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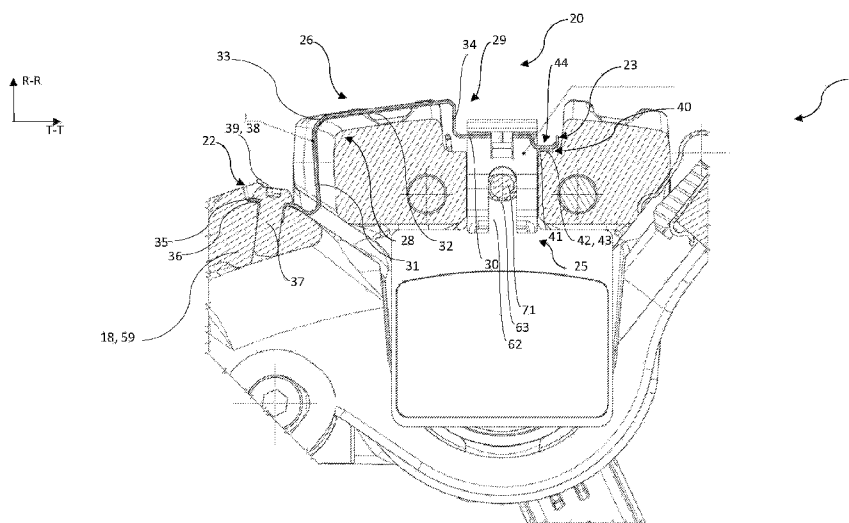


FIG. 3

(57) Abstract: The present invention relates to a repositioning spring configured to apply an elastic action, either directly or indirectly, to the floating element (7) with respect to the bracket (6), so as to bias the at least one reaction surface (17) away from the second braking surface (6), repositioning the floating element (7) towards the limit stop position when the reaction thrust ceases, wherein the repositioning spring (20) comprises a spring support element (21) and a spring pushing element (45) connected to each other, wherein the spring support element (20) comprises spring fixing portion (22) configured to rigidly constrain the repositioning spring (20) to a bracket portion (18), wherein the spring support element (20) comprises a spring sliding abutment portion (23) configured to radially abut against a floating element sliding surface (19) of the floating element (7) on a tangentially opposite side with respect to the bracket portion (18) while avoiding the repositioning spring (20) from being permanently coupled to the floating element (7) and so as to allow

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the floating element (7) to slide, at least axially, with respect to the repositioning spring (20), under the reaction action of the pushing device (14) and/or under said elastic action of the repositioning spring (20), radially abutting against the spring sliding abutment portion (23), the floating element sliding surface (19) mainly extending parallel to the axial direction (A-A), wherein the spring pushing element (45) comprises a first spring pushing portion (25) adapted to apply said elastic action, either directly or indirectly, to said reaction surface (17) to bias the reaction surface (17) of the floating element (7) away from the second braking surface (5) at least in the axial direction (A-A); wherein the spring pushing element (45) is connected to the spring fixing portion (22) and the sliding abutment portion (23), and is interposed between the spring fixing portion (22) and the spring sliding abutment portion (23), so as to be arranged at least partially inside a radial window or channel (11) delimited by the floating element (7) and extending at least along the radial direction (R-R) so as to expose the brake disc (3) at least partially radially.

"Repositioning spring, brake caliper and repositioning spring assembly"

DESCRIPTION

5 [0001]. Field of the invention

[0002]. The present invention relates to a repositioning spring for a brake caliper of the floating type for vehicles, e.g., for a parking brake caliper, as well as to a brake caliper and repositioning spring assembly.

[0003]. Background art

[0004]. In a disc brake, the brake caliper is generally arranged straddling the outer peripheral margin of a brake disc, adapted to rotate about a rotation axis defining an axial direction (X-X). In a disc brake, a radial direction (R-R), substantially orthogonal to said axial direction (X-X), and a tangential direction (T-T), orthogonal to both said axial direction (X-X) and said radial direction (R-R), are further defined.

[0005]. The disc brakes with floating caliper comprise a support bracket connectable to the suspension of the vehicle and a floating caliper body slidably mounted to the support bracket.

[0006]. The caliper body comprises a first wall arranged on a first side or first elongated element (actuation side) and a second wall arranged on a second side or second elongated element (reaction side) opposite to the first side.

[0007]. In addition, such disc brakes comprise at least a first

brake pad and at least a second brake pad supported by the support bracket and/or the floating caliper body on the first and second sides of the brake disc, respectively, for example by means of at least one suspension pin on which the brake pads are slidably supported, and at least one actuating piston supported by the floating caliper body housed at least partially in a respective seat made on the first side or actuation side only, the at least one actuating piston is connected to the at least one brake pad and is actuatable to bias the at least a first brake pad along a unidirectional pushing direction against the brake disc, directed towards the second side or reaction side.

[0008]. The actuation of the at least one actuating piston biases the at least a first brake pad against the brake disc, generating a reaction force which makes the floating caliper body slide, with respect to the support bracket, in the direction opposite to the unilateral pushing direction, so that the second wall or reaction wall of the caliper body pushes the at least a second brake pad against the brake disc, thus achieving a braking action on the brake disc with bilateral tightening of the brake disc. A floating brake caliper solution is known from document **EP2815146** to BREMBO S.p.A., which shows a floating parking brake caliper associated with a service brake caliper.

[0009]. Once the braking action is complete, the at least one piston usually retracts into its seat made in the actuation side of the floating caliper body, moving the at least a first brake pad

away from the brake disc, while the at least a second brake pad remains in contact against the disc, generating a residual drag torque even when no braking action is required. In other words, in the systems of the known type, the floating caliper body, once the actuation of the at least one piston is ended, usually does not return to its starting or limit stop position with respect to the brake disc, with the actuation side and the reaction side spaced apart in a predetermined manner from the brake disc while avoiding at least the second pad in contact with the reaction side from being spaced apart from the brake disc. The at least a second pad will detach from the disc only when the caliper body floats after a rotation of the brake disc, thus generating residual drag torque whenever the vehicle is restarted after the floating caliper is actuated.

[0010]. This residual drag torque is considered undesirable because it can generate noise due to the friction action between pads and disc braking surfaces, and it can generate uneven wear of the pads and brake disc, resulting in more frequent maintenance for their replacement, and increased fuel consumption of the vehicle for restarting following a braking action.

[0011]. In order to avoid and reduce the persistence of the drag action of the brake pad on the reaction side of the floating caliper, in disc brakes in which the at least a second brake pad is supported by the support bracket, for example as known from document US20130001024, leaf spring assemblies are provided, connected to

each of opposite sides of appropriate pockets made on the support portion of the floating caliper and connected at the ears provided on the sides of the pads. Such a solution is adapted to provide the pad with an elastic return action in the axial direction, but requires a complex assembly which first requires securing the opposite springs to the opposing sides of the pad housing pocket. Therefore, solutions of this type are disadvantageous in terms of assembly and impose laborious maintenance because they require, after the extraction of the pad, to disassemble the springs from the caliper body, which are usually fixed to portions of the caliper body which are not easily accessible.

[0012]. Differently, document **US4596313** shows a floating caliper, in which a helical spring is arranged on a support guide of the floating caliper body, which returns the floating caliper body to its predetermined initial position once the braking action has ceased. This solution, although simplified, increases the axial size of the brake caliper, because an axially elongated support guide is required to externally support the helical spring. In addition, in this solution, the helical spring is exposed to the external environment and could accumulate dust or other objects between the turns up to prevent the proper operation of the brake caliper itself, if not increase any residual torque problems over time.

[0013]. Therefore, the need is felt to provide solutions which allow a separation of the reaction side of a floating caliper at the end of the braking action, which are efficient, easily implementable

during assembly, and easily checkable or replaceable during maintenance without having to disassemble additional brake caliper components, also allowing use in very compact brake caliper solutions without increasing the overall size, in particular the axial size, of the brake caliper.

[0014]. Solution

[0015]. It is an object of the present invention to provide a repositioning spring, as well as a brake caliper and repositioning spring assembly which allow obviating at least some of the drawbacks highlighted in the prior art.

[0016]. These and other objects are achieved by a repositioning spring and a brake caliper and repositioning spring assembly according to the independent claims.

[0017]. Some advantageous embodiments are the subject of the dependent claims.

[0018]. By virtue of the suggested solutions, a repositioning spring which is easy to reposition is provided.

[0019]. By virtue of the suggested solutions, it is further possible to have easier maintenance of a repositioning spring and
5 brake caliper assembly of the floating type.

[0020]. In addition, by virtue of the suggested solutions, it is possible to reduce if not eliminate the residual torque between the reaction side of the floating brake caliper and the brake disc, without increasing the size of the brake caliper, and ensuring
10 better operating reliability.

[0021]. By virtue of the suggested solutions, it is possible to elastically reposition the floating element of the brake caliper in a limit stop position or floating caliper position by biasing the brake pad connected to the reaction side of the floating element
5 away from the brake disc until the braking command ceases.

[0022]. Drawings

[0023]. Further features and advantages of the repositioning spring as well as of the brake caliper and repositioning spring assembly will be apparent from the description provided below of preferred embodiments thereof, given by way of not limiting indication, with reference to the accompanying drawings, in which:

[0024]. - figure 1 shows a first axonometric view of a brake caliper and repositioning spring assembly according to the present invention;

[0025]. - figure 2 shows a second axonometric view of the brake caliper and repositioning spring assembly in figure 1, in which the brake caliper of the floating type is seen on a plane perpendicular to a preferred radial direction;

[0026]. - figure 3 shows a section view of the floating caliper in figure 2 taken along the section line A-A in figure 2, perpendicular to a preferred axial direction (A-A);

[0027]. - figure 4 shows an axonometric view of a repositioning spring according to an embodiment of the present invention;

[0028]. - figure 5 shows a view perpendicular to a preferred tangential direction (T-T) of the repositioning spring in figure 4;

[0029]. - figure 6 shows a view perpendicular to the preferred axial (A-A) of the repositioning spring in figure 4;

[0030]. - figure 7 shows a section view of the floating caliper in figure 2 taken along the line B-B in figure 2, perpendicular to a preferred tangential direction (T-T);

[0031]. - figure 8 diagrammatically shows a section view perpendicular to the preferred tangential direction (T-T) of the repositioning spring in contact with the first brake pad and the second brake pad in the unbraked condition, in which the floating element of the brake caliper is in the initial predetermined limit stop position;

[0032]. - figure 9 diagrammatically shows a view perpendicular to the preferred tangential direction (T-T) of the repositioning spring in contact with the first brake pad and the second brake pad in a braking condition with the pads in contact with the brake disc, in which disc and/or pads are in a non-worn condition;

[0033]. - figure 10 diagrammatically shows a view perpendicular to the preferred tangential direction (T-T) of the repositioning spring in contact with the first brake pad and the second brake pad in a braking condition with the pads in contact with the brake disc, in which disc and/or pads are in an advanced wear condition;

[0034]. - figures 11, 12, and 13 diagrammatically show in sequence, the movements of the brake pads and the floating element of the brake caliper with respect to the disc and the bracket remaining stationary during a braking action, in which the

repositioning spring is diagrammatically shown, where in figure 11 the floating element is in the limit stop configuration and the piston is in a resting configuration, where in figure 12 the piston is moved forward to abut the first brake pad against the first braking surface of the disc under the pushing action of the piston and in which the floating element is still in its limit stop configuration, where in figure 13 the floating element in reaction to the pushing action of the piston on the first brake pad against the disc is moved to the working configuration with the second brake pad abutting against the second braking surface of the disc;

[0035]. - figures 14, 15, and 16 diagrammatically show in sequence the movements of the brake pads and the floating element of the brake caliper with respect to the disc and bracket remaining stationary during a braking action, during the release of the braking action; where figure 14 shows the piston still in the maximum forward position, where figure 15 shows the piston retracted and, therewith, also the first brake pad connected thereto, and the floating element under the elastic action of the repositioning spring moves by moving away the reaction side of the disc, where figure 16 shows the piston fully retracted and the floating element repositioned in the limit stop configuration;

[0036]. - figure 17 diagrammatically shows a section view perpendicular to the preferred tangential direction (T-T) of the repositioning spring in contact with the second brake pad in a braking condition, in which the spring portions biased to twist in

the spring support element and the portions biased to bend in the spring pushing element can be seen;

[0037]. - figure 18 shows a view perpendicular to the preferred tangential direction (T-T) of the repositioning spring according to an embodiment,

[0038]. - figure 19 shows a view perpendicular to the preferred tangential direction (T-T) of the repositioning spring according to an embodiment,

[0039]. - figure 20 shows a view perpendicular to the preferred tangential direction (T-T) of the repositioning spring according to an embodiment,

[0040]. - figure 21 shows a view perpendicular to the preferred tangential direction (T-T) of the repositioning spring according to an embodiment.

[0041]. Description of some preferred embodiments

[0042]. According to a general embodiment, a repositioning spring for a brake caliper 2 of the floating type is indicated by reference numeral 20. In an embodiment, the repositioning spring 20 defines an axial direction A-A, a radial direction R-R perpendicular to the axial direction A-A, and a tangential direction T-T perpendicular to both the axial direction A-A and the radial direction R-R.

[0043]. The brake caliper 2 of the floating type is adapted to be arranged straddling a brake disc 3 having a first braking surface 4 and a second braking surface 5 opposite to the first braking surface 4 and adapted to rotate about a rotation axis X-X, which defines an

axial direction A-A, radial directions R-R orthogonal to said axial direction and passing through said rotation axis X-X as well as a tangential direction T-T orthogonal to the axial A-A and radial R-R directions. Similarly axial directions A-A.

[0044]. The brake caliper 2 comprises a bracket or support body 6 adapted to connect to a caliper support provided in a vehicle.

[0045]. The brake caliper 2 comprises a floating element or floating caliper body 7 slidably supported by said bracket 6 so as to move with respect to the bracket 6 along the axial direction A-A between a limit stop configuration and least one braking configuration.

[0046]. In the limit stop configuration, a reaction surface 17 of the floating element 7 is spaced apart from the second braking surface 5 avoiding a contact with the brake disc 3 of a second brake pad 16 supported by the brake caliper 2. The limit stop configuration usually is a resting configuration from which the floating element 7 can only slide in one way of the axial direction with respect to the bracket 6.

