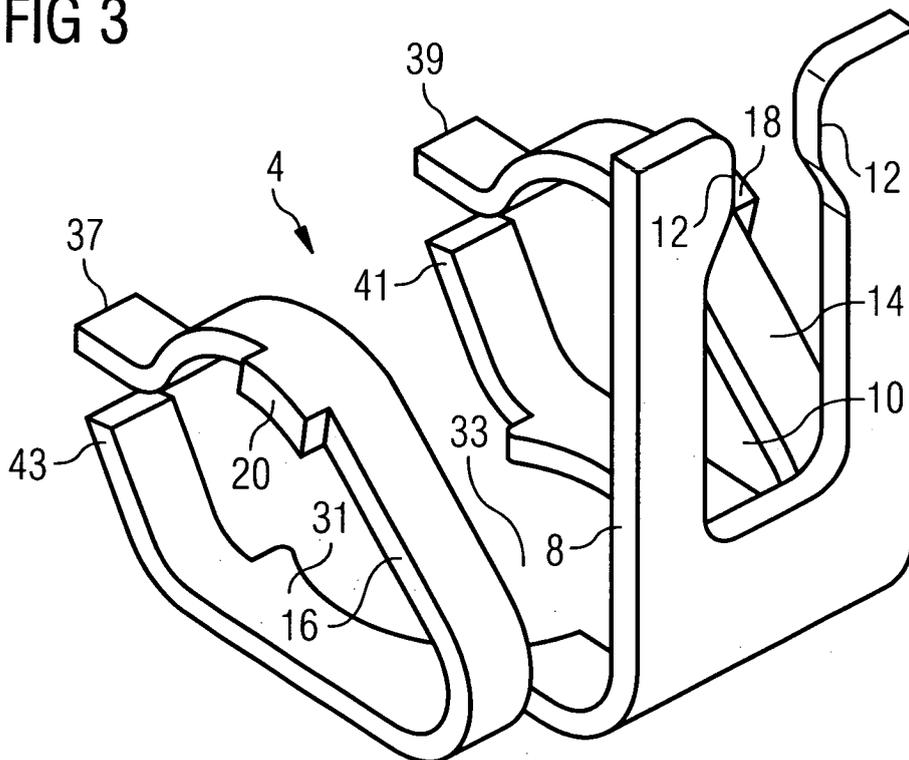
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(54) **Injector, fuel cup and holder**

(57) A Holder (4) for fixing an injector (2) to a fuel cup (6) comprises a bottom portion (31), a notch of the holder (4), an injector recess (33), and at least one elastic element (14,16). The notch of the holder (4) is arranged for engaging the notch of the holder (4) to a notch (26) of the fuel cup (6). The injector recess (33) in the bottom portion (31) of the holder (4) is formed in the bottom por-

tion (31) of the holder (4) for taking in the injector (2). The injector recess (33) of the holder (4) is formed and arranged in such a way that the holder (4) may be fixed to the injector (2) at the injector recess (33) of the holder (4) by a positive connection. The elastic element (14,16) is arranged at the bottom portion (31) of the holder (4) for forcing the injector (2) away from the fuel cup (6).

FIG 3



EP 1 892 408 A1

Description

[0001] The invention relates to a holder for fixing an injector to a fuel cup. Further, the invention relates to the injector and the fuel cup.

[0002] EP 0 969 204 A1 discloses a coupling system between an engine head, an injector and a fuel manifold. The engine head has a seating designed to house the injector. The fuel manifold extends above the engine head and is connected to the injector through a bush projecting from the fuel manifold. The injector is coupled to the seating by means of a ball coupling. The fuel manifold is rigidly secured to the engine head of the engine. An opposing spring is interposed between the fuel manifold and the injector to compress the injector inside the seat.

[0003] The object of the invention is to create an injector, a fuel cup and a holder for fixing the injector to the fuel cup which enable a proper coupling of the injector to the fuel cup.

[0004] The object of the invention is achieved by the independent claims 1, 9, 11, and 14. Advantageous embodiments are given in the sub-claims.

[0005] The invention is distinguished concerning a first aspect of the invention by a holder for fixing an injector to a fuel cup. The holder comprises a bottom portion, a notch of the holder, an injector recess, and at least one elastic element. The notch of the holder is arranged for engaging the notch of the holder to a notch of the fuel cup. The injector recess is formed in the bottom portion of the holder for taking in the injector. The injector recess of the holder is formed and arranged in such a way that the holder may be fixed to the injector at the injector recess of the holder by a positive connection. The elastic element is arranged at the bottom portion of the holder for forcing the holder away from the fuel cup.

