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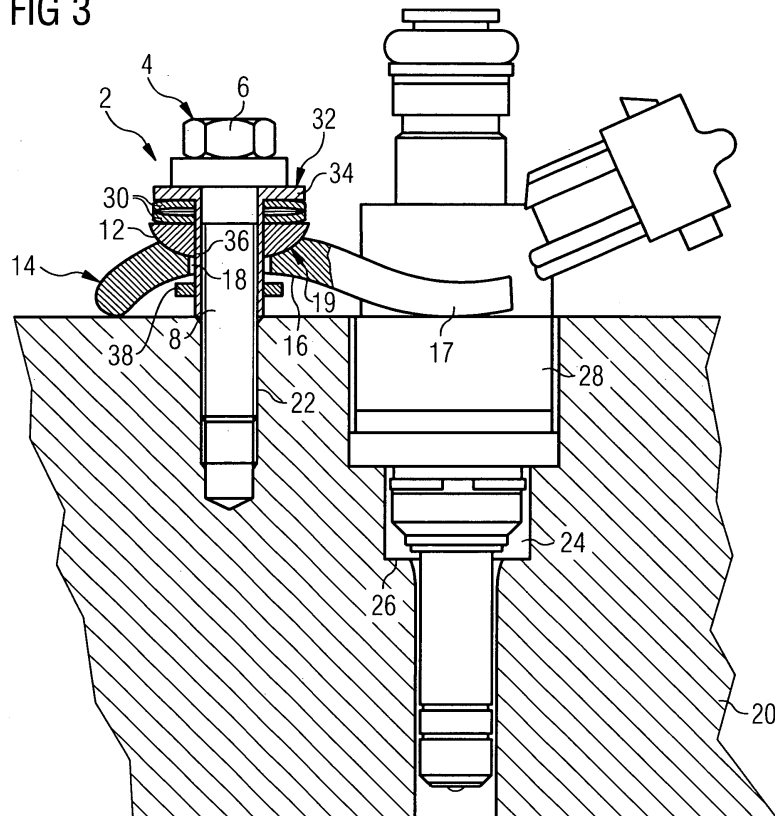
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57121 Livorno (IT)****(54) Clamping device and cylinder head arrangement**

(57) A clamping device (2) for clamping an injector (28) against an injector seat (26) comprises at least a fixation means (4), an elastic element (10), a washer (12) and a fork (14). The fixation means (4) is arranged for rigidly coupling the clamping device (2) to a body which comprises the injector seat (26). The fixation means (4) has a fixation means head (6) and a fixation means body (8). The elastic element (10) is penetrated by the fixation means body (8). The fixation means head (6) forms a

positive stop for the elastic element (10). The washer (12) has a spherical side and a flat side and is arranged on the fixation means body (8). The flat side is coupled to the elastic element (10). The fork (14) has two prongs (17) for a coupling with the injector (28) and a bended handle (15). The bended handle (15) comprises a recess (18) which is penetrated by the fixation means body (8) and which has a spherical section (19) forming a sphere-sphere coupling with the spherical side of the washer (12).

FIG 3

Description

[0001] The invention relates to a clamping device and a cylinder head arrangement which comprises the clamping device. The clamping device is arranged for clamping an injector against an injector seat. The clamping device has a fixation means for rigidly coupling the clamping device to a body which comprises the injector seat. The fixation means has a fixation means head and a fixation means body.

[0002] EP 1 262 652 A1 discloses a cylinder head and an injector which is arranged at the cylinder head. The injector is clamped against the cylinder head at least at one clamping area of the injector. At the clamping area, between the injector and the cylinder head, a dumping element is arranged which is generally formed by one of the materials, for example, graphite, polyformaldehyde, polytetrafluorethylen, memory metal.

[0003] It is an object of the invention to create a clamping device for a cylinder head arrangement and a cylinder head arrangement which enable an easy and precise fixation of an injector to the cylinder head.

[0004] The object of the invention is achieved by the independent claims 1 and 8. Advantageous embodiments of the invention are given in the sub-claims.