[0047]. In the at least one braking configuration, the reaction surface 17 is brought close to the second braking surface 5 by abutting the second brake pad 16 in contact with the second braking surface 5 by receiving a reaction thrust generated by a pushing device 14 housed in the floating element 7 and facing directly or indirectly the reaction surface 17, in reaction to a pushing action

of the pushing device 14 on a first brake pad 15 supported by the brake caliper 2 by abutting the first brake pad 15 against said first braking surface 4. As the friction material of the brake pads or the braking surfaces of the brake disc wear, switching from the limit stop configuration to the braking configuration or vice versa, the travel that can be traveled by the floating element increases.

[0048]. The repositioning spring 20 is configured to apply an elastic action, either directly or indirectly, to the floating element 7 with respect to the bracket 6, so as to bias the at least one reaction surface 17 away from the second braking surface 6, repositioning the floating element 7 towards the limit stop position when the reaction thrust ceases.

[0049]. Advantageously, the repositioning spring 20 comprises a spring support element 21 and a spring pushing element 45 connected to each other.

[0050]. The spring support element 20 comprises a spring fixing portion 22 configured to rigidly constrain the repositioning spring 20 to a bracket portion 18.

[0051]. The spring support element 20 comprises a spring sliding abutment portion 23 configured to abut radially against a floating element sliding surface 19 of the floating element 7 on a tangentially opposite side with respect to the bracket portion 18 while avoiding permanently coupling the repositioning spring 20 to the floating element 7 and so as to allow the floating element 7 to

slide at least axially with respect to the repositioning spring 20 radially abutting against the spring sliding abutment portion 23, under the reaction action of the pushing device 14 and/or under said elastic action of the repositioning spring 20. The floating element sliding surface 19 mainly extends parallel to the axial direction A-A. In an embodiment, the spring sliding abutment portion 23 avoids permanently coupling the repositioning spring 20 to the floating element 7 and so as to allow the floating element 7 to slide axially and tangentially with respect to the repositioning spring 20 radially abutting against the spring sliding abutment portion 23, under the reaction action of the pushing device 14 and/or under said elastic action of the repositioning spring 20. In an embodiment, the spring sliding abutment portion 23 avoids permanently coupling the repositioning spring 20 on the floating element 7, allowing the spring sliding abutment portion 23 to slide tangentially on the floating element sliding surface 19 while maintaining the radial abutment of the repositioning spring 20 on the floating element sliding surface 19.

[0052]. The spring pushing element 45 comprises a first spring pushing portion 25 adapted to apply said elastic action, either directly or indirectly, to said reaction surface 17 to bias the reaction surface 17 of the floating element 7 away from the second braking surface 5 at least in the axial direction A-A.

[0053]. In an embodiment, the spring pushing element 45 is

connected to the spring fixing portion 22 and the sliding abutment portion 23. In an embodiment, the spring pushing element 45 is interposed between the spring fixing portion 22 and the sliding abutment portion 23, so as to be arranged at least partially inside a radial window or channel 11 delimited by the floating element 7 and extending at least along the radial direction R-R so as to expose the brake disc 3 at least partially radially.

[0054]. In an embodiment, the spring pushing element 45 is configured to bend elastically in a plane comprising the axial direction A-A and the radial direction R-R so as to bias by elastic bending, at least along the axial direction A-A, the reaction surface 17 of the floating element 7 away from the second braking surface 5 and/or the brake pads 15, 16 away from the brake disc 3. For example, in figure 17, it is possible to see the zones biased to bending of the spring pushing element 45, in the bends of the spring arm which supports the first spring pushing portion 25 in contact with the second brake pad.

[0055]. In an embodiment, the spring support element 21 is configured to twist elastically about a torsion axis O-O substantially parallel to the tangential direction T-T and perpendicular to the plane comprising the axial direction A-A and the radial direction R-R so as to bias by elastic torsion, at least along the axial direction A-A, the reaction surface 17 of the floating element 7 away from the second braking surface 5 and/or the

brake pads 15, 16 away from the brake disc 3. For example, the torsionally biased zones of the spring support element 21 can be seen in figure 17 along its body, in particular in a first segment of the tangential spring arm directly connected to the spring fixing portion.

[0056]. In an embodiment, the spring support element 21 and spring pushing element 45 are made in separate pieces and assembled together. It is thus possible to simplify the assembly of the repositioning spring 20 as well as the mounting of the repositioning spring 20 to the brake caliper 2.

[0057]. In an embodiment, the spring support element 21 is shaped to project transversely to the axial direction A-A, radially overlapping at least partially, either directly or indirectly, a peripheral axial edge of the brake disc 3 on the outside of the brake disc 3.

[0058]. In an embodiment, the spring pushing element 45 is shaped to straddle the brake disc 3 at least to contact the second brake pad 16 and/or the reaction surface 17 of the floating element 7 biasing it away from the brake disc 3 at least in the axial direction A-A.

[0059]. In an embodiment, the spring pushing element 45 is connected to the spring support element 21 so as to arrange the spring pushing element 45 orthogonally to the spring support 21.

[0060]. In an embodiment, the spring support element 21 comprises

a tangential spring arm 26 which mainly extends in the tangential direction T-T along its longitudinal extension direction. The tangential spring arm 26 connects the spring fixing portion 22 to the spring sliding abutment portion 23.

[0061]. In an embodiment, the tangential spring arm 26 is shaped so as to avoid contacting the floating element 7 and to be arranged radially outside the brake disc 3 at least partially overlapping the brake disc 3 radially.

[0062]. In an embodiment, the spring pushing element 45 comprises a first spring arm 27 adapted to connect the first spring pushing portion 25 to said spring support element 21, so as to be placed orthogonally to said spring support element 21.

[0063]. In an embodiment, the spring pushing element 45 comprises a second spring pushing portion 49, axially opposite to the first spring pushing portion 25 and adapted to apply said elastic action to the first brake pad 15 by biasing it axially away from the first braking surface 4. The repositioning spring 20 thus keeps the two brake pads spaced apart and constantly biases them away from the respective braking surface of the brake disc. Even if the pushing device is not configured to retract when the braking action ceases, the elastic action of the repositioning spring thus moves away and/or facilitates the retraction of the first brake pad. Although the second spring pushing portion 49 is not shown in figures 11 to 16, the second spring pushing portion 49 and the second connecting

arm could be present with the second spring pushing portion 49 in contact with the plate of the first brake pad biasing it constantly away from the first braking surface of the brake disc.

[0064]. In an embodiment, the repositioning spring 20 is symmetrical with respect to a spring symmetry plane perpendicular to the axial direction (A-A) and/or comprising the tangential (T-T) and radial (R-R) directions, which divides the repositioning spring 20 in half. In an embodiment, the spring pushing element 45 is symmetrical with respect to a symmetry pushing plane which is perpendicular to the axial direction (A-A) and/or comprising the tangential (T-T) and radial (R-R) directions, which divides the spring pushing element 45 in half. In an embodiment, the first spring pushing portion 25 and the second spring pushing portion 49 are symmetrical with respect to the pushing symmetry plane and/or with respect to the spring symmetry plane. For example, the pushing symmetry plane and the spring symmetry plane coincide. In an embodiment, the spring support element 21 is symmetrical with respect to a support symmetry plane perpendicular to the axial direction (A-A) and/or comprising the tangential (T-T) and radial (R-R) directions, which divides the spring support element 21 in half. For example, the support symmetry plane and the spring symmetry plane coincide.

[0065]. In an embodiment, the spring pushing element 45 comprises a second spring arm 50 adapted to connect the second spring pushing

portion 49 to said spring support element 21, so as to be placed orthogonally to said spring support element 21.

[0066]. In an embodiment, the first spring arm comprises a bifurcated first arm portion 72 adapted to support a first contact portion 67 and a second contact portion 68 to straddle the suspension pin 71. The first contact portion 67 and the second contact portion 68 are adapted to directly contact the reaction brake pad plate. In an embodiment, the second spring arm 50 comprises a second bifurcated arm portion 73 adapted to support a third contact portion 69 and a fourth contact portion 70 to straddle the suspension pin 71.

[0067]. In an embodiment, each pushing portion 25, 50 comprises a pair of contact portions 67, 68, 69, 70 which are tangentially spaced apart so that each pair of contact portions is adapted to be arranged straddling a suspension pin 71, to which the brake pads are connected in a suspended manner. In an embodiment, each pair of contact portions 67, 68, 69, 70 is supported by a respective bifurcated arm portion 72, 73.

[0068]. In an embodiment, each spring contact portion 67, 68, 69, 70 comprises a relief forming an at least partially curved contact surface, e.g., made by sheet metal stamping. It is thus possible to promote a sliding of the contact portion on the plate of the respective pad as the pad and/or disc wear increases.

[0069]. In an embodiment, each spring arm 17, 50 is shaped

comprising a respective U-shaped spring arm portion 74, 75 connected to spring support element 21, having a first radially inner concavity facing the spring support element 21, and an S-shaped spring arm portion 76, 77, which extends from the U-shaped spring arm portion 74, 75 forming, in the first loop of the S-shaped portion, a second radially outer concavity and in the second loop of the S-shaped portion, comprises a third radially inner concavity.

[0070]. In an embodiment, in a view perpendicular to the tangential direction T-T, the first spring arm 17 is shaped comprising a first U-shaped spring arm portion connected to the spring support element 21 and having a radially inner concavity facing the spring support element 21, supporting the first spring pushing portion 25. In an embodiment, in a view perpendicular to the tangential direction T-T, the first spring arm 17 is shaped comprising a first S-shaped spring arm portion 76 connected to the spring support element 32 and supporting the first spring pushing portion 25.

[0071]. In an embodiment, the first spring pushing portion 25 and/or the second spring pushing portion 49 are supported in suspension by the spring fixing portion 22 and the spring sliding abutment portion 23. In an embodiment, the first spring arm 27 is adapted to connect the first spring pushing portion 25 to said tangential spring arm 27 so as to be placed orthogonally to said tangential spring arm 27. According to an embodiment, the second

spring arm 50 is adapted to connect the second spring pushing portion 49 to said tangential spring arm 27, so as to be placed orthogonally to said tangential spring arm 27.

[0072]. In an embodiment, the spring pushing element 45 and the spring support element 21 are interlockingly connected.

[0073]. In an embodiment, the spring support element 21 and spring pushing element 45 are made in separate pieces and assembled together, and slide with respect to each other within a maximum sliding clearance and/or assembled together with clearance, so as to compensate for the constructional positioning tolerances of the floating element 7 and the support bracket 6. Even when the elements of the spring are connected by interlocking, they can be mounted with clearance.

[0074]. In an embodiment, the spring support element 21 and the spring pushing element 45 are made in separate pieces and assembled together by interlocking, avoiding a permanent connection and allowing a relative sliding between the spring support element 21 and the spring pushing element 45. By virtue of the interlocking connection with the possibility of sliding between the spring support element 21 and the spring pushing element 45, it is possible to allow the recovery of assembly clearances and therefore adapt the repositioning spring 20 to self-adapt to the brake caliper by recovering any assembly clearance.

[0075]. In an embodiment, the spring pushing element 45 comprises

a coupling portion 51, and the spring support element 21 comprises a counter-coupling portion 52. According to an embodiment, the coupling portion 51 is shaped so as to couple to and/or interlock with the counter-coupling portion 52 forming a bilateral constraint of the spring pushing element 45 to the spring support element 21.

[0076]. In an embodiment, the counter-coupling portion 52 comprises a radially outer coupling surface 53 facing away from the brake disc 3, and an opposite radially inner coupling surface 54 facing the brake disc 3.

[0077]. In an embodiment, the coupling portion 51 comprises a coupling abutment portion 55 and a coupling reaction portion 56.

[0078]. The coupling abutment portion 55 and the coupling reaction portion 56 are connected so that the coupling abutment portion 55 is configured to abut against the radially inner coupling surface 54 and the coupling reaction portion 56 is configured to abut against the radially outer coupling surface 53 forming the bilateral constraint and elastically opposing a separation of the counter-coupling portion 52 and the coupling portion 51, e.g., in the radial direction R-R.

[0079]. In an embodiment, the counter-coupling portion 52 centrally delimits a coupling opening 58, passing through a thickness of the counter-coupling portion 52.

[0080]. In an embodiment, the coupling portion 51 comprises an insertion portion 57 configured to be inserted into said coupling

opening 58, opposing reciprocal movements between the counter-coupling portion 52 and the coupling portion 51 in the axial direction A-A and in the tangential direction T-T.

[0081]. In an embodiment, the spring pushing element 45 comprises a spring connecting portion 24. In an embodiment, the first spring arm 27 projects from the spring connecting portion 24. In an embodiment, the spring connecting portion 24 centrally connects the first spring arm 27 and the second spring arm 50 on sides axially opposite to the axial direction A-A. In an embodiment, the first spring arm 27 and the second spring arm 50 project from the spring connecting portion 24 on sides axially opposite to the axial direction A-A.

[0082]. In an embodiment, the spring connecting portion 24 comprises the coupling reaction portion 56, such as a radially inner surface thereof perpendicular to the radial direction R-R adapted to abut against the spring support element 21.

[0083]. In an embodiment, the spring connecting portion 24 comprises the insertion portion 57. In an embodiment, the insertion portion 57 is an insertion protuberance. In an embodiment, the insertion portion 57 comprises at least one insertion tab, bent into a hooked shape to interfere with the edges of the coupling opening 58.

[0084]. In an embodiment, the spring connecting portion 24 comprises the coupling abutment portion 55. The coupling abutment

portion 55 comprises at least one U-shaped tab configured to couple a radially inner edge of the spring support element 21, or at least one hook-shaped tab to contact the radially inner surface of the spring support element 21.

[0085]. In an embodiment, the first spring arm 27 and/or the second spring arm 50 comprise the coupling abutment portion 55. In an embodiment, the coupling abutment portion 55 comprises at least one coupling tab made on the first spring arm and/or the second spring arm. In an embodiment, the coupling tab is U-shaped forming a radially inner concavity and contacting the radially inner surface of the spring support element 21 with a free end of the tab. In an embodiment, the coupling tab is S-shaped forming a radially outer concavity and contacting a radially inner tangential edge of the spring support element 21 with the back of the portion having a radially outer concavity.

[0086]. In an embodiment, the spring support element 21 comprises a support connecting portion 24 to which the spring fixing portion 22 and the spring sliding abutment portion 23 are connected on tangentially opposite sides with respect to the tangential direction T-T.

[0087]. In an embodiment, the support connecting portion 24 comprises the counter-coupling portion 52. In an embodiment, the support connecting portion 24 is a sheet metal portion arranged substantially perpendicular to the radial direction R-R. In an

embodiment, the support connecting portion 24 has two radially inner tangential edges axially opposed to each other to which the spring pushing element 45 can be coupled.