[0006] The notch of the holder enables a simple coupling of the holder to the fuel cup. This contributes to a simple assembling of the injector to an internal combustion engine. The injector recess enables the positive connection between the holder and the injector. This contributes to a simple assembling of the holder to the injector. If the injector with the holder and the fuel cup is arranged in the internal combustion engine, the elastic elements are preloaded. So, the elastic elements apply a given force to the injector towards a combustion chamber of the internal combustion engine. This contributes to that the injector is pressed into a seat of the injector at the internal combustion engine despite a pressure which may be applied on the injector towards the fuel cup because of a pressure in the combustion chamber. Preferably, the fuel cup is coupled to a fuel rail and/or a part of the fuel rail.

[0007] In an advantageous embodiment of the first aspect of the invention, the holder comprises a first side portion. The first side portion extends away from a first side of the bottom portion and comprises the notch of the holder. The notch of the holder comprises a fuel cup re-

cess for taking in the notch of the fuel cup. The fuel cup recess has an open end of the fuel cup recess facing away from the bottom portion for introducing the notch of the fuel cup into the fuel cup recess of the holder. The fuel cup recess of the holder comprises a diminution of the fuel cup recess of the holder. The diminution of the fuel cup recess of the holder is formed at the open end of the fuel cup recess of the holder for engaging the notch of the fuel cup into the fuel cup recess of the holder. This contributes to a simple design of the notch of the holder and so to a low-cost production of the notch of the holder. This is especially advantageous, if the notch of the fuel cup comprises a T-shaped fixing element which may be introduced into the fuel cup recess for engaging the holder to the fuel cup.

[0008] In a further advantageous embodiment of the first aspect of the invention, the holder comprises a second and a third side portion. The second and the third side portions are coupled to a second and, respectively, a third side of the bottom portion of the holder. The second and the third side portions are arranged opposite to each other and each comprise at least one elastic element. This may contribute to apply an even load on the injector through the elastic element. This contributes to a proper coupling of the injector to the injector seat of the internal combustion engine.

[0009] In a further advantageous embodiment of the first aspect of the invention, the elastic elements each comprise at least one bended arm. Each bended arm is coupled to the bottom portion at a first end of the bended arm. The bended arm extends away from the bottom portion and then bends back towards the bottom portion. Each bended arm has a second end of the bended arm. The second end of the bended arm has a given distance to the bottom portion. This contributes to a simple design of the elastic elements. Further, this enables to form the holder and the elastic elements of one piece. This enables a low-cost production of the holder and in particular of the elastic elements.

[0010] In a further advantageous embodiment of the first aspect of the invention, each bended arm comprises an extension at a bended part of the bended arm for a coupling of the extensions to shoulders of the fuel cup. This contributes to a proper coupling of the bended arms to the fuel cup. This contributes to apply the given force on the injector properly.

[0011] In a further advantageous embodiment of the first aspect of the invention, the injector recess of the holder is open towards a fourth side of the bottom portion of the holder. The injector recess comprises an orientation element of the holder for avoiding a rotation of the holder relative to the injector around an axis of the injector. This enables the positive connection of the holder to the injector in a simple way. So, this contributes to a proper fixation of the holder to the injector.

[0012] In a further advantageous embodiment of the first aspect of the invention, the holder comprises back

stops for each of the bended arms. The back stops extend away from the bottom portion towards the second ends of the bended arms. The back stops of the bottom portion have the given distance to the second ends of the bended arms. This may contribute to stabilize the bended arms of the holder. This contributes to a proper functionality of the holder over a long lifetime of the holder.

[0013] The invention is distinguished concerning a second aspect of the invention by the injector. The injector is arranged for dosing fluid. The injector has a fluid connection and a groove. The groove at least partly extends around a circumference of the fluid connection for at least partly taking in a border of an injector recess of the holder. The groove is formed and arranged in such a way that the holder may be fixed to the injector at the groove of the injector by the positive connection. The groove enables the positive connection of the holder to the injector in a simple way. The positive connection contributes to the easy assembling of the injector to the internal combustion engine.

[0014] In an advantageous embodiment of the second aspect of the invention, the groove has an orientation element of the injector for avoiding a rotation of the holder relative to the injector around the axis of the injector. This contributes to a proper coupling of the holder to the injector.

[0015] The invention is distinguished concerning a third aspect of the invention by the fuel cup for the injector. The fuel cup comprises a fuel cup body with an injector recess of the fuel cup for sealingly taking in the fluid connection of the injector. The fuel cup further comprises a notch of the fuel cup for engaging the notch of the holder to the notch of the fuel cup. The injector recess enables a proper sealed coupling of the injector to the fuel cup. The notch of the fuel cup enables the fixation of the fuel cup to the holder.

