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(54) Title: SPRING FOR BRAKE PAD, BRAKE PAD INCORPORATING SAID SPRING AND METHOD OF MAKING THE SAME

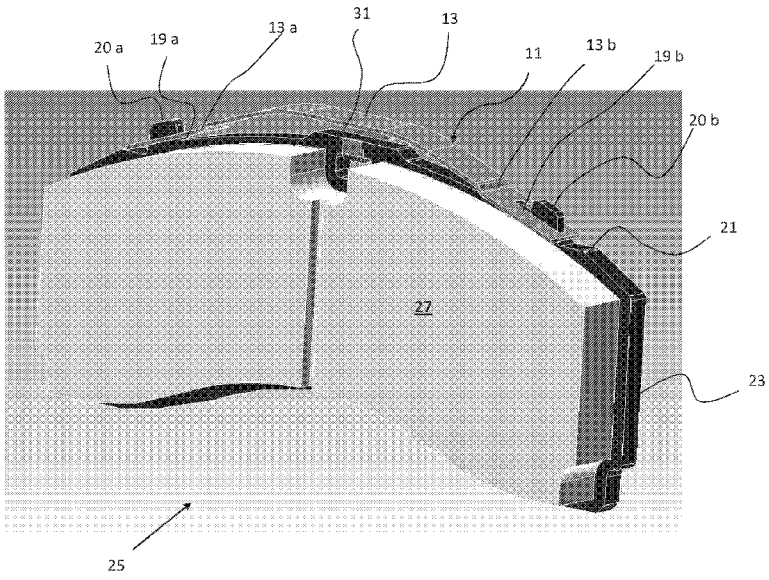

FIG 8

(57) Abstract: Leaf spring (11) for a brake pad (25) of disk brakes for vehicles, including an elongated rectilinear body (13) and a side tab (15) integral with the elongated body (13), said tab extending perpendicularly to the elongated body (13) and forming a corresponding hook in which there are defined a proximal section (15a), an intermediate section (15b) and a distal section (15c) perpendicular to one another, and wherein the proximal section (15a) extends perpendicularly to the plane containing the portion of the body (13) of the leaf spring (11) from which the tab (15) extends, the side tab (15) having in turn three parallel bending lines of which the first bending line (17a) substantially coincides with the perimetral line of the rectilinear body (13) and the second and third bending lines (17b, 17c) are located along the tab (15), wherein said bending lines define the proximal section (15a), the intermediate section (15b) and the distal section (15c).

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Spring for brake pad, brake pad incorporating said spring and method of making the same

DESCRIPTION

Technical Field

The present invention relates to a spring intended for a brake pad of disk brakes for motor vehicles, said spring being adapted for use, for instance, though not exclusively, on lorries, trucks and other vehicles for road transportation of goods.

Background Art

In lorries and transportation means in general, in order to hold brake pads well and firmly positioned in the corresponding calipers of the brake pads, it is known to provide a leaf spring, having a generally arched shape, along the side which, in the mounted position, is the outer side, in radial direction, of the brake pad. The function of such springs is to counteract the accelerations and biases applied to the brake pads during use of the vehicle, by discharging them onto a bracket of the brake caliper against which, in known brake calipers, the central arched section of the spring leans.

Examples of such springs are described in US 4 773 511 and FR 2 461 161. According to the teaching of said documents, the leaf spring has a substantially arched shape and has two ends bent approximately semi-circularly with a curvature opposed to the curvature of the central section of the spring. The spring is mounted onto the brake pad by more or less deforming the spring itself and inserting its two bent ends into corresponding seats formed on projections of the backing plate (also called pressure distribution plate) of the brake pad: the more or less slight preload due to the mounting deformation of the spring holds the spring in position on the brake pad.

Such spring are often delivered demounted in the package of the spare brake pads kit; depending on the kind of spring and brake pad, the automotive mechanic or in any case the operator must either: a) at first mount the springs onto the corresponding backing plates, and then mount the brake pad-spring assembly on the brake calipers of the motor vehicle, or b) mount the springs onto the brake pads when the latter are already mounted on the brake calipers of the motor vehicle. In both cases, as a result of a poorly carried out operation, such leaf springs can accidentally become unfastened and cause injuries to the installer. Furthermore, the more rigid the spring is, the more difficult and cumbersome it becomes to mount the spring onto the brake; a high rigidity of the spring, however, is desirable in order to hold the spring firmly positioned during use of the motor vehicle.