[0005] The invention is distinguished, concerning a first aspect of the invention, by a clamping device for clamping an injector against an injector seat. The clamping device comprises a fixation means for rigidly coupling the clamping device to a body which comprises the injector seat. The fixation means has a fixation means head and a fixation means body. At least one elastic element is penetrated by the fixation means body. The fixation means head forms a positive stop for the elastic element. A washer has a spherical side and a flat side and is arranged on the fixation means body. The flat side of the washer is coupled to the elastic element. A fork has two prongs for a coupling with the injector and a bended handle. The bended handle comprises a recess which is penetrated by the fixation means body and which has a spherical section forming a sphere-sphere coupling with the spherical side of the washer.

[0006] The sphere-sphere coupling contributes to a proper axial coupling of the fork to the washer independent from the orientation of the fork. The prongs of the fork hold the injector in its position rectangular to an axis of the injector. It is especially advantageous, if the fixation means comprises a screw, because then a defined clamping force may be easily applied on the injector. The bend of the handle of the fixation element contributes to a proper coupling of the injector to the injector seat.

[0007] In an advantageous embodiment of the first aspect of the invention the clamping device comprises a retainer body. The retainer body has a ring-shaped section which is penetrated by the fixation means body. The ring-shaped section is arranged between the fixation means head and the elastic element. This is especially advantageous if an outer diameter of the fixation means

head is smaller than an inner diameter of the elastic element. Further, this may contribute to avoid friction between the fixation means head and the elastic element.

[0008] In a further advantageous embodiment of the first aspect of the invention the retainer body has a cylinder-shaped section. The cylinder-shaped section of the retainer body is penetrated by the fixation means body and penetrates the elastic element, the washer, and the fork. This may contribute to a proper coupling of the elastic element, the washer, and/or the fork to the clamping device.

[0009] In a further advantageous embodiment of the first aspect of the invention the clamping device comprises a retaining ring. The retaining ring is fixed to the cylinder-shaped section of the retainer body in such a way that the elastic element, the fork, and the washer are held between the retaining ring and the ring-shaped section of the retainer body. In this way, the clamping device may be pre-assembled in such a way that the cylinder-shaped section of the retainer body penetrates the elastic element, the washer, and the fork, while the ring-shaped section of the retainer body and the retaining ring hold the elastic element, the washer, and the fork on the cylinder-shaped section of the retainer body. So, the pre-assembled clamping device has only two loose parts: the pre-assembled parts and the fixation means. This contributes to an easy and cheap assembling of the clamping device.

[0010] In a further advantageous embodiment of the first aspect of the invention the retaining ring is partly arranged in a groove of the cylinder-shaped section of the retainer body. This contributes to an easy and proper fixation of the retaining ring to the retainer body.

[0011] In a further advantageous embodiment of the first aspect of the invention the elastic element comprises at least one Belleville spring. This contributes to a proper elastic coupling of the washer and the fork.

[0012] In a further advantageous embodiment of the first aspect of the invention the fork is S-shaped. This may contribute to a proper axial clamping force of the fork against the injector.

[0013] The invention is distinguished, concerning a second aspect of the invention, by a cylinder head arrangement. The cylinder head arrangement comprises a cylinder head of an internal combustion engine. Further, the cylinder head arrangement comprises the clamping device and the injector. The clamping device is fixed to the cylinder head with an axial end of the fixation means body facing away from the fixation means head. A recess of the cylinder head comprises the injector seat. The injector is clamped to the recess of the cylinder head by the clamping device and is arranged between the prongs of the fork and the injector seat of the cylinder head.

[0014] The invention is explained in the following with the help of schematic drawings.

[0015] These are as follows:

figure 1 a first embodiment of a cylinder head arrangement,

figure 2 a fork of the cylinder head arrangement,

figure 3 a second embodiment of the cylinder head arrangement.

[0016] Elements with the same design or function that appear in the different illustrations are identified by the same reference characters.

[0017] A cylinder head arrangement (figure 1) comprises a clamping device 2, a cylinder head 20, and an injector 28. The cylinder head arrangement may be a part of an internal combustion engine. Preferably, the internal combustion engine is arranged in a vehicle.

[0018] The clamping device 2 comprises at least a fixation means 4, an elastic element 10, a washer 12, and a fork 14.