[0016] In an advantageous embodiment of the third aspect of the invention, the notch of the fuel cup comprises a T-shaped fixing element. The T-shaped fixing element radially extends away from the outside of the fuel cup body for introducing the T-shaped fixing element into the fuel cup recess of the holder. This is especially advantageous in combination with the fuel cup recess of the holder. The T-shaped fixing element comprises a first section and a second section. The second section is broader than the fuel cup recess of the holder. The first section is arranged between the fuel cup and the second section is slightly broader than the diminution of the fuel cup recess and smaller than the fuel cup recess. This enables to introduce the T-shaped fixing element into the fuel cup recess by slightly bending the first side portion of the holder in such a way that the diminution gets at least as broad as the first section of the T-shaped fixing element. This enables to form the notches in a very simple way.

[0017] In a further advantageous embodiment of the third aspect of the invention, the fuel cup comprises at least two shoulders. The two shoulders are formed and

arranged at the outside of the fuel cup opposite to each other for a coupling with the elastic elements of the holder. This contributes to a proper coupling of the bended arms to the fuel cup. This contributes to apply the given force on the injector properly.

[0018] The invention is distinguished concerning a fourth aspect of the invention by an injector assembly. The injector assembly comprises the holder, the injector, and the fuel cup. The holder is clamped to the injector in such a way that the border of the injector recess of the holder is at least partly arranged in the groove of the injector. The fuel cup is arranged in such a way that the fuel cup partly takes in the fluid connection of the injector. The notch of the fuel cup is engaged to the notch of the holder. The elastic elements of the holder are coupled to the fuel cup.

[0019] In an advantageous embodiment of the third aspect of the invention, the T-shaped fixing element of the fuel cup is arranged in the fuel cup recess of the holder. This enables the fixation of the holder to the fuel cup.

[0020] In a further advantageous embodiment of the fourth aspect of the invention, the orientation element of the holder is coupled to the orientation element of the injector. This enables to avoid the rotation of the injector relative to the holder and via the notches to avoid a rotation of the injector relative to the fuel cup.

[0021] In a further advantageous embodiment of the fourth aspect of the invention, the extensions of the bended arms of the holder are coupled to the shoulders of the fuel cup.

[0022] The invention is explained in the following with the help of schematic drawings.

[0023] These are as follows:

figure 1 an injector assembly,

figure 2 an exploded view of the injector assembly,

40 figure 3 a holder of the injector assembly,

figure 4 a cutted view through an injector of the injector assembly according to figure 2.

45 **[0024]** Elements with the same design or function that appear in the different illustrations are identified by the same reference characters.

[0025] An injector assembly (figure 1) comprises an injector 2, a holder 4, and a fuel cup 6. Preferably, the injector assembly is arranged at an internal combustion engine for injecting fluid into a combustion chamber of the internal combustion engine. Preferably, the fuel cup 6 is coupled to a fuel rail and/or a part of the fuel rail.

50 **[0026]** The injector 2 comprises an injector tip 3 facing away from the fuel cup 6. The injector tip 3 comprises at least one injector opening through which the fuel may be injected into the combustion chamber. Preferably, the injector 2 is arranged at the internal combustion engine

in such a way that a step 5 of the injector is coupled to an injector seat of an engine head of the internal combustion engine.

[0027] The holder 4 comprises a notch of the holder 4. The notch of the holder 4 is arranged for engaging the notch of the holder 4 to an notch of the fuel cup 6. Preferably, the notch of the holder 4 is formed by a first side portion 8 of the holder 4. The first side portion 8 comprises a fuel cup recess 10. The fuel cup recess 10 is arranged for introducing the notch of the fuel cup 6 into the fuel cup recess 10 of the holder 4.

[0028] For engaging the notch of the fuel cup 6 into the fuel cup recess 10 of the holder 4, the fuel cup recess 10 comprises a diminution 12 of the fuel cup recess 10. The diminution 12 is formed in such a way that, while the notch of the fuel cup is introduced into the fuel cup recess 10 of the holder 4, the first side portion 8 is bended in such a way that the diminution 12 gets broader. If the notch of the fuel cup 6 is introduced further into the fuel cup recess 10, the first side portion 8 bends back in its normal position and the notch of the fuel cup 6 is engaged into the fuel cup recess 10 of the first side portion 8 of the holder 4.