US 4 049 087, WO 87/00896 and EP 1 963 702 describe systems for securing the leaf spring which allow to hold the spring on the brake pad, substantially at the center of the spring, while retaining the capability of radial and tangential movements of the spring. These known systems, however, are complicated and expensive to be manufactured or they excessively weaken the structure of the spring.

It is an object of the present invention to provide a system which is adapted for securing a leaf spring onto a brake pad and the making of which is easy and does not involve substantial modifications to the spring structure.

It is another object of the invention to provide a leaf spring which does not have the drawbacks of the prior art and is more wear-resistant.

It is still a further object of the invention to provide a brake pad equipped with a spring having means adapted to secure it to the brake pad and arranged essentially at the center of the spring, wherein said brake pad should be easily

and safely mounted onto the brake calipers.

A not least object of the invention is to provide a brake pad of the aforesaid kind that is easy and inexpensive to manufacture and can therefore be produced on an industrial scale.

Disclosure of the Invention

These and other objects are achieved by a disk brake pad having the features defined in the appended claims.

The spring according to the invention can be obtained by cutting or shearing starting from a flat metal sheet. The body thus obtained can then be bent along bending lines, optionally after notching along said bending lines, so as to define a hook-shaped side tab. The spring can further be subjected to a heat treatment for providing the spring body with the convexity required by the application.

According to a preferred embodiment of the invention, the side tab is bent by 90° along three consecutive parallel lines, so as to define a hook-shaped section of the spring surrounding at least partially a section of the backing plate of the brake pad. The shape of the tab bent as a hook by 90° is further particularly of advantage because it prevents jamming of the surface of the backing plate of the brake pad upon radial deflection of the spring when the brake pad is mounted on the brake calipers.

Advantageously the brake pad thus obtained is much simpler to be manufactured than the brake pads of the prior art, it does not require assembly weldings and can be mounted manually without using any additional equipment.

According to the invention it is possible to provide that the spring tab is bent as a hook along the three bending lines before being mounted onto the brake pad (main option), or it is possible to provide that at least one of the tab sections, especially the distal section, is bent only after mounting of the spring onto the brake pad (secondary option).

Advantageously, according to the invention it is possible either to secure the spring onto the brake pad at the manufacturing stage, so that the installer only needs to mount the brake pad onto the brake calipers, or to furnish the installer with a kit containing the spring ready to be mounted onto the brake pad before mounting the brake pad onto the brake calipers, or to furnish the installer with a kit where the spring tab still needs to be bent along at least one bending line and can be bent as a hook along the remaining bending line(s) by the installer himself before mounting the brake pad onto the brake caliper.

Brief Description of the Drawings

Further advantages that can be attained with the present invention will become more evident to the man skilled in the art from the following detailed description of a non-limiting particular embodiment shown in the following schematic drawings, where:

- Figures 1 to 4 are top plan views of the leaf spring in as many manufacturing steps;
- Figure 5 is a partial front view of the brake pad provided with a spring according to the invention;
- Figure 6 is a partial rear view of the brake pad provided with a spring according to the invention;
- Figure 7 is a sectional view taken along the line VII-VII of Figure 5;
- Figure 8 is a front perspective view of the brake pad of Figure 5.

Referring to Figures 1 to 4, the spring according to invention, referred to as a whole with reference numeral 11, is made, preferably by shearing, starting from a flat steel sheet or a sheet of other suitable material. The form taken by the spring 11 immediately after shearing is shown in Figure 1. As it can be seen in Figure 1, immediately after cutting, the spring 11 includes a rectilinear body 13 and a

projection or side tab 15 made integral with the rectilinear body 13 and arranged essentially perpendicularly and co-planar with respect to the rectilinear body 13, which side tab gives a substantially T-like form to the spring 11. Preferably the tab 15 is arranged at the middle of the length of the body 13, but said position may vary depending on the applications.

According to the invention, the side tab 15 is bent by 90° along three parallel bending lines. Said bending lines can coincide with optional notches impressed into the spring 11, in order to facilitate bending. The first bending line, identified by the reference numeral 17a, coincides essentially with the perimetral line of the rectilinear body 13, the second and the third bending lines, identified by the reference numerals 17b and 17c, respectively, are located along the tab 15. The bending lines define a proximal section 15a of the tab, an intermediate section 15b and a distal section 15c. After bending, the proximal section 15a also extends perpendicularly to the plane of extension of the portion of the body 13 of the leaf spring 11 from which said tab 15 extends.