[0019] The fixation means 4 comprises a fixation means head 6 and a fixation means body 8. The elastic element 10 has a recess of the elastic element 10 and is stuck onto the fixation means body 8. The fixation means body 8 penetrates the elastic element 10 through the recess of the elastic element 10. The fixation means head 6 forms a positive stop for the elastic element 10. The washer 12 has a flat side, a spherical side, and a recess of the washer 12. The washer 12 is stuck onto the fixation means 4 in such a way that the fixation means body 8 penetrates the recess of the washer 12. The washer 12 is arranged in such a way that the flat side of the washer 12 is coupled to the elastic element 10.

[0020] The fork 14 preferably comprises two prongs 17 (figure 2) and a bended handle 15 which is bended at a bend 16. Further, the fork 14 comprises a recess 18 of the fork 14. The recess 18 of the fork 14 has a spherical section 19. The spherical section 19 of the recess 18 of the fork 14 is coupled to the spherical side of the washer 12. So, the spherical side of the washer 12 and the spherical section 19 of the recess 18 of the fork 14 form a sphere-sphere coupling. The fork 14 is arranged in such a way that an open side of the bend 16 is facing away from the washer 12. In other words: an outer side of the bend 16 is facing towards the washer 12.

[0021] The clamping device 2 is fixed to the cylinder head 20 by the fixation means body 8 and a fixation recess 22 of the cylinder head 20. Preferably, the fixation means 4 comprises a screw and the fixation means body 8 comprises a thread of the screw. Then, the fixation recess 22 of the cylinder head 20 comprises a corresponding thread for the screw. The screw enables an easy fixation of the clamping device 2 to the cylinder head 20. Further, the screw enables in an easy way to load the clamping device 2, in particular the elastic element 10 with a given force.

[0022] The injector 28 is arranged in an injector recess 24 of the cylinder head 20. The injector 28 is clamped between the prongs 17 of the fork 14 and an injector seat

26 of the cylinder head 20.

[0023] If the screw is screwed towards the cylinder head 20, a force is applied on the elastic element 10 and is transferred to the fork 14, in particular to the bend 16 of the fork 14, by the washer 12. The elastic element 10 and the fork 14 are elastically deformed by the force. The force is transferred to the injector 28 by the fork 14, in particular by the prongs 17 of the fork 14. The bended handle 15 of the fork 14 contributes to a proper force transfer from the fixation means 4 to the injector 28.

[0024] The sphere-sphere coupling enables to turn the fork 14 around an axis of the fixation means 4. Further the sphere-sphere coupling enables a movement of the prongs 17 parallel to an axis of the injector 28 in small range. So, the fork 14 and the sphere-sphere coupling enable a flexible coupling of the injector 28 to the cylinder head 20. The flexible coupling may contribute to compensate a system tolerance of the injector 28 and/or of the cylinder head 20. For example, because of the system tolerance the position of the injector recess 24 of the cylinder head 20 varies from one cylinder head 20 to another cylinder head 20 which may be compensated by turning the fork 14 around the axis of the fixation means 4. Further, because of the system tolerance the axial position of the injector 2 varies, which may be compensated by moving the prongs 14 parallel to the axis of the injector 28. Further, the sphere-sphere coupling enables in each of the orientations of the fork 14 mentioned above a proper force transfer in an axial direction from the fixation means 4 to the fork 14 and further to the injector 28.

[0025] The injector 28 is arranged between the two prongs 17 of the fork 14. So, turning the fork 14 around the axis of the fixation means 4 leads to a movement of the injector 28 rectangular to the axis of the injector 28. So, the position of the injector 28 in the injector recess 24 rectangular to the axis of the injector 28 may be given by the fork 14.

[0026] Preferably, the clamping device 2 comprises a retainer body 32 (figure 3). Preferably, the retainer body 32 comprises a ring-shaped section 34. The ring-shaped section 34 is arranged between the elastic element 10 and the fixation means head 6. The ring-shaped section 34 of the retainer body 32 is specially advantageous, if an inner diameter of the elastic element 10 is larger than an outer diameter of the fixation means head 6. Further, preferably, the retainer body 32 comprises a cylinder-shaped section 36. The cylinder-shaped section 36 is penetrated by the fixation means body 8. The cylinder-shaped section 36 of the retainer body 32 penetrates the elastic element 10, the washer 12, and the fork 14. Preferably, a retaining ring 38 is fixed to the cylinder-shaped section 36 of the retainer body 32. The retaining ring 38 may be welded to the cylinder-shaped section 36 of the retainer body 32. Preferably, the retainer body 32 comprises a groove at the cylinder-shaped section 36 in which the retaining ring 38 is arranged. Then, the retaining ring 38 preferably does not extend around the whole circumference of the cylinder-shaped section 36.