[0029] The holder 4 further comprises at least one elastic element. The elastic element is arranged in such a way that, if the injector assembly is arranged at the internal combustion engine, the injector 2 is pressed in its injector seat by the elastic element. Preferably, the holder 4 comprises two elastic elements which are arranged at two opposite sides of the holder 4. This contributes to an even load on the injector 2.

[0030] Preferably, the elastic elements each comprise a bended arm. In particular, the holder 4 comprises a bended arm 14 of a second side portion of the holder 4 and a bended arm 16 of a third side portion of the holder 4. The bended arms firstly extend away from a bottom portion 31 of the holder 4 (figure 2, figure 3). The bended arms each comprise a bend at which the bended arms secondly bend towards the bottom portion 31.

[0031] Preferably, the bended arm 14 of the second side portion of the holder 4 comprises a second end 39 of the bended arm 14 of the second side portion and the bended arm 16 of the third side portion comprises a second end 37 of the bended arm 16 of the third side portion of the holder 4. The second ends may be formed in such a way that the second ends extend parallel to the bottom portion 31 of the holder 4.

[0032] Additionally, the bottom portion 31 may comprise a first and a second back stop 41, 43 for the bended arms. The second ends have a given distance to the bottom portion 31 and, in particular, to the first and second back stops 41, 43.

[0033] Preferably, the holder 4 further comprises an extension 18 of the bended arm 14 of the second side portion and an extension 20 of the bended arm 16 of the third side portion. The extensions are formed for improving the coupling of the elastic elements to the fuel cup. In particular, the extensions are formed for improving the

coupling of the extensions to a first and, respectively, a second shoulder 22, 24 of the fuel cup 6. The extensions and the shoulders enlarge a coupling surface between the holder 4 and the fuel cup 6. This contributes to a proper load transfer from the fuel cup 6 to the injector 2, if the injector assembly is arranged at the internal combustion engine. For example, if the coupling surface between the elastic elements and the fuel cup 6 would be too small, the contact of the elastic elements to the fuel cup 6 may be lost during operation of the internal combustion engine because of vibrations of the internal combustion engine.

[0034] Preferably, the notch of the fuel cup 6 comprises a T-shaped fixing element 26. The T-shaped fixing element comprises a first section 28 of the T-shaped fixing element 26 and a second section 30 of the T-shaped fixing element 26. The T-shaped fixing element 26 is formed in such a way that the first section 28 is slightly broader than the diminution 12 of the fuel cup recess 10 and that the second section 30 is broader than the fuel cup recess 10 of the holder 4. This enables the engaging of the T-shaped fixing element 26 into the fuel cup recess 10 of the holder 4.

[0035] Preferably, the injector 2 comprises a fuel connection 34. The fuel connection 34 is arranged for sealingly coupling the injector 2 to the fuel cup 6. The fuel connection 34 may be introduced into an injector recess of the fuel cup 6. To improve the sealing between the injector 2 and the fuel cup 6, the injector 2 may comprise a sealing 36.

[0036] The injector 2 comprises a groove 38 of the injector 2. The groove 38 of the injector 2 is arranged at the fluid connection 34. The groove 38 may at least partly extend around the circumference of the fluid connection 34. Preferably, the groove 38 comprises two C-shaped parts (figure 4) and at least one orientation element 40 of the injector 2. The orientation elements 40 may comprise a rectangular shape. The orientation elements 40 of the injector 2 are arranged for a coupling with an orientation element 35 of an injector recess 33 of the bottom portion 31 of the holder 4. If the orientation elements 40 of the injector 2 are coupled to the orientation element 35 of the injector recess 33 and if the holder 4 is clamped to the injector 2, the orientation elements avoid a rotation of the holder 4 around an axis of the injector 2. The injector recess 33 of the holder 4 and the groove 38 of the injector 2 are formed and arranged in such a way that the holder 4 may be clamped to the injector 2 in such a way that a border of the injector recess 33 may be arranged partly in the groove 38. For this reason, the injector recess 33 of the holder 4 comprises an open end facing away from the first side portion 8 of the holder 4.

[0037] While assembling the injector assembly, for example, at an assembly line, the holder 4 may be clamped to the injector 2. Afterwards, the fluid connection 34 of the injector 2 is introduced into the fuel cup 6 and the T-shaped fixing element 26 is introduced into the fuel cup recess 10 of the holder 4. If the T-shaped fixing element

26 is engaged in the fuel cup recess 10, the fuel cup 6, the holder 4, and the injector 2 may be handled as one part. This is especially advantageous for the assembling of the injector assembly to the internal combustion engine. Preferably, the whole fuel rail of the internal combustion engine may be assembled in such a way that all injectors 2 of the fuel rail are clamped at their fuel cups 6 of the fuel rail and that the whole fuel rail with the injectors 2 may be handled as one piece.

