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DESCRIPTION

The invention relates to a disk brake for a utility vehicle, having a brake calliper that engages over a brake disk, is preferably designed as a sliding calliper, is arranged on a positionally fixed brake carrier and has an application device for applying the brake, having two brake pads, each of which has a pad carrier to which a friction pad is fixed, one of these brake pads being an application-side brake pad that can be pressed against the brake disk by means of the application device on one side of the brake disk, and the other being a reaction-side brake pad that is arranged on the opposing side of the brake disk, the two brake pads each being inserted in a pad slot, the brake calliper having above the brake disk a central calliper opening, through which the two brake pads can be inserted into their respective pad slots. The invention also relates to a brake pad set for a disk brake of this type.

In the event of braking by means of an application device that can be actuated pneumatically or by electric motor, a generic disk brake, in particular in the case of a generic disk brake designed as a sliding calliper brake, an action-side brake pad is pressed against a brake disk on the vehicle. As braking continues, the brake calliper is displaced counter to the application direction of the action-side brake pad in relation to the brake disk, entraining and pressing the opposing, reaction-side brake pad against the other side of the brake disk.

The prior art is described in DE 40 20 287 A1, which describes how a pad spring designed as a leaf spring is provided on both brake pads. Once inserted into their pad slots, the pad carriers are held in place by the pad springs, which, once fitted, are both secured by means of a retaining clip that acts on the leaf spring from above and extends in a direction transverse to the longitudinal axis of the leaf spring. To fix the pad spring in place, lugs provided with undercuts are integrally formed on the pad carrier (or pad carrier plate), these lugs extending through slot-like recesses in the pad spring and these recesses engaging behind the undercuts so as to make a form fit that holds the pad springs in a radial direction, specifically such that

they are prevented from being released of their own accord in an untensioned or partially untensioned state. Further similar prior art is presented in DE 14 2014 106 090 A1. According to these specifications, the brake calliper has a central calliper opening above the brake disk, through which the two brake pads can be inserted into the pad slots, thus permitting simple brake pad replacement. However, this means that it is also necessary to be able to secure the brake pads radially – i.e. outwards towards the brake disk axis of rotation for the purposes of this application – in the pad slots by simple means.

This problem does not occur in this form in the case of fixed-calliper brakes because they generally have a strut fitted across the brake disk and though this strut may have a ventilation opening, this opening is neither intended nor designed in terms of its dimensions for pad replacement. As a result there is no need for a pad retaining clip that extends over the calliper opening.

The solution described in the introduction is further developed in patents EP 1 963 702 B1 and EP 2 255 101 B1. Owing to a cover that is fixed and can preferably be moved radially in relation to the pad carrier, and through which the pad spring or part of the pad spring passes, these solutions ensure that the pad spring is always reliably fixed, in particular in the load region, and so is able to transmit load.

The technical background is also described in EP 0 694 134 B1, DE 10 2012 110 461 A1 and WO 2014/079 869 A1.

The invention is based on the object of developing a disk brake of the generic type in such a manner as to achieve good braking characteristics with simple design means. A further object consists in the provision of a corresponding brake pad set.

This object is achieved by means of a disk brake having the features of claim 1.

The further object is achieved by means of a brake pad set having the features of claim 22.

Claim 1 creates a disk brake for a utility vehicle, having a brake calliper that engages over a brake disk, is preferably designed as a sliding calliper, is arranged on a positionally fixed brake carrier and has an application device for applying the brake; and having two brake pads, each of which has a pad carrier to which a friction pad is fixed, one of these brake pads being an application-side brake pad that can be pressed against the brake disk by means of the application device on one side of the brake disk, and the other being a reaction-side brake pad that is arranged on the opposing side of the brake disk, the two brake pads each being inserted – or being capable of being inserted during fitting (and therefore having to be able to pass through this opening – in a pad slot, and the brake calliper having above the brake disk a central calliper opening, through which the two brake pads can be inserted into their respective pad slots. Also provided is a hold-down clip that is designed so as to secure one of the two brake pads – preferably but not necessarily the reaction-side brake pad – radially in its pad slot, the end of the hold-down clip averted from its/the brake pad being held on the brake calliper, in particular being held there releasably or non-releasably.

This creates an advantageous disk brake and a particularly advantageous reaction-side or application-side brake pad with a design that is simple, short and advantageously restricted in its function to holding down this one brake pad. Owing to the reduced amount of material used, this short hold-down clip results in reductions both in the weight and in the cost of the brake.

It is advantageous for the hold-down clip to engage in a manner entirely or partially axially parallel to the brake disk over only one of the two brake pads in order to secure it. The pad is therefore effectively held radially "from above" in the pad slot of the brake carrier or the brake calliper and secured against (excessively large radial) movements. In this arrangement it may be possible to insert the held-down pad in a pad slot of the brake carrier or the brake calliper. In a particularly preferred variant both brake pads are arranged in pad slots of the brake carrier and can be inserted into these pad slots through the opening in the brake calliper (effectively a fitting opening for the brake pads), specifically inserted substantially radially from above and in certain circumstances with a small axial movement. A brake carrier

with pad slots on either side of the brake disk is very stable and advantageous. The pad slot supports the pad in the circumferential direction and radially downwards towards the brake disk. The axially "short" hold-down clip then secures one brake pad upwards to prevent it from falling out or performing excessively large radial movements, in certain circumstances aided by an interposed spring. The other brake pad is secured radially in another manner – not by the same hold-down clip.

Securing the reaction-side brake pad with the "short" hold-down clip has the advantage of being simple to achieve, in particular if the brake pad is held in the brake calliper such that it is unable to move axially and so does not move in relation to the brake calliper, in particular in the region of its back-plate, during braking.

Depending on the variant, the hold-down clip may be fastened releasably or non-releasably on the brake calliper or formed in one piece with it.
An optional embodiment in which the hold-down clip and the brake pad form one unit that can be replaced in its entirety for pad replacement is advantageous. This is simple and means that all the elements in the "reaction-side pad" (brake pad; pad spring; cover and hold-down clip, where provided) can be replaced simply and reliably.

The hold-down clip may lie on the pad carrier or engage behind it and so cooperate with it. The hold-down clip may also cooperate with the pad carrier in a form-fit, e.g. via a projection that engages in a corresponding recess in the pad carrier (or vice versa) in a form fit, for example.

In one possible, and particularly advantageous, variant the hold-down clip may be connected captively to the pad, in particular connected captively to the pad carrier. This has the advantage that the assembly is fitted in one piece, thereby excluding the possibility of incorrect fitting. In this context, incorrect fitting means fitting the back-plate facing the brake disk.

In this arrangement various types of connection between the hold-down clip and the brake pad are possible. For example, the connection may take the form of a cover, there being provided one or more lugs, which engage

completely or partially around the hold-down clip and are subsequently fitted by means of welding, riveting, radial riveting or a similar methods such that it is impossible to remove the component without destroying it. This engagement here may be behind the hold-down clip, as shown in the drawings, or over it.

The connection may also take the form of a collar pin that engages through the hold-down clip and is welded or riveted to the cover (cohesively or in a force fit or form fit), for example.

The connection may also take the form of a bolt that is fastened in the pad back-plate either permanently or such that it can be displaced.

The hold-down clip may also engage completely or partially through the pad back-plate. With a variant of this type, a spring is then permanently fastened to a hold-down clip such that the hold-down clip is connected captively to the pad, as described above.

In a further concept, the pad retaining spring can be moved away from the pad. The temperatures occurring in a region further away from the pad are generally lower than those prevailing at the pad itself. This has a positive influence on service life and provides more options for the choice of spring materials. Temperature also affects the service life of the corrosion-protection coatings applied to the springs and so a further improvement can be achieved here. In this arrangement the hold-down clip is connected to the pad permanently or with play for tolerance compensation, and the spring pushes the hold-down clip downwards. The hold-down clip then pushes the pad downwards onto the brake carrier. This spring action can be achieved by various different spring designs including leaf springs, spiral springs, leg springs, etc.

The hold-down clip can be stopped or held at the pad and/or the brake calliper simply by one or a plurality of fastening means, in particular bolts, brackets or one or more screws.

It is thus conceivable, and advantageously simple, for the hold-down clip to be fixed such that it cannot be released to a part of the reaction-side brake pad. It may, for example, also be fastened cohesively to the pad carrier using a method such as welding, for example.

The invention also discloses an advantageous brake pad for a disk brake according to one of the relevant claims, having a pad carrier to which a friction pad is fastened, the brake pad being designed to cooperate with the hold-down clip. In this arrangement the hold-down clip and the brake pad may, though need not necessarily, form one unit.

In this arrangement the hold-down clip is preferably designed such that it secures only one of the two brake pads radially in its pad slot on a disk brake.

It is particularly advantageous if the hold-down clip is fixed to the reaction-side brake pad because this reaction-side brake pad is fixed axially in the brake calliper and is not pushed into it as wear increases. This is a simple way of realising the invention, though the invention is not restricted to this variant.

A further advantageous variant that is described in greater detail in subclaims 16 to 20 has a cable bridge on which is arranged and held at least one signal cable that bridges the opening of the brake calliper and is fastened directly or indirectly to the brake calliper in at least two regions. In this manner a signal cable can be laid across the opening of the brake calliper in an effective manner despite the "short" hold-down clip.

The invention also provides for a brake pad set having a reaction-side brake pad according to any one of claims 22 to 28 and an application-side brake pad that is secured radially in the brake carrier by means of at least one form-fit element on the pad carrier. As a result, the brake pad on the application side does not require a hold-down clip for radial securing purposes. Furthermore, the pad reduces the effect of diagonal wear. In one version of the invention the reaction-side pad need not necessarily be of this design. In fact, the reaction-side pad may also be designed without

projections, in which case the "short" hold-down clip is particularly advantageous. All in all, this is a very inexpensive way of producing a disk brake with two brake pads that are optimally adapted to their tasks and form a pad set.

In summary, the invention also advantageously provides for a disk brake for a utility vehicle, having a brake calliper that engages over a brake disk, is preferably designed as a sliding calliper, is fastened to a positionally fixed brake carrier and has a central calliper opening above the brake disk, having an application device for applying the brake, and having two brake pads that can be inserted through the calliper opening, each of which has a pad carrier to which a friction pad is fixed, one of these brake pads being an application-side brake pad that can be pressed against the brake disk by means of the application device on one side of the brake disk, and the other being a reaction-side brake pad that is arranged on the opposing side of the brake disk, there being provided a hold-down clip that is designed so as to radially secure or hold down only one of the two brake pads in the pad slot, or hold it down radially in relation to the brake disk axis of rotation.

Further advantageous embodiments of the invention are characterised in the subclaims.

Embodiments of the invention are described below with reference to the appended drawings.

Fig. 1 shows in 1a) a perspective view of a first disk brake according to the invention and in 1b) a view of a brake carrier of the disk brake from 1a).

Fig. 2 shows the view from Fig. 1a with part of the brake calliper omitted.

Fig. 3 shows a perspective view of an application-side brake pad of the disk brake from Fig. 1 (and the disk brake from Fig. 9).

Fig. 4 shows a first reaction-side brake pad with a pad spring and a cover on which a hold-down clip is arranged.

Fig. 5 shows a partial sectional view of the arrangement from Fig. 4.

Fig. 6 shows the brake pad in the arrangement from Figs. 4 and 5.

Fig. 7 shows the hold-down clip in the arrangement from Fig. 4.

Fig. 8 shows a cover in the arrangement from Fig. 4.

Fig. 9 shows a perspective view of a second disk brake according to the invention.

Fig. 10 shows the view from Fig. 9 with part of the brake calliper omitted.

Fig. 11 shows a variant of a reaction-side brake pad with a hold-down clip arranged on it.

Fig. 12 shows a partial sectional view of the arrangement from Fig. 11.

Fig. 13 shows the brake pad in the arrangement from Figs. 11 and 12.

Fig. 14 shows the hold-down clip in the arrangement from Fig. 11.

Fig. 15 shows a cover of the brake pad from Figs. 13 and 14.

Fig. 16 shows a further variant of a reaction-side brake pad with a hold-down clip arranged on it.

Fig. 17 shows in a) a perspective view of a part of a third disk brake according to the invention, in b) a section through a partial region of the arrangement from a), in c) a partial sectional view of a partial region of the arrangement from a), and in d) a

separate perspective view of a hold-down clip from the arrangement from a).

Fig. 18 shows a perspective view of a part of a fourth disk brake according to the invention.

Fig. 19 shows in a) a perspective view of a part of a fifth disk brake according to the invention, and in b) a separate perspective view of a hold-down clip for the arrangement from a).

Fig. 20 shows in a) a perspective view of a part of a further disk brake according to the invention, and in b) a separate perspective view of a hold-down clip for the arrangement from Figs. 19 or 20a).

Fig. 21 shows in a) a perspective view of a part of a sixth disk brake according to the invention with a cable bridge, and in b) the cable bridge of the disk brake from a).

Fig. 22 shows in a) a perspective view of a part of a seventh disk brake according to the invention with a cable bridge of different design to that shown in Fig. 21, in b) an enlarged detail from a), in c) the cable bridge of the disk brake from a), and in d) a pad hold-down clip of the disk brake from a).

Figs. 1a and 2 and Figs. 9 and 10 each show a disk brake for a utility vehicle. The disk brake has a brake calliper 1 that engages over a brake disk 2. An associated electrical or pneumatic actuator (e.g. a brake cylinder) is not illustrated. The brake disk 2 has a brake disk axis of rotation D. The brake calliper 1 is arranged on a brake carrier 3. In a preferred version the brake calliper 1 is arranged on the brake carrier 3 so as to be displaceable axially in the direction of the brake disk axis of rotation D (to which terms such as “axial” and “radial” relate here) in relation to the brake disk 2. To this end the brake calliper 1 is mounted on guide bars 4 (not visible in detail here) that are connected to the brake carrier 3, which is held positionally fixedly on the vehicle.

The brake calliper 1 comprises an application portion 1a, a calliper back 1b and two tension struts 1c. The application portion 1a accommodates an application device (not shown) of the disk brake 1.

One side of the application portion 1a runs parallel to the plane of the brake disk 2 on one side of the brake disk 2. The calliper back 1b is arranged on the other side of the brake disk 2, also running parallel to the brake disk 2. The two ends of the calliper back 1b are connected to the application portion 1a by means of tension struts 1c. These tension struts 1c run substantially at right angles to the application portion 1a and to the calliper back 1b.

In this arrangement, the application portion 1a, the calliper back 1b and the tension struts 1c together define a central opening 1d that spans the brake disk 2. The opening 1d has a notional longitudinal centre line that lies in the plane of the brake disk 2 and connects the notional centres of the tension struts 1c. The opening 1d also has a further notional transverse centre line that connects a notional centre of the application portion 1a to a notional centre of the calliper back 1b.

A brake pad 100, 200 (not illustrated in Fig. 9) is provided on either side of the brake disk 2. One brake pad 100, also referred to below as the application-side brake pad 100, is arranged on the side of an application device. The other brake pad 200, also referred to below as the reaction-side brake pad 200, is arranged on the side of the brake disk 2 opposite the application side.

The central calliper opening 1d above the brake disk is designed and dimensioned such that the two brake pads can be inserted through the calliper opening into the brake carrier, thereby permitting simple pad replacement.

Braking is effected by means of the application device that is arranged in a receiving space in the application portion 1a of the brake calliper 1, this application device having a brake lever that is positioned in a dome, or the application portion 1a, of the brake calliper 1. The application device is

actuated by an actuator (not illustrated), preferably pneumatically or electromechanically. To this end it is preferably provided with a brake cylinder that can be arranged on the brake calliper of the disk brake (not shown here).

During braking, the two brake pads 100, 200 can be pressed against either side of the brake disk 2. In an embodiment as a sliding calliper brake, the application-side brake pad 100 makes contact with the brake disk 2 during braking. As braking continues, the brake calliper 1 is displaced in the opposite direction by reaction forces, entraining the reaction-side brake pad 200 until it also comes into frictional contact with the brake disk 2.

Each of the brake pads 100, 200 (see Figs. 3, 4 and 11 and 16) has a pad carrier 110, 210 to the side of which facing the brake disk is fixed a friction pad 120, 220 that is pressed against the brake disk 2 in operation, i.e. during a braking.

The brake pads 100, 200 can be accessed through the central opening 1d for replacement and maintenance. They can be inserted into and removed from associated pad slots radially "from above" through this central opening 1d. This is the sense in which the terms "above" and "below" are used below.

An application-side pad slot 11 for the application-side brake pad 100 is formed in the brake carrier 3 on the side of the application device or in an application-side portion of the brake carrier. This can be seen from Fig. 1b.

The brake carrier 3 engages around an upper edge region of the brake disk 2 in the manner of a frame and has an application-side portion and a reaction-side portion. A second pad slot 12 for the reaction-side brake pad is preferably also formed in the brake carrier 6 (on the reaction side, see Figs. 1a and b). Alternatively, however, the reaction-side pad slot 12 for the reaction-side brake pad 100 may also be formed in the brake calliper 1 (if the brake carrier only has an application-side portion and no reaction-side portion – not shown here).

The pad slots 11, 12 (see Figs. 1a and 1b) are each delimited laterally (or in a direction of rotation U and counter to direction of rotation U) by support surfaces 11a, 11b; 12a, 12b on the brake carrier horns 13, 14 and 15, 16, and each have a pad-slot base 11c, 12c that is formed between the brake carrier horns 13 and 14 and 15 and 16.

The application-side brake pad 100 and reaction-side brake pad 200 shown here are of different design. The application-side brake pad 100 may be designed in a variety of ways. The version shown in Figs. 2 and 3 is particularly advantageous but not essential.