[0088]. In an embodiment, since the spring support element 21 and spring pushing element 45 are substantially orthogonal to each other, in the description of the shaping of the spring support element 21 reference is made to a view perpendicular to the axial direction A-A, and in the description of the shaping of the pushing element 45 reference is made to a view perpendicular to the tangential direction T-T.

[0089]. In an embodiment, the tangential spring arm 26 comprises a first L-shaped portion 28 connected to the spring fixing portion 22. In an embodiment, the tangential spring arm 26 comprises a second L-shaped portion 29 radially facing away from the first L-shaped portion 28. In an embodiment, the second L-shaped portion 29 is connected, on one side, to the first L-shaped portion 28 and, on the other side, to the sliding abutment portion 23. In an embodiment, the first L-shaped portion 28 has a first concavity facing the brake disc 3, and said second L-shaped portion 29 has a second concavity facing the brake disc 3 in the opposite direction. In an embodiment, the tangential spring arm 26, preferably at the second L-shaped portion 29, comprises a support connecting portion 30 to which the first spring pushing portion 25 is connected.

[0090]. In an embodiment, the tangential spring arm 26 comprises a

first segment 31 directly connected to the spring fixing portion 22, and a second segment 32 directly connected to the first segment 31, preferably where the first segment 31 is wider in the axial direction A-A than the second segment 32, preferably where the first segment 31 and the second segment 32 are connected forming a first L-shaped portion 28.

[0091]. In an embodiment, the tangential spring arm 26 comprises a central reinforcing portion 33 which forms a first raised surface and a second depressed surface opposite to each other. The first surface facing a radially outer side, i.e., the side opposite to the disc 3 and/or the floating element 7. The second surface facing a radially inner side, i.e., towards the disc 3 and/or the floating element 7. In an embodiment, the central reinforcing portion 33 is made along the first L-shaped portion 28 and/or at least partially along the first segment 31 and along the second segment 32. In an embodiment, the central reinforcing portion 33 has a central portion width in the axial direction A-A which is smaller than the width in the axial direction A-A of the tangential spring arm 26. In an embodiment, the central portion width in the axial direction A-A is substantially constant along the longitudinal extension of the central reinforcing portion 33. In an embodiment, the central reinforcing portion 33 is obtained by stamping on sheet metal.

[0092]. In an embodiment, the tangential spring arm 26 comprises a third segment 34 and a support connecting portion 30 connected to

each other. In an embodiment, the support connecting portion 30 is directly connected to the spring sliding abutment portion 23. In an embodiment, the third segment 34 and the support connecting portion 30 are connected thus forming a second L-shaped portion 29. In an embodiment, the third segment 34 is connected to the second segment 32, where the support connecting portion 30 is wider than the third segment 34 in the axial direction A-A.

[0093]. In an embodiment, the spring fixing portion 22 comprises a central tab 35, where said central fixing tab 35 delimits a through-hole 36 adapted to accommodate fixing means 37 to fix the spring 20 to the bracket portion 18.

[0094]. In an embodiment, the spring fixing portion 22 comprises a first contrast tab 38 and a second contrast tab 39 diametrically opposite with respect to a central fixing tab 35 along the axial direction A-A. In an embodiment, the first contrast tab 38 and the second contrast tab 39 are configured to abut against respective backing surfaces of said bracket portion 18 by elastically tightening the spring 20 and/or the spring fixing portion 21 against the bracket portion 18 when the central fixing tab 35 is fixed to the bracket portion 18.

[0095]. In an embodiment, the first contrast tab 38 and the second contrast tab 39 are configured to oppose rotations of the spring 20 at the spring fixing portion 22.

[0096]. In an embodiment, the first contrast tab 38 and the second

contrast tab 39 are bent with respect to the central fixing tab 35 forming a bend angle in a plane perpendicular to the axial direction A-A. In an embodiment, the bending angle is between 10 and 45 degrees.

[0097]. In an embodiment, the spring sliding abutment portion 23 comprises at least one raised contact portion 40 configured to abut against the floating element sliding surface 19. In an embodiment, the raised contact portion 40 is shaped so as to limit the surface of the spring sliding abutment portion 23 which contacts the floating element sliding surface 19 so as to limit the static and dynamic friction forces between the spring sliding abutment portion 23 and the floating element 7 when the floating element slides along the axial direction A-A. In an embodiment, the spring sliding abutment portion 23 comprises a base portion 41 with respect to which the at least one raised contact portion 40 is raised at least in the radial direction R-R.

[0098]. In an embodiment, the at least one raised contact portion 40 comprises at least one boss 42, 43. In an embodiment, the at least one raised contact portion 40 comprises a first boss 42 and a second boss 43 arranged to be spaced apart from each other in the axial direction A-A so as to form two contact snagging portions which oppose torsional rotations of the spring 20. According to an embodiment, each boss 42, 43 has a curved contact surface, preferably in the shape of a spherical cap, for example obtained by

sheet metal stamping.

[0099]. In an embodiment, the spring sliding abutment portion 23 comprises a U-shaped portion 44, connected on one side to the spring pushing portion 25 and/or the spring fixing portion 22, e.g., by means of the tangential spring arm 26, and forming a free end of the spring 20 on the opposite side. In an embodiment, the U-shaped portion 44 is bent forming a radially outer concavity opposite to the brake disc 3 and/or the floating element 7. In an embodiment, the U-shaped portion 44 comprises said base portion 41, where the raised contact portion 40 is raised on the radially opposite side with respect to the concavity of the U-shaped portion 44.

[00100]. In an embodiment, the spring support element 21 comprises a first strip body 46. In an embodiment, said spring body 46 is strip-shaped and obtained from a blanked and shaped sheet of spring steel. According to an embodiment, the first strip spring 46 comprises a first spring thickness 48. In an embodiment, the axial direction A-A is perpendicular to the surface of the spring thickness, and/or to a section of the first strip body 46 or spring support element 21.

[00101]. In an embodiment, the spring pushing element 45 comprises a second strip body 47. In an embodiment, said second strip body 47 is strip-shaped and obtained from a blanked and shaped sheet of spring steel. In an embodiment, before being shaped the second strip body has a rectangular shape having two bifurcated portions at the

opposite ends of the rectangle.

[00102]. The present invention further relates to a caliper assembly and a positioning device 1.

[00103]. The assembly 1 comprises a brake caliper 2 of the floating type, the brake caliper 2 being adapted to straddle a brake disc 3 having a first braking surface 4 and a second braking surface 5 opposite to the first braking surface 4. The brake caliper 2 comprises a bracket or support body 6 adapted to connect to a caliper support provided in a vehicle, and a floating element or floating caliper body 7 slidably supported by said bracket 6 so as to move with respect to the bracket 6 along the axial direction A-A. The floating element 7 comprises a first floating element portion 8 adapted to face, either directly or indirectly, the first braking surface 4, said first floating element portion 8 comprising at least one pushing device or piston seat 13 adapted to accommodate a pushing device or piston 14 connectable to a first brake pad 15 facing the first braking surface 4. The floating element 7 comprises at least a first floating element bridge 9, 10 supported by said first floating element portion 8 and projecting to straddle said brake disc 3. The floating element 7 comprises a second floating element portion 12 supported to be cantilevered to said at least one floating element bridge 9, 10, the second floating element portion 12 being adapted to face the second braking surface 5 either directly or indirectly, said second floating element portion 12

comprising at least one reaction surface 17 configured to contact, either directly or indirectly, a second brake pad 16 facing the second braking surface 5. Said at least one floating element bridge 9 and said second floating element portion 12 at least partially delimit a window or channel 11 extending at least along the radial direction R-R and configured to expose at least partially the brake disc 3 radially. The pushing device 14 is configured to apply, at least in the axial direction A-A, a pushing action to the first brake pad 15 in one action direction by moving the first brake pad 15 towards the first braking surface 4 by abutting the first brake pad 15 against said first braking surface 4. The floating element 7 is configured to receive, from the pushing device 14 in reaction to the action thrust on the first braking surface 4, a reaction thrust along a reaction direction opposite to the action direction by moving the reaction surface 17 towards the second braking surface 5 by abutting the second brake pad 16 against the second braking surface 5 by tightening the brake disc 2 between the first brake pad 15 and the second brake pad 16 to apply a braking action to the brake disc 3. The floating element 7 is movable under the reaction thrust between a limit stop configuration, in which the reaction surface 17 is spaced apart from the second braking surface 5 avoiding a contact of the second brake pad 16 with the brake disc 2, and at least one braking configuration, in which the reaction surface 17 is brought close to the second braking surface 5 by

abutting the second brake pad 16 in contact with the second braking surface 5.

[00104]. The assembly 1 comprises a repositioning spring 20 according to one or more of the previously described embodiments connected to the brake caliper 2.

[00105]. In an embodiment, the floating element 7 comprises a first floating element bridge 9 and a second floating element bridge 10 supported by said first floating element portion 8 and projecting to straddle said brake disc 3. In an embodiment, the first floating element bridge 9 and the second floating element bridge 10 are spaced apart along the tangential direction T-T. In an embodiment, the second floating element portion 12 is supported to be cantilevered to said first floating element bridge 9 and to said second floating element bridge 10. In an embodiment, the first floating element bridge 9, the second floating element bridge 10 and the second floating element portion 12 delimit at least partially the window or channel 11. In an embodiment, the second floating element bridge 10 comprises the floating element sliding surface 19 extending at least parallel to the axial direction A-A and preferably facing away from the brake disc 3 in the radial direction R-R.

[00106]. In an embodiment, the bracket 6 comprises at least one bracket bridge 59 projecting to straddle said brake disc 3 at least until it radially overlaps the brake disc 3, and the at least one

bracket bridge 59 comprises the bracket portion 18 to which the repositioning spring 20 is rigidly constrained, e.g., in a position overlapping the brake disc 3.

[00107]. In an embodiment, the spring support element 21 is shaped to be arranged aligned with the brake disc radially outside the brake disc and the first floating element bridge 9 until it abuts against the floating element sliding surface 19.

[00108]. In an embodiment, said bracket portion 18 comprises a connection seat comprising a threaded hole obtained in a first connection surface configured to house the central tab 35 to overlap the through-hole 36 onto the threaded hole. In an embodiment, the connection seat further comprises side walls transverse to the first surface arranged and opposite in the axial direction A-A so as to guide the central tab 35 on the first connection surface.

[00109]. In an embodiment, the brake caliper 2 comprises the first brake pad 15 and the second brake pad 16, each brake pad 15, 16 comprising a respective support plate 60 and a respective friction material 60 constrained to the respective plate. In an embodiment, each plate comprises a substantially rectangular portion and a radially projecting portion 62 which projects from the substantially rectangular portion. In an embodiment, each radially projecting portion delimits a respective plate slot 63, passing through the thickness of the respective plate and preferably having a closed contour, adapted to receive a suspension pin with clearance. In an

embodiment, the brake caliper 2 comprises a suspension pin 71 supported, on axially opposite sides, by the first floating element portion 8 and the second floating element portion 9, and on which the brake pads 15, 16 are supported on opposite sides.

[00110]. In an embodiment, the first spring pushing portion 25 is constantly in contact with the plate of the second brake pad 16 on a plate surface facing the second braking surface 5 of the brake disc 3 by directly biasing the second brake pad 16 away from brake disc 3 and indirectly biasing the floating element reaction surface 17 away from the second braking surface 5.

[00111]. In an embodiment, the first spring pushing portion 25 is free to slide radially on the plate according to the wear condition of the friction material of the brake pads between the limit stop configuration and the at least one working configuration of the floating element, or vice versa.

[00112]. According to an embodiment, the second spring pushing portion 49 is constantly in contact with the plate of the first brake pad 15 on a plate surface facing the first braking surface 4 of the brake disc 3 biasing the second brake pad away from the brake disc 3. According to an embodiment, the second spring pushing portion 49 is free to slide radially on the plate depending on the wear condition of the friction material of the brake pads between the limit stop configuration and the at least one working configuration of the floating element, or vice versa.

[00113]. In an embodiment, the brake caliper 2 comprises an abutment spring 64 connected to the floating element 7 and configured to elastically bias constantly the second brake pad 16 against the floating element reaction surface 17 so that the second brake pad 16 is always in integral contact with the floating element reaction surface 17.

[00114]. In an embodiment, the second pad abutment spring 64 is a wire spring adapted to be arranged with a first portion thereof abutting against a surface of the first floating element portion 8 and with a second portion thereof coupled to the plate of the second brake pad 16, for example on the back thereof, and abutting against the floating element reaction surface 17.

[00115]. In an embodiment, the brake caliper 2 comprises the pushing device or piston 14. In an embodiment, the pushing device 10 is connected to the first brake pad 15. In an embodiment, the pushing device 14 is electrically actuatable forward and backward. In an embodiment, the pushing device 14 is hydraulically actuatable.

[00116]. In an embodiment, the brake caliper 2 comprises a first floating element sliding guide 65 and a second floating element sliding guide 77 connected to the floating element 7 and the bracket 6 to allow the floating element 7 to be slidingly supported by the bracket 6.

[00117]. In an embodiment, said brake caliper 2 is a parking caliper integrated into a service caliper, where the bracket 6 is a

portion of a caliper body of the service caliper.