[0038] If the injector 2 is arranged in its injector seat of the engine head of the internal combustion engine, for example, a screw may be stuck through a fixing recess 32 of the fuel cup 6. If the fuel cup 6 is fixed by the screw at the engine head, the notches lose their sense and do not further contribute to fix the injector 2 to the fuel cup 6. However, then the fuel cup 6 loads the elastic elements of the holder 4. The load on the elastic elements leads to a bending of the bended arms towards the bottom portion 31. The back stops may contribute to that the bended arms are not bended in such a way that the bended arms break. Further, if the second ends of the bended arms are in contact with the back stops and if the load further increases, the back stops may also be bended and contribute to increase the elastic force of the elastic elements. The load is transferred to the injector 2 in such a way that the injector 2 is pressed against its injector seat in the engine head. This contributes to that the injector 2 stays in its injector seat despite a pressure which may force the injector 2 away from its injector seat and which may be produced by a pressure in the combustion chamber of the internal combustion engine.

[0039] The invention is not restricted by the explained embodiments. For example, the holder 4 may comprise only one or more than two elastic elements. Further, the elastic elements may be formed alternatively, for example by springs. Further, the notches may comprise an alternative embodiment and/or there may be arranged further notches. Further, the bended arms may be formed without the extensions and the fuel cup 6 may be formed without the shoulders, respectively.

Claims

1. Holder (4) for fixing an injector (2) to a fuel cup (6), the holder (4) comprising
 - a bottom portion (31),
 - a notch of the holder (4) for engaging the notch of the holder (4) to a notch of the fuel cup (6),
 - an injector recess (33) in the bottom portion (31) of the holder (4) for taking in the injector (2), wherein the injector recess (33) of the holder (4) is formed and arranged in such a way that the holder (4) may be fixed to the injector (2) at the injector recess (33) of the holder (4) by a positive connection,
 - at least one elastic element which is arranged

at the bottom portion (31) of the holder (4) for forcing the injector (2) away from the fuel cup (6).

2. Holder (4) in accordance with claim 1 comprising a first side portion which extends away from a first side of the bottom portion and which comprises the notch of the holder (4), with the notch of the holder (4) comprising a fuel cup recess (10) for taking in the notch of the fuel cup (6), wherein the fuel cup recess (10) has an open end of the fuel cup recess (10) facing away from the bottom portion (31) for introducing the notch of the fuel cup (6) into the fuel cup recess (10) of the holder (4) and wherein the fuel cup recess (10) of the holder (4) comprises a diminution (12) of the fuel cup recess (10) of the holder (4) at the open end of the fuel cup recess (10) of the holder (4) for engaging the notch of the fuel cup (6) into the fuel cup recess (10) of the holder (4).
3. Holder in accordance with claim 2 comprising a second and a third side portion which are coupled to a second and, respectively, a third side of the bottom portion (31) of the holder (4) and which are arranged opposite to each other and which each comprise at least one elastic element.
4. Holder (4) in accordance with claim 3, with the elastic elements each comprising at least one bended arm which
 - is coupled to the bottom portion (31) at a first end of the bended arm,
 - extends away from the bottom portion (31) and which then bends back towards the bottom portion (31),
 - each have a second end of the bended arm, the second end of the bended arm has a given distance to the bottom portion (31).
5. Holder (4) in accordance with claim 5 with each bended arm comprising an extension at a bended part of the bended arm for a coupling of the extensions to shoulders of the fuel cup.
6. Holder (4) in accordance with one of the preceding claims, with the injector recess (33) of the holder (4) being open towards a fourth side of the bottom portion (31) facing away from the first side of the bottom portion (31) of the holder (4) and with the injector recess (33) comprising an orientation element (35) of the holder (4) for avoiding a rotation of the holder (4) relative to the injector (2) around an axis of the injector (2).
7. Holder (4) in accordance with one of the claims 4 to 7 comprising back stops for each of the bended arms, with the back stops extending away from the bottom portion (31) towards the second ends of the bended