According to the invention, the proximal section 15a has a tapered form beginning from its attachment to the rectilinear body 13. Said tapered form is preferably that of a rectangular trapezoid, wherein the major base of the trapezoid corresponds to the bending line 17a and the minor base corresponds to the bending line 17b. The oblique legs of the trapezoid are moreover inclined at about 30°. The intermediate section 15b and the distal section 15c of the tab 15 both have preferably a rectangular form.

Referring now also to Figures 5 to 8, the rectilinear body 13 of the leaf spring 11 preferably further includes, at its ends, coupling means adapted to cooperate with corresponding coupling means provided on that side of the

backing plate of the brake pad which is arranged for receiving the leaf spring 11. In the embodiment shown, the coupling means provided on the spring are a pair of slots 19a,19b, adapted to receive corresponding projections 20a,20b provided on the flank 21 of the backing plate 23 of the brake pad 25. Said slots 19a,19b can be made by shearing, simultaneously with the cutting of the body 13 of the leaf spring 11 or thereafter.

The body 13 may further include, close to its opposite ends and close to the slots 19a,19b, where provided, a corresponding inclined section 13a,13b, for stiffening the structure of the body 13 of the leaf spring 11.

Referring now more particularly to the Figures 5 to 8, according to the invention there is illustrated a brake pad 25 provided with a leaf spring 11, of the kind described above with reference to Figures 1 to 4. According to the invention the body 13 of the leaf spring is associated to the backing plate 23 of the brake pad 25, which backing plate is covered, by means of a known technique, with a layer of friction material 27. Advantageously, the body 13 of the leaf spring 11 is associated to the flank 21 of the backing plate 23 not only by means of the aforesaid optional coupling means mentioned above, but also by means of the side tab 15. To this aim, the backing plate 23 includes a hole 29 defining a corresponding segment 31 which is at least partially surrounded by the tab 15 bent as a hook. According to the invention, when the spring 11 is mounted on the brake pad 25, preferably three sides of the segment 31, flanks and bottom side, are surrounded by the tab 15. Moreover, the hole 29 is preferably provided at the middle of the length of the flank 21, at such a distance from the surface of the flank 21 as to define a thickness for the segment 31 of some mm, typically 2-5 mm, and has a cross-section of about 5 – 10 mm, so as to allow the passage of the tab 15 with a certain play both in

axial direction and in tangential direction. Said play allows the spring 11 to deflect radially with respect to the body of the brake pad, under the thrust exerted by the radial forces acting against the spring 11 once the latter is mounted on the brake calipers of a vehicle. Preferably, the hole 29 has a square or rectangular cross-section or in any case preferably a cross-section so as to define an inner surface 33a of the segment 31, said inner surface being substantially flat and parallel to the flank 21. Said flat surface defines a corresponding supporting surface for the tab 15, especially for the intermediate section 15b of the tab 15, when the spring 11 is completely radially extended in the distal direction relative to the flank 21 of the backing plate 23. This arrangement corresponds essentially to the arrangement illustrated in Figures 5 to 8, where the brake pad 25 is ready to be mounted onto the brake calipers. When in use, the intermediate section 15b of the tab 15 can move radially inside the hole 29 during deflections of the spring until it abuts against the abutment surface 33b opposite to the surface 33a.

According to a preferred embodiment of the invention, the proximal section 15a, the intermediate section 15b and the distal section 15c of the tab 15 are bent by 90° before associating the tab 15 to the backing plate 23 of the brake pad 25. In accordance with this embodiment, the distal section 15c and the intermediate section 15b of the tab 15 are inserted - usually after flattening the spring body 13 when this has been made convex for instance by heat treatment - already bent into the hole 29 of the brake pad 25. When the spring 11 is subsequently released, the three sections 15a, 15b and 15c surround at least partially the segment 31 of the backing plate, and the intermediate section 15b of the tab 15 is essentially in abutment against the inner surface 33a of the segment 31 of the backing plate.

According to an alternative embodiment of the invention, only the proximal section 15a and the intermediate section 15b of the tab 15 are bent by 90° before associating the spring 11 and the tab 15 to the backing plate 23 of the brake pad 25. Still according to this alternative embodiment of the invention, the distal section 15c of the tab 15 is bent so that the tab 15 surrounds at least partially the segment 31, after the intermediate section 15b has been inserted into the hole 29. Thus, according to this embodiment of the invention, only the distal section 15c of the tab 15 is bent along the line 17c, after the spring 11 has been associated to the brake pad 25, whereas the remaining two bendings along the lines 17a,17b are effected in advance, i.e. when the spring is still separated from the brake pad.

