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(54) **A pedal mechanism and a low cost production method of a bracket therefor**

(57) The present invention proposes a pedal mechanism comprising a pedal (1) for holding the pedal, a bracket (2) and a sensor (7) for sensing the position of the pedal, wherein the bracket (2) comprises a first U-profile with a base width of W1, and a second U-profile with a base width of W2, where W2 is greater than W1; the first U-profile (U1) and the second U-profile (U2) are integral with each other and are made from a single piece of a sheet material; and - the sensor (7) is attached to the first U-profile (U1). Also a bracket production method is proposed.

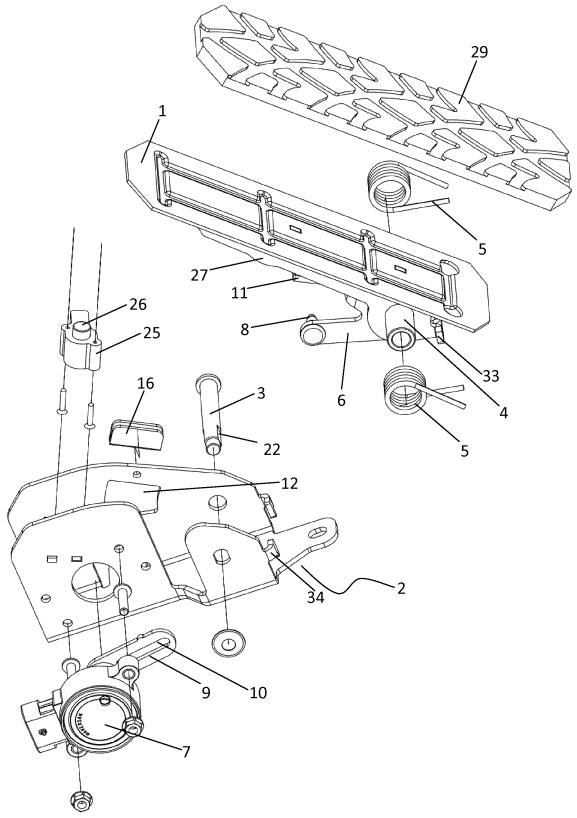


FIG. 1

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Description

[0001] The present invention is related to a pedal mechanism and a low-cost method for production of a bracket for said pedal mechanism.

[0002] Pedal mechanisms such as clutch, gas and brake pedals are used for adjusting the drive parameters e.g. in vehicles and heavy equipments. Pedal mechanisms equipped with position sensors e.g. rotary position sensors are widely used in automotive products. Such mechanisms indicate the position of corresponding pedals and produce electrical signals accordingly.

[0003] Conventional pedal mechanisms having pedals with position sensors usually have brackets made of sheet metal which are formed so that they have a U-shaped cross-section. Motion range of a pedal mounted on such bracket is limited by geometrical obstacles on internal surfaces of the bracket. Motion axis of such pedal is defined with a shaft passing through slots on the pedal and the bracket, thus it provides connection between the pedal and the bracket which allows a rotational motion. The shaft further transmits any momentary position of the pedal to the position sensor by rotating around said axis according to the position of the pedal.

[0004] One of the shortcomings of above-explained pedal mechanism is that the sensors protrudes from lateral surfaces of said brackets, which results in ineffective use of limited space in a vehicle and increases the probability of damages of the sensor which stays open to accidental physical contact.

[0005] Another shortcoming is that the angular motion range of such sensor located on the rotational axis of the pedal, is the same with that of the pedal, which causes a rather low resolution due to limited angular motion full range of the pedal which is usually around 20 deg. Thus a large portion of the range of such sensor remains out of reach which can be considered as inefficient use of its measuring potential.

[0006] Brackets for pedal mechanisms are usually prepared by combining a part for holding a pedal with another part for holding a sensor. These parts are prepared in different production lines, which means two separated steps, and then connected with each other in an additional step. Thus, a three-step process is required for preparing conventional pedal brackets, which results in a considerable labour and time cost.

[0007] Hence, the pedal mechanisms and their production methods are required to be improved considering the abovementioned shortcomings.

[0008] Primary object of the present invention is to overcome the abovementioned shortcomings encountered in pedal mechanisms of prior art.

[0009] Another object of the present invention is to provide a pedal mechanism with high-precision and improved utilization of the sensor range.

[0010] Another object of the present invention is to provide a safe, stable and durable pedal mechanism with long technical working life.

[0011] Another object of the present invention is to provide a simple and low cost production method for a pedal mechanism.

[0012] The present invention proposes a pedal mechanism comprising a pedal, a bracket for holding the pedal, and a sensor for sensing the position of the pedal, wherein the bracket comprises a first U-profile U1 with a base width of W1, and a second U-profile U2 with a base width of W2, where W2 is greater than W1; U1 and U2 are integral with each other and are made from a single piece of a sheet material; and the sensor is attached to U1. The sensor is at least partly, preferably completely accommodated within a space W3 defined by a difference W2-W1 and under the projection of the pedal, such that the sensor is protected from presumable impacts in angular direction of the pedal (1). A side wall of the bracket is provided with a window for limiting the motion of a range restrictor connected to the pedal. The pedal is provided with a pedal-side flexible element holder and the bracket is provided with a bracket-side flexible element holder for supporting the pedal with respect to said bracket. The pedal is further provided with and an extension provided with a coupling means for coupling with a lever having a rotation axis connected to the sensor; a distance Y is defined between the lever rotation axis and the coupling means, and a distance X is defined between the coupling means and a pedal axis, where the distance X is greater than the distance Y, so that an angular detection range (α) of the sensor is greater than an angular rotation range (β) of the pedal. The pedal is further provided with an axle housing receiving an axle for pivotable montage of the pedal to the bracket. The pedal is supported by at least two flexible elements located around the axle housing. The sensor is a rotary position sensor. The pedal is provided with a protrusion and the bracket is provided with a button facing the protrusion for indicating the user with a click sound when the pedal is pushed to its full extent. The pedal mechanism is provided with a casing having a casing opening receiving a rod portion of the pedal for moving in the casing opening. The sensor is located within a projection of the pivotal movement range of the pedal, providing protection from presumable impacts.

[0013] Also a manufacturing method of a bracket for a pedal mechanism is proposed, which method comprises the following steps:

(a) Selecting a single piece of flat sheet material, and marking a first bending line between a base and a first side wall, a second bending line between the base and a second side wall, and a third bending line between the base and a third side wall on said piece,

(b) Bending the piece in accordance with a first bending line, a second bending line and a third bending line; such that the piece has the form of a bracket with a first U-profile and a and a second U-profile,

- the first U-profile has a first base width W1 between the first bending line and the second bending line,

- and the second U-profile has a second base width W2 between the first bending line and the third bending line, where W2 is greater than W1.

[0014] The method may further comprise cutting the piece through a cutting line for facilitating the bending step. The method may further comprise cutting a window on one of the side walls.

[0015] Accompanying drawings are given solely for the purpose of exemplifying a pedal mechanism whose advantages over prior art were outlined above and will be explained in detail hereinafter:

Fig. 1 demonstrates an exploded perspective view of a pedal mechanism embodiment according to the present invention.

Fig. 2 demonstrates (a) a front perspective view, and (b) a rear perspective view of the pedal mechanism embodiment of Fig. 1 according to the present invention.

Fig. 3 demonstrates a side view of the pedal mechanism embodiment of Fig. 1 according to the present invention wherein the pedal is in its released position (a) and the pedal is pushed (b)

Fig. 4 demonstrates a section side views taken along the line C - C of Fig. 2(b) according to a pedal mechanism embodiment of Fig. 1 according to the present invention, wherein the pedal is (a) released and (b) pushed.

Fig. 5 demonstrates section front perspective views taken along the line D - D of Fig. 3(a) which shows the pedal mechanism embodiment of Fig. 1 according to the present invention, wherein the pedal is (a) released and (b) pushed.

Fig. 6 demonstrates a perspective exploded view showing the connection of a pedal to a bracket used at the pedal mechanism embodiment of Fig. 1 according to the present invention.

Fig. 7 (a) demonstrates a section rear view taken along the line B - B of Fig. 3(a), and (b) a section top view taken along the line A - A of Fig. 3(a), showing the connection a pedal to a bracket used at the pedal mechanism embodiment of Fig. 1 according to the present invention.