- arms having the given distance to the second ends of the bended arms.
- 8.** Injector (2) for dosing fluid having a fluid connection (34) and a groove (38) which at least partly extends around a circumference of the fluid connection (34) for at least partly taking in a border of an injector recess (33) of a holder (4), with the groove (38) being formed and arranged in such a way that the holder (4) may be fixed to the injector (2) at the groove (38) of the injector (2) by a positive connection.
- 9.** Injector (2) in accordance with claim 9 with the groove (38) having an orientation element (40) of the injector (2) for avoiding a rotation of the holder (4) relative to the injector (2) around an axis of the injector (2).
- 10.** Fuel cup (6) for an injector (2) comprising a fuel cup body with an injector recess of the fuel cup (6) for sealingly taking in a fluid connection (34) of the injector (2) and comprising a notch of the fuel cup (6) for engaging a notch of a holder (4) to the notch of the fuel cup (6).
- 11.** Fuel cup (6) in accordance with claim 11 with the notch of the fuel cup (6) comprising a T-shaped fixing element (26) which radially extends away from the outside of the fuel cup body for introducing the T-shaped fixing element (26) into a fuel cup recess (10) of a holder (4).
- 12.** Fuel cup (6) in accordance with one of the claims 11 or 12 comprising at least two shoulders which are formed and arranged at the outside of the fuel cup (6) opposite to each other for a coupling with an elastic element of the holder (4).
- 13.** Injector assembly comprising
- the holder (4) according to one of the claims 1 to 8,
 - the injector (2) according to claim 9 or 10,
 - the fuel cup (6) according to one of the claims 11 to 13, with the holder (4) being clamped to the injector (2) in such a way that the border of the injector recess (33) of the holder (4) is at least partly arranged in the groove of the injector (2) and with the fuel cup (6) being arranged in such a way that the fuel cup (6) partly takes in the fluid connection (34) of the injector (2) and that the notch of the fuel cup (6) is engaged to the notch of the holder (4) and that the elastic elements of the holder (4) are coupled to the fuel cup (6).
- 14.** Injector assembly in accordance with claim 14 with the T-shaped fixing element (26) of the fuel cup (6) being arranged in the fuel cup recess (10) of the holder (4).
- 15.** Injector assembly in accordance with claim 14 or 15 with the orientation element (35) of the holder (4) being coupled to the orientation element of the injector (2).
- 16.** Injector assembly in accordance with one of the claims 14 to 16 with the extensions of the bended arms of the holder (4) being coupled to the shoulders of the fuel cup (6).