In other embodiments it is also possible to bend one or more of the sections 15a,15b,15c of the tab 15, before inserting the tab 15 into the hole 29, and bend the remaining section(s) only subsequently. It is also possible to bend one or more of the sections 15a,15b,15c of the tab 15 by an angle other than 90°, before associating the spring 11 to the brake pad 25, and bring said angle to 90° only after having inserted the tab 15 into the hole 29.

According to the invention the metal sheet from which the spring 11 is obtained has preferably a uniform thickness comprised between 1 and 2 mm and more preferably it has a uniform thickness of about 1.5 mm. Moreover, the spring 11 is preferably subjected to the a heat treatment for providing the spring body with the convexity required by the application.

The invention as described and illustrated is open to several modifications and variants falling within the same inventive principle.

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CLAIMS

1. Leaf spring (11) for a brake pad (25) of disk brakes for vehicles, characterized in that it includes an elongated rectilinear body (13) and a side tab (15) integral with the elongated body (13), said tab extending perpendicularly to the elongated body (13) and forming a corresponding hook in which there are defined a proximal section (15a), an intermediate section (15b) and a distal section (15c) perpendicular to one another, and wherein the proximal section (15a) extends perpendicularly to the plane containing the portion of the body (13) of the leaf spring (11) from which the tab (15) extends, and in that the side tab (15) has three parallel bending lines of which the first bending line (17a) substantially coincides with the perimetral line of the rectilinear body (13) and the second and third bending lines (17b,17c) are located along the tab (15), wherein said bending lines define the proximal section (15a), the intermediate section (15b) and the distal section (15c).

2. Spring according to claim 1, wherein the proximal section (15a) has a tapered form beginning from its attachment to the rectilinear body (13).

3. Spring according to claim 1 or 2, wherein the proximal section (15a) has the form of a rectangular trapezoid beginning from the attachment to the rectilinear body (13), wherein the major base of the trapezoid corresponds to the first bending line (17a) and the minor base corresponds to the second bending line (17b).

4. Spring according to claim 3, wherein the oblique legs are inclined at approximately 30°.

5. Spring according to any of the preceding claims, wherein the intermediate section (15b) and the distal section (15c) of the tab (15) both have a rectangular form.

6. Spring according to any of the preceding claims, wherein the spring body (13) further includes, close to its opposite ends, a corresponding inclined section (13a,13b) for stiffening the structure of the body (13) of the spring (11).

7. Brake pad for disk brakes including a backing plate (23) covered at least partially with a layer of friction material (27), and a leaf spring (11) including an elongated rectilinear body (13) and a side tab (15) integral with the elongated body (13), said tab extending perpendicularly to the elongated body (13) and forming a corresponding hook in which there are defined a proximal section (15a), an intermediate section (15b) and a distal section (15c) perpendicular to one another, and wherein the proximal section (15a) extends perpendicularly to the plane containing the portion of the body (13) of the leaf spring (11) from which the tab (15) extends, said body being associated to a flank (21) of the backing plate (23) by means of the side tab (15), and wherein the backing plate (23) includes a hole (29) defining a corresponding segment (31) of the backing plate that is at least partially surrounded by the side tab (15) bent as a hook.

8. Brake pad according to claim 7, wherein the hole (29) has a cross-section defining an inner surface (33a) of the segment (31) of the backing plate, said surface being plane and parallel to the flank (21) of the backing plate to which the spring is associated, said plane surface defining a corresponding supporting surface for the intermediate section (15b) of the tab (15) when the spring (11) is completely

radially extended in the distal direction relative to the flank (21) of the backing plate (23).

9. Method for making a brake pad of a disk brake for vehicles, said method comprising the steps of:
- providing a leaf spring (11) including an elongated rectilinear body (13) and a side tab (15) integral with the elongated body (13), said tab extending perpendicularly to the elongated body (13) and forming a corresponding hook in which there are defined a proximal section (15a), an intermediate section (15b) and a distal section (15c) perpendicular to one another, and wherein the proximal section (15a) extends perpendicularly to the plane containing the portion of the body (13) of the leaf spring (11) from which the tab (15) extends (11),
- providing a backing plate (23) covered at least partially with a layer of friction material and including a hole (29) which defines a corresponding segment (31) of the backing plate that can be at least partially surrounded by the side tab (15) bent as a hook,
- associating said spring (11) to the backing plate (23) so as to surround at least partially the segment (31) with the side tab bent as a hook.