[0027] The retainer body 32 and the retaining ring 38 take in the elastic element 10, the washer 12, and the fork 14 in axial direction. The retainer body 32 and the retaining ring 38 preferably are arranged and formed in such a way that the elastic element 10, the washer 12, and the fork 14 are held together by the retainer body 32 and the retaining ring 38. In that way, the clamping device 2 may comprise only two loose parts. A first part comprises the retainer body 32 and the retaining ring 38 which hold the elastic element 10, the washer 12, and the fork 14 and is preferably pre-assembled. A second part of the clamping device 2 is the fixation means 4. Having only these two loose parts may contribute to an very easy and cheap assembling of the clamping device and/or of the clamping device to the cylinder head 20.

[0028] In a preferred embodiment, the elastic element 10 comprises at least one, preferably more Belleville springs 30. The Belleville springs 30 contribute to a proper transfer of the force from the fixation means 4 to the fork 14 while being very robust and having a long lifetime.

Claims

1. Clamping device (2) for clamping an injector (28) against an injector seat (26) comprising
 - a fixation means (4) for rigidly coupling the clamping device (2) to a body which comprises the injector seat (26), the fixation means (4) having a fixation means head (6) and a fixation means body (8),
 - at least one elastic element (10) which is penetrated by the fixation means body (8), the fixation means head (6) forming a positive stop for the elastic element (10),
 - a washer (12) which has a spherical side and a flat side and which is arranged on the fixation means body (8), the flat side being coupled to the elastic element (10),
 - a fork (14) which has two prongs (17) for a coupling with the injector (28) and which has a bended handle (15), the bended handle (15) comprising a recess (18) which is penetrated by the fixation means body (8) and which has a spherical section (19) forming a sphere-sphere coupling with the spherical side of the washer (12).
2. Clamping device (2) in accordance with claim 1 comprising a retainer body (32) having a ring-shaped section (34) which is penetrated by the fixation means body (8) and which is arranged between the fixation means head (6) and the elastic element (10).
3. Clamping device (2) in accordance with one of the preceding claims with the retainer body (32) having a cylinder-shaped section (36) which is penetrated by the fixation means body (32) and penetrates the elastic element (10), the washer (12), and the fork (14).
4. Clamping device (2) in accordance with one of the preceding claims comprising a retaining ring (38) which is fixed to the cylinder-shaped section (36) of the retainer body (32) in such a way that the elastic element (10), the fork (14), and the washer (12) are held between the retaining ring (38) and the ring-shaped section (34) of the retainer body (32).
5. Clamping device (2) in accordance with claim 4 with the retaining ring (38) being partly arranged in a groove (40) of the cylinder-shaped section (36) of the retainer body (32).
6. Clamping device (2) in accordance with one of the preceding claims with the elastic element (10) comprising at least one Belleville spring (30).
7. Clamping device (2) in accordance with one of the preceding claims with the fork (14) being S-shaped.
8. Cylinder head arrangement comprising
 - a cylinder head (20) of an internal combustion engine,
 - the clamping device (2) according to one of the preceding claims, with the clamping device (2) being fixed to the cylinder head (20) with an axial end of the fixation means body (8) facing away from the fixation means head (6),
 - a recess (24) of the cylinder head (20) which comprises the injector seat (26),
 - an injector (28) which is clamped into the recess (24) of the cylinder head (20) by the clamping device and which is arranged between the prongs (17) of the fork (14) and the injector seat (26) of the cylinder head.