The application-side brake pad 100 shown in Figs. 2 and 3 (suitable for the brake shown in Fig. 1 and Fig. 9) has a pad carrier 110, on one side of which is arranged the pad material 120, which, when fitted, faces the brake disk 2. The pad carrier 110 also has two lateral edges 111, 112 that run parallel to the associated support surfaces of the brake carrier horns 13, 14. Based on the preferred direction of rotation U (corresponding to forward travel), one lateral edge 111 is configured on the output side and so serves as a support surface during braking when travelling forwards. Based on the preferred direction of rotation U (corresponding to forward travel), the other lateral edge 112 is configured on the input side and so serves as a support surface during braking when travelling in reverse.

At least one projection 113, 114 on each of the lateral edges 111, 112 – here their lower edges in the pad slot 11 – projects outwards in mutually opposite directions. Each of these projections 113, 114 engages in an associated undercut 17, 18 of the brake carrier 3 (see Fig. 1b) formed in the brake carrier horns 13, 14 of the application-side pad slot 11. The fitted application-side brake pad 100 is thus secured both radially in the brake carrier 3 and against rotating out during braking. The projections also serve as additional support regions during braking. During replacement the new brake pad 100 is inserted radially and then displaced axially so that the projections 113 and 114 engage in the undercuts 17, 18.

The application-side brake pad 100 can also have a pad spring 130. This pad spring engages centrally under a retaining clip 115 that is formed in one

piece on or with the pad carrier 110, thereby securing the pad spring 130 radially. The pad spring 130 also has on either side of the retaining clip 115 a slot 131, 132 through which extend lugs/projections 116, 117 on the top of the pad carrier 110, thereby securing the pad spring 130 both axially and against rotating out. The ends 133, 134 of the pad spring 130 are preferably seated resiliently on the brake carrier horns 13, 14. This spring preloading pulls the application-side brake pad 100 upwards in its pad slot 12 in the brake carrier 3.

The application-side brake pad 100 is thus well secured and held in the brake carrier 3, particularly radially. As a result there is no need for the hold-down clip to be fixed to the brake calliper.

The reaction-side brake pad 200 shown in Fig. 4 and Fig. 11 also has a pad carrier 210, on one side of which is arranged the pad material 220 which, when fitted, faces the brake disk 2.

The pad carrier 210 also has two lateral edges 211, 212, which in this case are oriented in parallel and, in addition, run parallel to the associated support surfaces 12a, b of the brake carrier horns 15, 16 of the reaction-side pad slot 12 of the brake carrier 3 (Fig. 1a).

Based on the preferred direction of rotation U (corresponding to forward travel), one lateral edge 211 is again configured on the output side and so serves as a support surface during braking when travelling forwards. Based on the preferred direction of rotation U (corresponding to forward travel), the other lateral edge 212 is configured on the input side and so serves primarily as a support surface during braking when travelling in reverse.

As shown in Figs. 4 and 5 and Figs. 12, 13 and 15, the reaction-side brake pad 200 has a pad spring 230. This pad-holding spring 230 is preferably non-detachably fastened to or arranged/held on a cover 240 on the upper longitudinal edge of the pad carrier 210 (see Figs. 5, 6, 8 and Figs. 12, 13 and 15). The cover 240 can preferably be tilted to a limited extent at the pad carrier 210.

In this case, there are no projections projecting outwards in mutually averted directions on the lateral edges 211, 212 – here their lower edges in the pad slot 12 – of the pad carrier 210, and the brake pad is thus not secured radially. Another device is therefore required to secure it radially in the pad slot. A hold-down clip 250 is (thus) provided to secure the reaction-side brake pad 200 radially in its pad slot 12. This hold-down clip 250 may comprise one or more parts.

One end 251 of the hold-down clip 250 is fixed to the brake calliper 1 to prevent it becoming detached during braking. The hold-down clip 250 may nevertheless be detached from the brake calliper 1 in order to replace the pad.

The hold-down clip 250 is designed and dimensioned so as to hold down only one of the two brake pads 100, 200. In this case it holds down the reaction-side brake pad 220 but not the application-side brake pad 100, which it neither secures radially nor holds down.

The hold-down clip 20 is preferably a generally flat component perpendicular to its axial direction. This is advantageous but not essential. It does, however, produce a space-saving design. The cross section of the hold-down clip 250 may preferably be rectangular with two parallel short sides and two parallel long sides.

The hold-down clip 250 thus cooperates with the brake pad 220. The brake pad 220 is designed to be held down by this hold-down clip 250 either directly or via one or more interposed elements. The brake pad 220 extends parallel to the brake disk axis from the brake calliper back 1b into the calliper opening 1d, into which it projects but which it does not fully bridge. The end 252 of the brake pad 220 averted from the brake calliper 1 engages over the pad carrier 210 of the reaction-side brake pad 200. However, this end 252 preferably engages neither over the brake disk 2 nor over the application-side brake pad 100 (see Figs. 1 and 9).

Neither does it engage completely over the calliper opening 1d in the axial direction (parallel to the brake disk). The hold-down clip 250 is therefore

simple in design yet very reliable. It need only be fastened to one edge of the opening 1d on the brake calliper 1, preferably to the calliper back 1b.

The end 252 of the hold-down clip 250 averted from the brake calliper 1 preferably engages over at least the pad carrier 210 of the reaction-side brake pad 200. It preferably also engages axially from the brake calliper 1 over the cover 240 through which the pad spring 230 or a part of the pad spring 230 passes.

In one variant it is advantageous if the hold-down clip 250 engages over the reaction-side brake pad 200 only axially and so secures it radially, but is not fastened to the brake calliper 200. This ensures that the reaction-side brake pad 200 is well secured radially.

In contrast, in a further variant it is advantageous if the hold-down clip 250 is also fastened to the reaction-side brake pad 200. This forms an easy-to-handle assembly unit that facilitates pad replacement.

In a development of this variant it is advantageous if the hold-down clip 250 is fastened non-releasably to the reaction-side brake pad 200.

This both provides an easy-to-handle assembly unit and ensures the hold-down clip 250 (also subject to heavy loads due to significant braking) is also reliably replaced when the pad is replaced.

To release the hold-down clip 250 its fixing to the brake calliper 1 is simply released. The reaction-side brake pad 200 is then replaced together with the hold-down clip 250 as one unit. This unit advantageously also comprises the pad spring 230. It also advantageously comprises the cover 240.

The hold-down clip 250 may be fastened to the reaction-side brake pad 220 in a variety of ways, for example by means of a form-fit or cohesive connection to part of the reaction-side brake pad 220. In one variant (see Fig. 16) this part may expediently be the pad carrier 210 or the pad spring 230 (not shown). This part may also expediently be the cover 240 (where present). This advantageous variant is illustrated in Figs. 1 to 15.

The hold-down clip 250 may be connected cohesively to the cover 240, e.g. welded or brazed directly or indirectly (via an intermediate part such as a bolt) to the cover. The hold-down clip 250 may also be screwed to the cover 240 or fastened to the cover 240 by means of a rivet (not shown).

Alternatively, it is also advantageous for the cover 240 to have an integrally formed part, such as an arm or plurality of arms or even a circumferentially closed ring 245 (Fig. 6), that is preferably formed in one piece with the cover 240, and by means of which the hold-down clip 250 is non-detachably attached to the cover 240. The hold-down clip 250 preferably passes through the ring 245 (Fig. 4). Additionally, the hold-down clip 250 may be cohesively connected to the ring 245, for example by means of welding.

When seen in side view (see Fig. 4, for example), the hold-down clip 250 may be stepped in form. Amongst other functions, this serves to compensate for a difference in height in relation to the brake calliper 1. This Z-shape may also be used to fix the hold-down clip 250 to the brake calliper 1 in a simple, uncomplicated manner.

The end of the hold-down clip 250 that is fastened to the brake calliper 1 may be fixed there in a variety of ways. It is advantageous for this end to be fixed to the brake calliper 1 in a form-fit by means of a pin 255 (Fig. 1a, Fig. 9). To this end, the pin 255 extends through openings 1e (in this case bores) in two lugs 1f that are spaced apart on the brake calliper 1, and engages over the hold-down clip 250, the end 251 of the hold-down clip 250 lying on the brake calliper 1 between the lugs 1f. The T-shaped design of the end 251 here ensures that the hold-down clip 250 is unable to slip through the lugs 1f in an axial direction.

Lugs or projections 213, 214 formed integrally on the pad carrier 210 on the top of the pad carrier 210 pass through slots 231, 232 provided at either end of the pad-holding spring 230 (once again see Fig. 4).
The cover 240, which preferably has an approximately rectangular cross section (see Fig. 4 in particular and also Fig. 15) with two parallel legs 241, 242 that are connected to one another by a web 243 above the pad carrier 210 and a further web 244 (that passes through an opening of the pad

carrier 210), is provided to ensure the preferably non-releasable connection between the pad-holding spring 230 and the pad carrier 210.

Made approximately centrally between the slots 231, 232 in the pad-holding spring 3 is a longitudinal slot 233 through which one of the legs 242 of the cover 240 is inserted. Like the opposite leg 241, this leg 242 abuts or approximately abuts an associated wide side of the pad carrier 210.

As is also clearly visible in Fig. 5, the pad-holding spring 230 is preferably wider or thicker than the axial thickness of the pad carrier 210 such that the pad-holding spring 230 protrudes in the direction of the friction pad 220, whereas its other longitudinal edge is approximately flush with the rear of the pad carrier 210. Fig. 5 also shows how the connecting web 244 that runs parallel to the web 243 connects to the legs 241 at the bottom.

Any non-destructive detachment of the cover 240 is excluded by means of a preferably cohesive connection, thereby ensuring the secure fastening of the pad-holding spring 230. The cover 240 may also be cohesively fastened to the pad-holding spring 230 or to the pad carrier 210.

Moreover, the legs 241, 242 have a preferably trapezoidal shape, the wide side being formed by the web 243 while the narrower side is defined by the connecting web 244, which in this arrangement can be passed through the through-hole 215 in the pad carrier 210. As already described, the longitudinal slot 233 is preferably arranged approximately centrally in relation to the longitudinal extent of the pad-holding spring 230. This longitudinal slot 233 is particularly preferably arranged exactly centrally (see also EP 1 963 702 B1 and EP 2 255 101 B1 for further background).

The cover 240 can preferably be titled radially to a limited extent at the pad carrier 210. To this end, the web 244 of the cover 240 extends through the through-hole 215.

Since the position of the reaction-side brake pad 220 in the brake calliper 1 does not change even with increasing wear, it is possible to configure the hold-down clip 250 as one unit with the reaction-side brake pad 200. The

cover 240 is particularly expedient for this purpose and so assumes a further, hitherto unknown, function: fixing the hold-down clip (as shown in Figs. 4, 11 and Figs. 5 and 12, for example). This creates a particularly advantageous reaction-side brake pad 200 with a short hold-down clip 250 of a type advantageously restricted to the function of holding down this one brake pad, and preferably takes the form of an integrated component. These advantages include simple fitting, reduced production costs, relatively low loads and a guarantee of correct fitting.

An embodiment in which the hold-down clip 250 and this brake pad together form one unit that can be replaced in its entirety when the pad is changed is therefore advantageous. This is simple and results in the renewal of all the elements in the "reaction-side pad" unit (brake pad, pad spring, if present: cover and hold-down clip) to be replaced.

Whereas in Figs. 2 to 8 the hold-down clip 250 extends through the ring 245 of the cover 240, to which the hold-down clip 250 is preferably also cohesively fixed, Figs. 9 to 15 show the use of a pin 254 (collar bolt, head bolt, etc.) for fastening the hold-down clip 250 to the cover 240 and thus to the brake pad 200. The pin 250 passes radially through the hold-down clip in the region of a bore 253 (Fig. 14) and is welded, for example, or fastened to the cover 240 in some other manner (e.g. by riveting, pressing etc.). The ring 245 may take the form of lugs of the cover 240 and may be circumferentially closed or non-circumferentially closed in form.

The hold-down clip 250 may also be arranged directly on the pad spring 230 or on the pad carrier 210 (the latter variant being illustrated by way of example in Fig. 16).

As shown in Fig. 16, the pad carrier 210 has an opening 216 in which engages the end 252 of the hold-down clip 250 that points towards the pad carrier 210 (i.e. "a portion located closer to the pad carrier 210"). The opening 216 may take the form of a blind hole or a through-hole. The other end 251 of the hold-down clip 250 (i.e. a region located closer to the brake calliper 1) may be fixed (preferably non-releasably) in/at the opening 1d in a form-fit and/or cohesively. The end 251 of the hold-down clip 250 closer to

the brake calliper 1 faces towards the brake calliper 1 and is fixed there (preferably releasably) in a form-fit and/or cohesively (not shown here), in a manner similar to that show in Fig. 1a or 17. There may also be provided on the hold-down clip 250 a spring 256 that can be used as a resilient support for the brake pad 210 in relation to a counter-bearing such as the brake calliper 1 (not shown here).

The hold-down clip 250 can thus engage fully or partially through the pad back-plate or the pad carrier 210. The spring 256 is then fastened to the hold-down clip such that, as already detailed above, the hold-down clip together with the spring 256 are connected captively to the reaction-side brake pad 200. The pad-holding spring is thus moved away or axially spaced apart from the brake pad 200. This offers the advantages already described in the introduction.

According to Figs. 17a, 17b, 17c and 17d, the hold-down clip 250 has a through-opening 257 (such as a bore, for example) preferably parallel to the brake disk 2, in which the end 251 of the hold-down clip 250 that is fastened to the brake calliper 1 is held by means of a/the bolt or pin 255 that runs parallel to the plane of the brake disk 2. To this end, the bolt or pin 255 passes through the through-opening 257 and the lugs 1f on the brake calliper 1. One end of the bolt or pin 255 has a head 255a outside the two lugs 1f, and the other end is secured by means of a securing element 260 (in this case a pin and washer). A form-fit means such as a projection 258 at the bottom of the pad-retaining clip at the other end 252 of the hold-down clip on the pad carrier 210 or on the pad spring 230 cooperates with a corresponding form-fit means on the pad carrier 210 to make a form fit such that the brake pad is fixed axially and radially. The end 251 of the hold-down clip 250 that is fastened to the brake calliper 1 also engages axially in a recess 1g of the brake calliper 1, additionally securing the hold-down clip 250 on the brake calliper.

A contour 2502 (a type of projection) on the end 251 of the hold-down clip 250 on the brake calliper 1 restricts the rotation of the hold-down clip 250, which is preferably not connected to the brake pad 200 here, and ensures that a predefined envelope contour of the brake is maintained. In the

variants described above this is also achieved by means of the end 251 of the hold-down clip 250 on the brake calliper 1. A further contour 2501 (a downward projection) on the hold-down clip that is inserted into the recess 1g facilitates the fitting of the hold-down clip 250, which must be pushed against a pad spring 230 in order to insert the bolt 255.

According to Fig. 18, the hold-down clip 250 is fastened detachably on the brake calliper 1 in a simple manner by means of one or more screws 259 that are screwed into the brake calliper 1, here in a radial direction, for example.

The through-opening or through-openings 257 for the bolt or pin 255 for fastening or holding the hold-down clip 250 may have a circular cross section or some other cross section, e.g. a polygonal cross section (as shown in Figs. 19a, 19b; Figs. 20a, 20b). The pin may therefore be appropriately shaped as a circular pin or a flat web (not shown here – it may also be curved at one end or have an angled portion or an enlarged head such that one side of it abuts the through-opening but is unable to slip through it). On the other side of the through-opening, the pin may be secured by means of a split pin or a nut on a threaded portion or by some other suitable means. The pin 255 in the form of the flat web is inserted through one or more through-openings 257 of the hold-down clip 250 and one or more corresponding through-openings of the lug or lugs 1f on the brake calliper 1, and fixed. This also prevents the hold-down clip 250 from rotating.

The hold-down clip 250 may be produced in a variety of ways. It may be formed as a punched/bent part (see, for example, Fig. 19a, where it is a flat web with two lugs that lies flat on the brake pad 200, or Fig. 20a, where it is a flat web that lies perpendicularly on the brake pad 200), or as a cast part, for example, or as a part produced in some other way.

The embodiments shown in Figs. 21a, b and 22a-c are considered in greater detail below.

A wear sensor (not shown) is integrated in each brake pad or friction pad 220 to detect wear arising at the brake pard of friction pad 220 due to

braking. Connected to each wear sensor is a signal cable (not shown) that has at least one conductor, preferably at least one electrical conductor. This at least one conductor may be enclosed in insulation and/or in a cable sheath.

At least one of the signal cables is laid so as to fully cross the opening 1d of the brake calliper 1 and runs to a brake-pad-wear detection and possibly display device of the disk brake (not visible here). To this end, the signal cable is arranged and held on a cable bridge 271. The cable bridge 271 bridges or crosses the opening 1d of the brake calliper 1 completely. It preferably bridges the opening 1d completely in an axial direction parallel or substantially parallel to the brake disk axis of rotation or axis.

The cable bridge 271 may be made of metal. It may also advantageously simply be a punched/bent part made from a metal sheet. However, it may also be made of another material.

The cable bridge 271 preferably has a central web portion 272. Here the web portion 272 is of straight design. When fitted, this web portion extends parallel to or substantially parallel to the brake disk axis of rotation D.

The web portion 272 preferably has first and second fastening means 273 and 274 at its two mutually averted ends. These first and second fastening means 273 and 274 of the cable holder or cable bridge 271 serve to fasten the cable holder 271 to corresponding first and second counterpart fastening means 275, 276 of the brake calliper 1 (Fig. 21) or of an element fastened to the brake calliper 1 (Fig. 22).