10. Method according to claim 9, wherein there are provided the steps of:
- inserting the distal section (15c) and the intermediate section (51b) of the tab (15) into the hole (29) of the backing plate (23), possibly after flattening the spring body (13),
- releasing the spring (13) so that the three tab sections (15a, 15b,15c) surround at least partially the segment (31) of the backing plate and wherein the intermediate section (15b) of the tab (15) is substantially in abutment against

the inner surface (33a) of the segment (31) of the backing plate.

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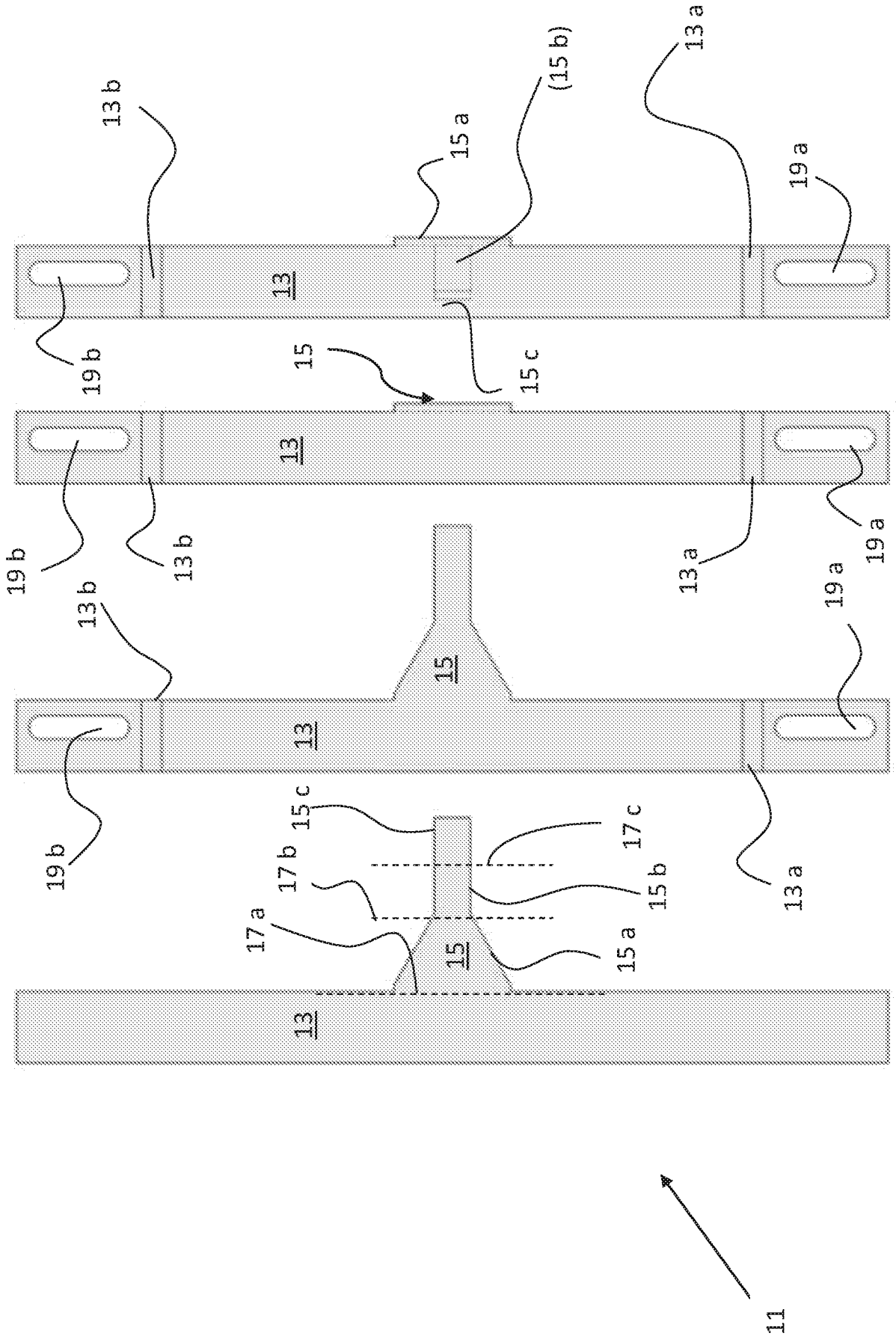