Fig. 8 demonstrates an exploded view of a second pedal mechanism embodiment according to the present invention.

Fig. 9 demonstrates side views of a pedal mechanism embodiment according to the present invention, wherein the pedal is (a) released and (b) pushed.

Fig. 10 demonstrates section rear views of the pedal mechanism embodiment of Fig. 8 according to the present invention, taken along the line E - E of Fig. 9, wherein the pedal is (a) released and (b) pushed.

Fig. 11 demonstrates section side views of the pedal mechanism embodiment of Fig. 10 according to the present invention, taken along the line F - F of Fig. 10, wherein the pedal is (a) released and (b) pushed.

Fig. 12 demonstrates an exploded view showing the connection between the pedal and bracket of the pedal mechanism embodiment of Fig. 8 according to the present invention.

Fig. 13 (a) demonstrates a section front view taken along the line G - G of Fig. 11(b), and (b) a section top view taken along the line H - H of Fig. 13(a), showing the connection between the pedal and bracket of the pedal mechanism embodiment of Fig. 10 according to the present invention.

Fig. 14 demonstrates an exploded view of a third pedal mechanism embodiment according to the present invention.

Fig. 15 demonstrates a perspective view (a) of a bracket for the pedal mechanism according to the present invention, (b) bare and (c) with a position sensor mounted.

Fig. 16 shows a front perspective view (a) of a pedal for the pedal mechanism embodiment of Fig. 14, and side views where the pedal is (b) released and (c) pushed to its full extent.

Fig. 17 shows front perspective section views (a) taken along the line L - L of Fig. 16(b), and (b) along the line J - J of Fig. 16(c).

Fig. 18 demonstrates an exploded view (a); a section rear view (b) taken along the line M - M, and a section top view (c) taken along the line N - N of Fig. 16(b), showing the connection between the pedal and bracket of the pedal mechanism embodiment of Fig. 14 according to the present invention.

Fig. 19 demonstrates an (a) exploded view and section rear views taken along (b) the line P - P and (c) the line S - S of Fig. 16(b) showing the relation between the pedal, bracket and flexible elements of the pedal mechanism embodiment shown in Fig. 14.

Fig. 20 shows a top view (a) of the pedal mechanism embodiment of Fig. 14 according to the present invention, and side views taken along the line K - K of Fig. 1(a), wherein the pedal is (b) released and (c) pushed.

Fig. 21 demonstrates (a) a first and (b) a second sample drawing schematizing the treatment areas and example markings on the bracket material before preparing the bracket.

[0016] Referring now to the figures outlined above, the present invention proposes a pedal mechanism described below.

[0017] Fig.1 shows an exploded view of a first pedal mechanism embodiment according to the present invention. A pedal (1) is connected to a bracket (2) by an axle (3) which is at least partly surrounded by an axle housing (4) on the pedal (1), providing a maximized stability. The pedal (1) is supported by at least two flexible elements independent from each other. The flexible elements (5) located around the axle housing (4) for maintaining a neutral position to the pedal (1) relative to the bracket (2) when the pedal (1) is not pushed by a user. Thus in case of failure in a flexible element (5), at least another flexible element (5) will still be operative and the pedal mechanism according to the present invention will remain secure.

[0018] Each flexible element (5) is supported by a pedal-side flexible element holder (33) and a bracket-side flexible element holder (34). The flexible elements (5) can be springs. The pedal has an extension (6) for transmitting rotational motion thereof towards a sensor (7), which is suitable for use in pedal mechanisms, e.g. a rotary position sensor. The extension (6) is preferably equipped with a coupling means (8) e.g. a pin suitable for coupling with a lever (9) which is rotatably connected to the sensor (7) at a lever rotation axis (11). The lever (9) can have a channel (10) for a secure coupling with the coupling means (8), so that any motion of the pedal (1) can precisely be conducted to the sensor (7) via the extension (6), the coupling means (8) and the lever (9). Positions of the lever (9) according to those of the pedal (1) are clearly visible in Fig. 4.

[0019] As can be seen in Fig.4, the distance Y between the lever rotation axis (11) and the coupling means (8) is shorter than the distance X between the coupling means (8) and pedal axis (23). This provides greater angular travels of the lever (9) in comparison with those of the pedal (1), thus the angular detection range (α) of the sensor (7) is greater than the angular rotation range (β) of the pedal (1), and this provides a high resolution and precision to the sensor thanks to broadened movement angle thereof by improved utilization of the sensor (7) range.

[0020] The lever (9) and thus the channel (10) can be open-ended in one end. At another embodiment shown in Fig. 20(b), the lever (9) is open-ended and shorter; which results in a minimized material consumption and low production cost. This also provides user comfort by reducing the extent of pedal movement.

[0021] The pedal according to the present invention is further provided with a range restrictor (11) which protrudes towards an opening, namely a window (12) which is preferably located on a first side wall (13) of the bracket (2). One end of the range restrictor (11) is fixed to the pedal (1) and is bent so that the other end of the range restrictor (11) remains in or passes through the window (12). The window (12) is provided with a first portion (14) and a second portion (15) to define a limitation to the pedal movement. As the pedal (1) is moved, the range restrictor (11) restricts the movement of the pedal (1) in accordance with the distance between the first and second portions (14 and 15, respectively), since the range restrictor (11) is only able to move between the edges of the window (12). At the normal position of the pedal (1) where the pedal (1) is not pushed e.g. by a user, the range restrictor (11) touches to the first portion (14) of the window. This provides a first limitation to the pedal movement. A full extent for the movement of the pedal (1) is defined with the second portion (15), where the range restrictor (11) is not able to move further, and the same applies for the pedal (1). Fig. 9 shows side views (a) of a pedal mechanism embodiment according to the present invention, wherein the pedal is (a) released and (b) pushed to its full extent. The above-explained range limitation of the pedal (1) provides safety to the pedal mechanism of the present invention, by eliminating the risk of collision of the pedal (1) whilst intentional or accidental disassembly of the pedal mechanism.

[0022] The first portion (14) of the window (12) can be provided with a stopper (16) preferably made of resilient material. This improves the user comfort by cushioning any presumable slam between the range restrictor (11) and the first portion (14) in case of a sudden release of the pedal (1). In that case, the above described first limitation is the contact between the range restrictor (11) and the stopper (16).

[0023] The present invention defines a specific bracket (2) geometry, which provides a recess for the sensor (7) for maximizing its technical working life and durability of the pedal mechanism. As can be seen in Fig. 15, the bracket (2) has a first U-profile (U1) with a first base width (W1) and a second U-Profile (U2) with a second base width (W2), where W2 is greater than W1. Thus the bracket (2) comprises three side walls, namely a first side wall (13), a second side wall (17) and a third side wall (18), which are preferably integral with a base (19) of the bracket (2). The first side wall (13) faces the second (17) and the third (18) side walls. A base (19) connects the side walls (13, 17 and 18) with each other. The sensor (7) is connected to the first U-profile (U1), preferably to the second side wall (17); and is accommodated at least partly and preferably completely within a space W3 defined by a difference (W2-W1), so that the sensor (7) remains within the projection of the pedal (1) range when the pedal

mechanism according to the present invention is assembled. Hence, the bracket geometry explained above serves for protecting the sensor (7) from unnecessary user contacts, from accidental collisions and from any impact from above. The bracket (2) also comprises a perforation (Z1) suitable for constituting a window (5). This structure is preferably achieved by following steps:

(a) Selecting a single piece (37) of flat sheet material, and marking a first bending line (BL1) between a base (19) and a first side wall (13), a second bending line (BL2) between the base (19) and a second side wall (17), and a third bending line (BL3) between the base (19) and a third side wall (18) on said piece (37);
(b) Bending the piece (37) in accordance with a first bending line (BL1), a second bending line (BL2) and a third bending line (BL3); such that the piece (37) has the form of a bracket (2) with a first U-profile (U1) and a and a second U-profile (U2),

- the first U-profile (U1) has a first base width (W1) between the first bending line (BL1) and the second bending line (BL2),

- and the second U-profile (U2) has a second base width (W2) between the first bending line (BL1) and the third bending line (BL3), where W2 is greater than W1.