The first and second fastening means 273 and 274 of the cable holder or of the cable bridge 271 and the corresponding first and second counterpart fastening means 275, 276 of the brake calliper 1 may take the form of a substantially tolerance-free first fastening on one side of the opening 1d of the brake calliper 1, and of a second fastening with a tolerance-compensating action on the other side of the opening 1d.

To this end, in a variant with an easy to construct design, the first and second fastening means 273, 274 may take the form of a circular hole 273 and an elongated hole 274 at or in opposite ends of the cable holder 271. The corresponding counterpart fastening means 275, 276 may then advantageously and simply take the form of screws 275, 276 or pins, for example, of the brake calliper 1 that are fixed to the brake calliper 1, for example screwed fast into bores of the brake calliper 1.

If the end of the hold-down clip 250 that is fastened to the brake calliper 1 is fixed in a form-fit to the brake calliper 1 by means of a pin 255 (Fig. 1a, Fig. 9; Fig. 21), this pin 255 fixed to the brake calliper 1 is able to pass through the bore 276 (preferably the elongated hole for tolerance compensation purposes). The elongated hole 276 can then move on the pin. The end of the hold-down clip 250 with the bore 276 is then arranged in the manner of a washer between a head of the pin 255 and a contact surface of the brake calliper 1. This fastening variant is simple and inexpensive to produce because one single fastening means – the pin 255 – is used twice.

In a preferred embodiment the cross section of the web portion 272 of the cable holder 271 is preferably U-shaped. The closed side of the U preferably faces towards the brake pads 100, 200 in order to provide a shield against the heat that is radiated by the brake disk and the brake pads. The signal cable can then be placed in the U-shaped web portion 272 and secured there. To this end, lugs 277 can be formed on the web portion 272 and can be bent over once the signal cable 271 has been placed in the web portion 272 such that sections of the signal cable are held on the web portion 272 so as to be entirely or substantially circumferentially closed in.

The web portion 272 is able to engage freely over the opening 1d. This means that the two ends of the web portion 272 are fastened to the brake calliper 1 only, in the manner described above, for example, and preferably not to other elements of the disk brake.

Optionally or alternatively, however, the web portion 272 may also be fixed (at one of its ends or more centrally in the web region 271) to the hold-down

clip 250 that does not fully cross the opening 1d and holds down only one of the two brake pads 100, 200.

To this end it is advantageous to fix a further lug 278 of the web portion 272 to the pad-retaining clip 250 (see Figs. 22a-c). This may be done in a variety of ways. In a preferred variant, for example, it may be fixed by placing the lug 278 around a web 262 on the hold-down clip 250 to encompass it. In this arrangement is it also advantageous for the web 272 to project axially like a sort of finger element from the end of the hold-down clip 250 and for this finger element to radially hold down the brake pad assigned to it. It is thus possible for the hold-down clip 250 and the web portion 271 to move simply and to a limited extent in relation to one another, in particular to pivot in relation to one another. Relative movements of this type may arise during braking. The lug 278 alone may thus form the counterpart fastening means 276. The hold-down clip 250 is fastened to the brake calliper 1 and the cable bridge 271 is thus in turn fastened – indirectly – to the brake calliper 1.

However, the web portion 272 may also be fastened to the pad-retaining clip 250 in some other way, such as by means of at least one screw or a rivet, for example.

It is thus advantageous, generalising from the variant shown in Fig. 22, for the cable bridge 271 to be fastened in a force-fit and/or a form-fit to the hold-down clip 250, in particular to the web 262 of the hold-down clip 250. A force fit may be achieved by clamping the cable bridge 272 laterally to the hold-down clip 250 (not shown). It is possible, in particular, to attach it laterally – tangentially – in the circumferential direction to the hold-down clip 250 on a narrow side of the hold-down clip 250.

This forms a type of cable bridge 272 that preferably performs the dual functions of cable guidance and thermal and mechanical shielding. As already described, the cable bridge 272 is attached permanently to the application side of to the brake calliper 1 (screw connection). On the reaction side, the cable bridge is fixed to the pad-retaining clip bolt or pin 255 by means of an elongated hole in a type of floating bearing arrangement with a

tolerance-compensating action. The cable bridge 272 is thus able to compensate effectively for calliper deformation.

However, the fastening may also be realised by configuring the pad-holding bolt or pin as a fixed bearing and configuring the fastening to the calliper on the other side of the opening 1d as a floating bearing.

The cable guide on the cable bridge 272 is designed to be as far from the brake disk as possible in order to keep the thermal load as low as possible. The cable guide is positioned so as to be situated in the shadow of the axial tension struts of the brake calliper 1, thereby affording them effective protection against foreign bodies (e.g. ice, dirt, stones) entrained by the wheel rim. This enables the necessary sheet-metal thickness at the cable guide to be reduced to a minimum.

The invention is not limited by the embodiments described above. It may be modified in a variety of ways within the scope of the appended claims.

KEY TO REFERENCE NUMERALS

Brake calliper	1
Application portion	1a
Calliper back	1b
Tension strut	1c
Opening	1d
Openings (bores)	1e
Lugs	1f
Recess	1g
Brake disk	2
Brake disk axis of rotation	2a
Brake carrier	3
Guide bars	4
Pad slots	11, 12
Support surfaces	11a, 11b; 12a, 12b
Pad-slot base	11c; 12c
Brake carrier horns	13, 14 and 15, 16
Undercut	17, 18
Brake pad	100
Pad carrier	110
Lateral edges	111, 112
Projection	113, 114
Retaining clip	115
Lugs	116, 117
Friction pad	120
Pad spring	130
Slot	131, 132
Ends	133, 134
Brake pad	200
Pad carrier	210

Lateral edges	211, 212
Lugs	213, 214
Through-hole	215
Opening	216
Form-fit means	217
Friction pad	220
Pad spring	230
Slots	231, 232, 233
Cover	240
Leg	241, 242
Web	243
Connecting web	244
Ring	245
Hold-down clip	250
End	251
End	252
Bore	253
Pin	254
Bolt/pin	255
Spring	256
Through-opening	257
Projection	258
Screws	259
Securing element	260
Lugs	261
Web	262
Contours	2501, 2502
Cable bridge	271
Web portion	272
Fastening means	273, 274
Counterpart fastening means	275, 276

Lugs	277
Lug	278
Direction of rotation	U
Axis of rotation	D

Patentkrav

1. Skivebremse (100) til et erhvervskøretøj, med
a) en bremsesaddel (1), som griber over en bremseskive (2) og fortrinsvis er udformet som en skydesaddel, hvilken bremsesaddel er anbragt på en stationær bremsebærer (6) og med en tilspændingsindretning til tilspænding af bremsen,
b) to bremsebelægninger (100, 200), som hver især har en belægningsbærer (110, 210) og en derpå befæstet friktionsbelægning (120, 220), hvoraf den ene som tilspændingssidig bremsebelægning (100) kan presses ind mod bremseskiven (2) ved hjælp af tilspændingindretningen på den ene side af bremseskiven (2), og hvoraf den anden som reaktionssidig bremsebelægning (200) er anbragt på den modsat beliggende side af bremseskiven (2), og som hver især er sat ind i en belægningsskakt (11, 12),
c) hvor bremsesadlen har en central saddelåbning (1d) over bremseskiven (2), hvorigennem de to bremsebelægninger (100, 200) kan sættes ind i den respektive belægningsskakt,
kendetegnet ved, at
d) der er tilvejebragt en nedholdebøjle (250), som er udformet på en sådan måde, at denne udelukkende radialt sikrer den ene af de to bremsebelægninger (100), 200) i sin belægningsskakt (11, 12), og
e) nedholdebøjlen (250) er holdt på bremsesadlen (1) med sin ende, der vender væk fra bremsebelægningen (200).

2. Skivebremse ifølge krav 1, **kendetegnet ved, at** nedholdebøjlen (250) udelukkende radialt sikrer den reaktionssidige bremsebelægning (200) i belægningsskakten (12).

3. Skivebremse ifølge krav 2, **kendetegnet ved, at** nedholdebøjlen (250) griber over den ene bremsebelægning (200) helt eller delvist aksialt parallelt med bremseskiven (2).

4. Skivebremse ifølge krav 2 eller 3, **kendetegnet ved, at** nedholdebøjlen (250) udelukkende griber over den reaktionssidige bremsebelægning (200)

fortrinsvis helt eller delvist aksialt parallelt med bremseskiven (2) og sikrer denne radialt i sin belægningsskakt.

5. Skivebremse ifølge krav 2, 3 eller 4, **kendetegnet ved, at** nedholdebøjlen (250) med sin ende, der vender væk fra især den reaktionssidige bremsebelægning (200), som skal sikres radialt, er holdt frigørligt på bremsesadlen (1).

6. Skivebremse ifølge et af de foregående krav, **kendetegnet ved, at** nedholdebøjlen (250) er fastgjort især på den reaktionssidige bremsebelægning (200), der skal sikres radialt, især er fastgjort ikke-frigørligt på en del af den reaktionssidige bremsebelægning (200).

7. Skivebremse ifølge et af de foregående krav, **kendetegnet ved, at** belægningsskakten af især den reaktionssidige bremsebelægning, som skal sikres, er udformet i bremsebæreren (110) eller i bremsesadlen (1), og at belægningsskakten af den tilspændingssidige bremsebelægning er udformet i bremsebæreren (110).

8. Skivebremse ifølge krav 6 eller 7, **kendetegnet ved, at** nedholdebøjlen (250) er fastgjort på en hætte (240) og/eller en belægningsfjeder (230) af bremsebelægningen (200), som skal holdes nede.

9. Skivebremse ifølge et af de foregående krav, **kendetegnet ved, at** belægningsfjederen (230) helt eller delvist går gennem hætten (240).

10. Skivebremse ifølge et af de foregående krav, **kendetegnet ved, at** belægningsfjederen (230) er udformet i ét stykke med hætten (240), eller at den er forbundet med hætten (240) på en materialesluttende måde.

11. Skivebremse ifølge et af de foregående krav, **kendetegnet ved, at** nedholdebøjlen (250) er forbundet med hætten (240) på en formsluttende måde.

12. Skivebremse ifølge et af de foregående krav, **kendetegnet ved, at** nedholdebøjlen (250) er befæstet på bremsesadlen (1) på en frigørlig eller ikke

frigørlig måde eller er udformet med denne i ét stykke.

13. Skivebremse ifølge et af de foregående krav, **kendetegnet ved, at** den tilspændingssidige bremsebelægning (100) ved hjælp af en formslutning er sikret radialt i bremsebæreren (3) i sin belægningsskakt.

14. Skivebremse ifølge et af de foregående krav, **kendetegnet ved, at** den tilspændingssidige bremsebelægning (100) ved hjælp af fremspring (17, 18) på belægningsbæreren (210) er sikret radialt i bremsebæreren (3).

15. Skivebremse ifølge et af de foregående krav, **kendetegnet ved** en kabelbro (271), på hvilken der er anbragt og holdt mindst et signalkabel, hvilken kabelbro forbinder åbningen (1d) af bremsesadlen (1), og hvilken kabelbro i mindst to områder er direkte eller indirekte befæstet på bremsesadlen (1).

16. Skivebremse ifølge et af de foregående krav, **kendetegnet ved, at** kabelbroen (271) har et forbindelsesstykkeafsnit (272), der på sine begge ender, der vender væk fra hinanden, har første og andre befæstelsesmidler (273 og 274), som er udformet til befæstelse af kabelbroen (271) på tilsvarende første og andre modbefæstelsesmidler (275, 276) af bremsesadlen (1).

17. Skivebremse ifølge et af de foregående krav, **kendetegnet ved, at** de første og andre befæstelsesmidler (273 og 274) af kabelbroen (271) og de tilsvarende første og andre modbefæstelsesmidler (275, 276) af bremsesadlen (1) hhv. på en side af åbningen (1d) udgør en i videst muligt omfang tolerancefri første befæstelse og på den anden side af åbningen (1d) af bremsesadlen (1) en anden befæstelse, der virker på en toleranceudlignende måde.

18. Skivebremse ifølge et af de foregående krav, **kendetegnet ved, at** de første og andre befæstelsesmidler (273 og 274) er udformet som et hul og som et langhul.

19. Skivebremse ifølge et af de foregående krav, **kendetegnet ved, at** de første og andre befæstelsesmidler (273 og 274) er udformet som et hul og som et langhul, som hver især gennemgribes af en skrue eller en stift (255), der er

fastgjort på bremsesadlen.

20. Skivebremse ifølge krav 19, **kendetegnet ved, at** stiften (255) også tjener til befæstelse af nedholdebøjlen (250).

21. Skivebremse ifølge et af kravene 15 til 20, **kendetegnet ved, at** kabelbroen er befæstet på nedholdebøjlen (250), især på et forbindelsesstykke (262) af nedholdebøjlen (250), på en kraft- og/eller formsluttende måde.

22. Bremsebelægningssæt til en skivebremse ifølge et af de foregående krav, med
a) en reaktionssidig bremsebelægning (200), som har en belægningsbærer (210) og en derpå befæstet friktionsbelægning (220), hvor bremsebelægningen er udformet til at samvirke med en nedholdebøjle (250), hvilken nedholdebøjle (250) er udformet på en sådan måde, at denne udelukkende radialt sikrer den reaktionssidige bremsebelægning (200) i sin belægningsskakt (12) på en skivebremse, og
b) med en tilspændingssidig bremsebelægning (100), som ved hjælp af mindst et formslutningselement på belægningsbæreren (110) er sikret radialt i bremsebæreren, hvortil den tilspændingssidige bremsebelægning (100) ved hjælp af fremspring (113, 114) på belægningsbæreren (110) er sikret radialt i bremsebæreren (200).

23. Bremsebelægningssæt (100, 200) ifølge krav 22, **kendetegnet ved, at** den reaktionssidige bremsebelægning (200) er udformet som konstruktionsenhed med en nedholdebøjle (250), hvilken nedholdebøjle (250) er udformet på en sådan måde, at denne udelukkende radialt sikrer den reaktionssidige bremsebelægning (200) i sin belægningsskakt 12) på en skivebremse.

24. Bremsebelægningssæt ifølge krav 23, **kendetegnet ved, at** nedholdebøjlen (250) er fastgjort, er fortrinsvis ikke-frigørligt fastgjort, på den reaktionssidige bremsebelægning (200).

25. Bremsebelægningssæt ifølge krav 24, **kendetegnet ved, at** nedholdebøjlen (250) er befæstet på en hætte (240) og/eller en belægningsfjeder (230).

26. Bremsebelægningssæt ifølge et af de foregående krav 22 til 25, **kendetegnet ved, at** nedholdebøjlen (250) er udformet i ét stykke med hætten (240).

27. Bremsebelægning ifølge et af de foregående krav, **kendetegnet ved, at** nedholdebøjlen (250) er forbundet med hætten (240) på en materialesluttende måde og/eller er forbundet med denne på en formsluttende måde.