FIG 1

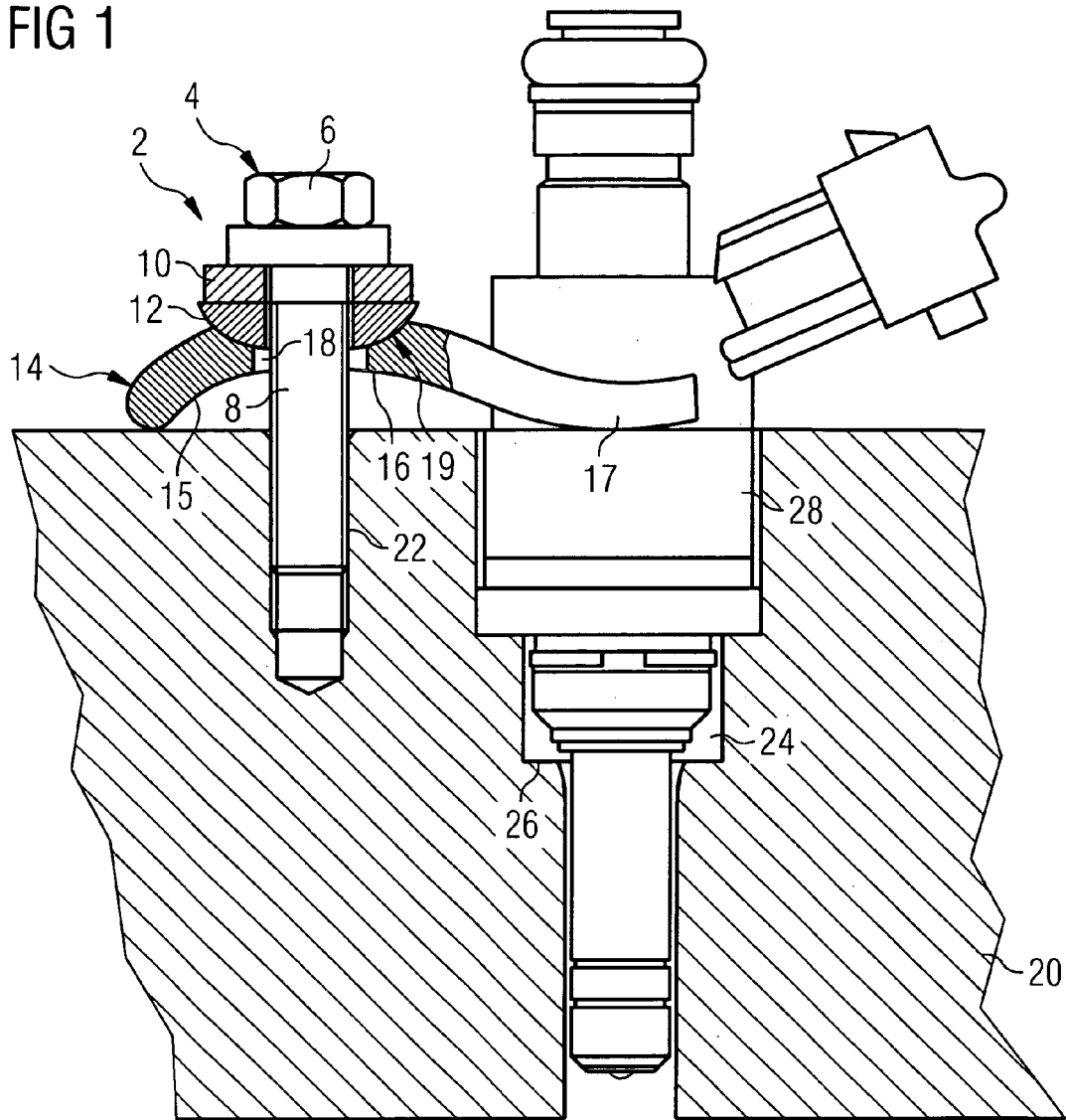


FIG 2

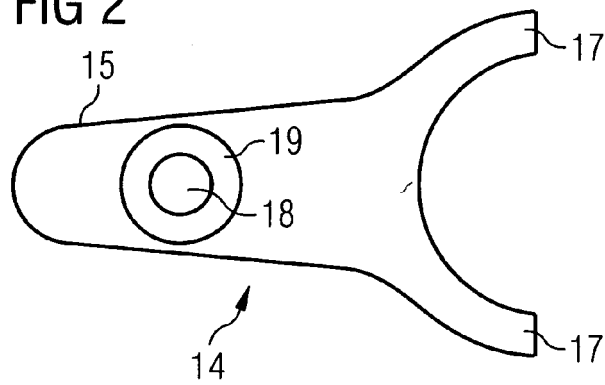