FIG 4

FIG 3

FIG 2

FIG 1

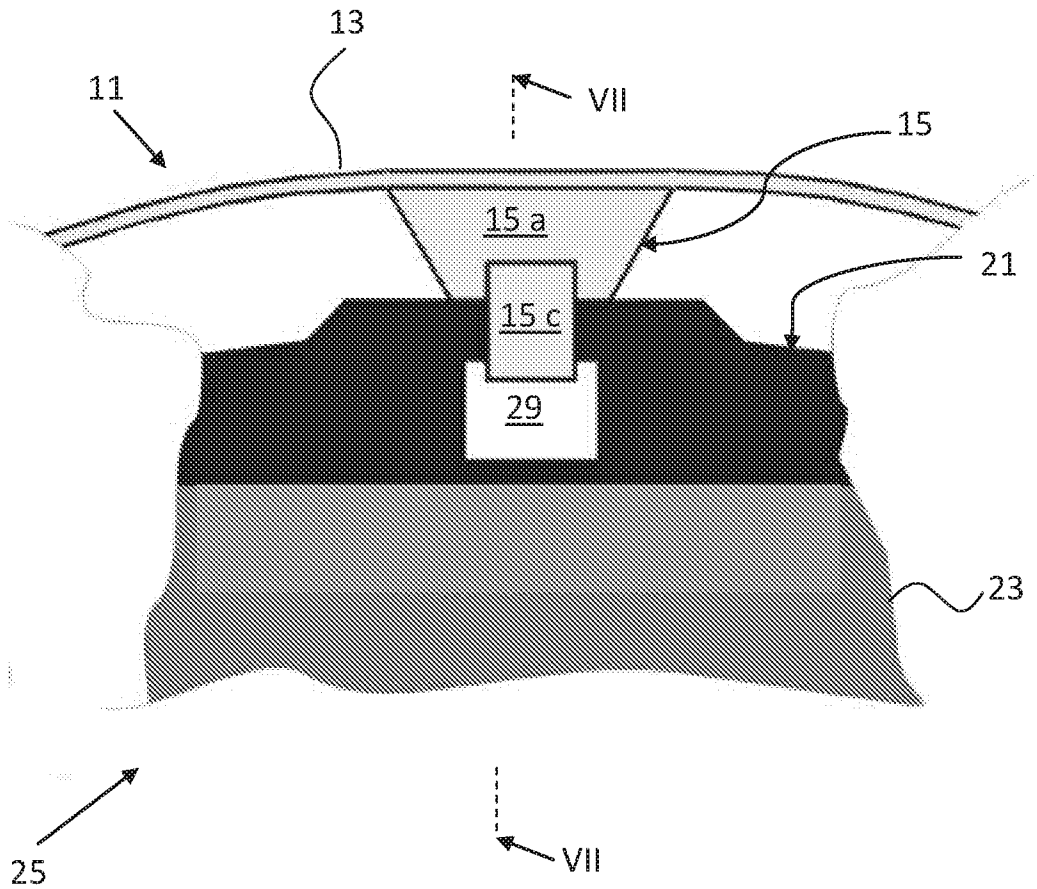

FIG 5