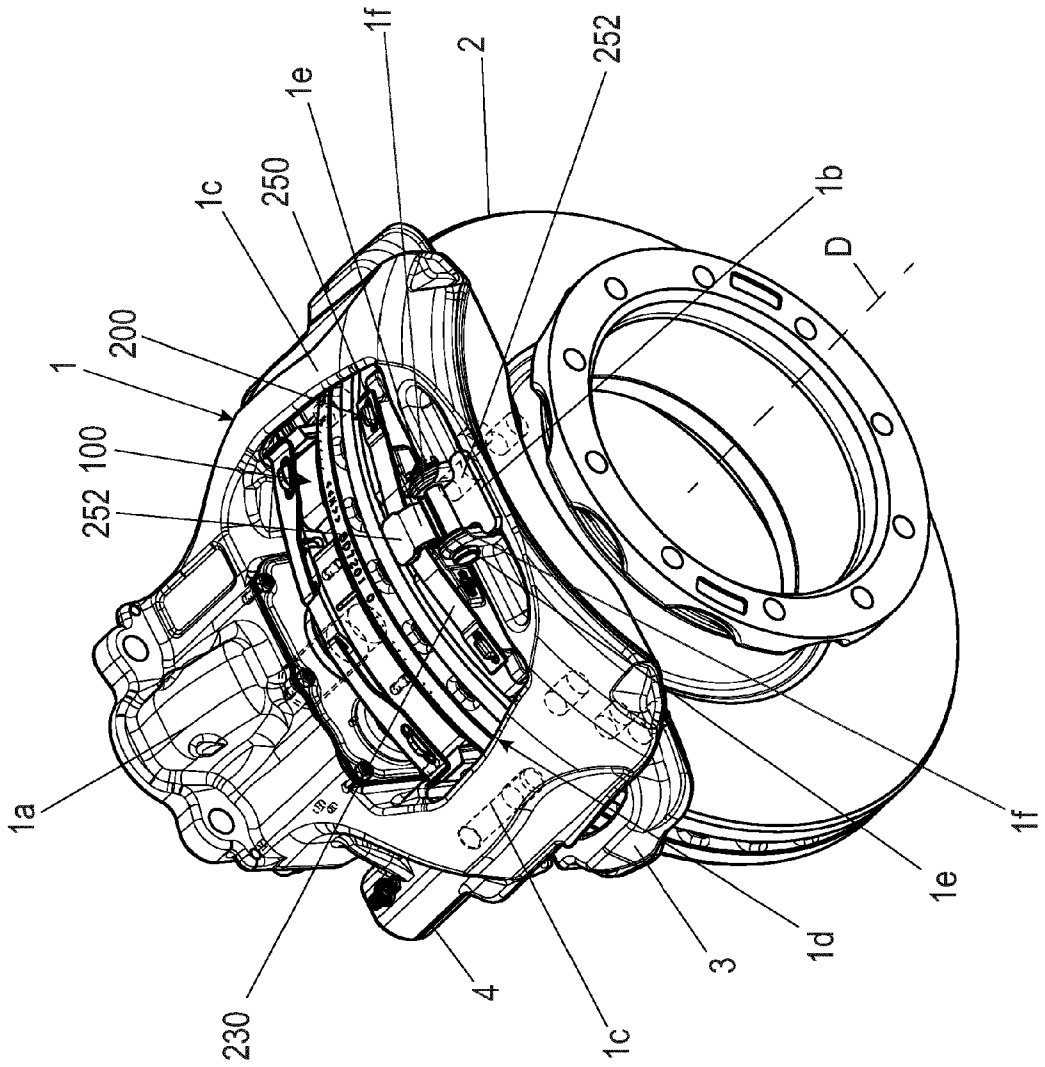


Fig. 1a

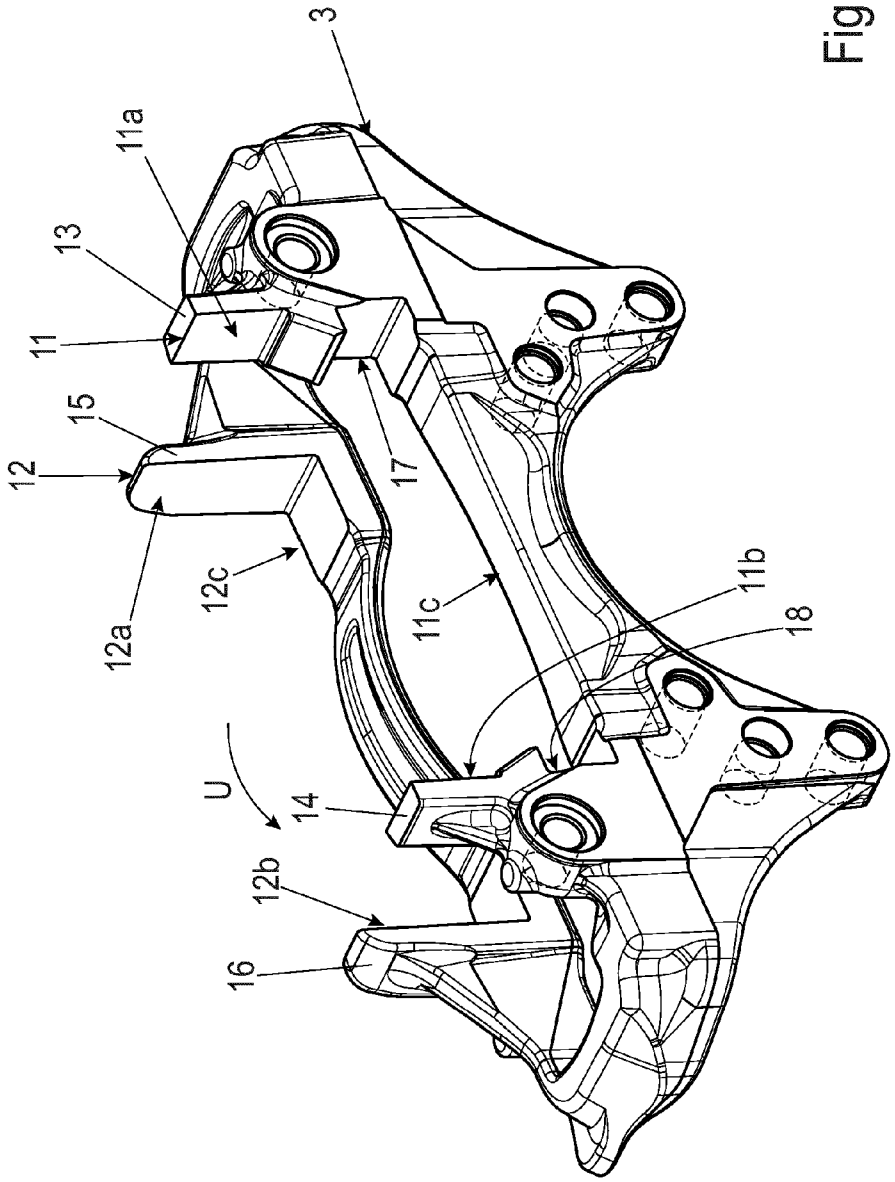
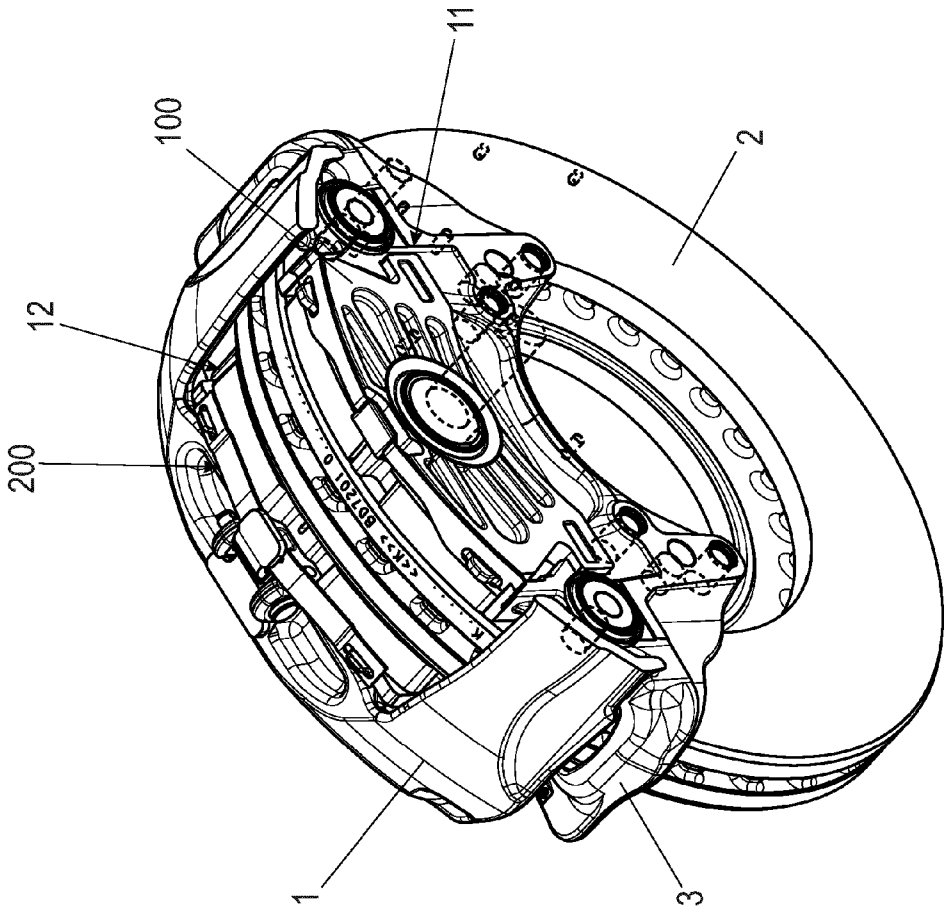


Fig. 1b

Fig. 2



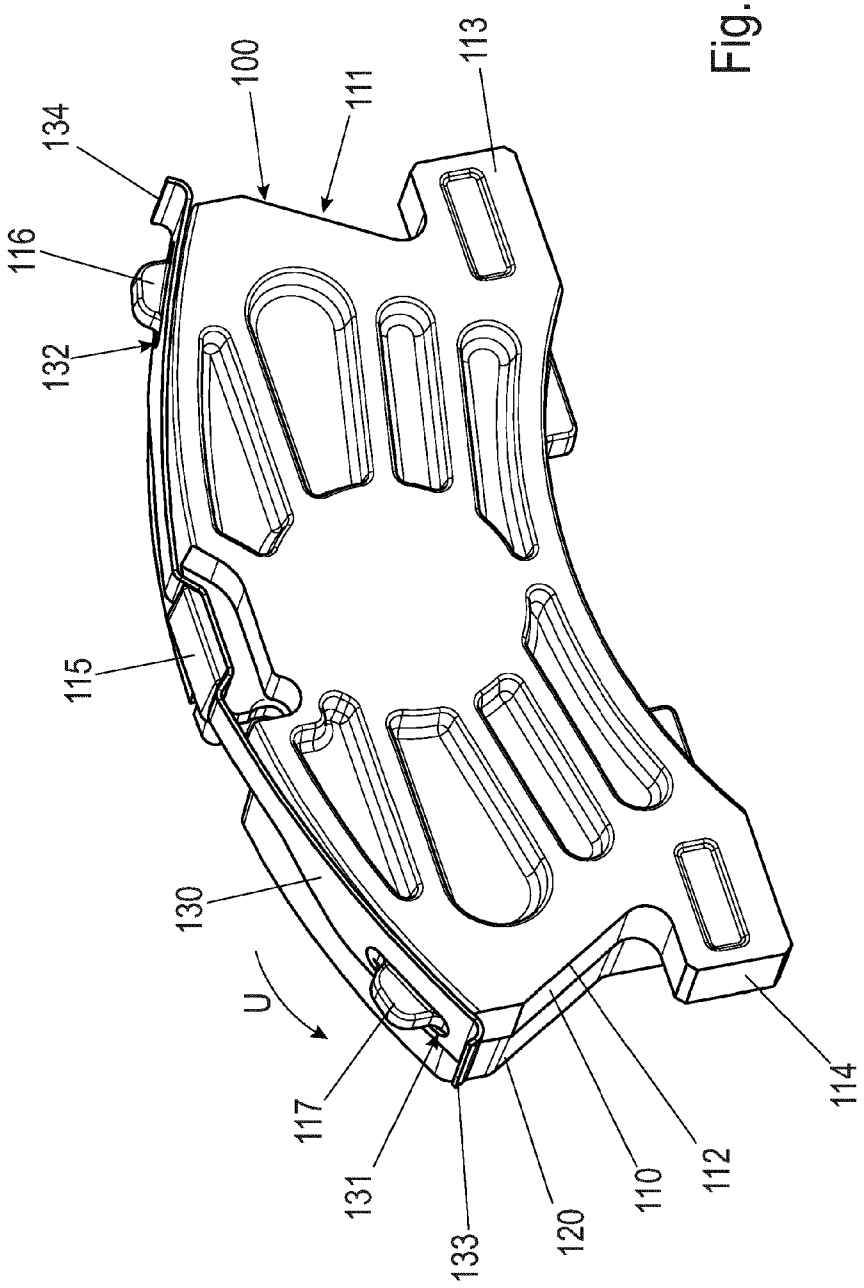


Fig. 3

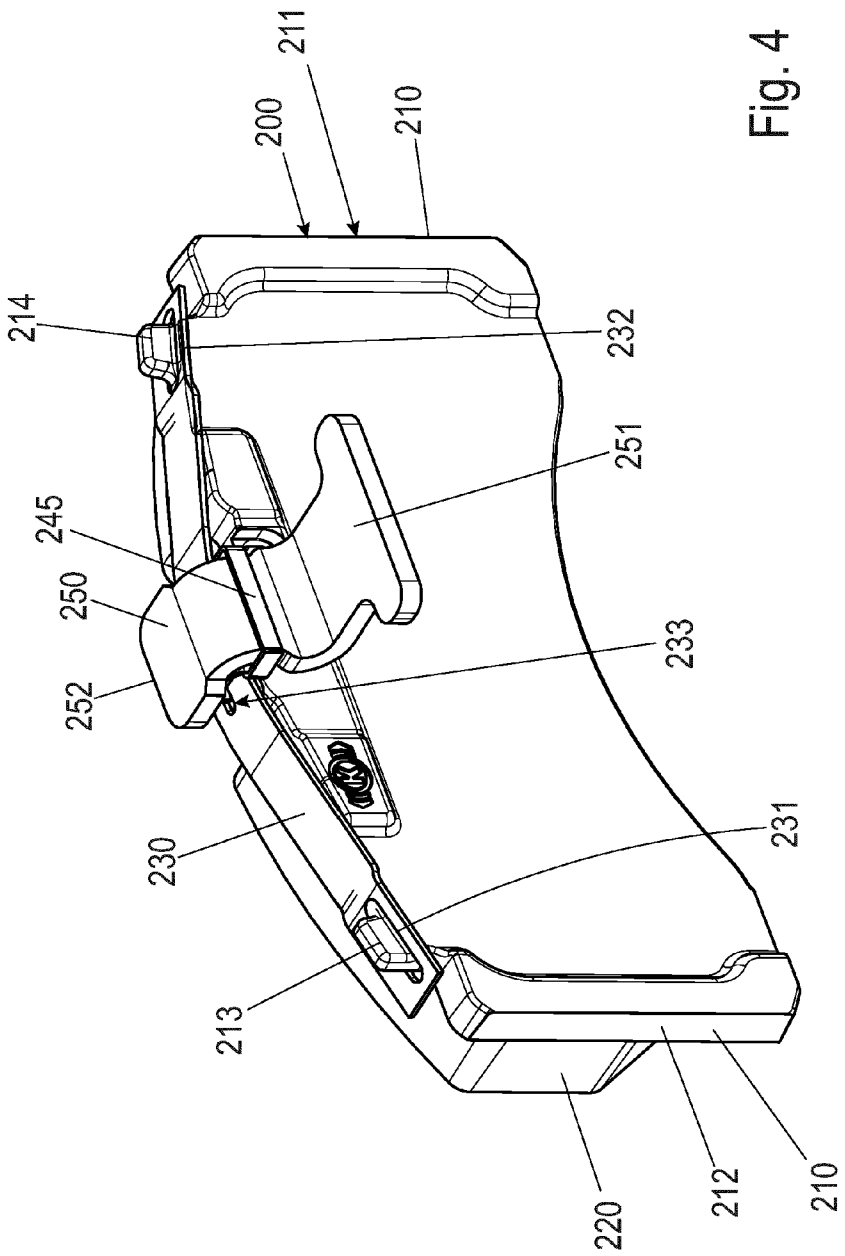
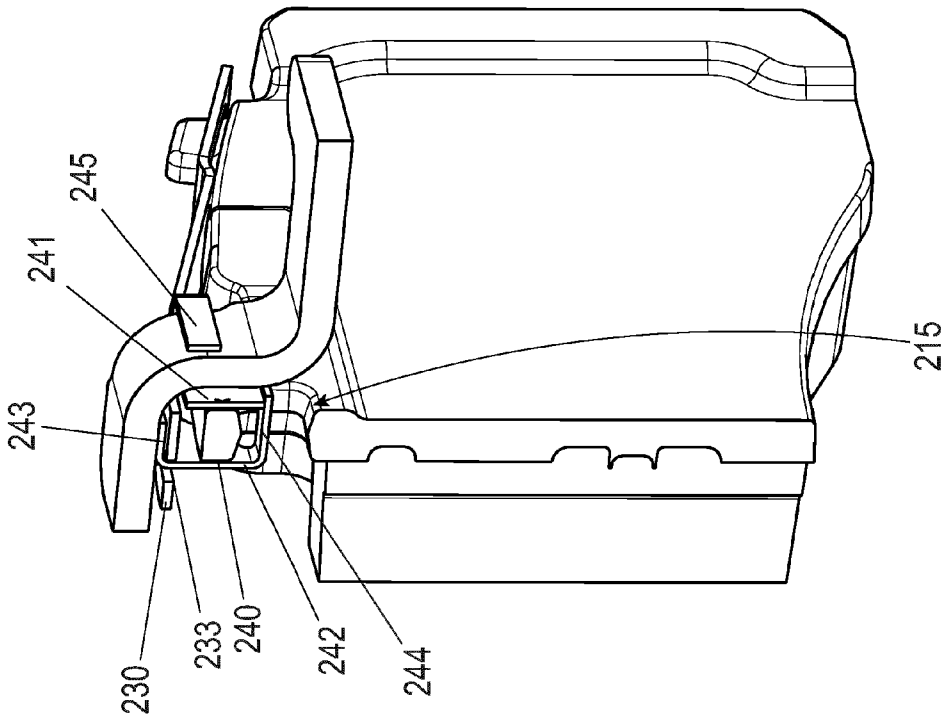