[0024] The bracket (2) is then preferably coated for corrosion prevention. The method may further comprise cutting the piece (37) through a cutting line (CL) for facilitating the bending step (b). The method may further comprise cutting a window (12) on one of the side walls (13, 17, 18).

[0025] The bracket (2) production method of the present invention, which is explained above is thus simple by requiring a low number of steps, resulting in considerably low labour and time costs.

[0026] A montage method of the pedal (1) to the bracket (2) is also proposed by the present invention. The method comprises the following subsequent steps:

(a) Locating at least two flexible elements (5) each having two ends, around the axle housing (4),

(b) Aligning the axle housing (4) between a first axle hole (20) and a second axle hole (21) which are both located on the bracket (2), then securing the axle (3) to the bracket (2) so that the first axle hole (20), the second axle hole (21) and the axle housing (4) surround the axle (3),

(c) Installing an end of the flexible element (5) to a pedal-side flexible element holder (33) and the other end of the flexible element (5) to a bracket-side flexible element holder (34).

[0027] The above explained pedal geometry provides an additional protection to the sensor, since the sensor (7) remains within the projection of pedal movement. Thus in use, also impact and damage risks on the sensor (7) are prevented even when a user slips her foot sideways and misses the pedal (1) instead of directing force onto it. This provides a high stability and technical working life to the sensor (7) and thus provides durability to the pedal mechanism according to the present invention.

[0028] The first side wall (13) comprises a first axle hole (20) which is preferably circular to receive the axle (3) as shown in Fig. 6. The axle (3) has a wedged portion (22) to settle into a second axle hole (21) which is a wedged opening located on the third side wall (18). A fixing member (24) grasps the axle (3) extending through the second axle hole (21) preferably by snap-fitting, so that a fixed connection between the axle (3) and the third side wall (18) is provided, which defines a pedal axis (23) perpendicular to the first (13) and third (18) side walls.

[0029] The sensor (7) is fixed to the second side wall (17) so that the lever rotation axis (36) remains perpendicular to both the first (13) and second (17) side wall surfaces. The sensor (7) is located on the outer surface of the second side wall (17), so that it does not face the first side wall (13). The sensor (7) can be connected using screw connection, but other conventional releasable montage means can also be used.

[0030] The pedal mechanism of the present invention can be equipped with a kickdown unit (25), which comprises a button (26) facing the pedal (1). The kickdown unit (25) can be located on a bridge (28) fixed between the first and second side walls (13 and 17) of the base. When the pedal (1) is pushed to a certain extent, the lower side of the pedal (1), or preferably a protrusion (27) located under the pedal (1) or located along the lower side thereof and supporting it, touches the button (26). The button (26) is a flexible element button which has a flexible element resistance against being pushed further, and the kickdown unit (25) which preferably comprises a ball-flexible element mechanism (35). The ball-flexible element mechanism (35) has a specific resistance of its own flexible element, and when said resistance is exceeded by the force applied to the pedal by the user, the button (26) is instantly pushed and the pedal reaches to its full rotational movement extent which corresponds a contact between the range restrictor (11) and the second portion (15) of the window (12). This instant motion of the pedal (1) preferably accompanied with a click sound from the button (26) informs the user that the pedal (1) is pushed to its full extent. Fig. 5 demonstrates section front perspective views taken along the line D - D of Fig. 3(a) which shows the pedal mechanism embodiment of Fig. 1 according to the present invention, wherein the pedal is (a) released and (b) pushed. To provide a closer look to the interaction between the button (26) and the protrusion (27), Fig. 17 shows front perspective section views (a) taken along the line L - L of Fig. 17(b) where the pedal (1) is released, and (b) along the line J - J of

Fig. 17(c) where the pedal (1) is pushed to its full extent.

[0031] Fig. 8 demonstrates an exploded view of a second pedal mechanism embodiment according to the present invention. The positions of the button (26) in accordance with the positions of the pedal (1) when it is released (a) and pushed (b) is shown in Fig. 10 (a) and (b), respectively. The positional accordance between the pedal (1) and the lever (9) are observable in Fig. 11, which demonstrates section side views of the pedal mechanism embodiment of Fig. 8 according to the present invention, taken along the line F - F of Fig. 10 wherein the pedal is (a) released and (b) pushed. Fig. 11 demonstrates side views of the pedal mechanism embodiment of Fig. 8 according to the present invention, wherein the pedal is released (a) and pushed (b). Connection between the pedal (1) and bracket (2) at this embodiment is shown in Fig. 12. Fig. 13 (a) demonstrates a section front view taken along the line G - G of Fig. 11(b), and (b) a section top view taken along the line H - H of Fig. 11(a).

[0032] The pedal mechanism according to the present invention can be provided with a casing (30) having a casing opening (31) receiving a rod (32) portion of the pedal (1) suitable for moving in said casing opening (31). The pedal according to the present invention can also be equipped with a pedal covering (29) of resilient material.

[0033] According to the above description, a stable, high-precision, safe and durable pedal mechanism with a long technical working life; and a low-cost, simple production method thereof is provided by the present invention.

Claims

1. A pedal mechanism comprising a pedal (1), a bracket (2) for holding the pedal, and a sensor (7) for sensing the position of the pedal, **characterized in that**

   - the bracket (2) comprises a first U-profile (U1) with a base width of W1, and a second U-profile (U2) with a base width of W2, where W2 is greater than W1,
   - the first U-profile (U1) and the second U-profile (U2) are integral with each other and are made from a single piece of a sheet material, and
   - the sensor (7) is attached to the first U-profile (U1).

2. A pedal mechanism according to the Claim 1, wherein the sensor (7) is accommodated within a space W3 defined by a difference (W2-W1) and under the projection of the pedal (1), such that the sensor (7) is protected from any impact in angular direction of the pedal (1).

3. A pedal mechanism according to the Claim 1, wherein a side wall (13, 17 or 18) of the bracket (2) is provided with a window (12) for limiting motion of a range restrictor (11) connected to the pedal (1).

4. A pedal mechanism according to the Claim 1, wherein the pedal (1) is provided with a pedal-side flexible element holder (33) and the bracket (2) is provided with a bracket-side flexible element holder (34) for supporting the pedal (1) with respect to said bracket (2).

5. A pedal mechanism according to the Claim 1, wherein the pedal (1) is provided with an extension (6) provided with a coupling means (8) for coupling with a lever (9) having a rotation axis (11) connected to the sensor (7); a distance Y is defined between the lever rotation axis (11) and the coupling means (8), and a distance X is defined between the coupling means (8) and a pedal axis (23), where the distance X is greater than the distance Y, so that an angular detection range (α) of the sensor (7) is greater than an angular rotation range (β) of the pedal (1).

6. A pedal mechanism according to the Claim 1, wherein the pedal (1) is provided with an axle housing (4) receiving an axle (3) for pivotable montage of the pedal (1) to the bracket (2).

7. A pedal mechanism according to the Claim 6, wherein the pedal (1) is supported by at least two flexible elements (5) located around the axle housing (4).

8. A pedal mechanism according to the Claim 1, wherein the sensor (7) is a rotary position sensor.

9. A pedal mechanism according to the Claim 1, wherein the pedal (1) is provided with a protrusion (27) and the bracket (2) is provided with a button (26) facing the protrusion (27) for indicating the user with a click sound when the pedal (1) is pushed to its full extent.

10. A pedal mechanism according to the Claim 1, wherein the pedal mechanism is provided with a casing (30) having a casing opening (31) receiving a rod (32) portion of the pedal (1) for moving in the casing opening (31).

11. A pedal mechanism according to Claim 1, wherein the sensor (7) is located within a projection of the pivotal movement range of the pedal (1), providing protection from presumable impacts.

12. A method for manufacturing of a bracket (2) for a pedal mechanism, comprising the following steps:

    (a) Selecting a single piece (37) of flat sheet material, and marking a first bending line (BL1) between a base (19) and a first side wall (13), a second bending line (BL2) between the base

(19) and a second side wall (17), and a third bending line (BL3) between the base (19) and a third side wall (18) on said piece (37);
(b) Bending the piece (37) in accordance with a first bending line (BL1), a second bending line (BL2) and a third bending line (BL3); such that the piece (37) has the form of a bracket (2) with a first U-profile (U1) and a and a second U-profile (U2),

- the first U-profile (U1) has a first base width (W1) between the first bending line (BL1) and the second bending line (BL2),
- and the second U-profile (U2) has a second base width (W2) between the first bending line (BL1) and the third bending line (BL3), where W2 is greater than W1.