LIST OF REFERENCE SIGNS

	1	Brake caliper and repositioning spring assembly
	2	floating brake caliper or floating parking brake caliper
	3	brake disc
5	4	first braking surface of brake disc
	5	second braking surface of brake disc
	6	bracket or support body
	7	floating element or floating caliper body
	8	first floating element portion or actuating portion
10	9	first floating element bridge
	10	second floating element bridge
	11	radial window or channel
	12	second floating element portion or reaction portion
	13	pushing device or piston seat
15	14	pushing device or piston
	15	first brake pad
	16	second brake pad
	17	reaction surface
	18	bracket portion
20	19	floating element sliding surface
	20	repositioning spring
	21	spring support element
	22	spring fixing portion
	23	spring sliding abutment portion
25	24	spring connecting portion
	25	spring pushing portion
	26	tangential spring arm
	27	first spring arm
	28	first L-shaped portion
30	29	second L-shaped portion
	30	support connecting portion
	31	first segment
	32	second segment
	33	central reinforcing portion
35	34	third segment
	35	central tab
	36	through-hole
	37	fixing means
	38	first contrast tab
40	39	second contrast tab
	40	raised contact portion

	41	portion base
	42	first boss
	43	second boss
	44	U-shaped portion
5	45	spring pushing element
	46	first strip body
	47	second strip body
	48	first spring thickness
	49	second spring pushing portion
10	50	second spring arm
	51	coupling portion
	52	counter-coupling portion
	53	radially outer coupling surface
	54	radially inner coupling surface
15	55	coupling abutment portion
	56	coupling reaction portion
	57	insertion portion
	58	coupling opening
	59	bracket bridge
20	60	support plate
	61	friction material
	62	radially projecting plate portion
	63	plate slot
	64	second pad abutment spring
25	65	first floating element sliding guide
	66	second floating element sliding guide
	67	first contact portion
	68	second contact portion
	69	third contact portion
30	70	fourth contact portion
	71	suspension pin
	72	first bifurcated arm portion
	73	second bifurcated arm portion
	74	U-shaped portion of first arm
35	75	U-shaped portion of second arm
	76	S-shaped portion of first arm
	77	S-shaped portion of second arm
	X-X	rotation axis
40	A-A	axial direction
	R-R	radial direction
	T-T	tangential direction
	O-O	torsion axis

CLAIMS

1. A repositioning spring (20) for a brake caliper (2) of the floating type,

the brake caliper (2) being adapted to straddle a brake disc (3)

5 having a first braking surface (4) and a second braking surface (5)

opposite to the first braking surface (4) and adapted to rotate

about a rotation axis (X-X) defining an axial direction (A-A), at

least one radial direction (R-R) orthogonal to said axial direction

and passing through said rotation axis (X-X) as well as a tangential

10 direction (T-T) orthogonal to the axial (A-A) and radial (R-R)

directions, the brake caliper (2) comprising a bracket or support

body (6) adapted to connect to a caliper support provided in a

vehicle, a floating element or floating caliper body (7) slidably

supported at said bracket (6) so as to move with respect to the

15 bracket (6) along the axial direction (A-A) between:

- a limit stop configuration, in which a reaction surface (17) of the floating element (7) is spaced apart from the second braking surface (5) avoiding a contact with the brake disc (3) of a second brake pad (16) supported by the brake caliper (2),

20 - and at least one braking configuration, in which the reaction surface (17) is brought close to the second braking surface (5) by abutting the second brake pad (16) in contact with the second braking surface (5) receiving a reaction thrust generated by a pushing device (14) housed in the floating element (7) and directly
25 or indirectly facing the reaction surface (17), in reaction to an

action thrust of the pushing device (14) on a first brake pad (15) supported by the brake caliper (2) by abutting the first brake pad (15) against said first braking surface (4),
said repositioning spring (20) being configured to apply an elastic
5 action, either directly or indirectly, to the floating element (7) with respect to the bracket (6), so as to bias the at least one reaction surface (17) away from the second braking surface (6), repositioning the floating element (7) towards the limit stop position when the reaction thrust ceases,

10 **characterized in that**

the repositioning spring (20) comprises a spring support element (21) and a spring pushing element (45) connected to each other, wherein the spring support element (20) comprises:

- a spring fixing portion (22) configured to rigidly constrain the
15 repositioning spring (20) to a bracket portion (18),

- a spring sliding abutment portion (23) configured to radially abut against a floating element sliding surface (19) of the floating element (7) on a tangentially opposite side with respect to the bracket portion (18) while avoiding the repositioning spring (20)

20 from being permanently coupled to the floating element (7) and so as to allow the floating element (7) to slide, at least axially, with respect to the repositioning spring (20), under the reaction action of the pushing device (14) and/or under said elastic action of the repositioning spring (20), radially abutting against the spring
25 sliding abutment portion (23), the floating element sliding surface

(19) mainly extending parallel to the axial direction (A-A),
and wherein the spring pushing element (45) comprises:

- a first spring pushing portion (25) adapted to apply said elastic action, either directly or indirectly, to said reaction surface (17) to bias the reaction surface (17) of the floating element (7) away from the second braking surface (5) at least in the axial direction (A-A);

wherein the spring pushing element (45) is connected to the spring fixing portion (22) and the sliding abutment portion (23), and is interposed between the spring fixing portion (22) and the spring sliding abutment portion (23), so as to be arranged at least partially inside a radial window or channel (11) delimited by the floating element (7) and extending at least along the radial direction (R-R) so as to expose the brake disc (3) at least partially radially.

2. A repositioning spring (20) according to the preceding claim, wherein the spring pushing element (45) is configured to bend elastically in a plane comprising the axial direction (A-A) and the radial direction (R-R) so as to bias the reaction surface (17) of the floating element (7) away from the second braking surface (5) and/or the brake pads (15, 16) away from the brake disc (3) by elastic bending, at least along the axial direction (A-A);

and/or wherein the spring support element (21) is configured to twist elastically about a torsion axis (O-O) substantially parallel

to the tangential direction (T-T) and perpendicular to the plane comprising the axial direction (A-A) and the radial direction (R-R) so as to bias the reaction surface (17) of the floating element (7) away from the second braking surface (5) and/or the brake pads (15, 5 16) away from the brake disc (3) by elastic torsion, at least along the axial direction (A-A).

3. A repositioning spring (20) according to any one of the preceding claims,

10 wherein the spring support element (21) and spring pushing element (45) are made in separate pieces and assembled together,

wherein the spring support element (21) is shaped to project transversely to the axial direction (A-A), radially overlapping at least partially, either directly or indirectly, a peripheral axial 15 edge of the brake disc (3) on the outside of the brake disc (3),

wherein the spring pushing element (45) is shaped to straddle the brake disc (3) at least to contact the second brake pad (16) and/or the reaction surface (17) of the floating element (7) biasing it away from the brake disc (3) at least in the axial direction (A-A),

20 wherein the spring pushing element (45) is connected to the spring support element (21) so as to arrange the spring pushing element (45) orthogonally to the spring support (21).

4. A repositioning spring (20) according to the preceding claim,

wherein the spring pushing element (45) and the spring support element (21) are interlockingly connected,

wherein the spring pushing element (45) comprises a coupling portion (51),

5 wherein the spring support element (21) comprises a counter-coupling portion (52),

wherein the coupling portion (51) is shaped so as to couple to and/or interlock with the counter-coupling portion (52) forming a bilateral constraint of the spring pushing element (45) to the
10 spring support element (21).

5. A repositioning spring (20) according to the preceding claim,

wherein the counter-coupling portion (52) comprises a radially outer coupling surface (53) facing away from the brake disc (3), and an
15 opposite radially inner coupling surface (54) facing the brake disc (3),

wherein the coupling portion (51) comprises a coupling abutment portion (55) and a coupling reaction portion (56),

wherein the coupling abutment portion (55) and the coupling reaction
20 portion (56) are connected so that the coupling abutment portion (55) is configured to abut against the radially inner coupling surface (54) and the coupling reaction portion (56) is configured to abut against the radially outer coupling surface (53) forming the bilateral constraint and elastically opposing a separation of the

counter-coupling portion (52) and the coupling portion (51),
and/or wherein the counter-coupling portion (52) centrally delimits
a coupling opening (58), passing through a thickness of the counter-
coupling portion (52),

5 wherein the coupling portion (51) comprises an insertion portion
(57) configured to be inserted into said coupling opening (58),
opposing reciprocal movements between the counter-coupling portion
(52) and the coupling portion (51) in the axial direction (A-A) and
tangential direction (T-T).

10

6. A repositioning spring (20) according to any one of the preceding
claims,

wherein the spring support element (21) comprises:

- a tangential spring arm (26) mainly extending in the tangential
15 direction (T-T) and adapted to connect the spring fixing portion
(22) to the spring sliding abutment portion (23),

said tangential spring arm (26) being shaped so as to avoid
contacting the floating element (7) and to be arranged radially
outside the brake disc (3) at least partially overlapping the brake
20 disc (3) radially,

and/or wherein

said spring pushing element (45) comprises

- a first spring arm (27) adapted to connect the first spring
pushing portion (25) to said spring support element (21), so as to

be placed orthogonally to said spring support element (21),
and/or wherein

said spring pushing element (45) comprises:

- a second spring arm (50) adapted to connect a second spring
5 pushing portion (49), axially opposite to the first spring pushing
portion (25) and adapted to apply said elastic action to the first
brake pad (15) by biasing it axially away from the first braking
surface (4), to said spring support element (21), so as to be placed
orthogonally to said spring support element (21).

10

7. A repositioning spring (20) according to any one of the preceding
claims,

wherein said spring fixing portion (22) comprises a central tab
(35), wherein said central fixing tab (35) delimits a through-hole
15 (36) adapted to accommodate fixing means (37) to fix the spring (20)
to the bracket portion (18),

and/or wherein said spring fixing portion (22) comprises a first
contrast tab (38) and a second contrast tab (39) diametrically
opposite to a central fixing tab (35) along the axial direction (A-
20 A);

wherein preferably the first contrast tab (38) and the second
contrast tab (39) are configured to abut against respective backing
surfaces of said bracket portion (18) by elastically tightening the
spring (20) and/or the spring fixing portion (21) against the

bracket portion (18) when the central fixing tab (35) is fixed to the bracket portion (18).

8. A repositioning spring (20) according to any one of the preceding
5 claims,

wherein the spring sliding abutment portion (23) comprises at least one raised contact portion (40) configured to abut against the floating element sliding surface (19),

wherein the raised contact portion (40) is shaped so as to limit the
10 surface of the spring sliding abutment portion (23) which contacts the floating element sliding surface (19) so as to limit the static and dynamic friction forces between the spring sliding abutment portion (23) and the floating element (7) when the floating element slides along the axial direction (A-A),

15 and/or wherein the spring sliding abutment portion (23) comprises at least one boss (42, 43), preferably a first boss (42) and a second boss (43) arranged to be spaced apart from each other in the axial direction (A-A) so as to form two contact portions adapted to oppose torsional rotations of the spring (20).

20

9. A repositioning spring (20) according to any one of the preceding claims,

wherein the spring support element (21) comprises a first strip body (46), wherein the first strip body (46) is strip-shaped and is

obtained from a cut and shaped spring steel sheet,
and/or wherein the spring pushing element (45) comprises a second
strip body (47), wherein the second strip body (47) is strip-shaped
and is obtained from a cut and shaped spring steel sheet.

5

10. A brake caliper and repositioning device assembly (1)
comprising:

-a brake caliper (2) of the floating type for a disc brake (100),
the brake caliper (2) being adapted to straddle a brake disc (3)
10 having a first braking surface (4) and a second braking surface (5)
opposite to the first braking surface (4) and adapted to rotate
about a rotation axis (X-X) defining an axial direction (A-A),
radial directions (R-R) orthogonal to said axial direction and
passing through said rotation axis (X-X), as well as punctually a
15 tangential direction (T-T) orthogonal to the axial (A-A) and radial
(R-R) directions passing through a point,
the brake caliper (2) comprising:

- a bracket or support body (6) adapted to connect to a caliper
support provided in a vehicle,
20 - a floating element or floating caliper body (7) slidably
supported at said bracket (6) so as to move with respect to the
bracket (6) along the axial direction (A-A),
the floating element (7) comprising:
- a first floating element portion (8) adapted to face, either

directly or indirectly, the first braking surface (4), said first floating element portion (8) comprising at least one pushing device or piston seat (13) adapted to accommodate a pushing device or piston (14) connectable to a first brake pad (15) facing the first
5 braking surface (4),

- at least one floating element bridge (9, 10) supported at said first floating element portion (8) and projecting to straddle said brake disc (3),

- a second floating element portion (12) supported to be
10 cantilevered to said at least one floating element bridge (9, 10), the second floating element portion (12) being adapted to face the second braking surface (5) either directly or indirectly, said second floating element portion (12) comprising at least one reaction surface (17) configured to contact, either directly or
15 indirectly, a second brake pad (16) facing the second braking surface (5),

wherein said at least one floating element bridge (9) and said second floating element portion (12) at least partially delimit a window or channel (11) extending at least along the radial direction
20 (R-R) and configured to expose the brake disc (3) at least partially radially,

wherein the pushing device (14) is configured to apply, at least in the axial direction (A-A), an action thrust to the first brake pad (15) in one action direction by moving the first brake pad (15)

towards the first braking surface (4) by abutting the first brake pad (15) against said first braking surface (4),
wherein the floating element (7) is configured to receive, from the pushing device (14) in reaction to the action thrust on the first
5 braking surface (4), a reaction thrust along a reaction direction opposite to the action direction by moving the reaction surface (17) towards the second braking surface (5) by abutting the second brake pad (16) against the second braking surface (5) by tightening the brake disc (2) between the first brake pad (15) and the second brake
10 pad (16) to apply a braking action to the brake disc (3),
wherein the floating element (7) is movable under the reaction thrust between a limit stop configuration, in which the reaction surface (17) is spaced apart from the second braking surface (5) avoiding a contact of the second brake pad (16) with the brake disc
15 (2), and at least one braking configuration, in which the reaction surface (17) is brought close to the second braking surface (5) by abutting the second brake pad (16) in contact with the second braking surface (5),
said assembly (1) comprising a repositioning spring (20) configured
20 to apply an elastic action, either directly or indirectly, to the floating element (7) with respect to the bracket (6), so as to bias the at least one reaction surface (17) away from the second braking surface (6), repositioning the floating element (7) towards the limit stop position when the reaction thrust ceases,

characterized in that

the repositioning spring (20) comprises a spring support element (21) and a spring pushing element (45) connected to each other, wherein the spring support element (20) comprises:

- 5 - a spring fixing portion (22) configured to rigidly constrain the repositioning spring (20) to a bracket portion (18), the fixing portion (22) being directly or indirectly constrained to the bracket portion (18) through fixing means (37),
- a spring-sliding abutment portion (23) configured to abut radially
10 against a floating element sliding surface (19) of the at least one floating element bridge (9, 10) on a tangentially opposite side with respect to the bracket portion (18) while avoiding the repositioning spring (20) from being permanently coupled to the floating element (7) and so as to allow the floating element (7) to slide at least
15 axially with respect to the repositioning spring (20), under the reaction action of the pushing device (14) and/or under said elastic action of the repositioning spring (20), radially abutting against the spring sliding abutment portion (23), the floating element sliding surface (19) extending at least parallel to the axial
20 direction (A-A) and preferably facing in the radial direction (R-R) on the opposite side with respect to the brake disc (3), the floating element sliding surface (19) axially sliding along the axial direction (A-A) at least radially abutting along the radial direction (R-R) against the spring sliding abutment portion (23),
25 and wherein the spring pushing element (45) comprises:

- a first spring pushing portion (25) adapted to apply said elastic action, either directly or indirectly, to said reaction surface (17) to bias the reaction surface (17) of the floating element (7) away from the second braking surface (5) at least in the axial direction (A-A);

wherein the first spring pushing portion (25) is supported by the spring support element (21) between the spring fixing portion (22) and the spring sliding abutment portion (23) so as to be arranged at least partially within the radial window or channel (11).