Fig. 4

Fig. 5



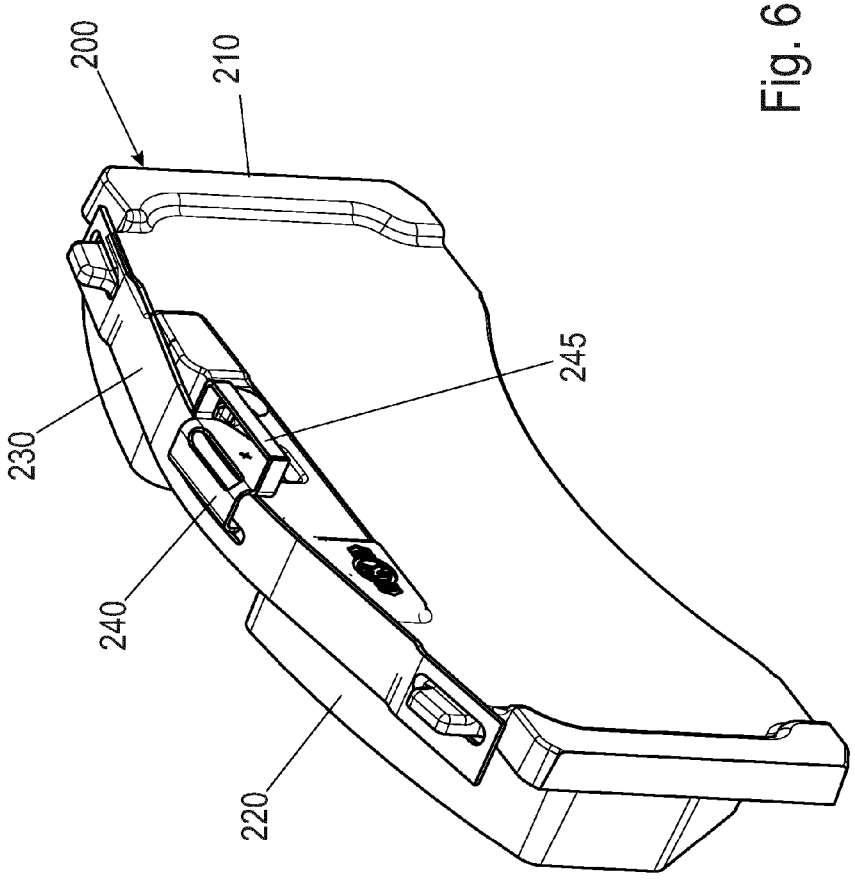


Fig. 6

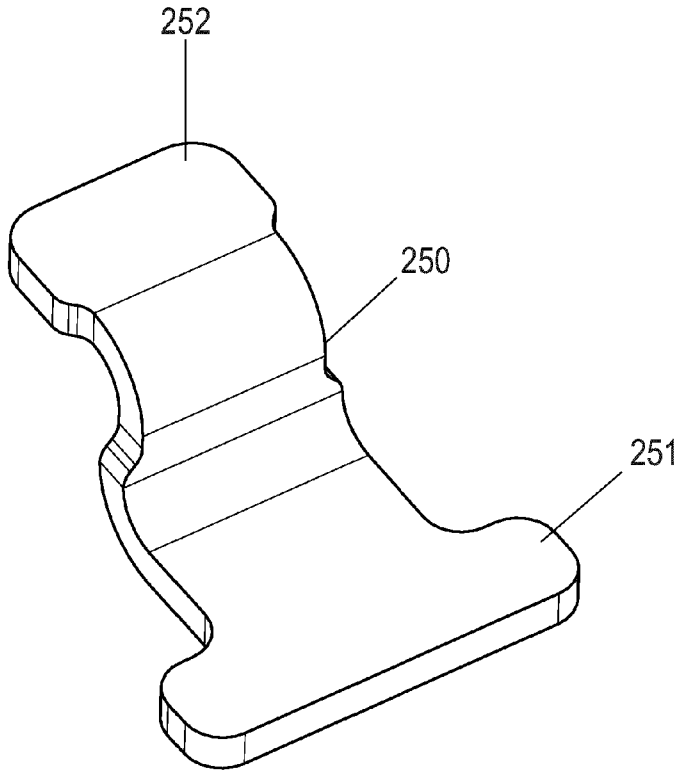


Fig. 7

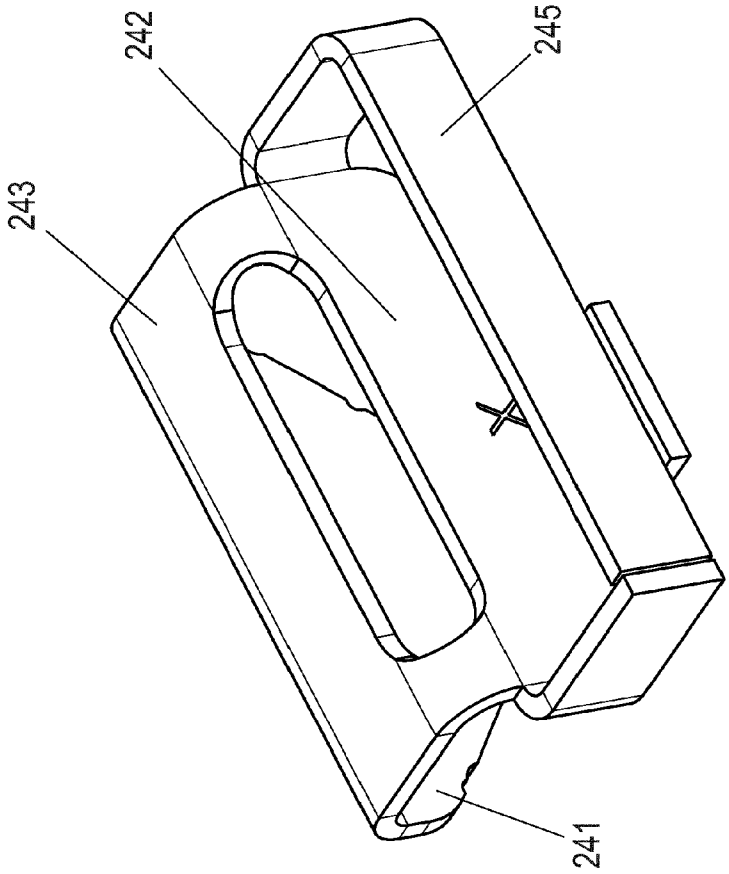
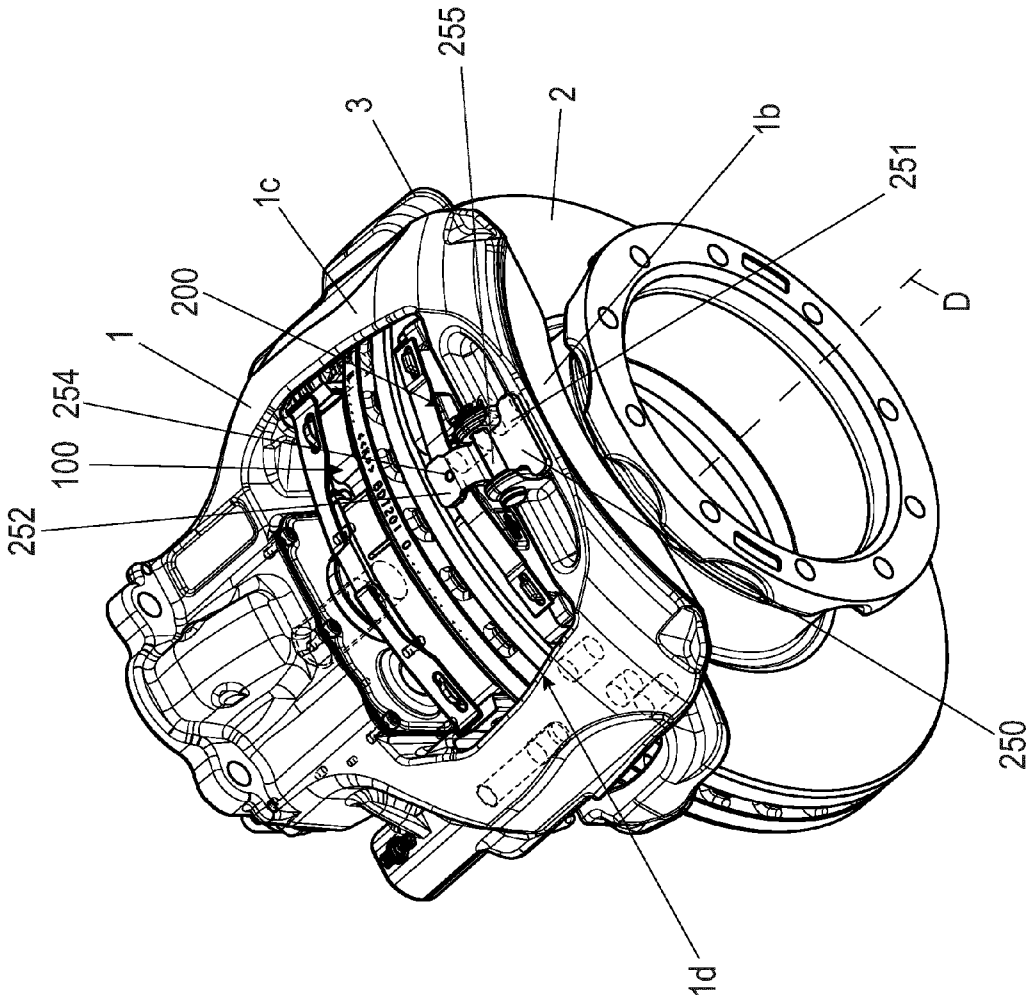


Fig. 8

Fig. 9



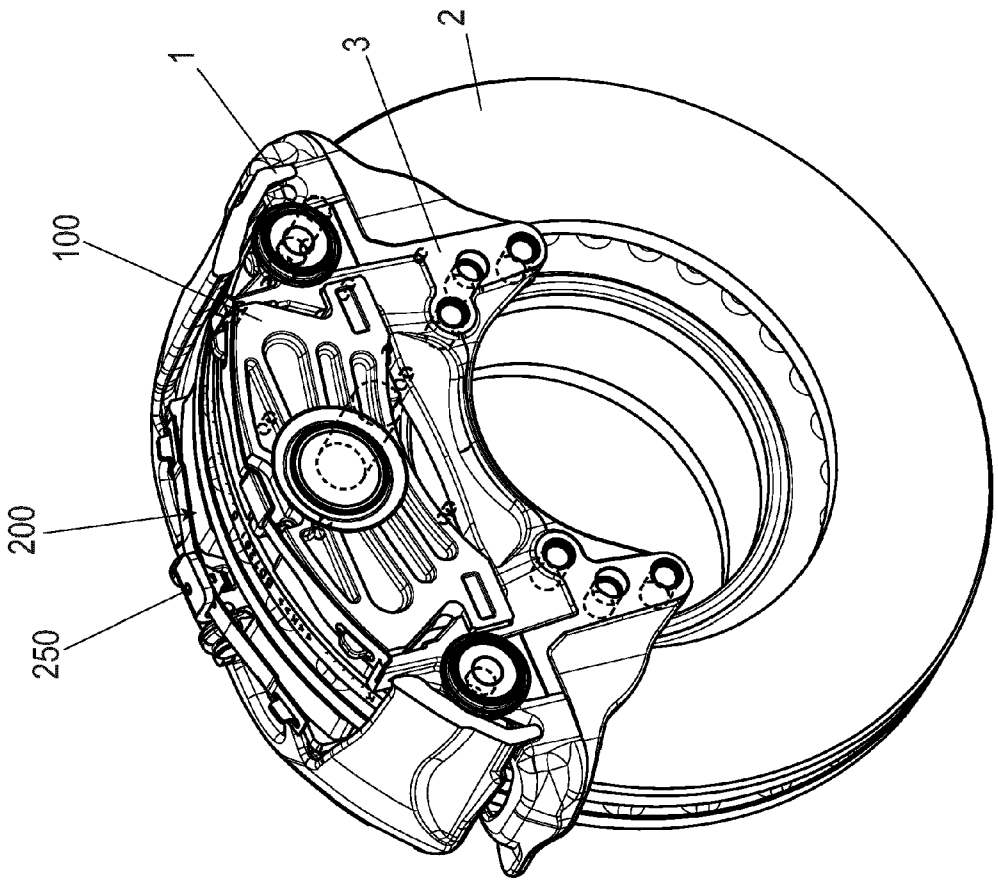


Fig. 10

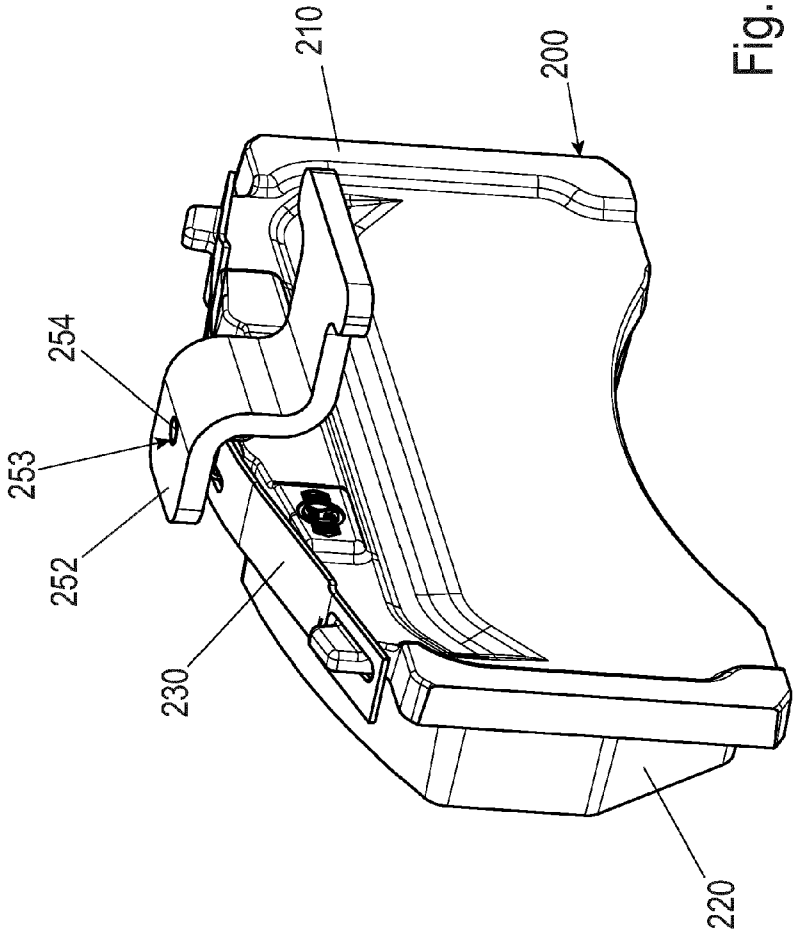
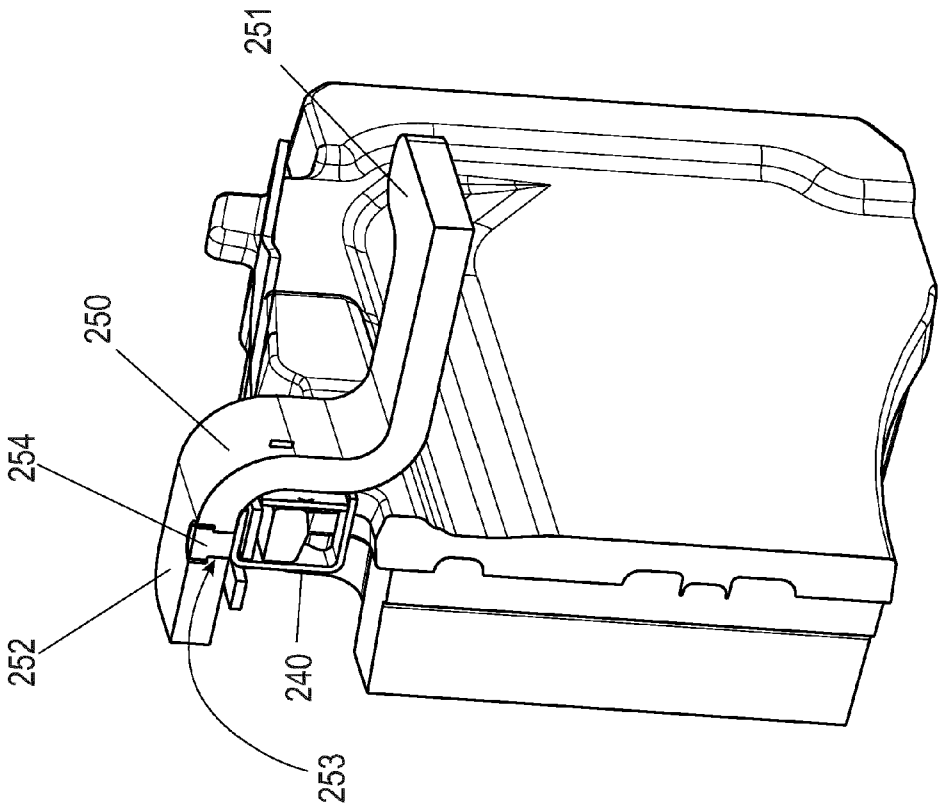