13. A method according to Claim 12, wherein the method further comprises cutting the piece (37) through a cutting line (CL) for facilitating the bending step (b).

14. A method according to Claim 12, wherein the method further comprises cutting a window (12) on one of the side walls (13, 17, 18).

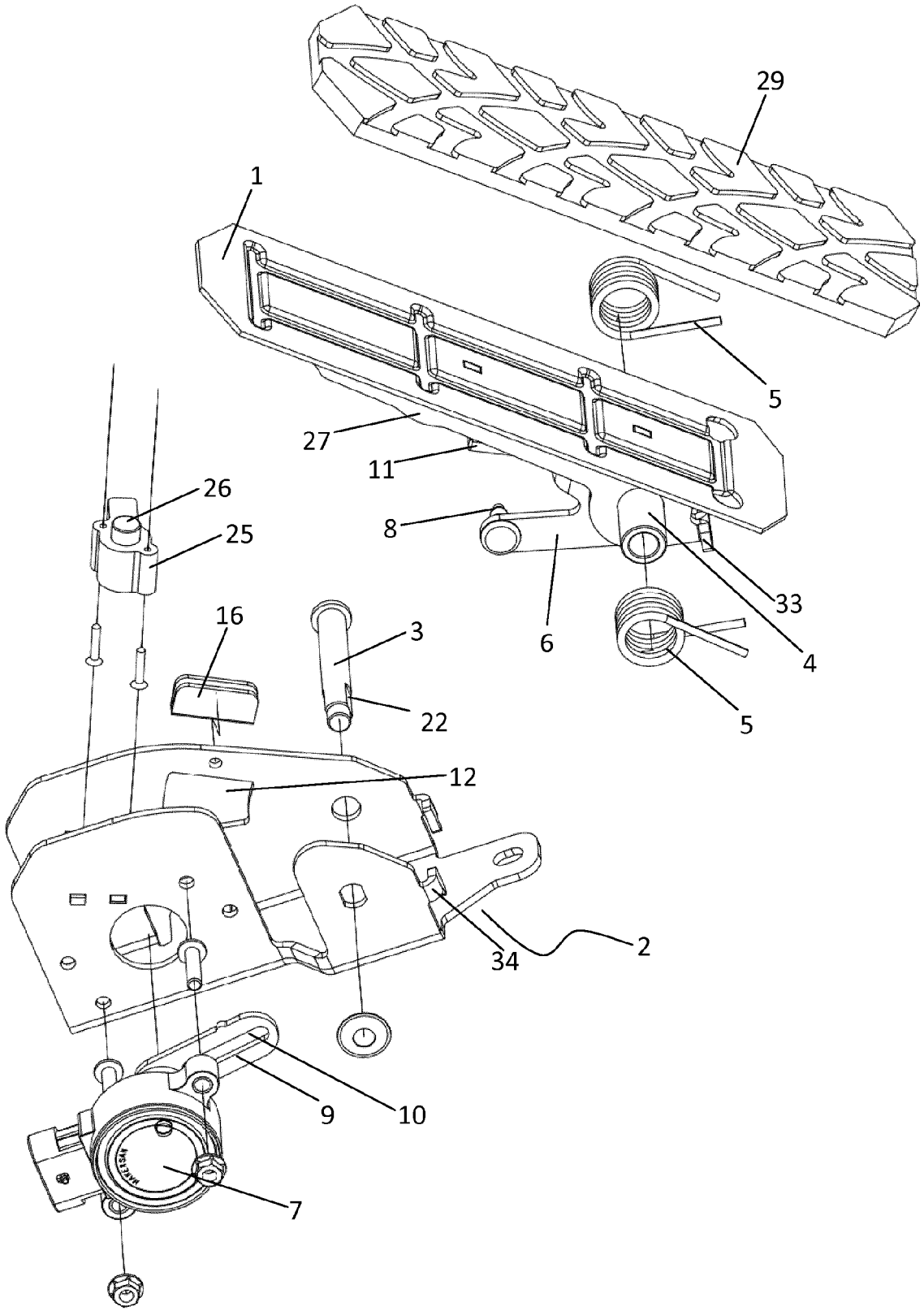


FIG. 1

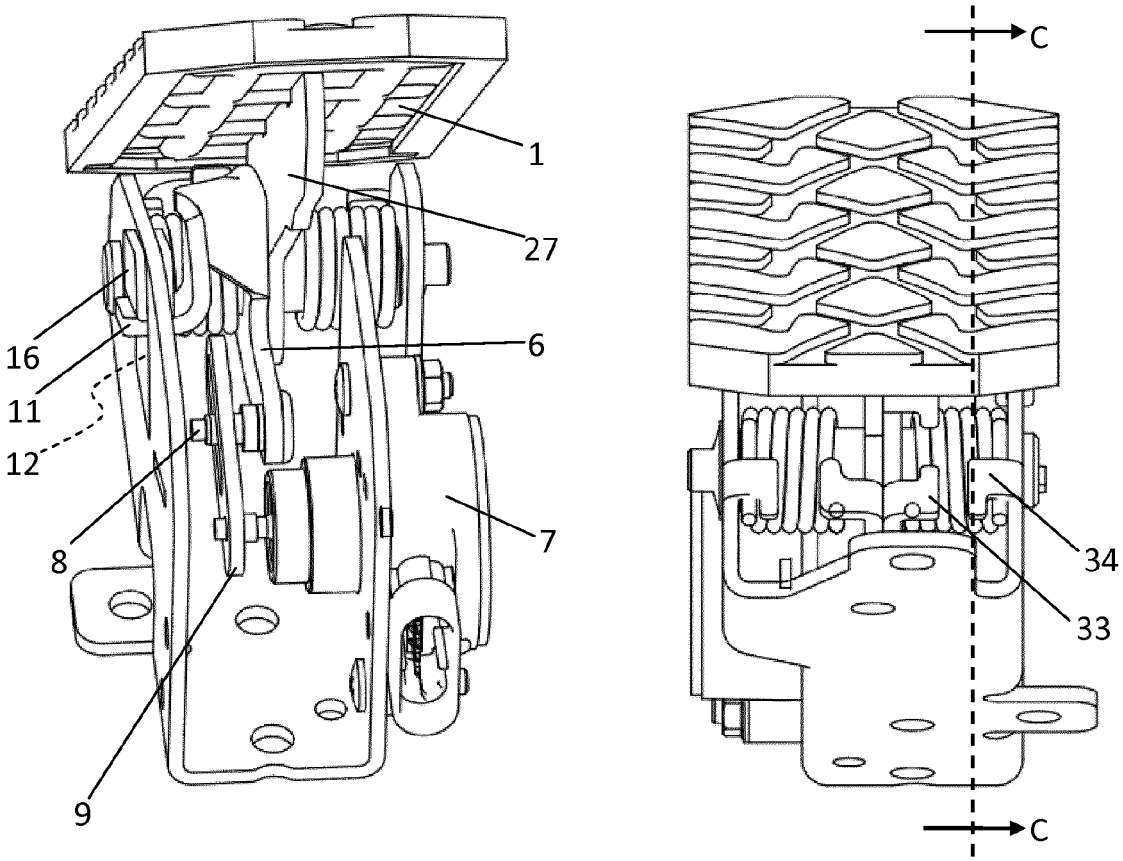
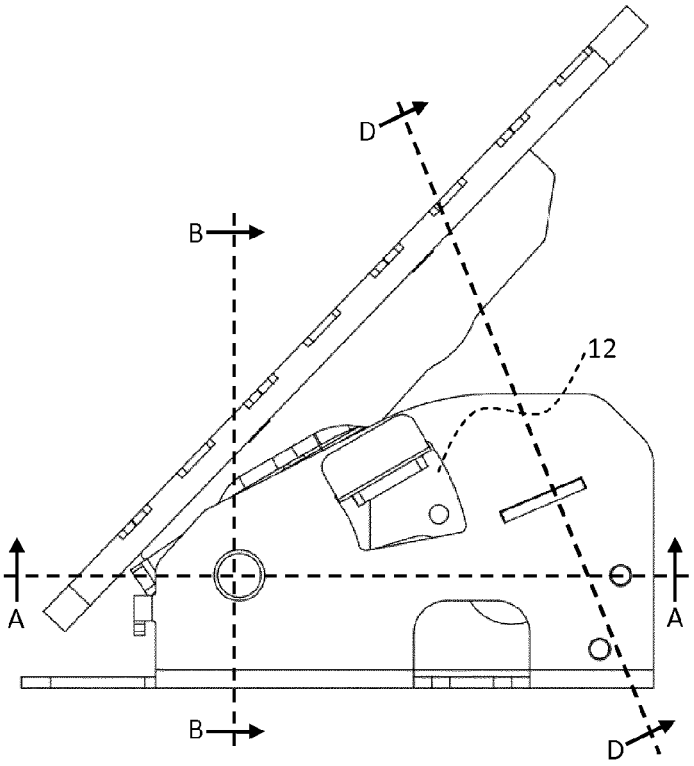
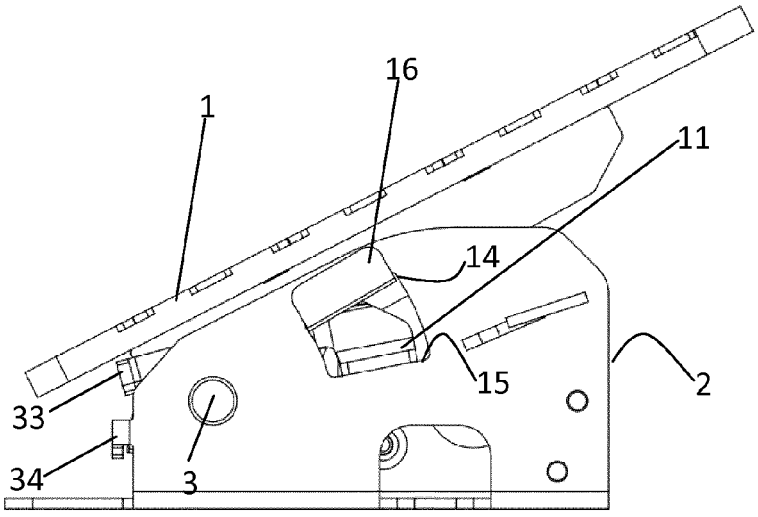