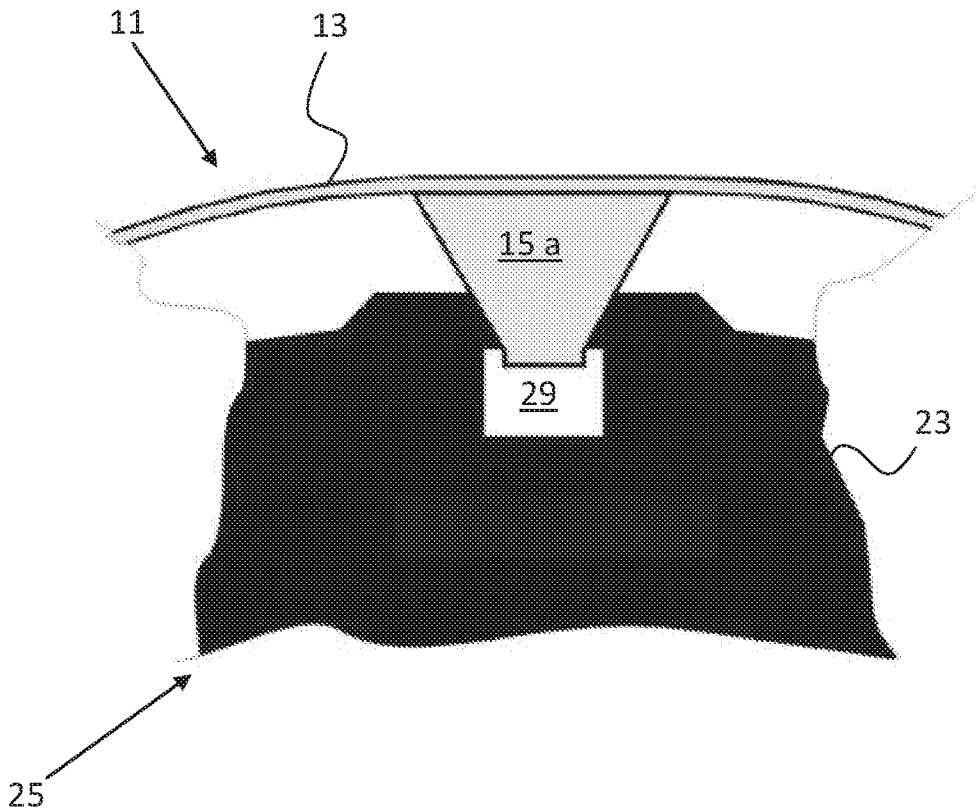

FIG 6

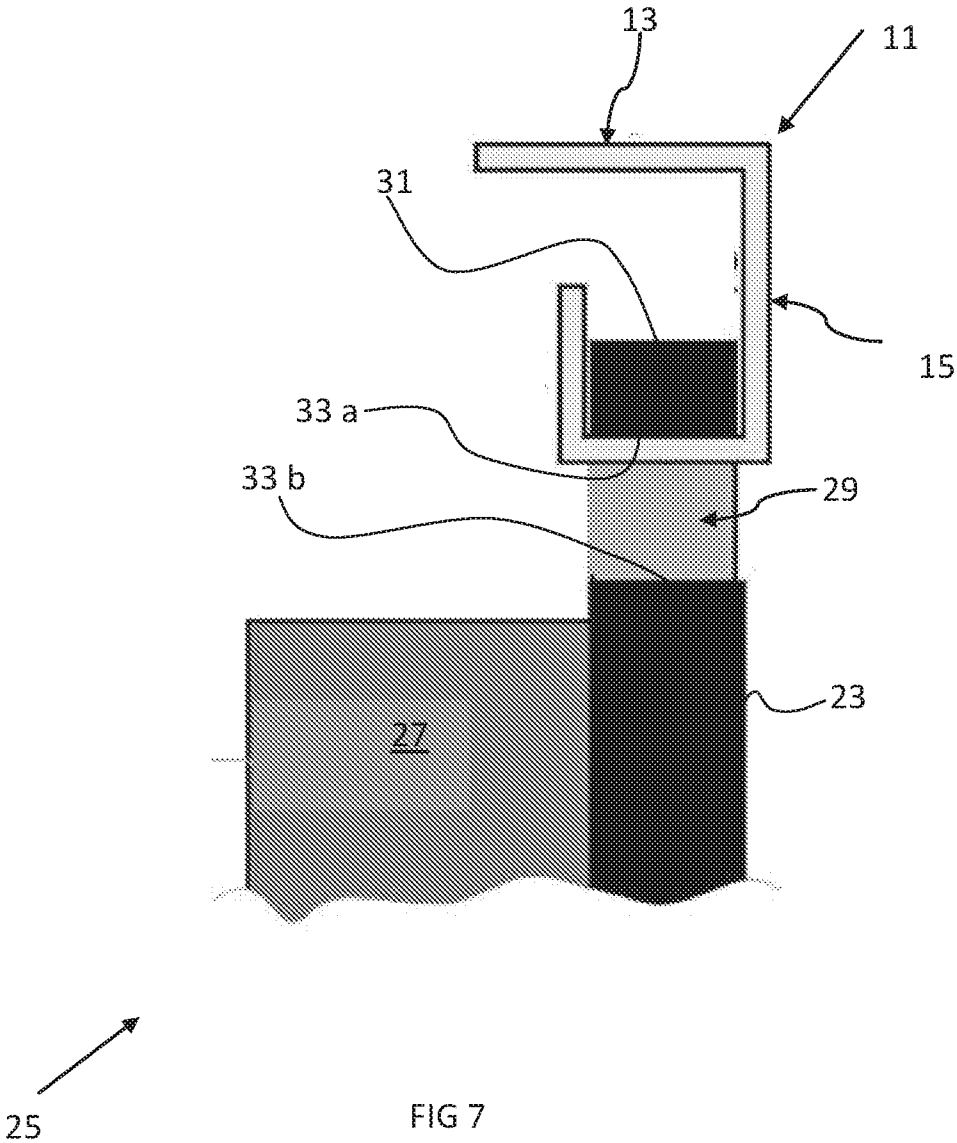