Fig. 11

Fig. 12



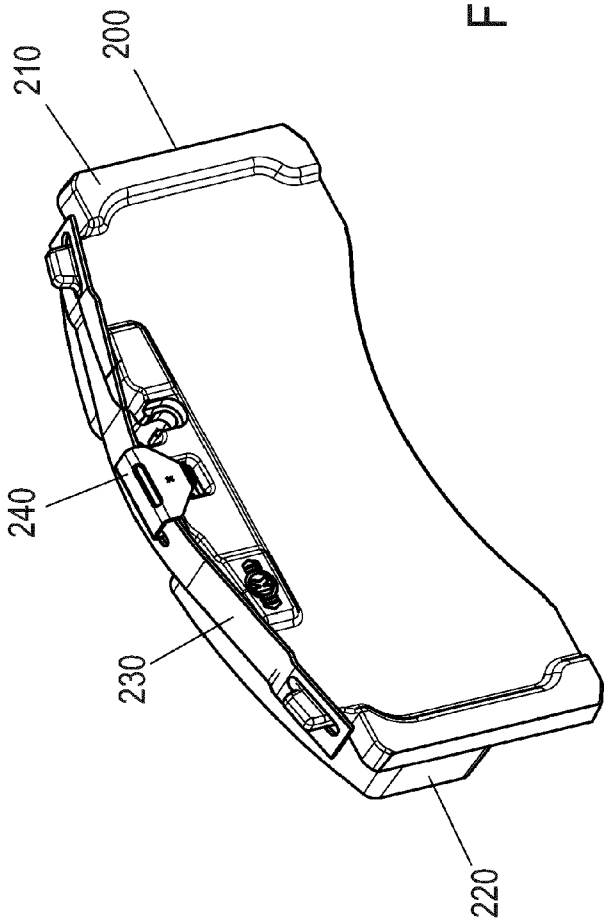


Fig. 13

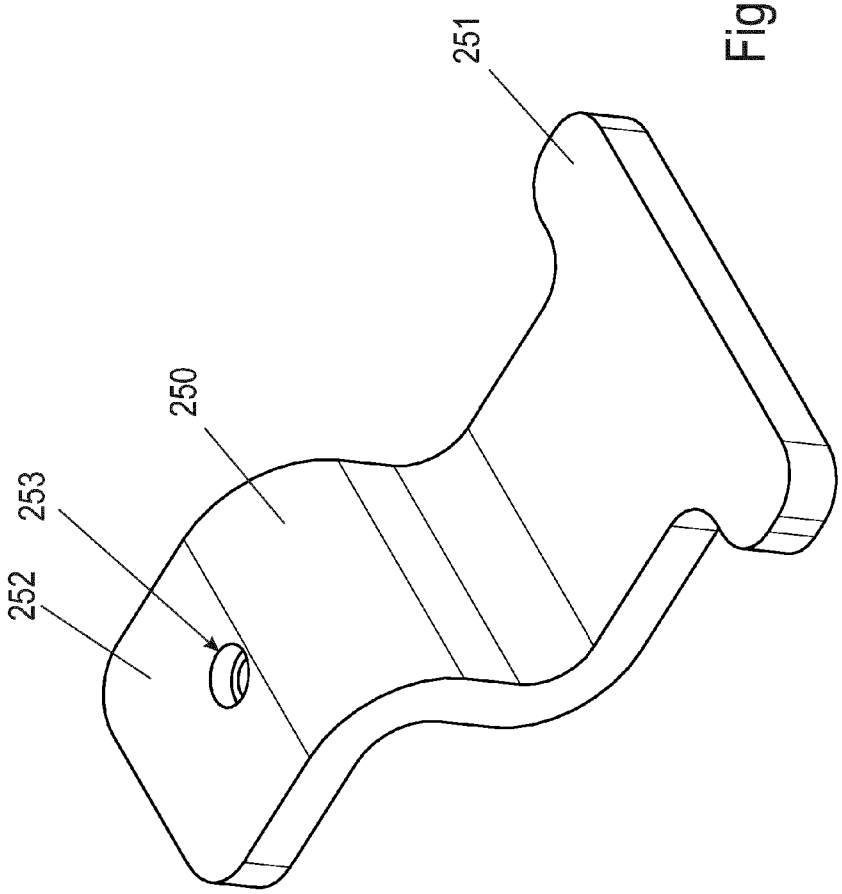


Fig. 14

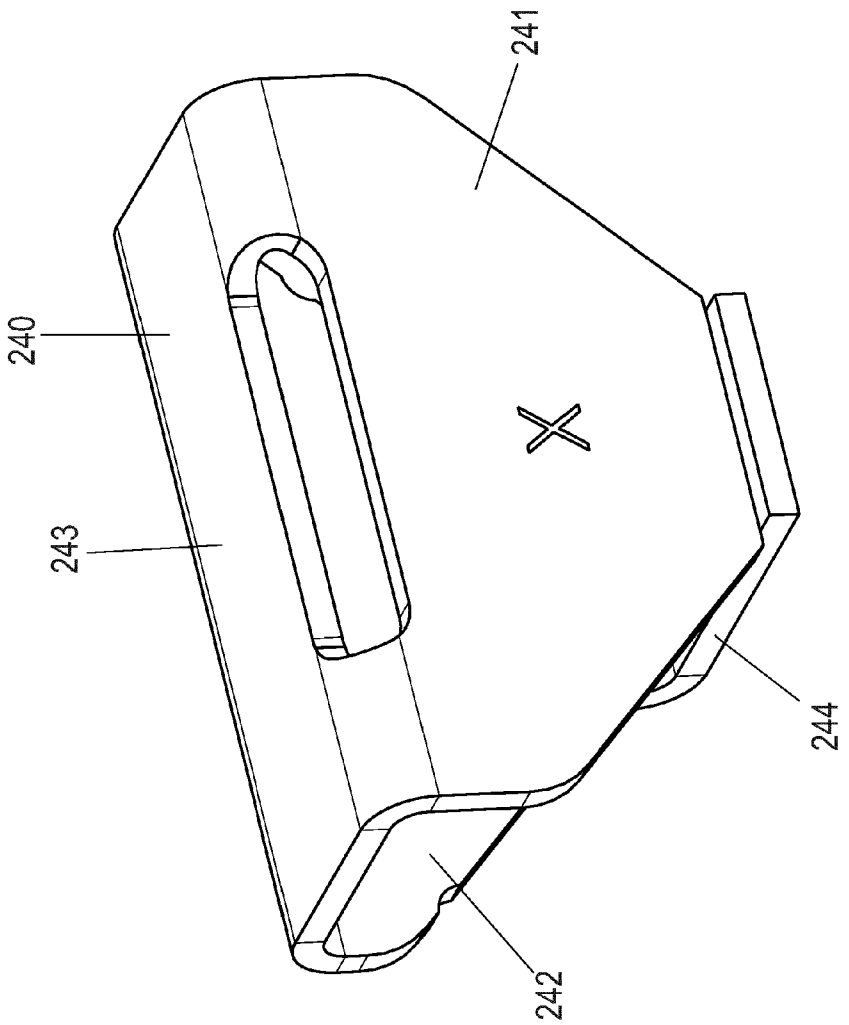


Fig. 15

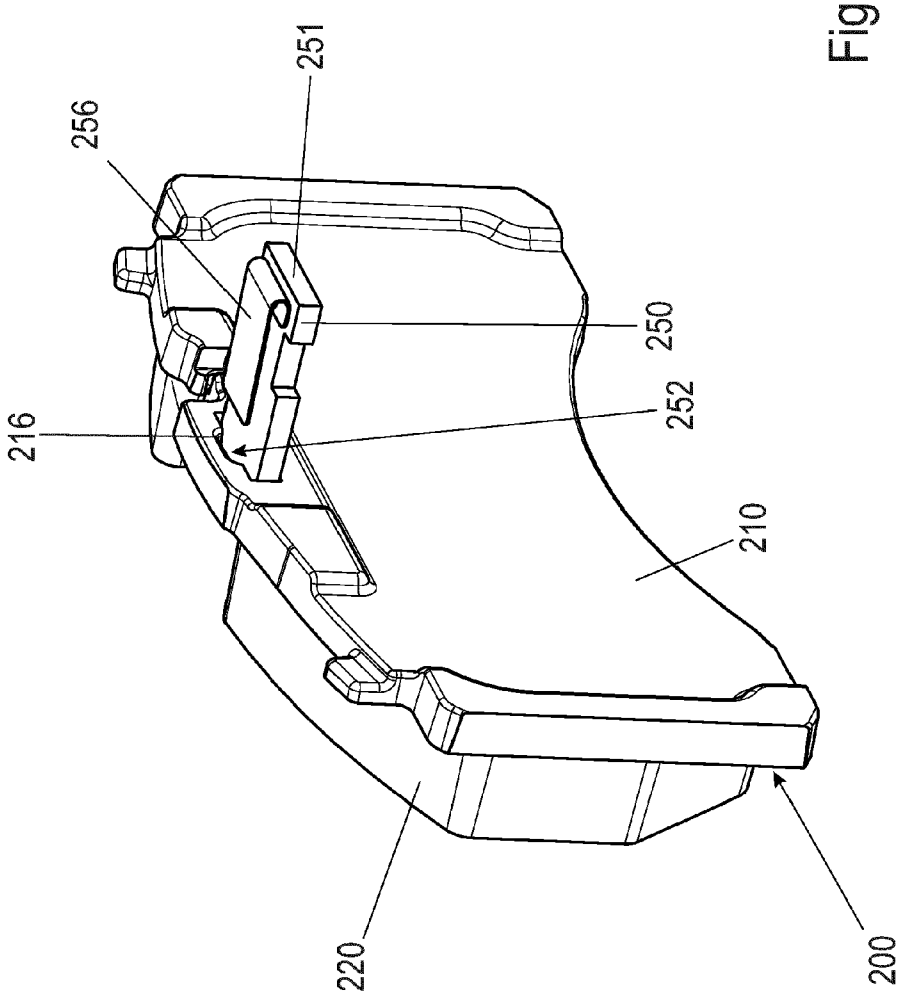
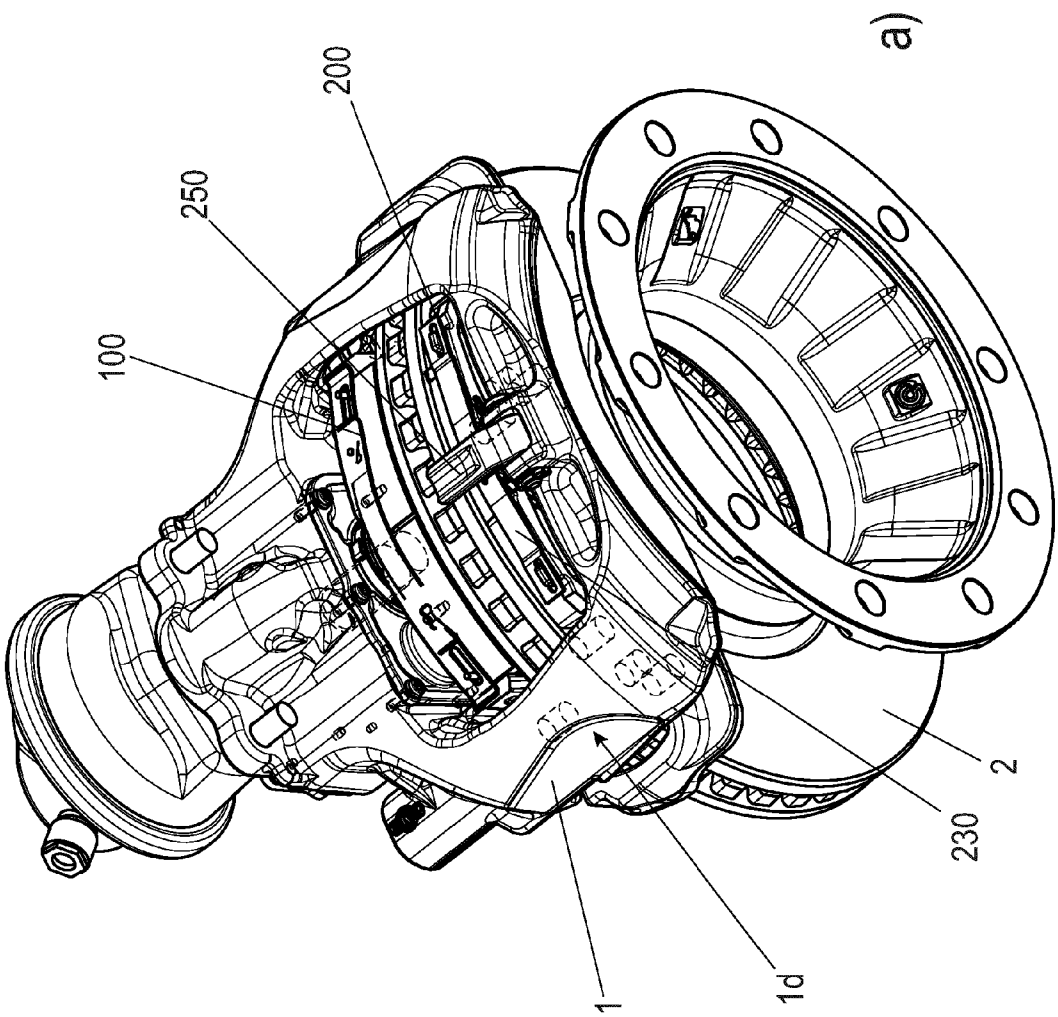
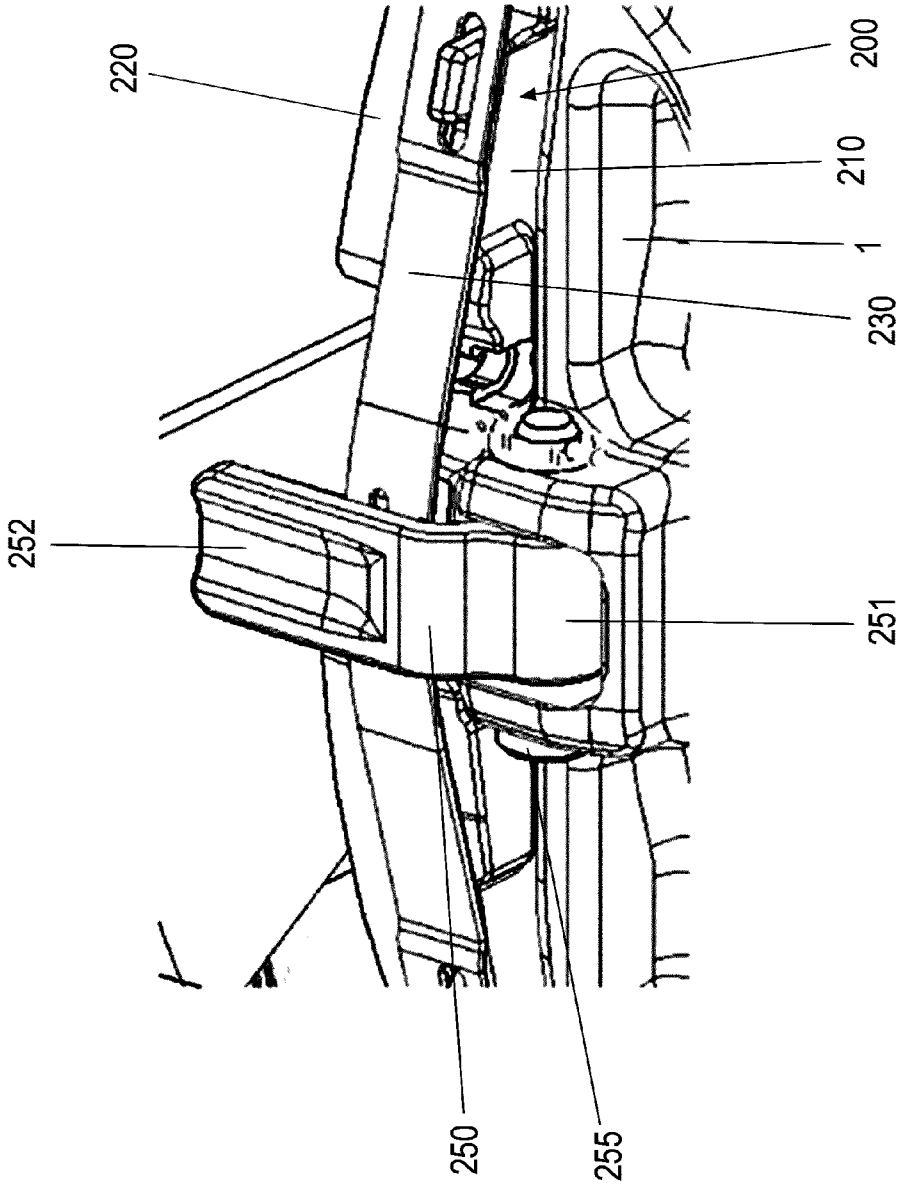


Fig. 16

Fig. 17





b)