FIG.2



(a)



(b)

FIG. 3

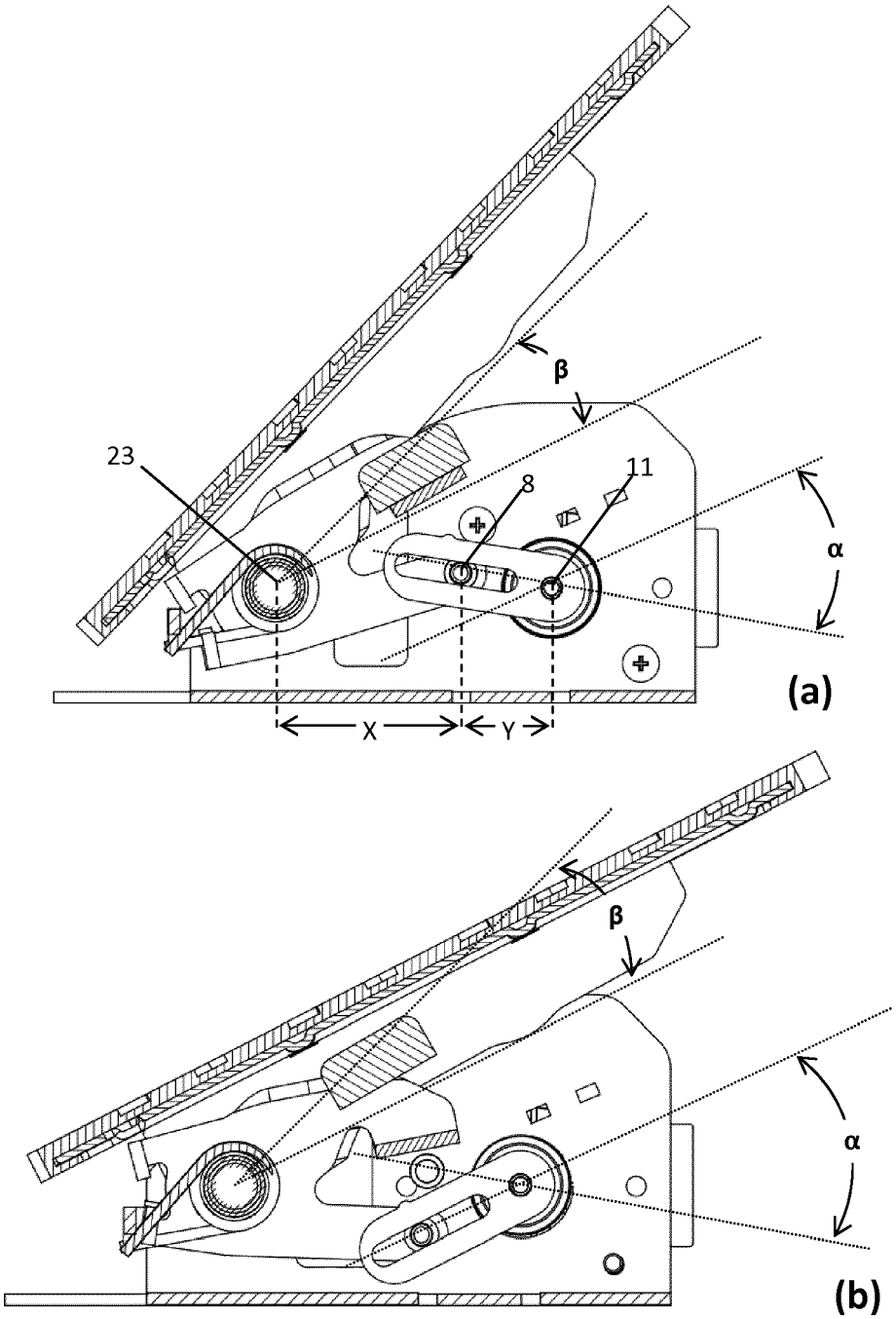


FIG. 4

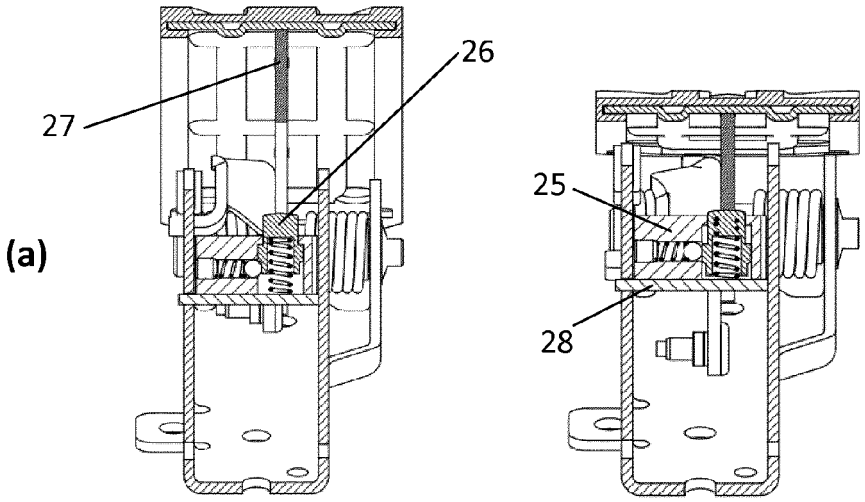


FIG. 5

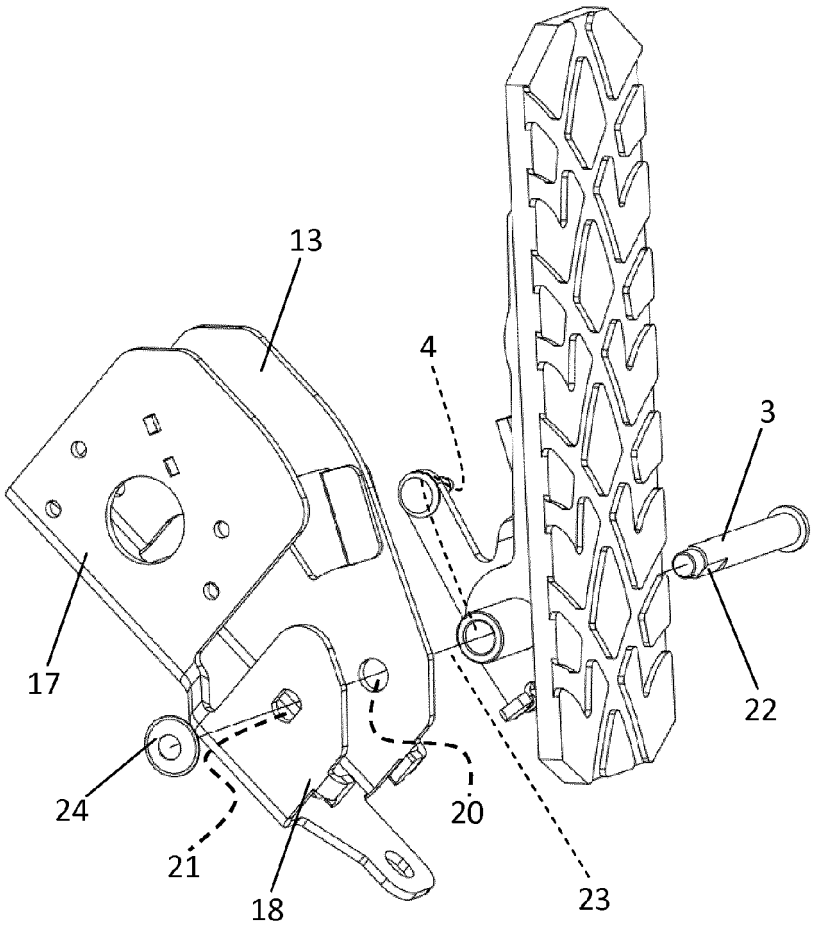
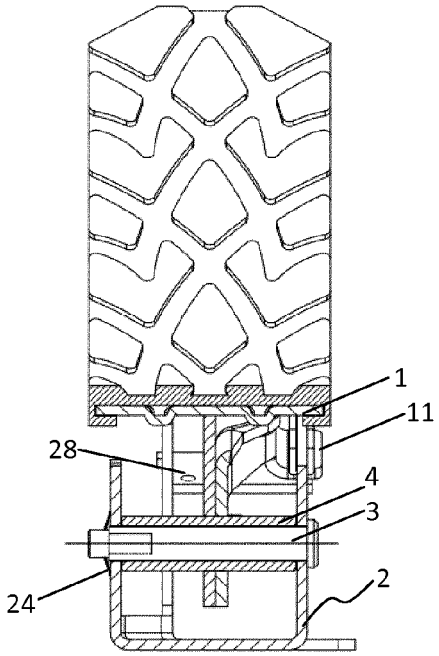