FIG 1

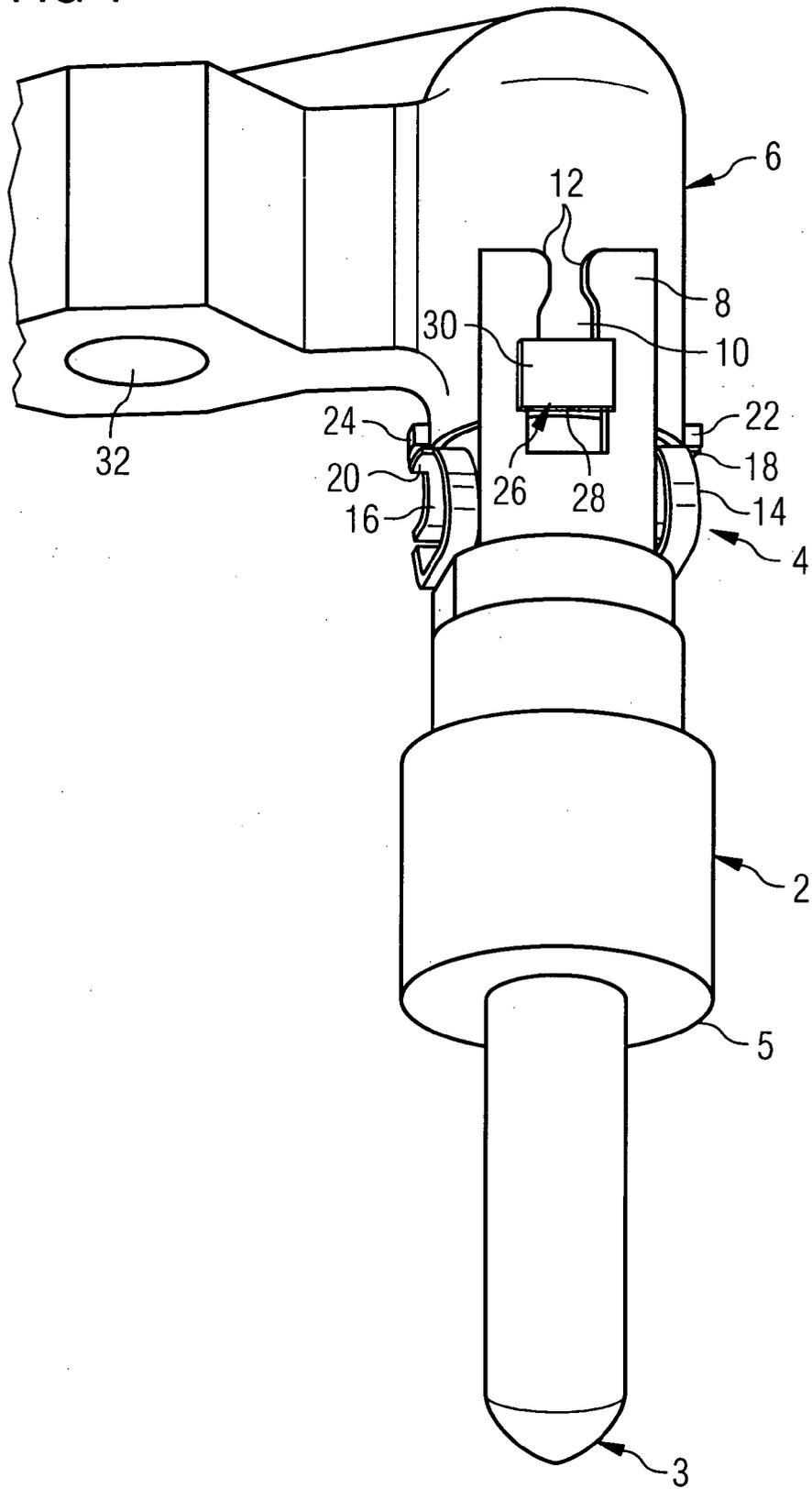


FIG 2

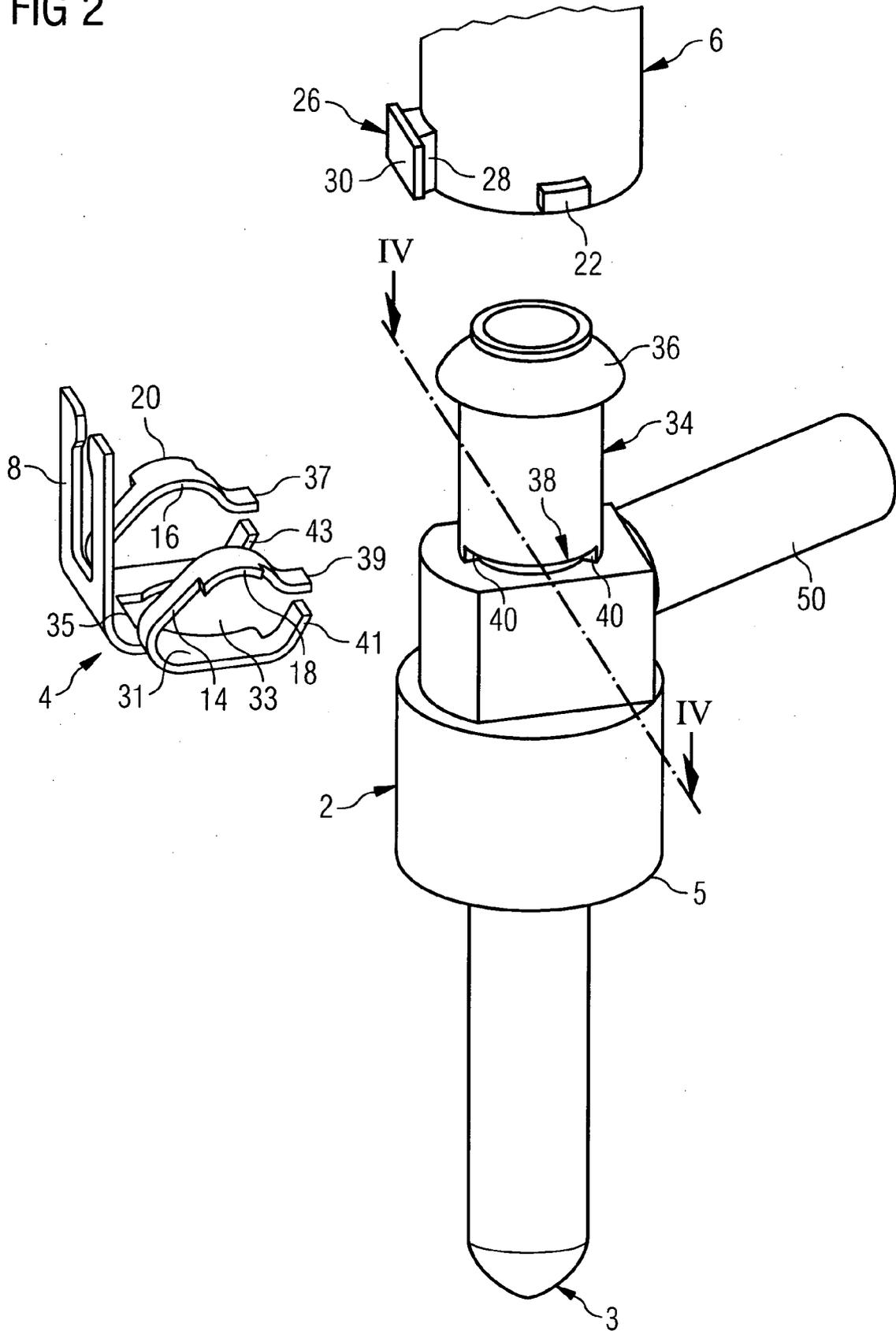


FIG 3

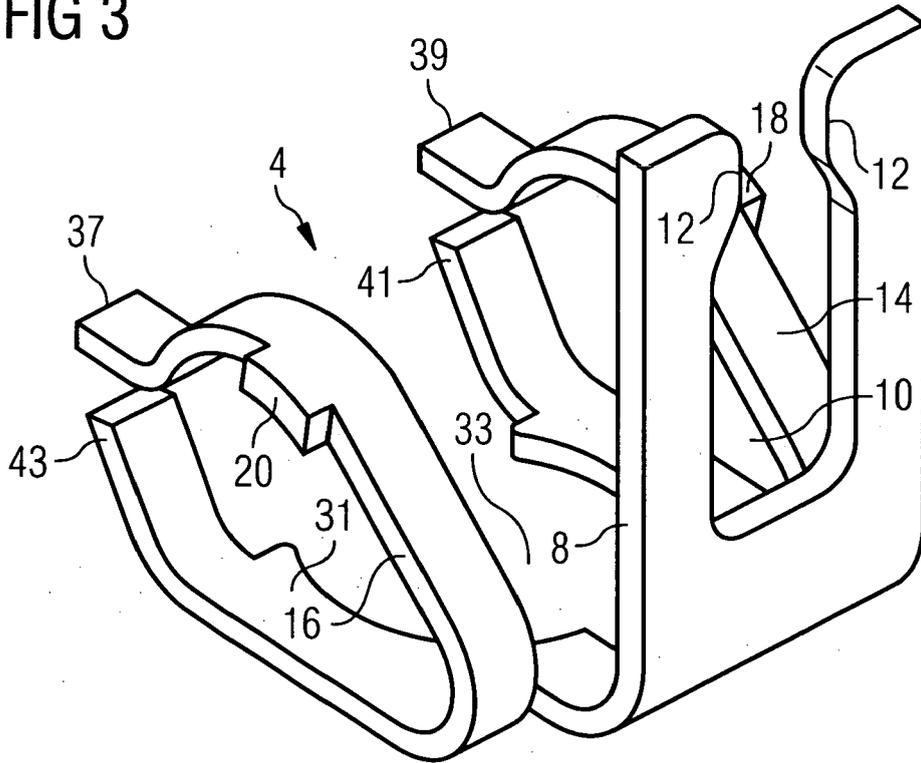
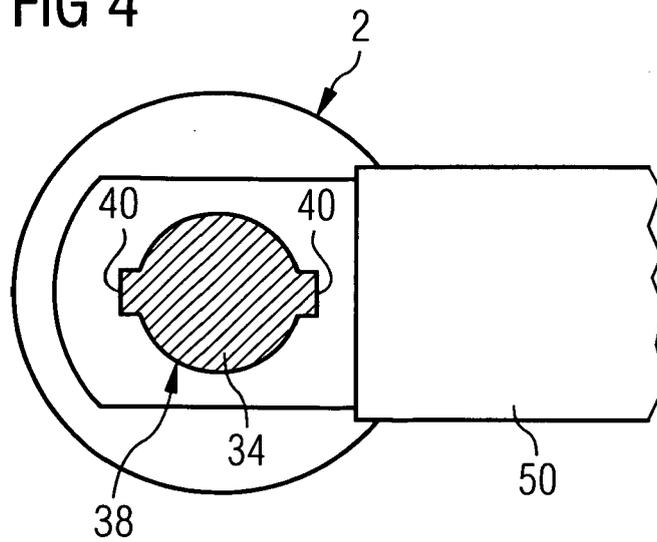


FIG 4





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4 EPO FORM 1503 03.82 (F04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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