Fig. 17

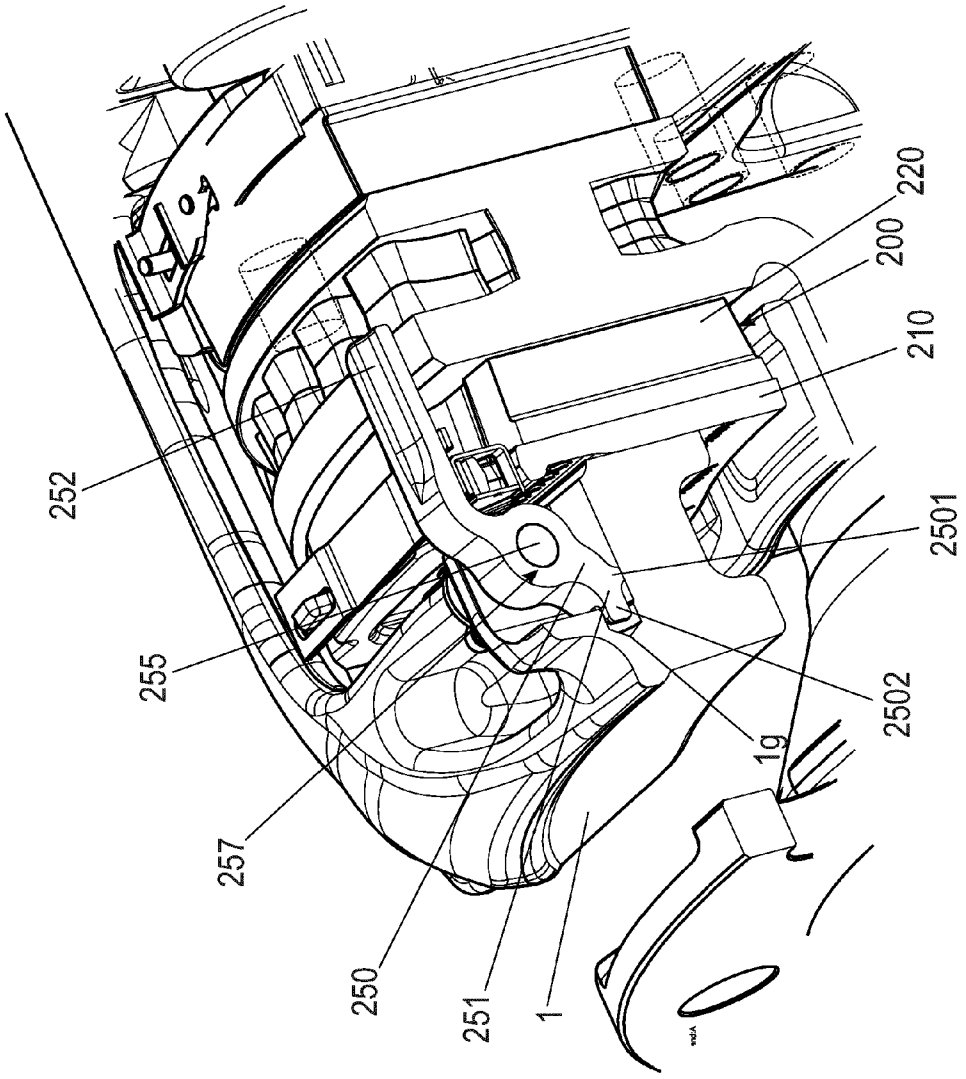


Fig. 17

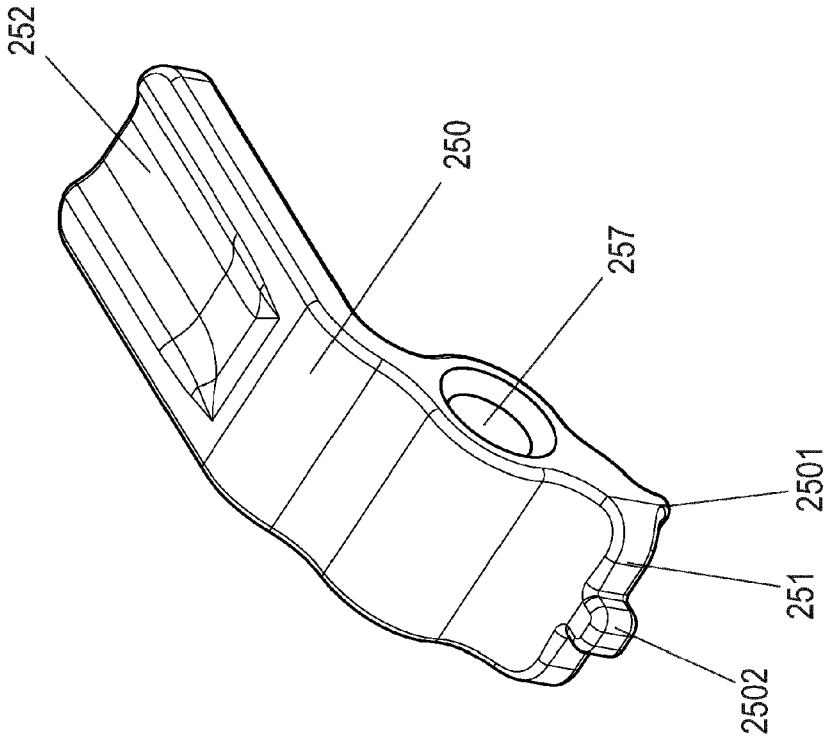


Fig. 17

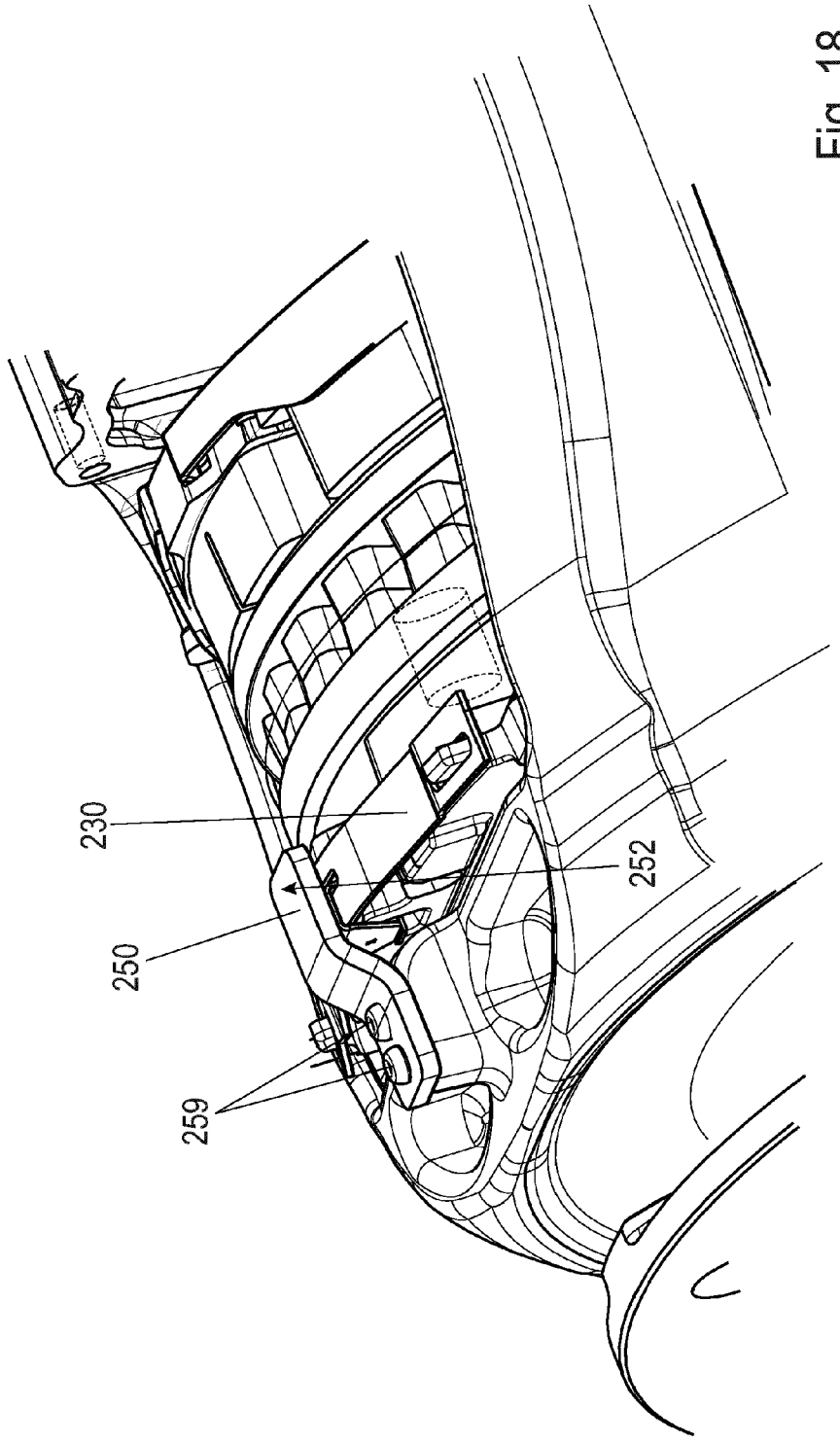


Fig. 18

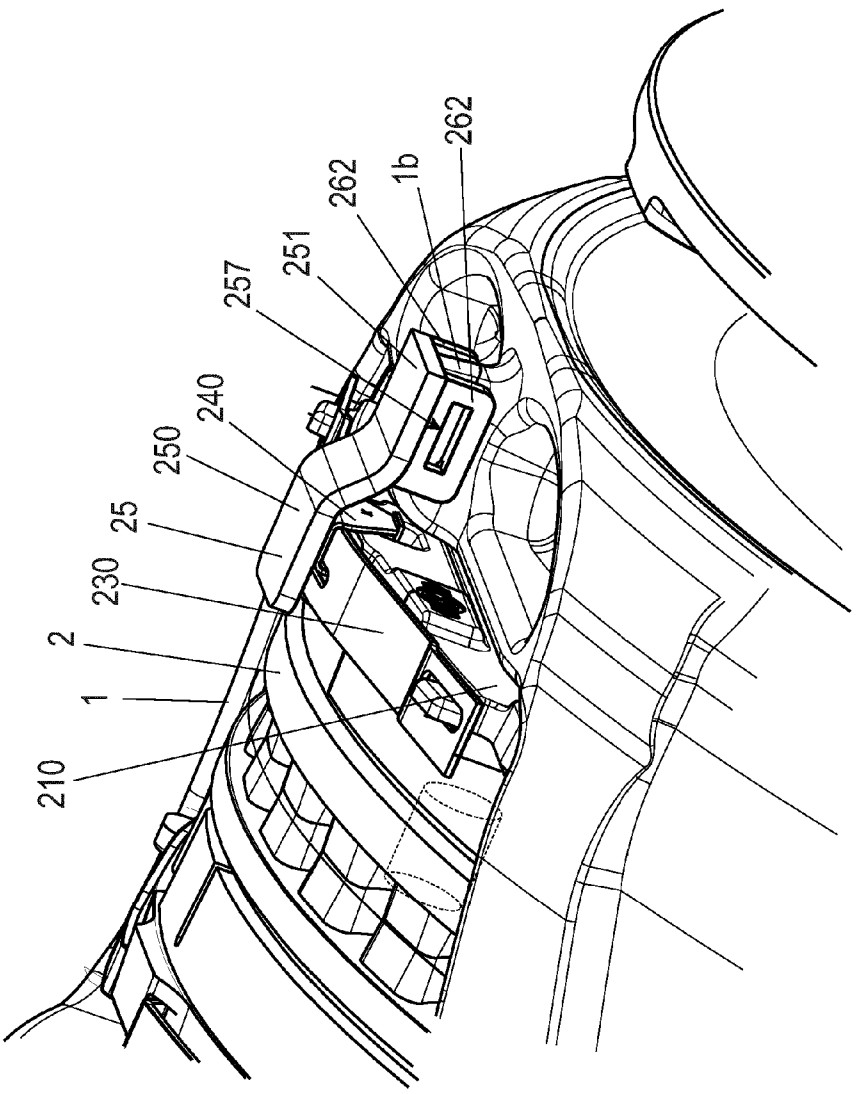
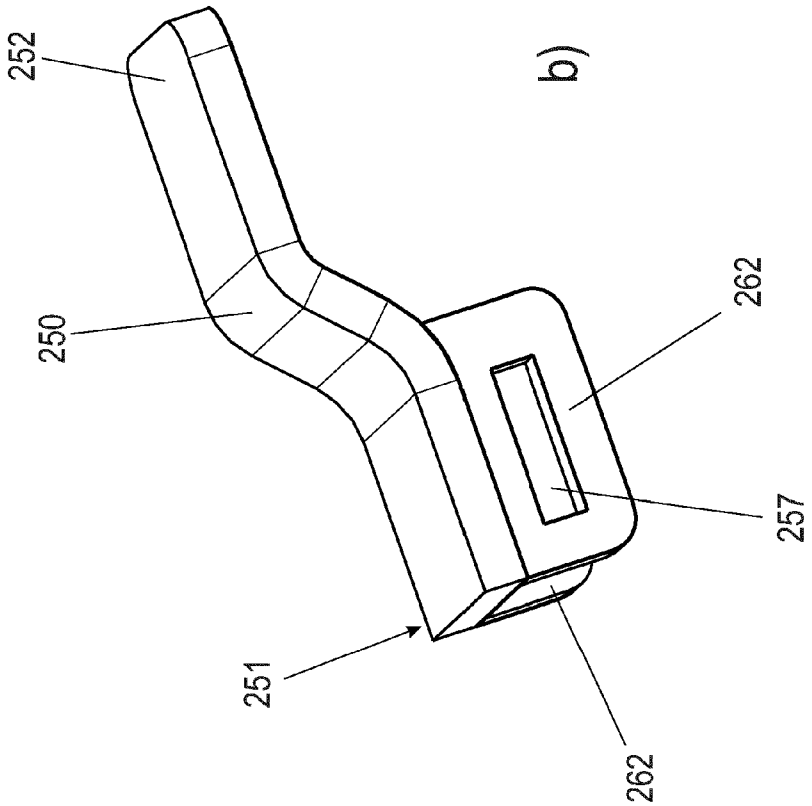


Fig. 19

Fig. 19



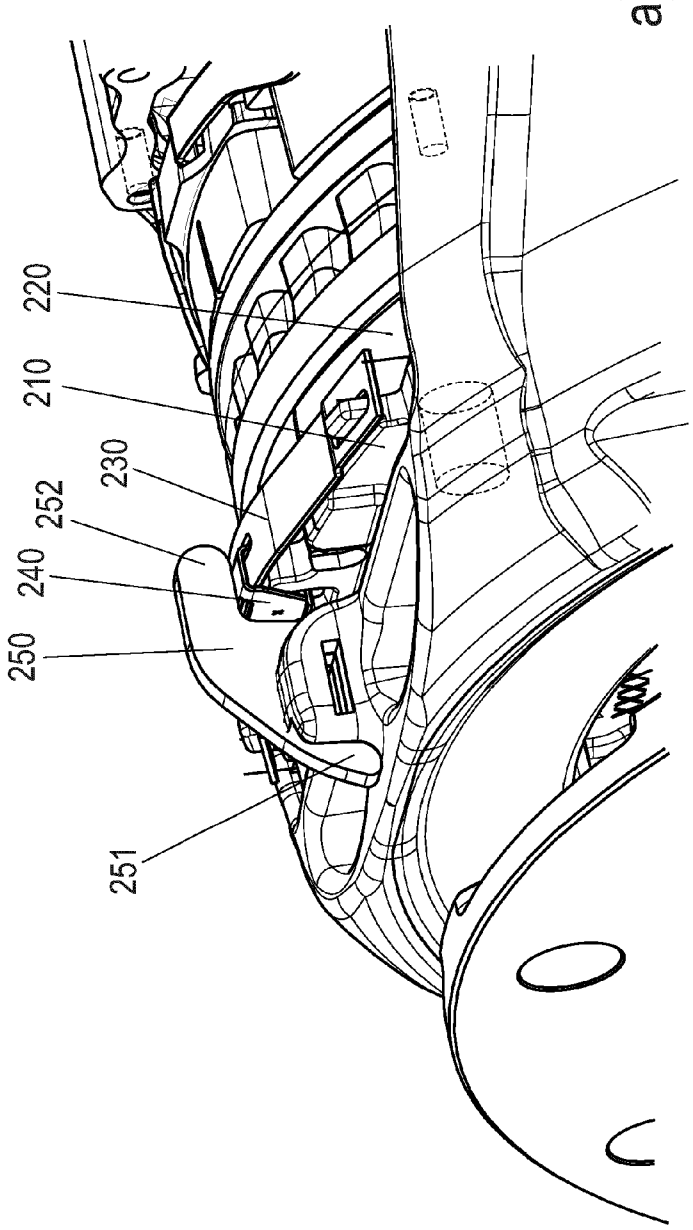
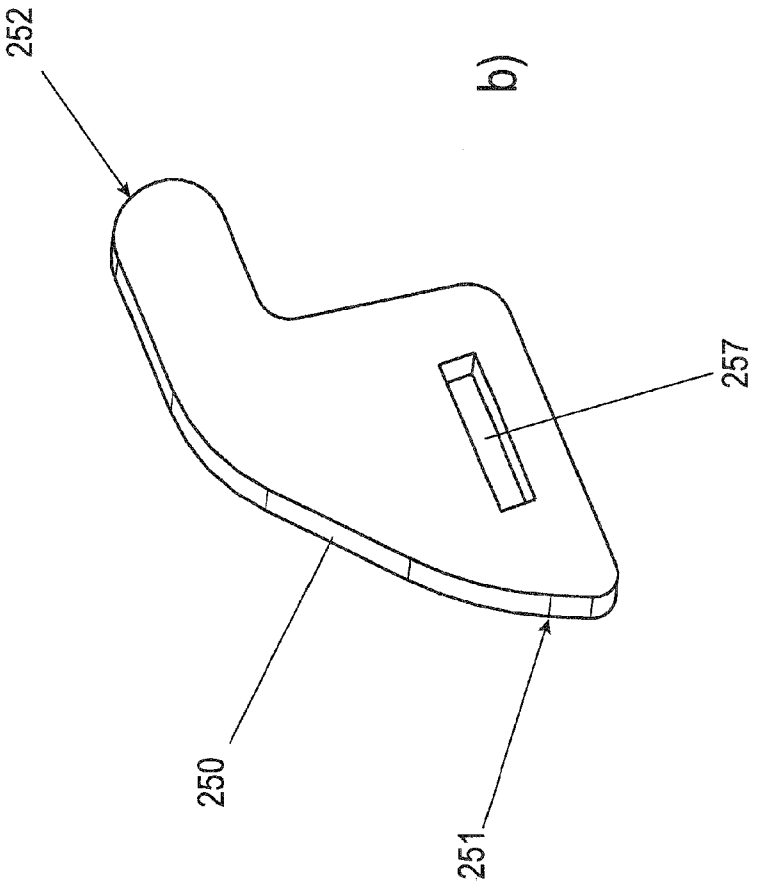