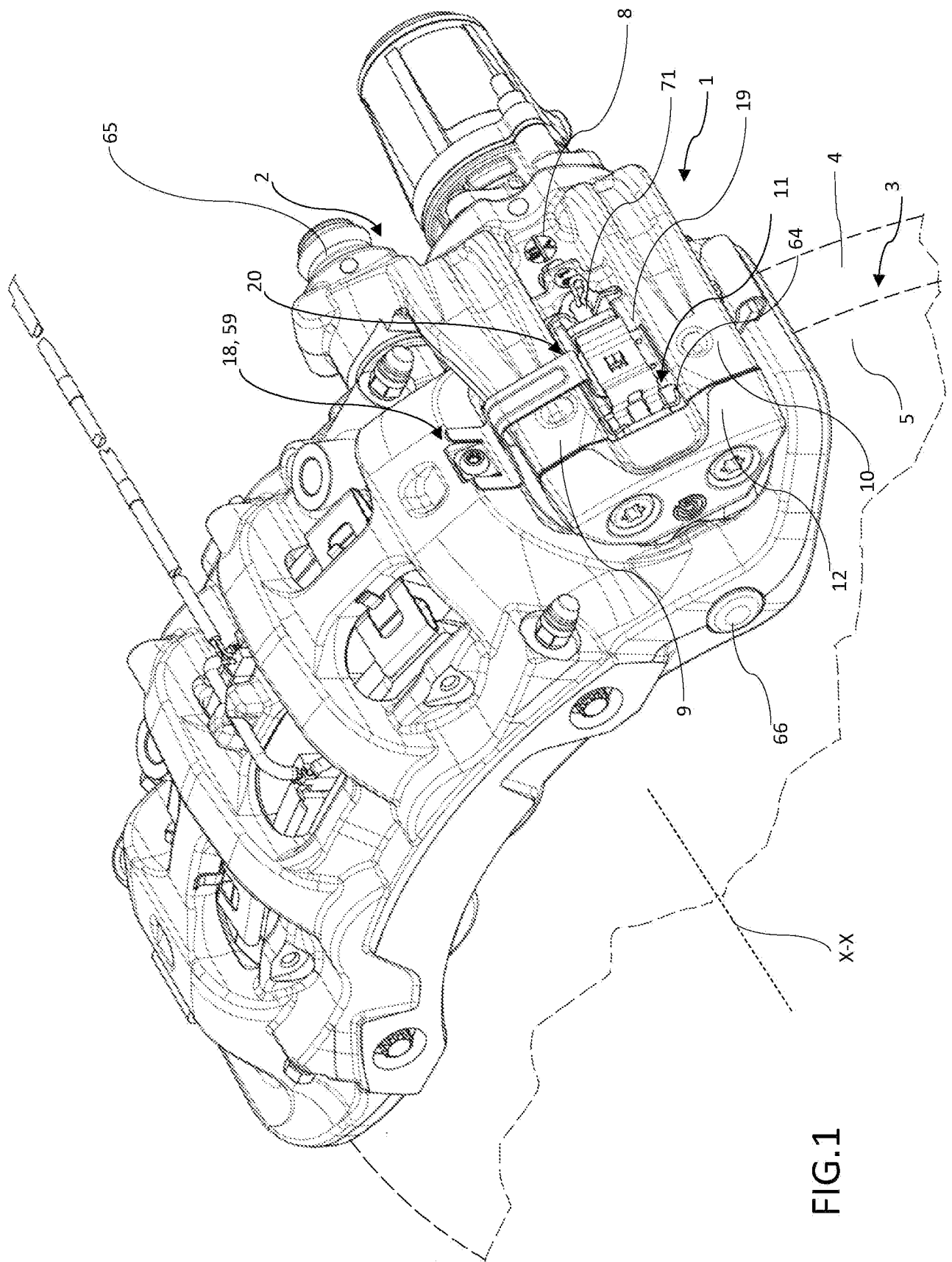
11. An assembly (1) according to the preceding claim, comprising one or more of the following features:

wherein the repositioning spring (20) is a repositioning spring according to any one of the preceding claims 1 to 9;

and/or wherein the bracket (6) comprises at least one bracket bridge (59) projecting so as to straddle said brake disc (3) at least until it radially overlaps said brake disc (3), wherein the at least one bracket bridge (59) comprises the bracket portion (18) to which the repositioning spring (20) is rigidly constrained, in a position overlapping the brake disc (3), and wherein the spring support element (21) is shaped to be arranged aligned with the brake disc radially outside the brake disc and the first floating element bridge (9) until it abuts against the floating element sliding surface (19),

and/or wherein said bracket portion (18) comprises a connection seat

comprising a threaded hole made in a first connection surface configured to house the central tab (35) to overlap the through-hole (36) on the threaded hole, wherein the connection seat further comprises side walls transverse to the first surface and arranged
5 and opposite in the axial direction (A-A) to guide the central tab (35) on the first connection surface,
and/or wherein said brake caliper (2) is a parking caliper integrated into a service caliper, wherein the bracket (6) is a portion of a caliper body of the service caliper.