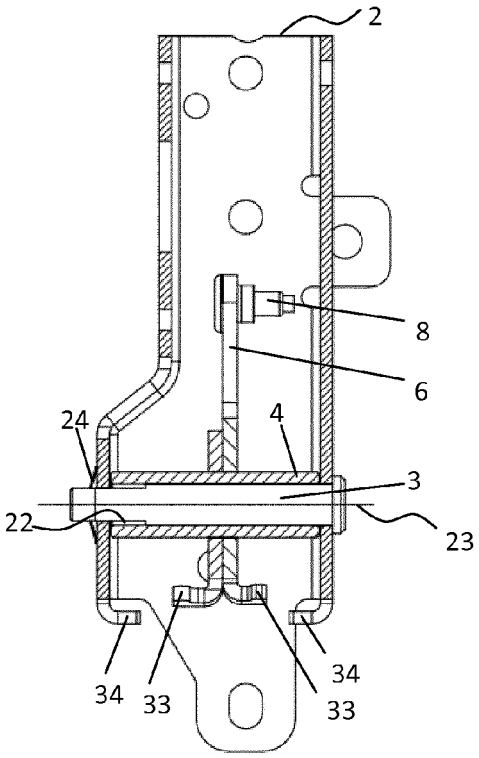


FIG. 6



(a)



(b)

FIG. 7

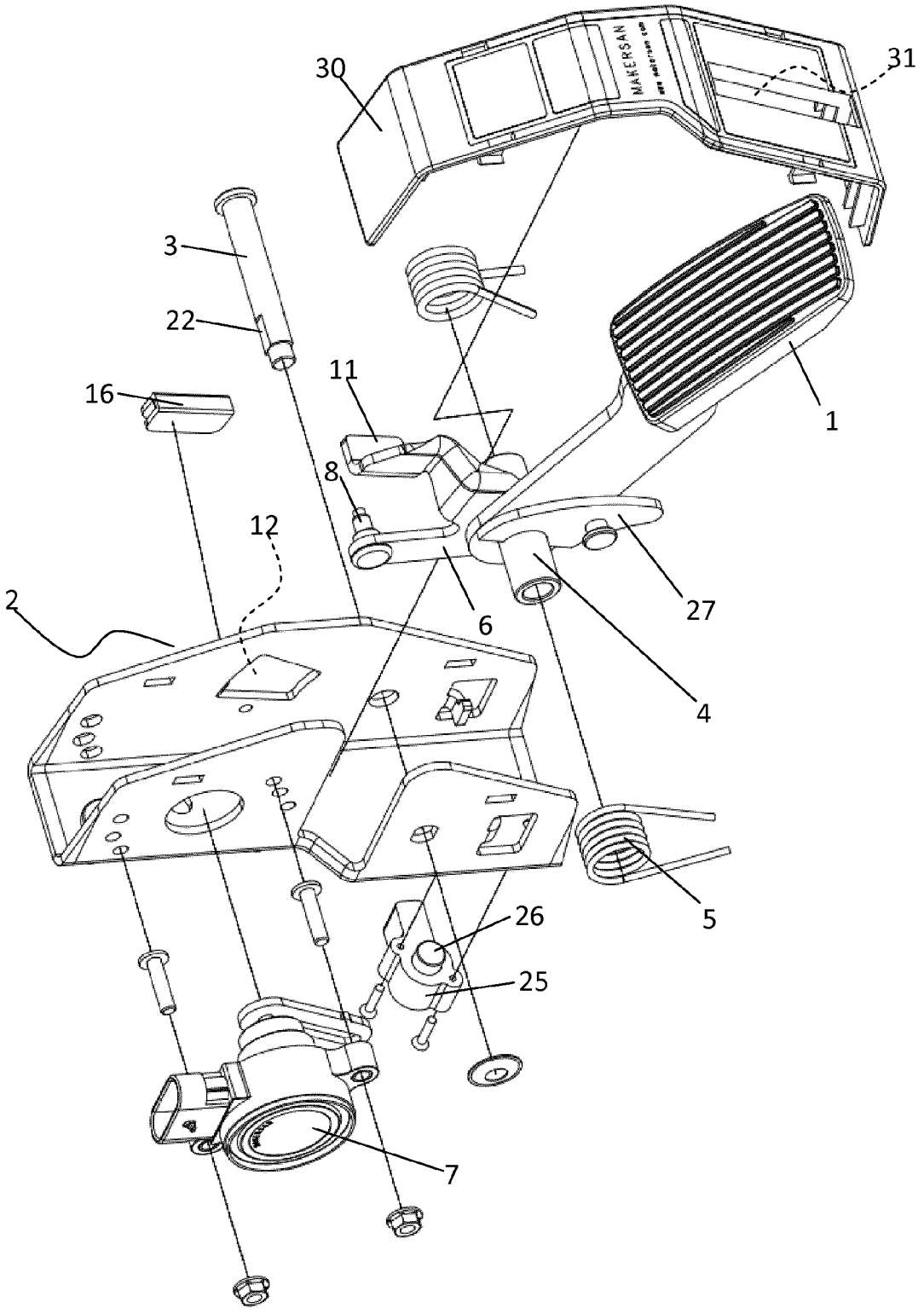
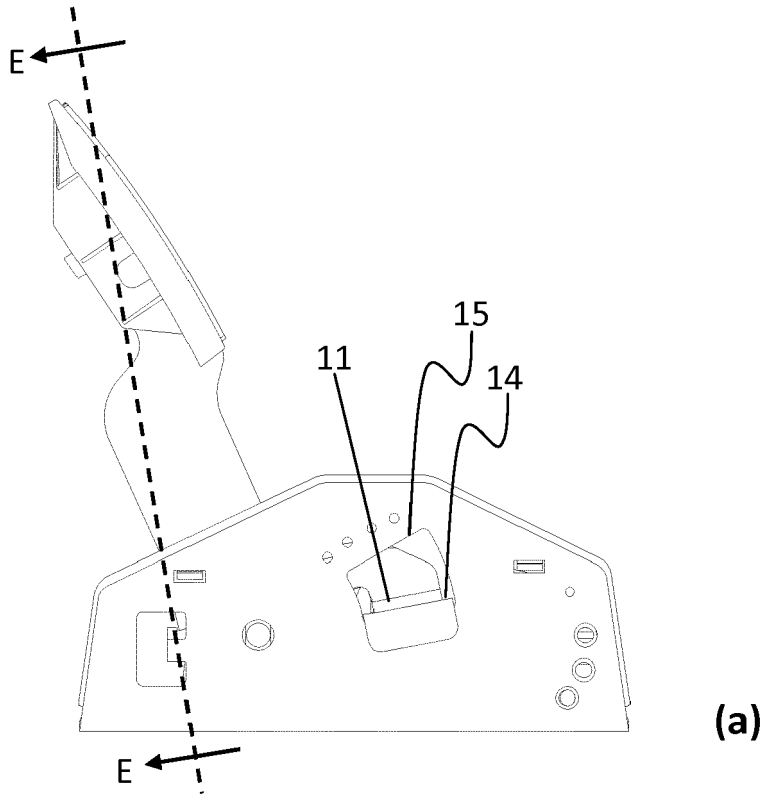
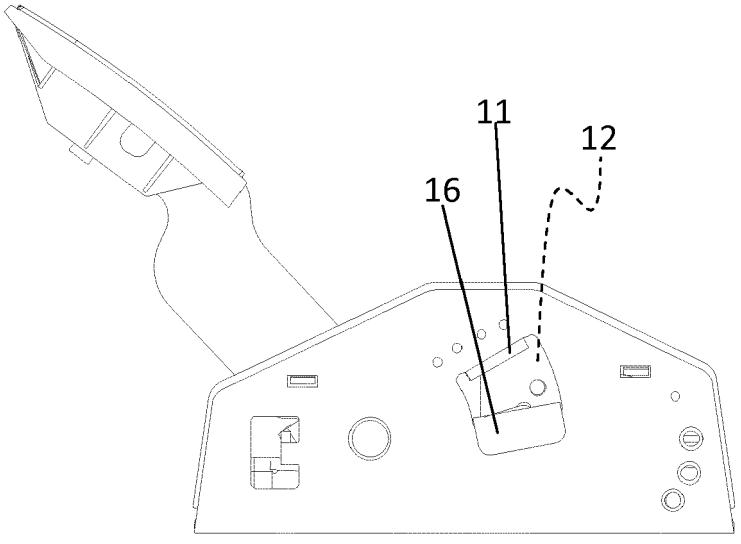