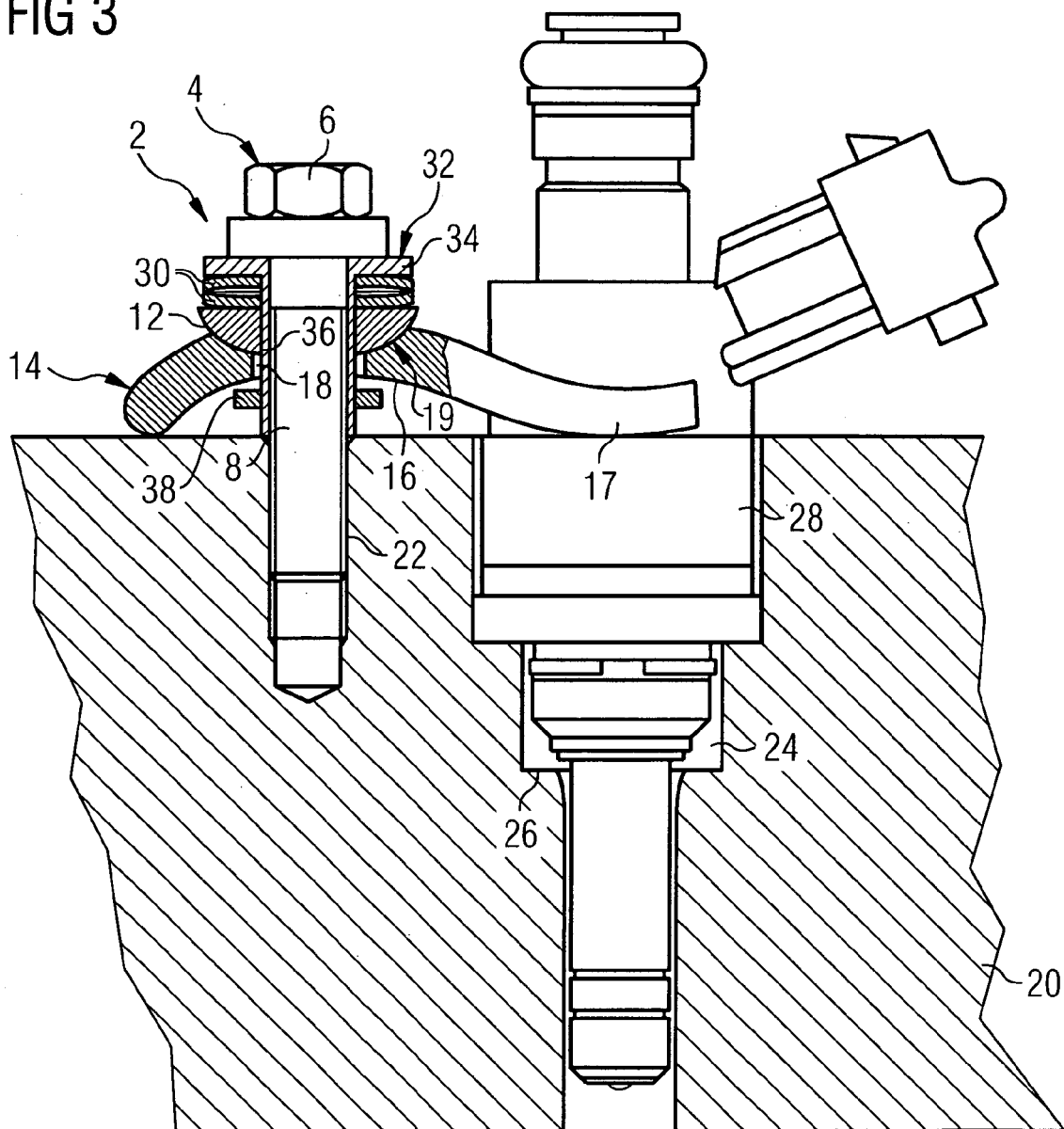


FIG 3





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