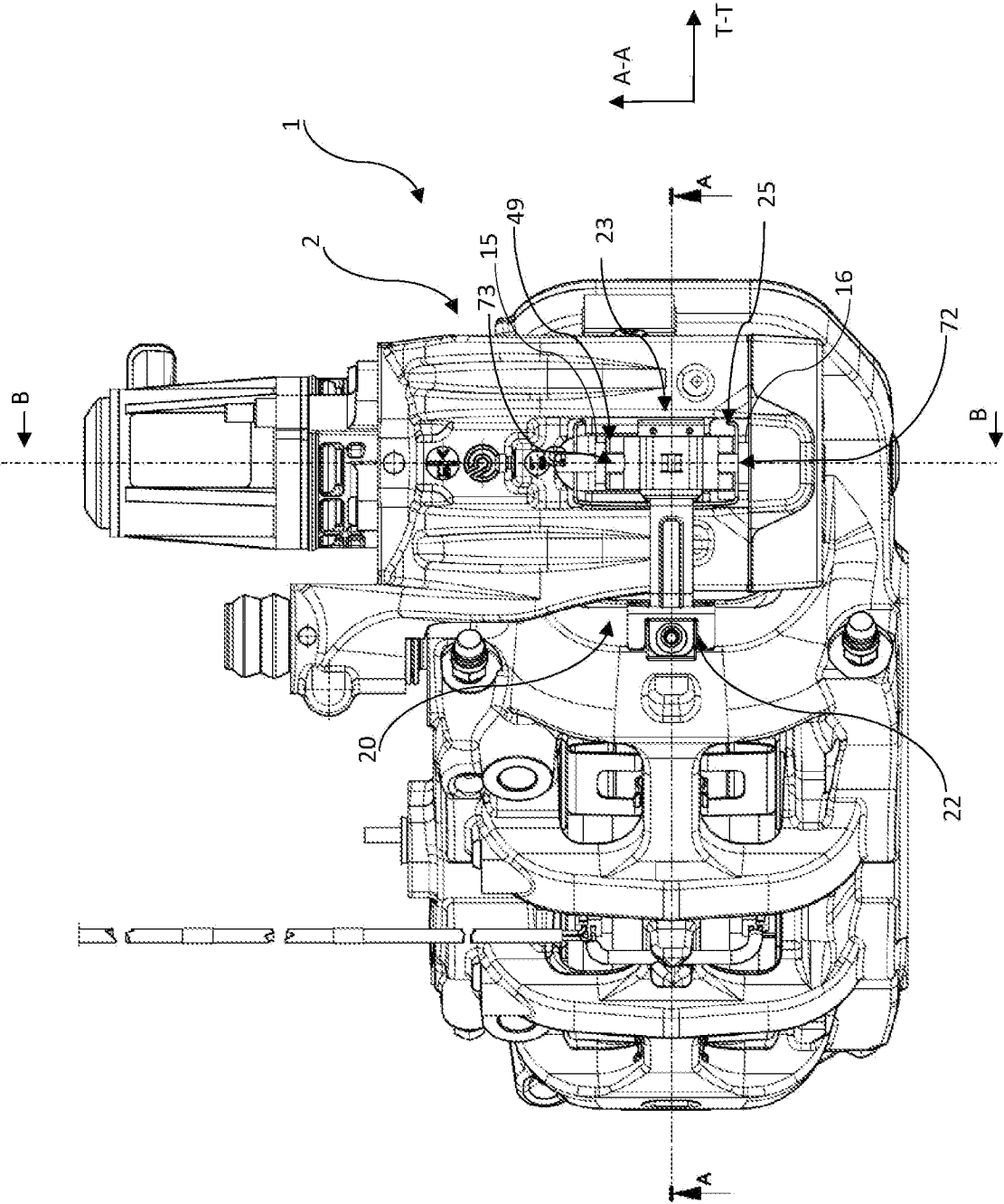


FIG.2

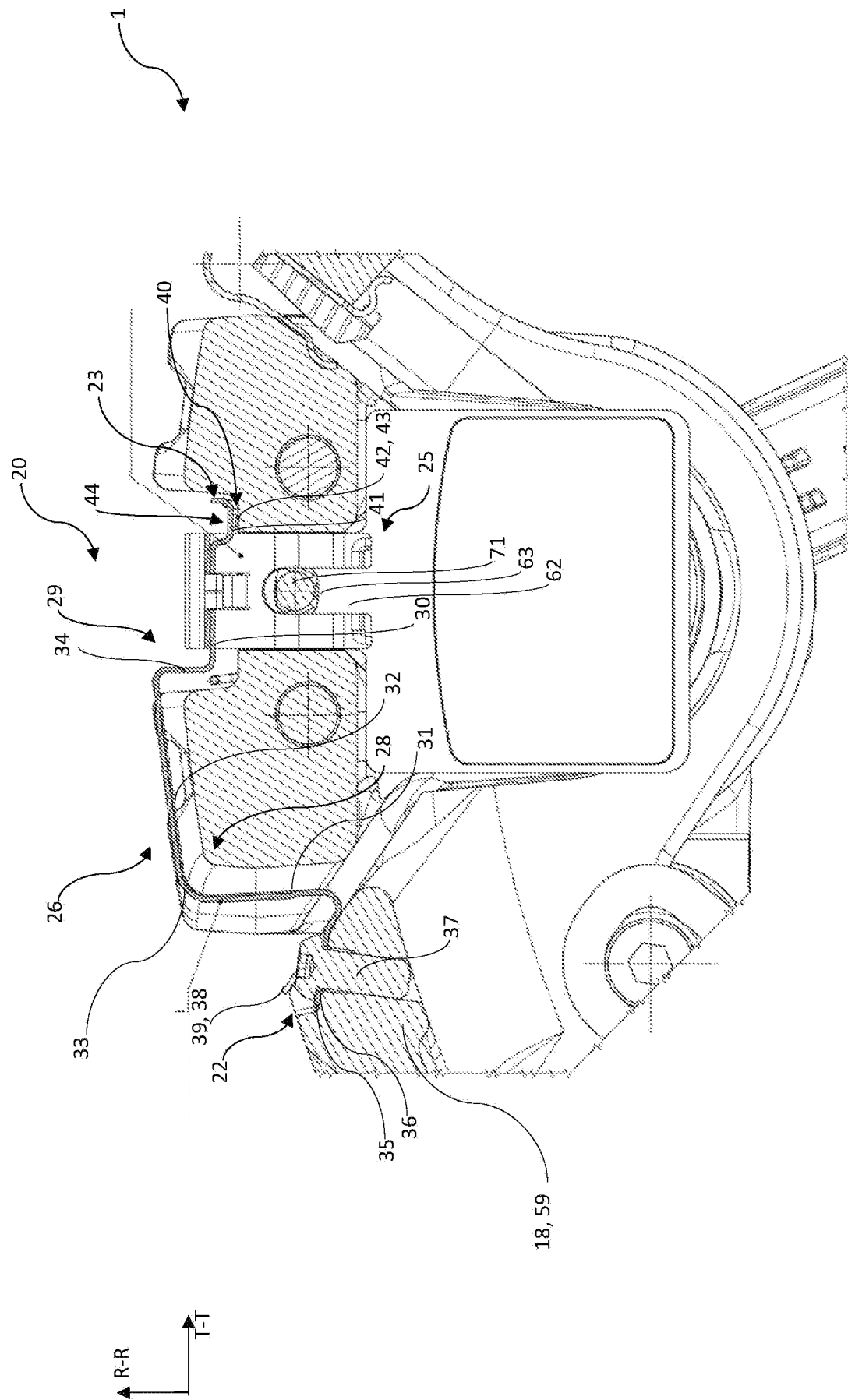


FIG.3

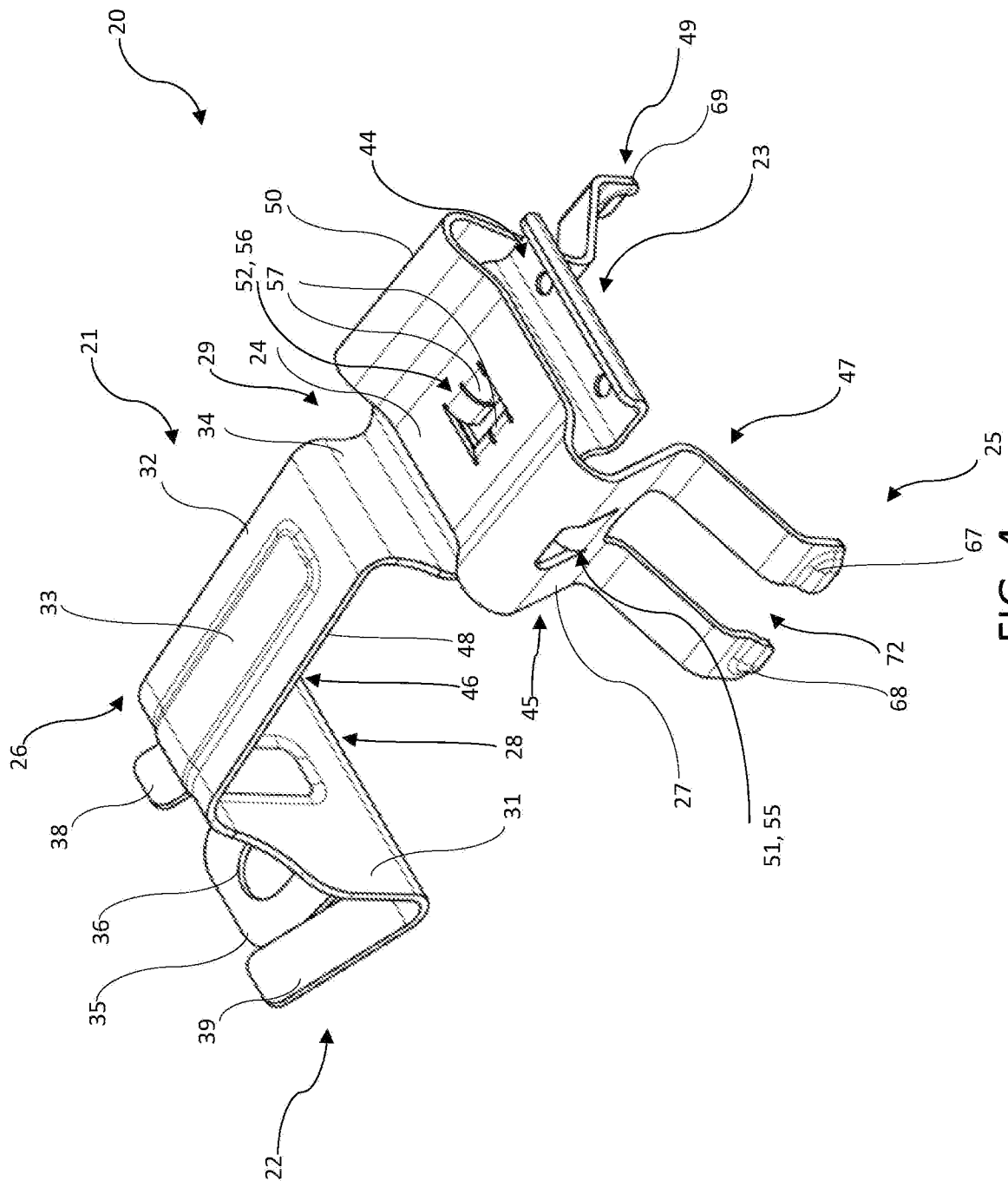


FIG. 4

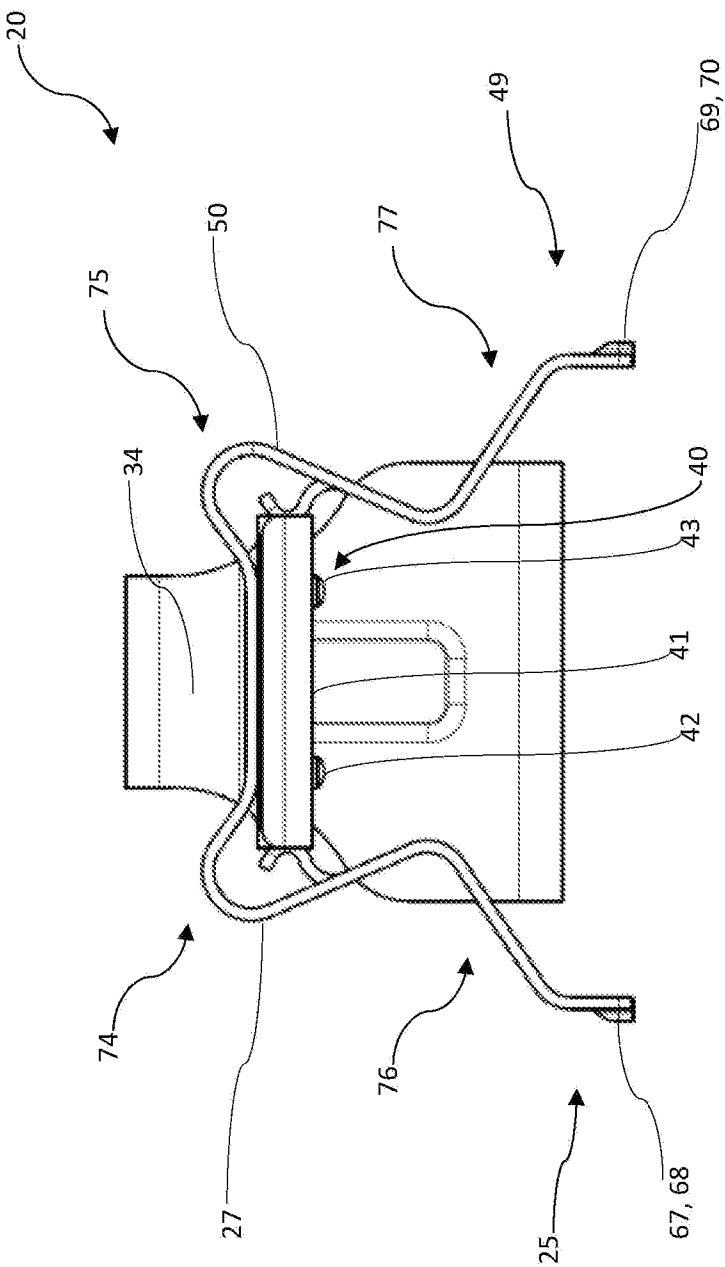
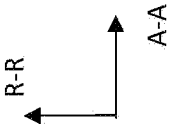
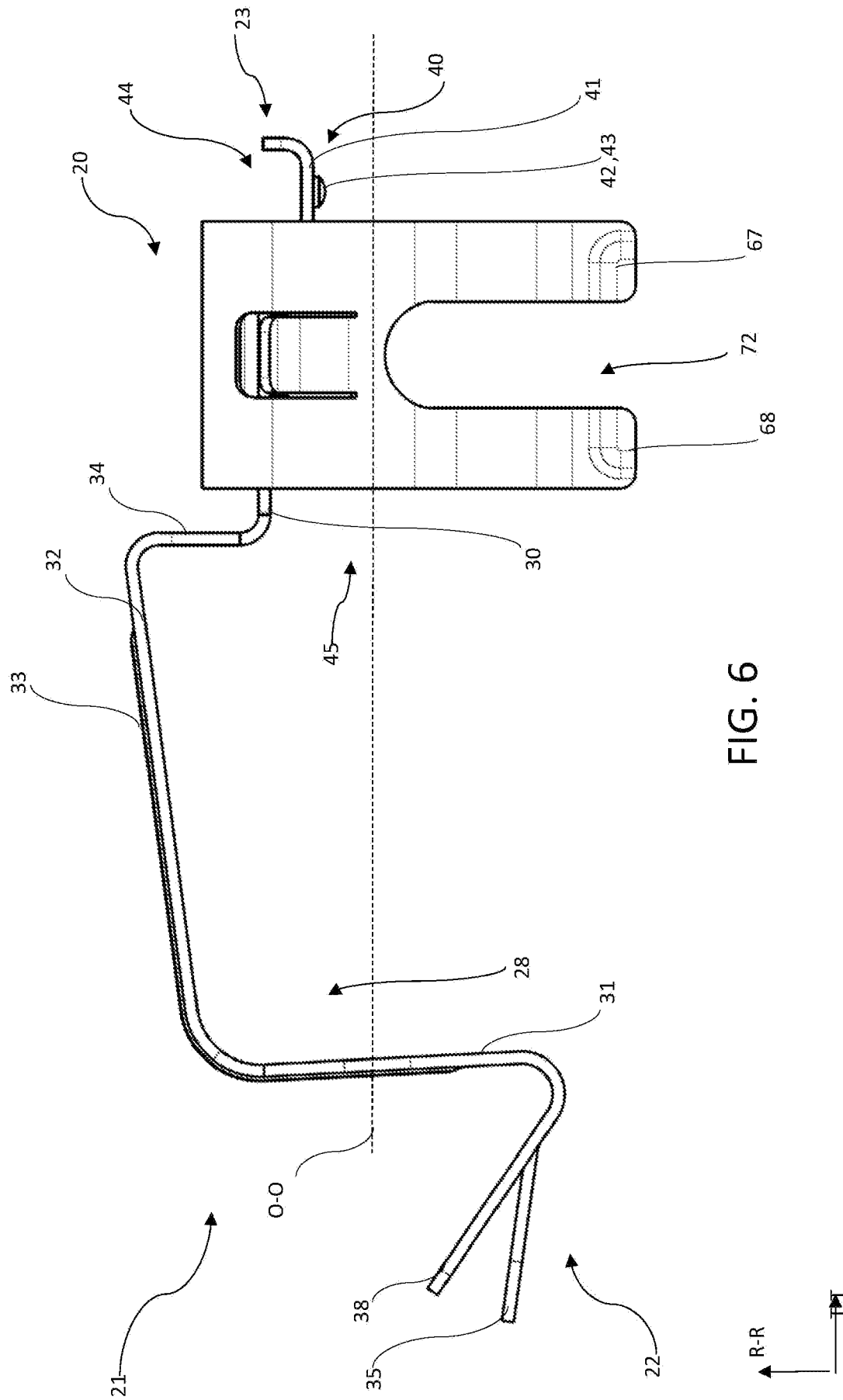