FIG. 8



(a)



(b)

FIG. 9

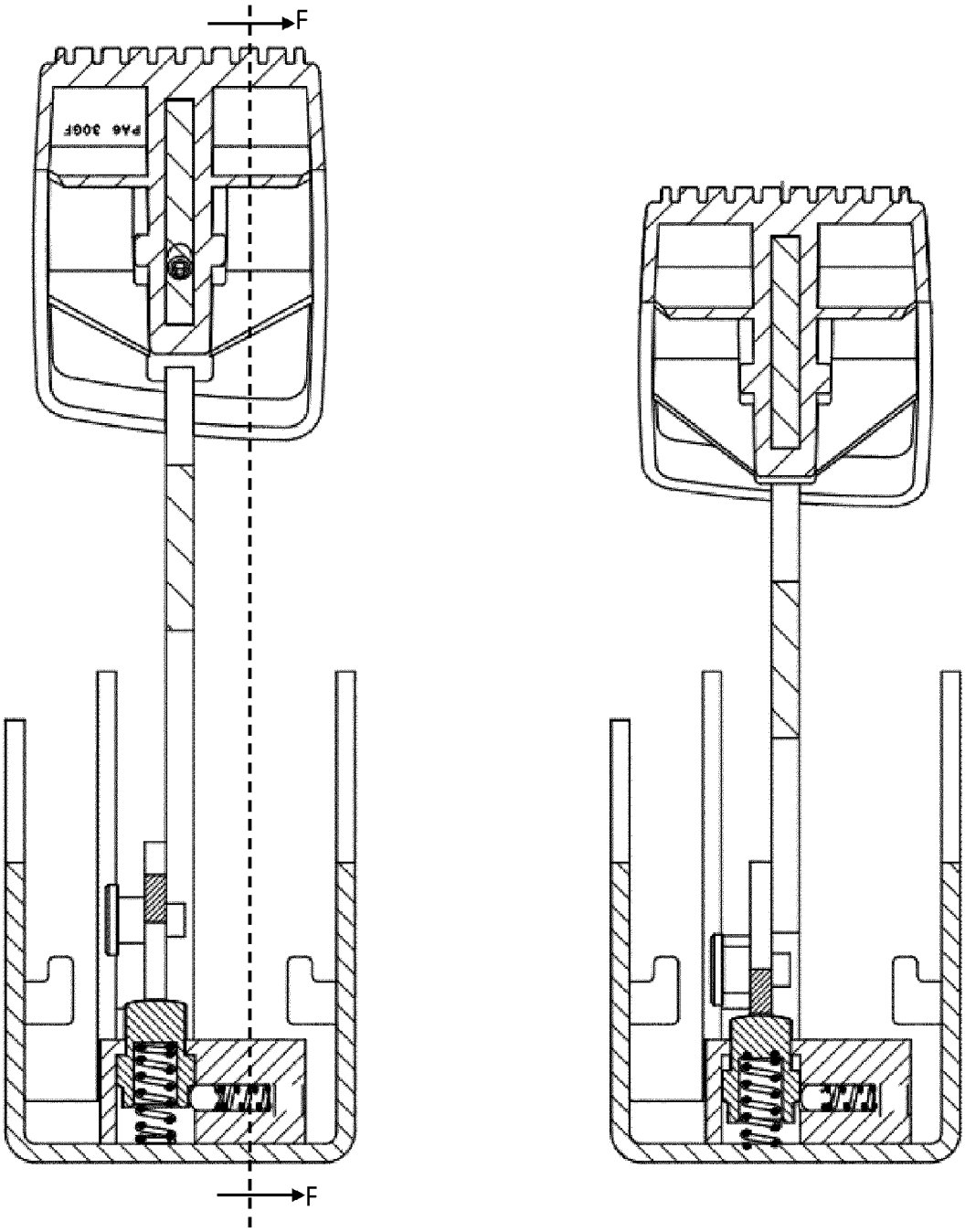
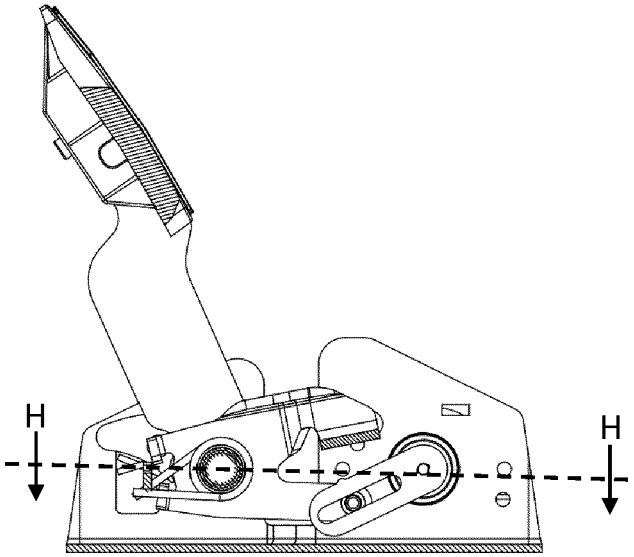
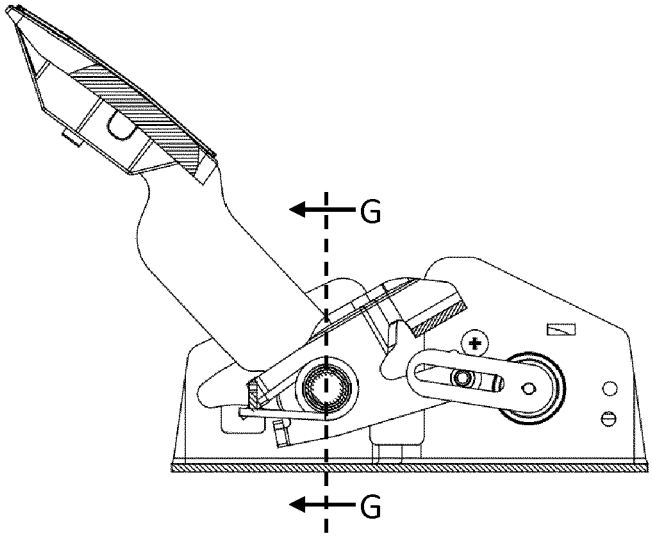