Fig. 20

Fig. 20



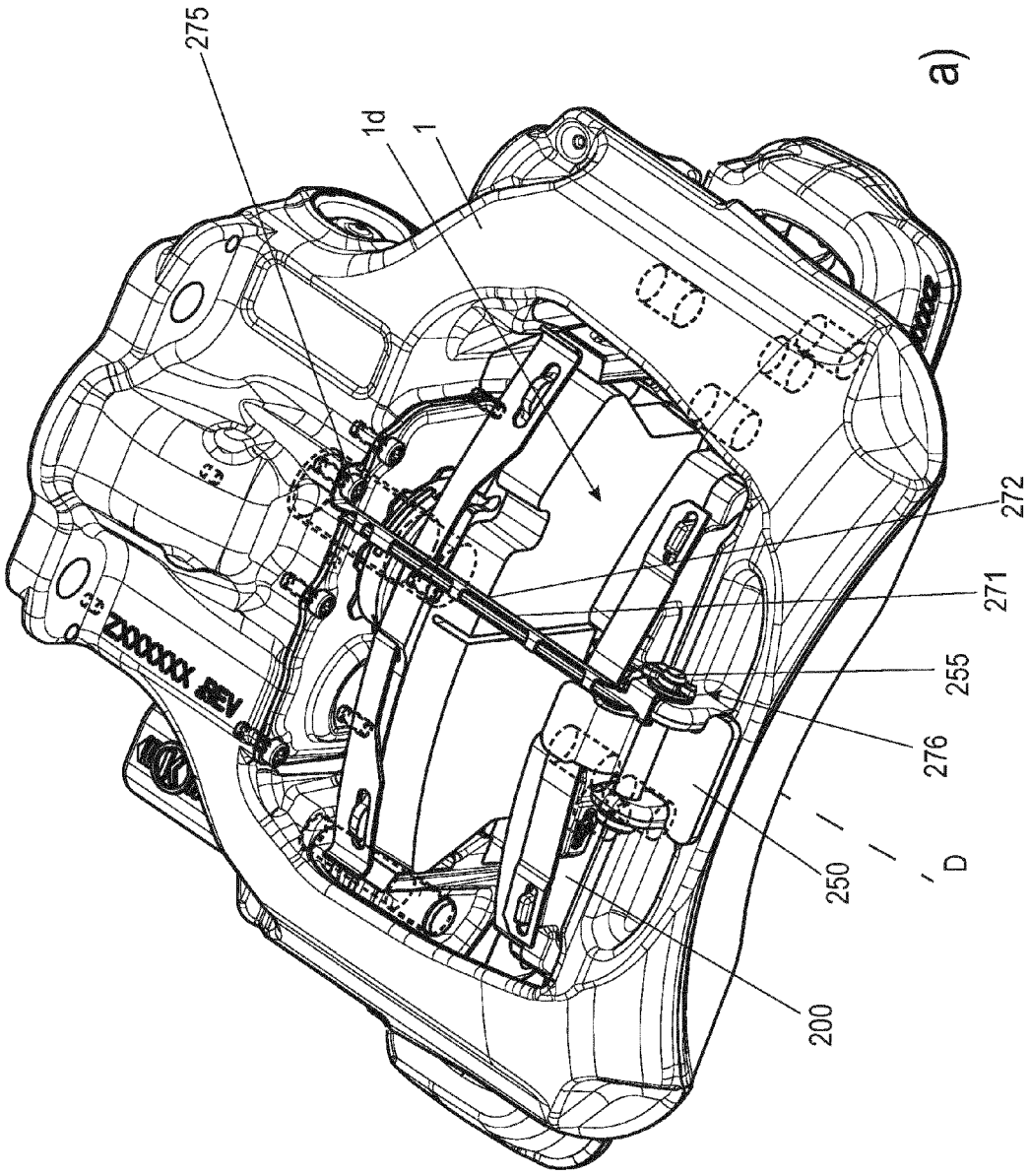


Fig. 21

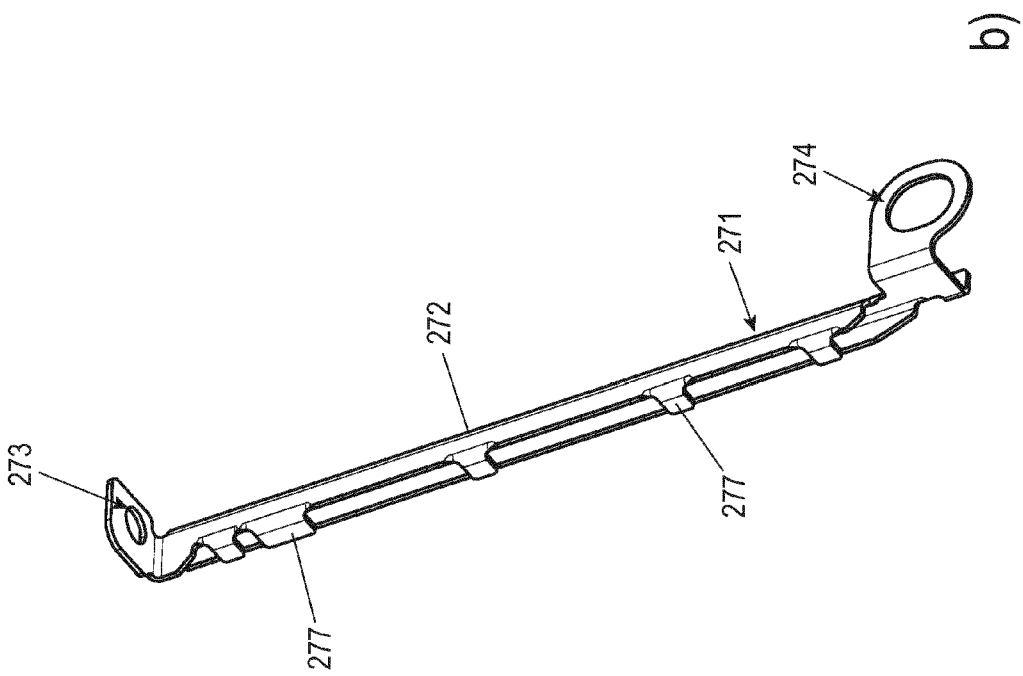


Fig. 21

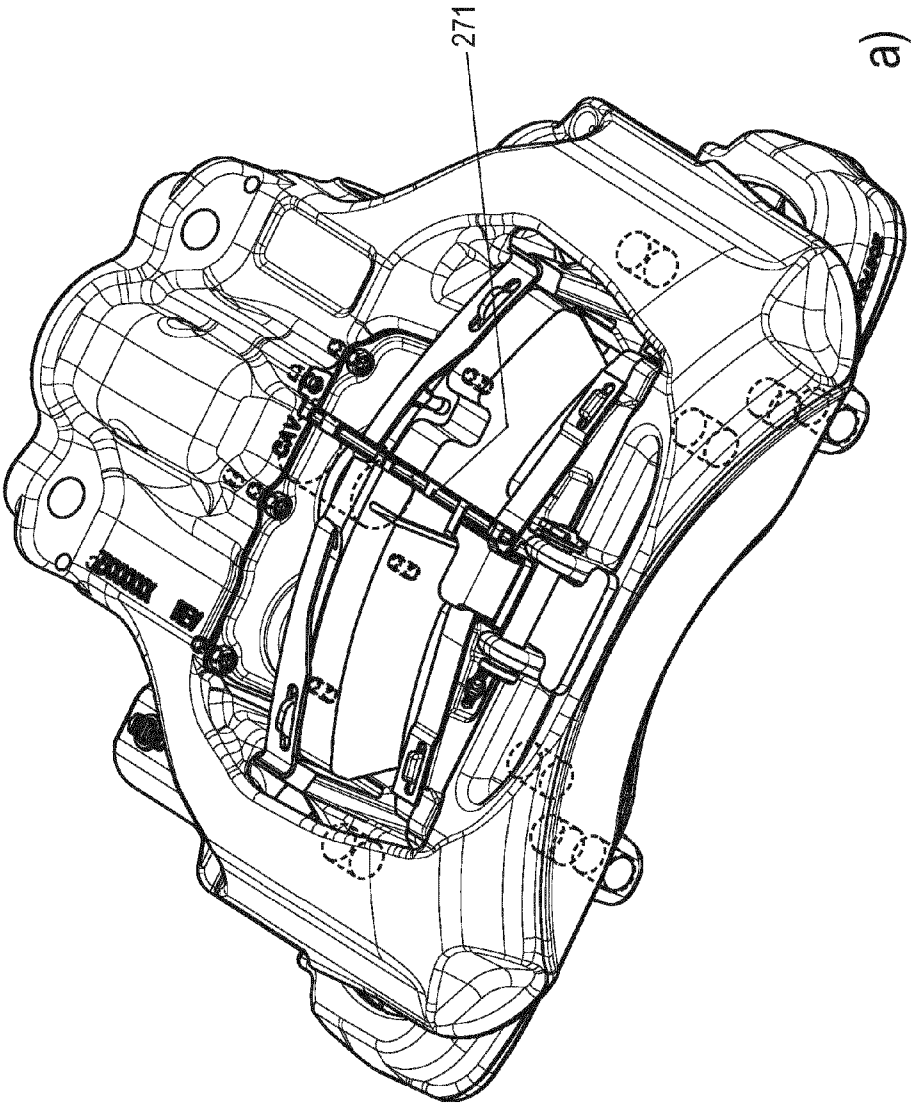
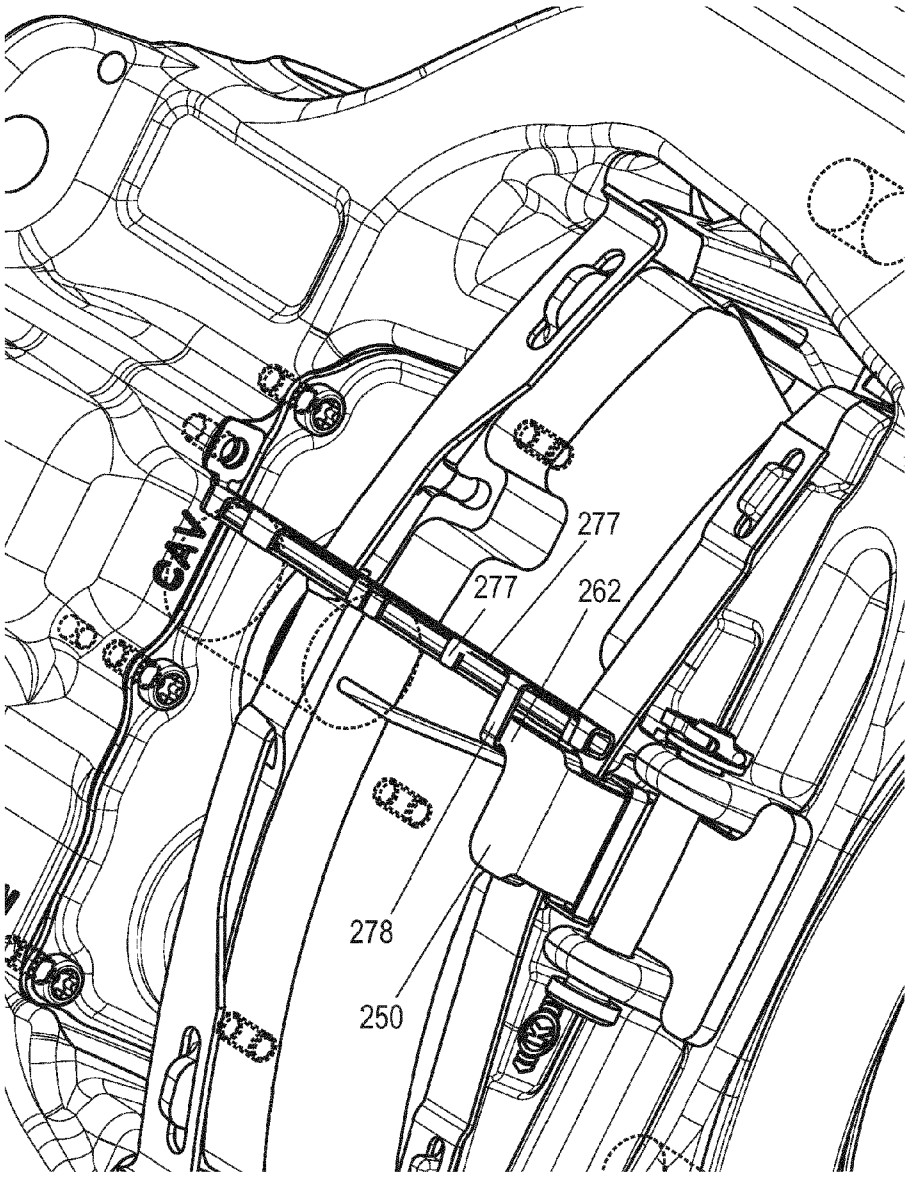


Fig. 22

Fig. 22



b)

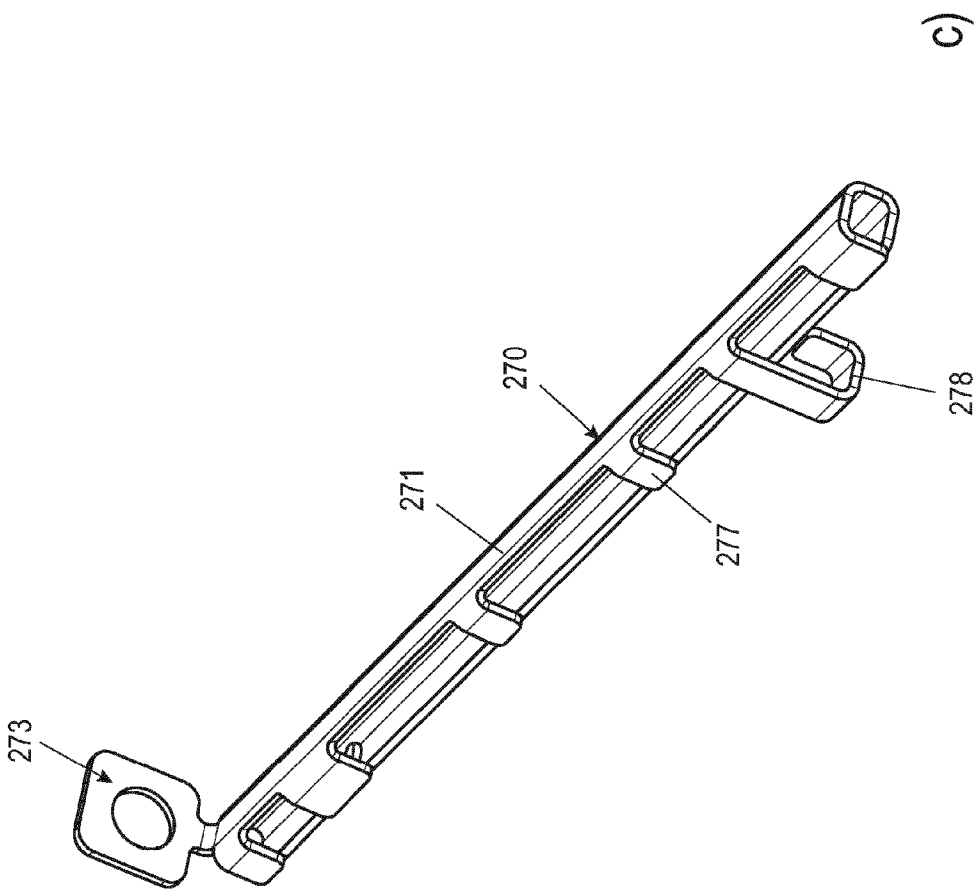
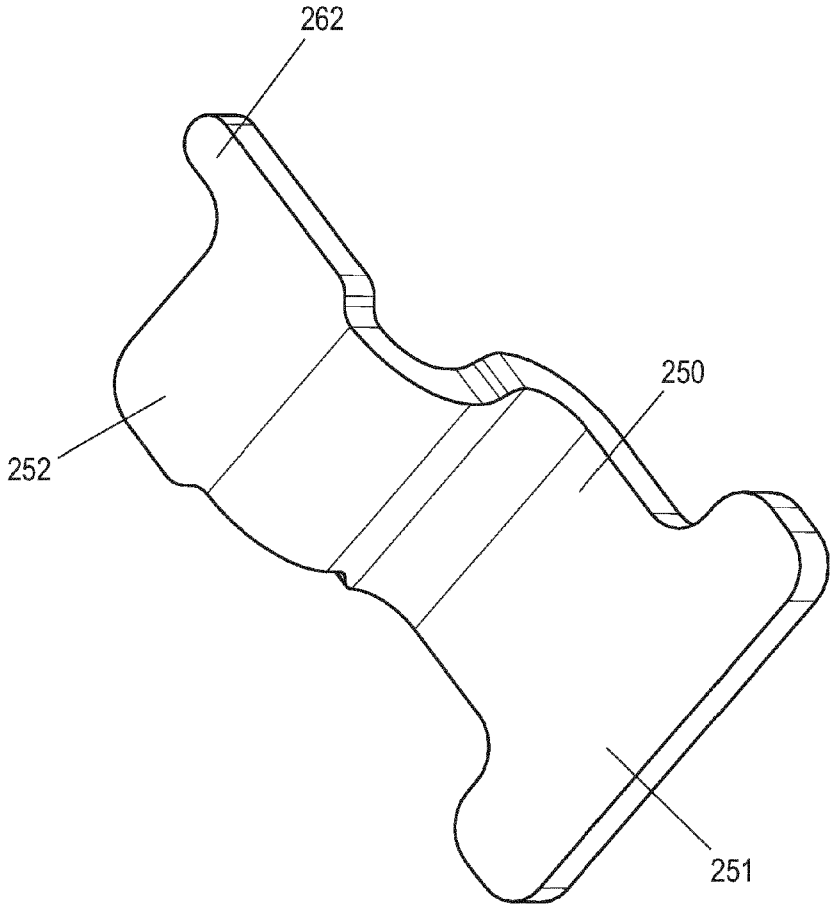


Fig. 22

Fig. 22



d)