FIG. 5





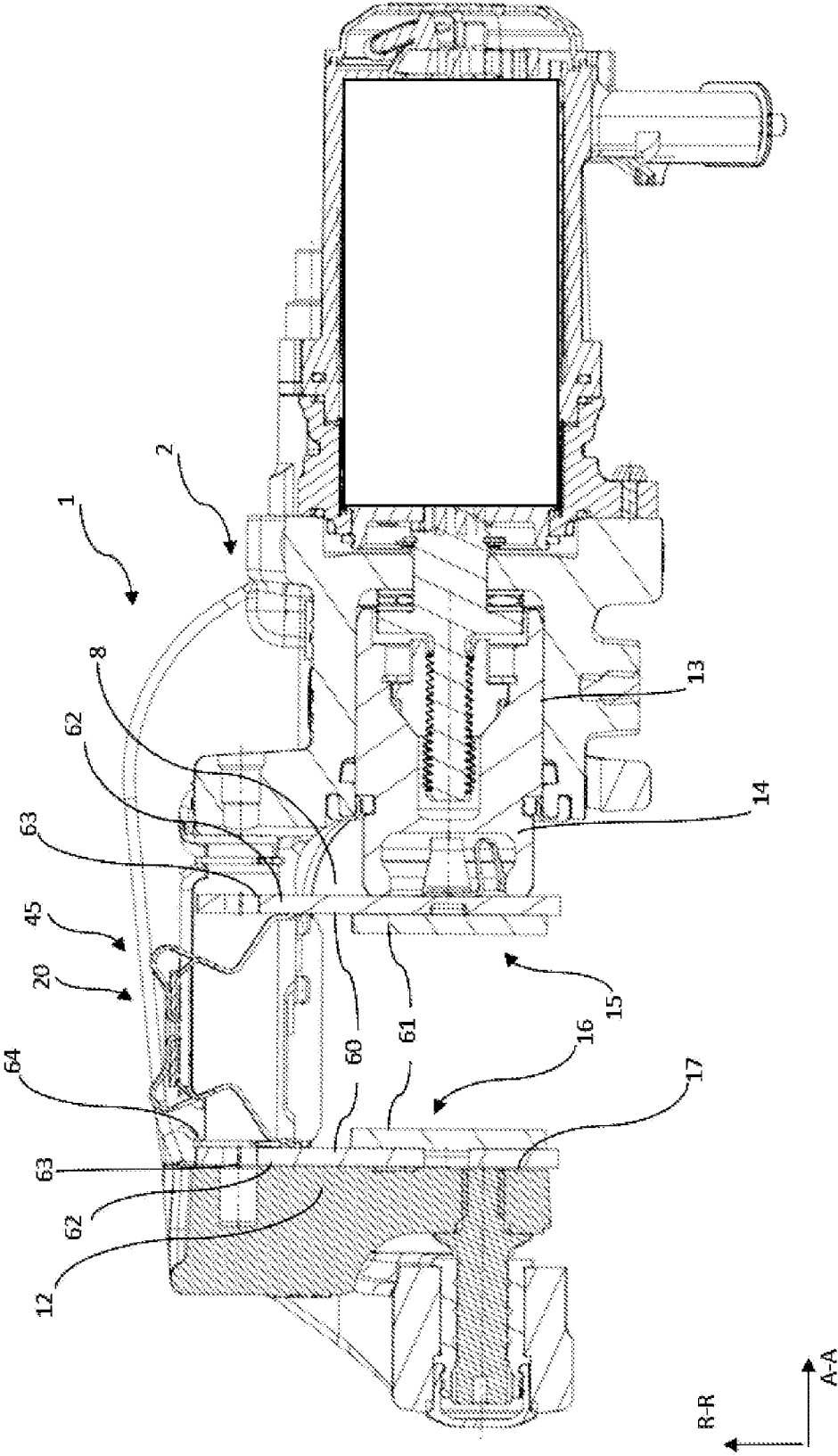


FIG. 7

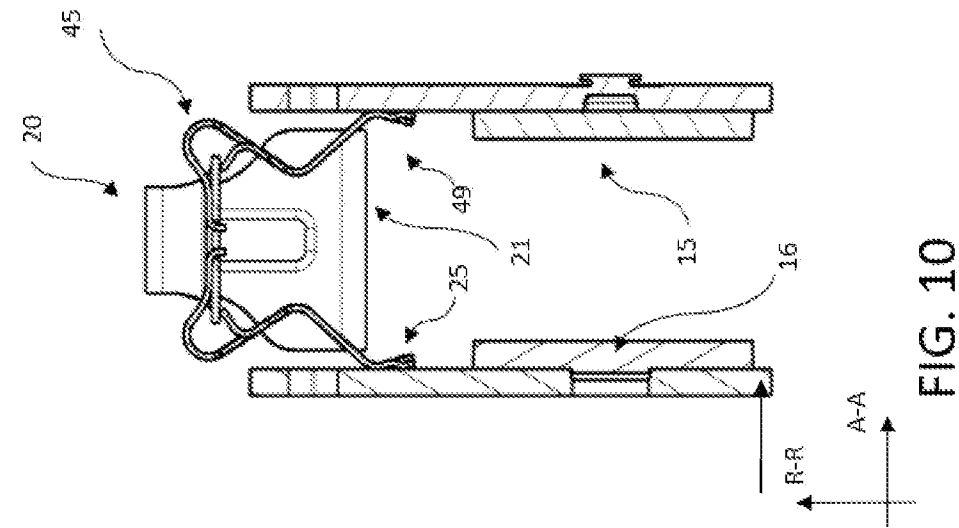


FIG. 10

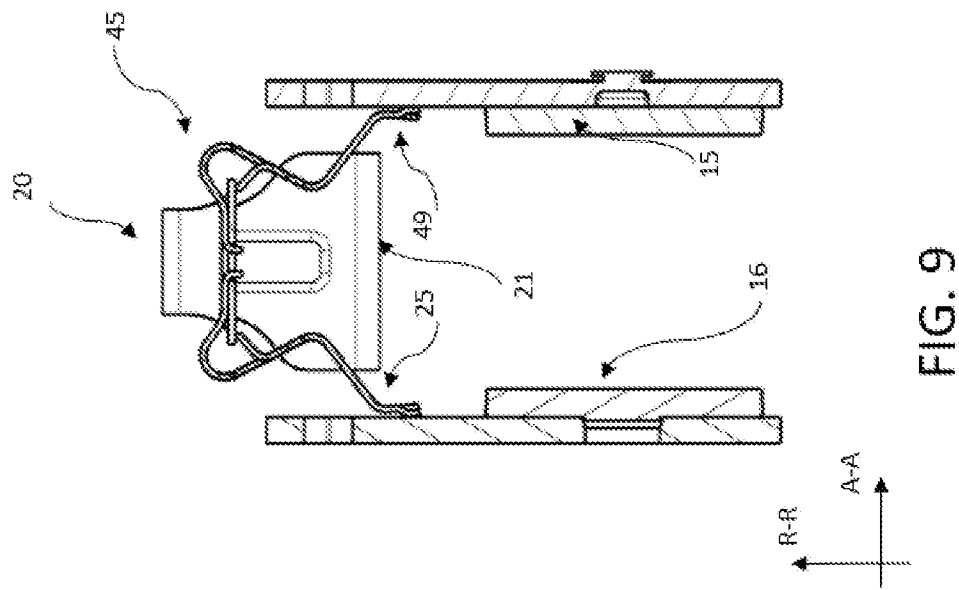


FIG. 9

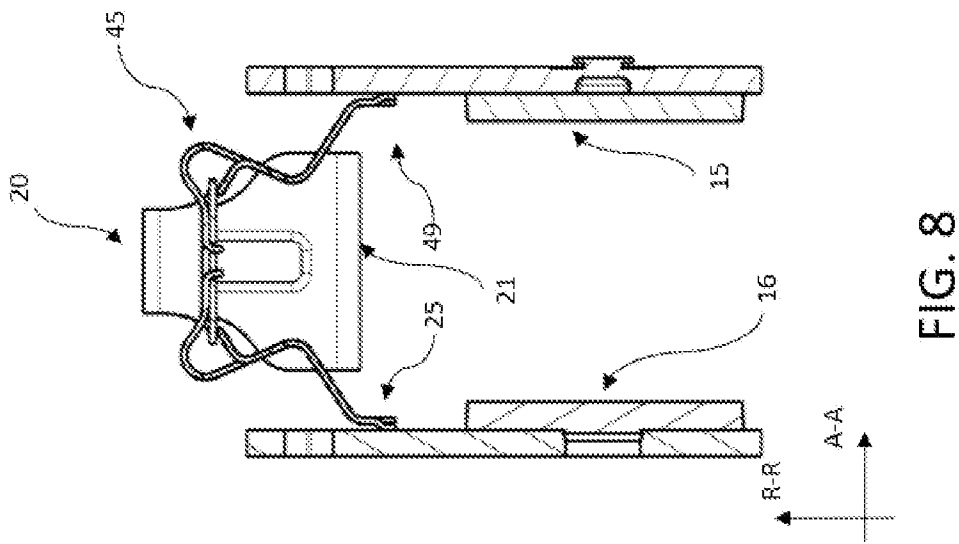


FIG. 8

FIG. 14

FIG. 15

FIG. 16

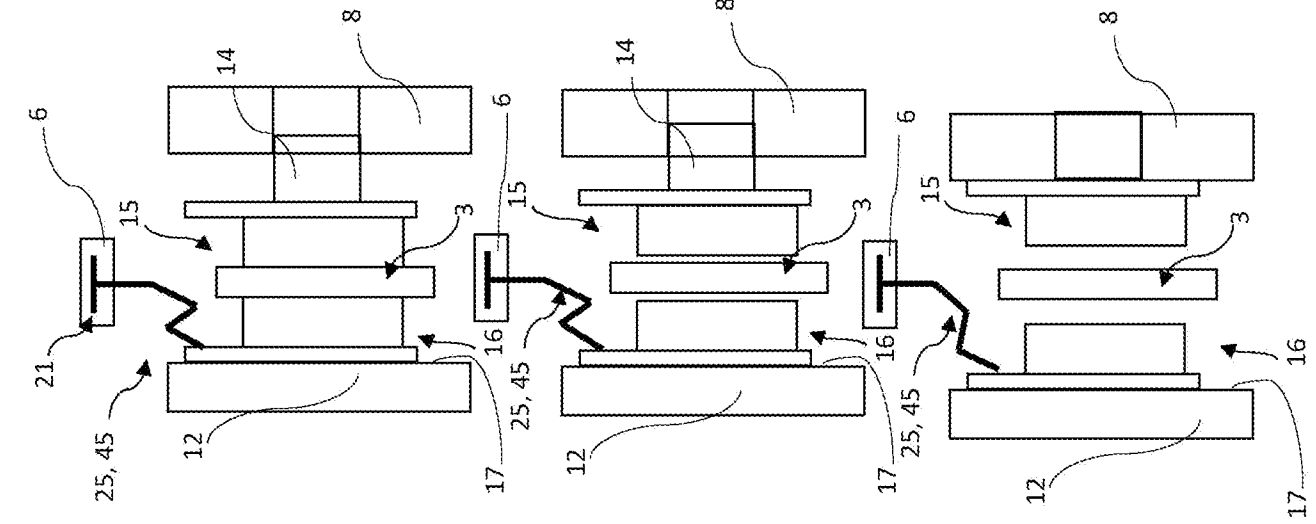
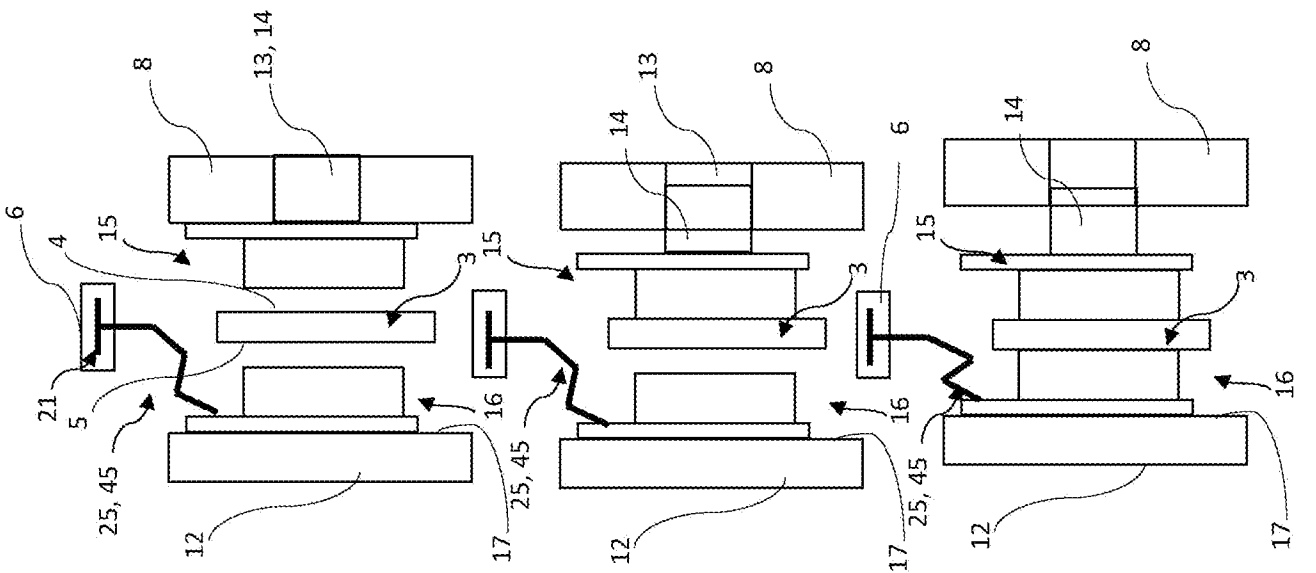