FIG 7

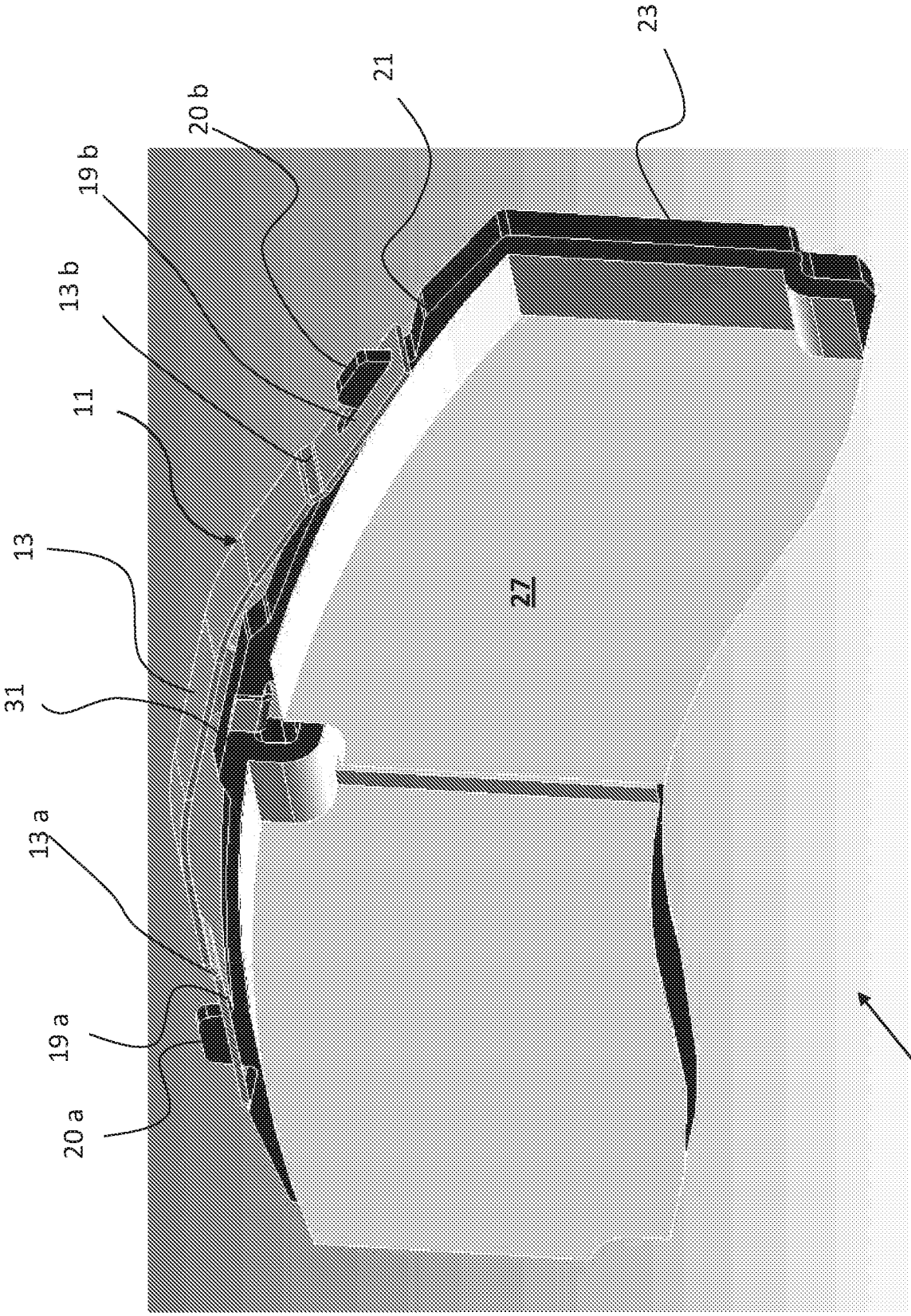

FIG 8