FIG. 11

FIG. 12

FIG. 13



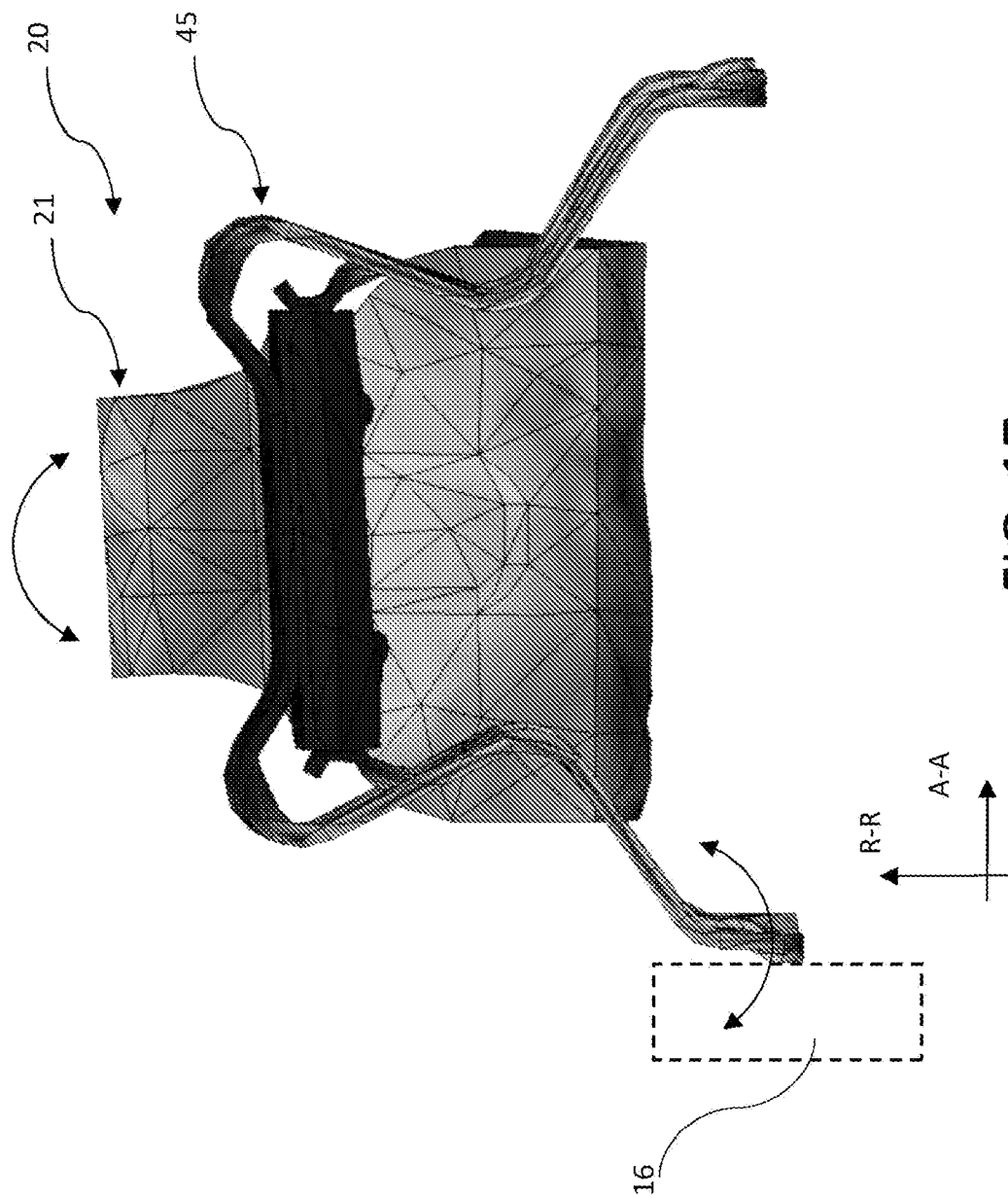


FIG. 17

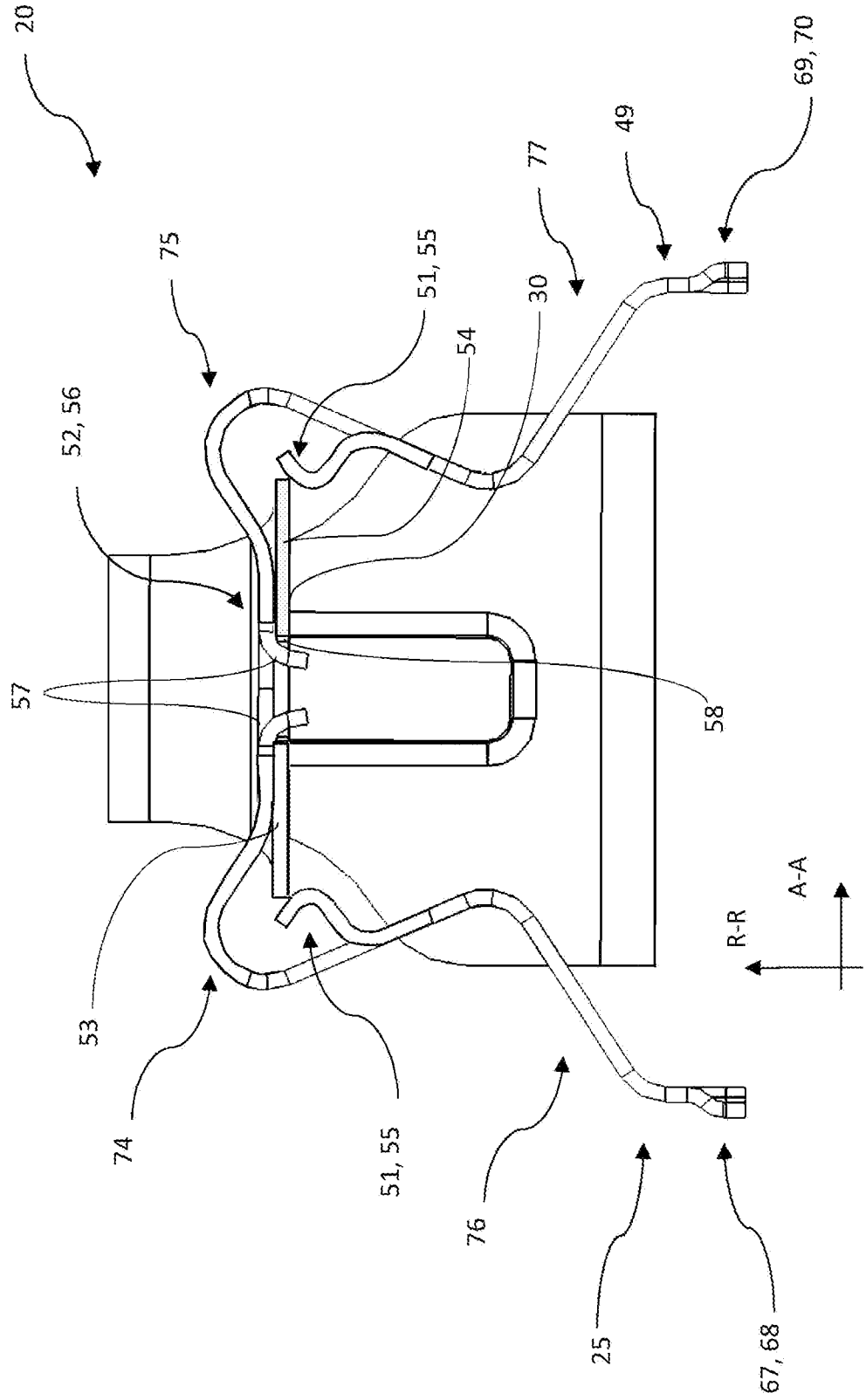
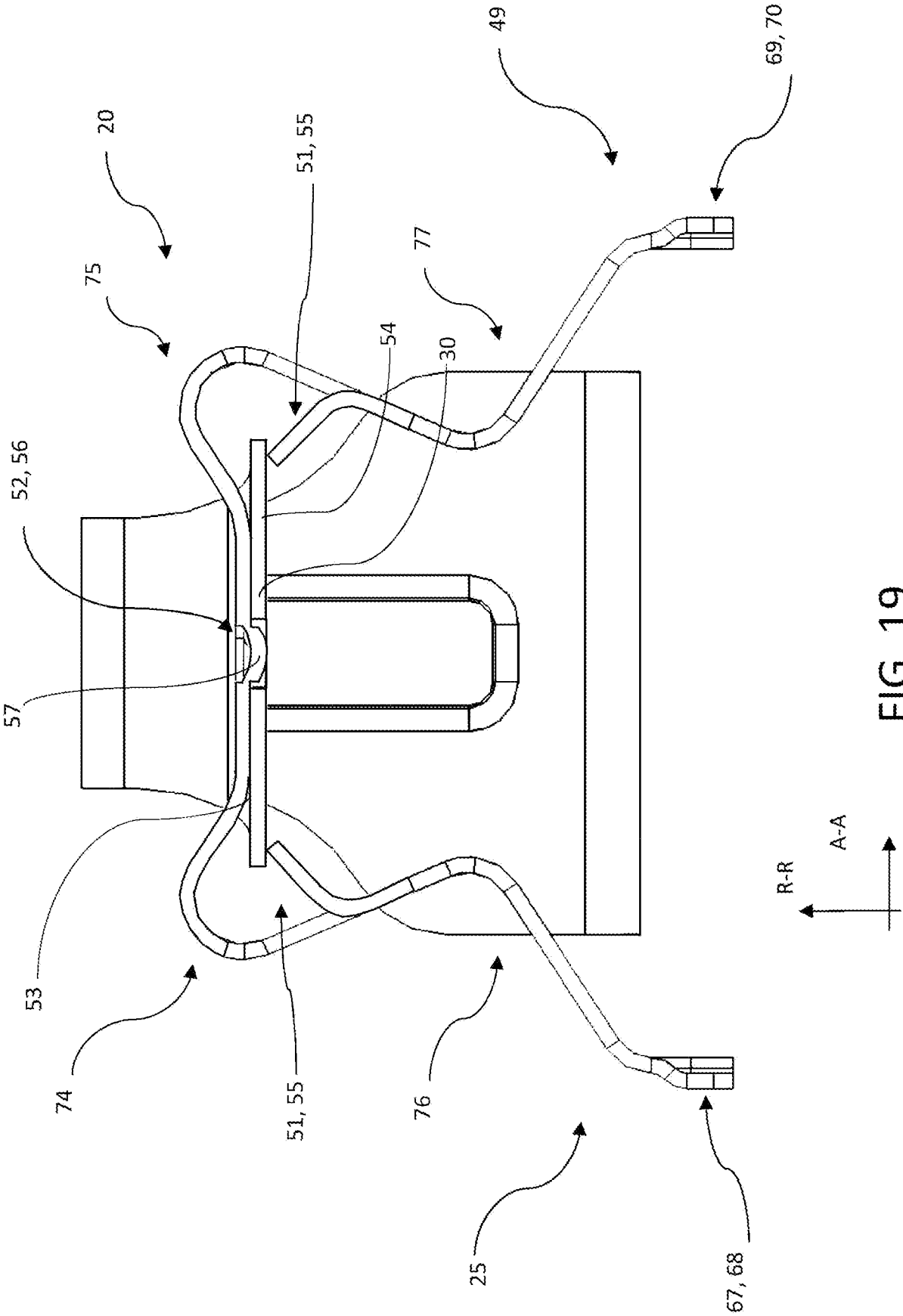
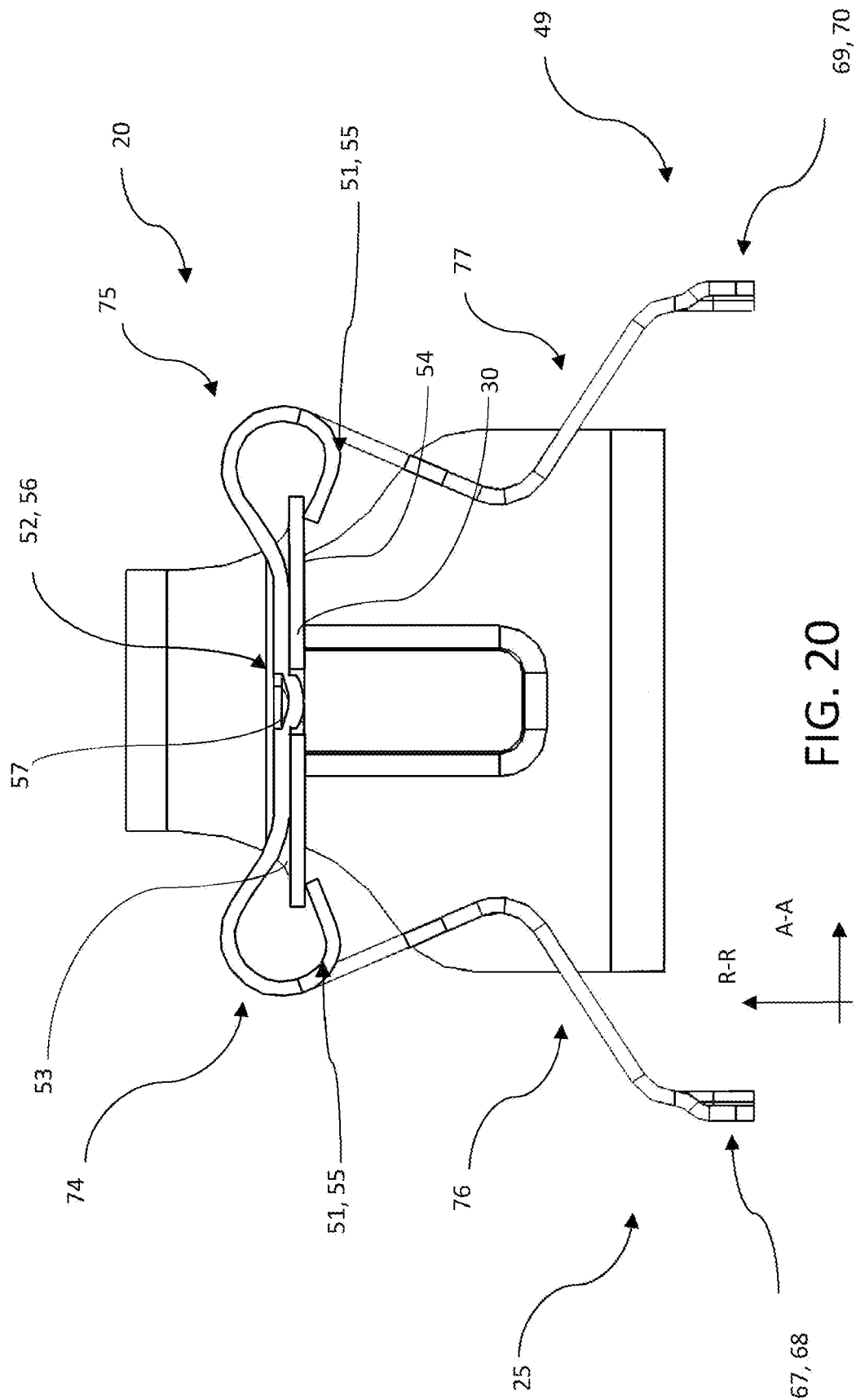


FIG. 18





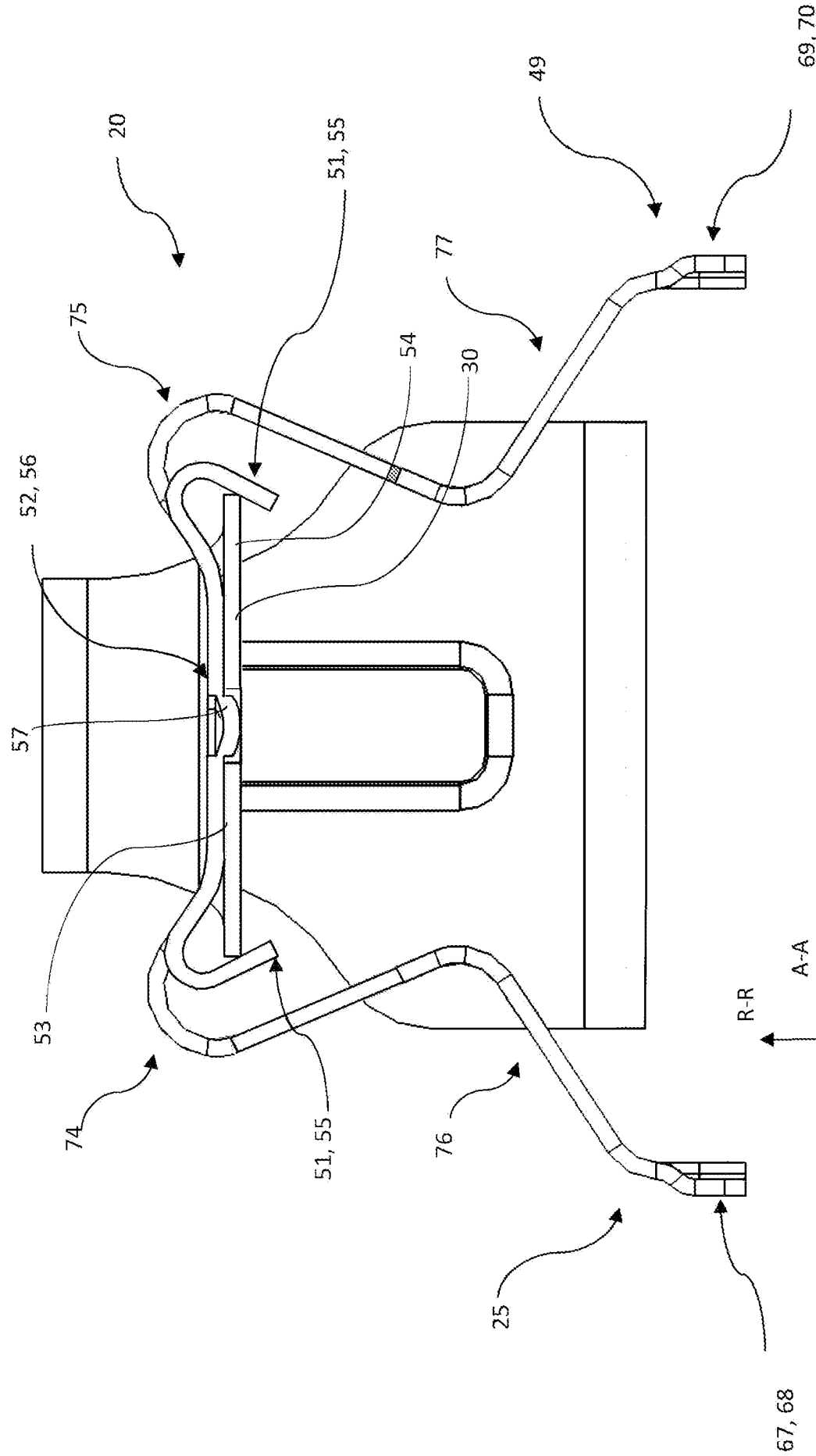


FIG. 21

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2024/052242

A. CLASSIFICATION OF SUBJECT MATTER INV. F16D65/097 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) F16D		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2022/153235 A1 (BREMBO SPA [IT]) 21 July 2022 (2022-07-21) paragraphs [0047] - [0067]; figures 1-3,7,8 -----	1-11
A	US 2017/037916 A1 (CRIPPA CRISTIAN [IT] ET AL) 9 February 2017 (2017-02-09) paragraphs [0084] - [0103]; figures 3,4 -----	1-11
A	US 2022/056970 A1 (MAMBRETTI MAURO [IT] ET AL) 24 February 2022 (2022-02-24) paragraphs [0061] - [0080]; figures 8,9 -----	1-11
A	US 2022/056969 A1 (FUMAGALLI MARCO [IT] ET AL) 24 February 2022 (2022-02-24) paragraphs [0058] - [0075]; figures 1,2 ----- -/-	1-11
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "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 "X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "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 16 May 2024		Date of mailing of the international search report 29/05/2024
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Raffaelli, Leonardo

INTERNATIONAL SEARCH REPORT

International application No

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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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A	CN 209 414 470 U (WANXIANG QIANCHAO SHANGHAI AUTOMOTIVE SYSTEMS CO LTD) 20 September 2019 (2019-09-20) the whole document -----	1 - 11

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Information on patent family members

International application No

PCT/IB2024/052242

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