FIG. 10



(a)



(b)

FIG. 11

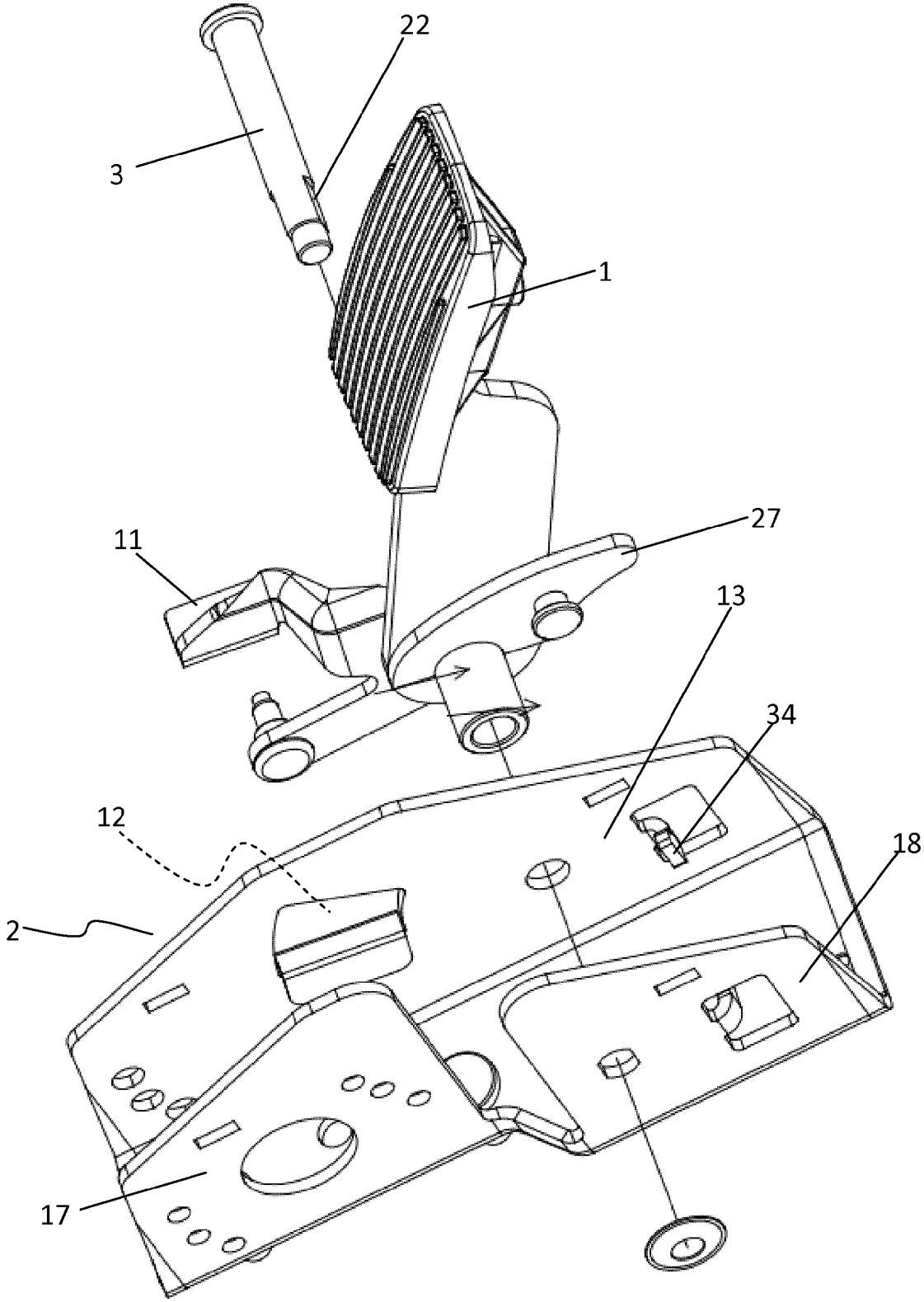


FIG. 12

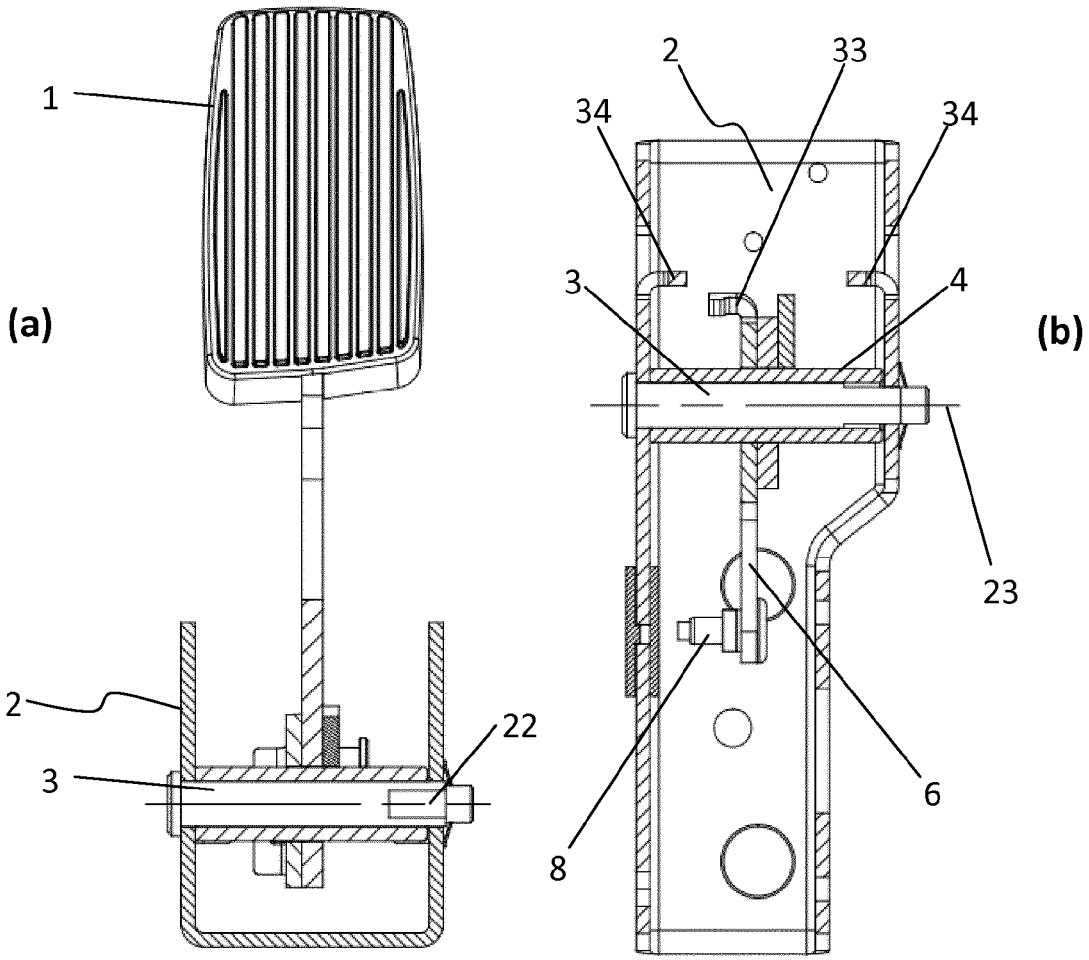


FIG. 13

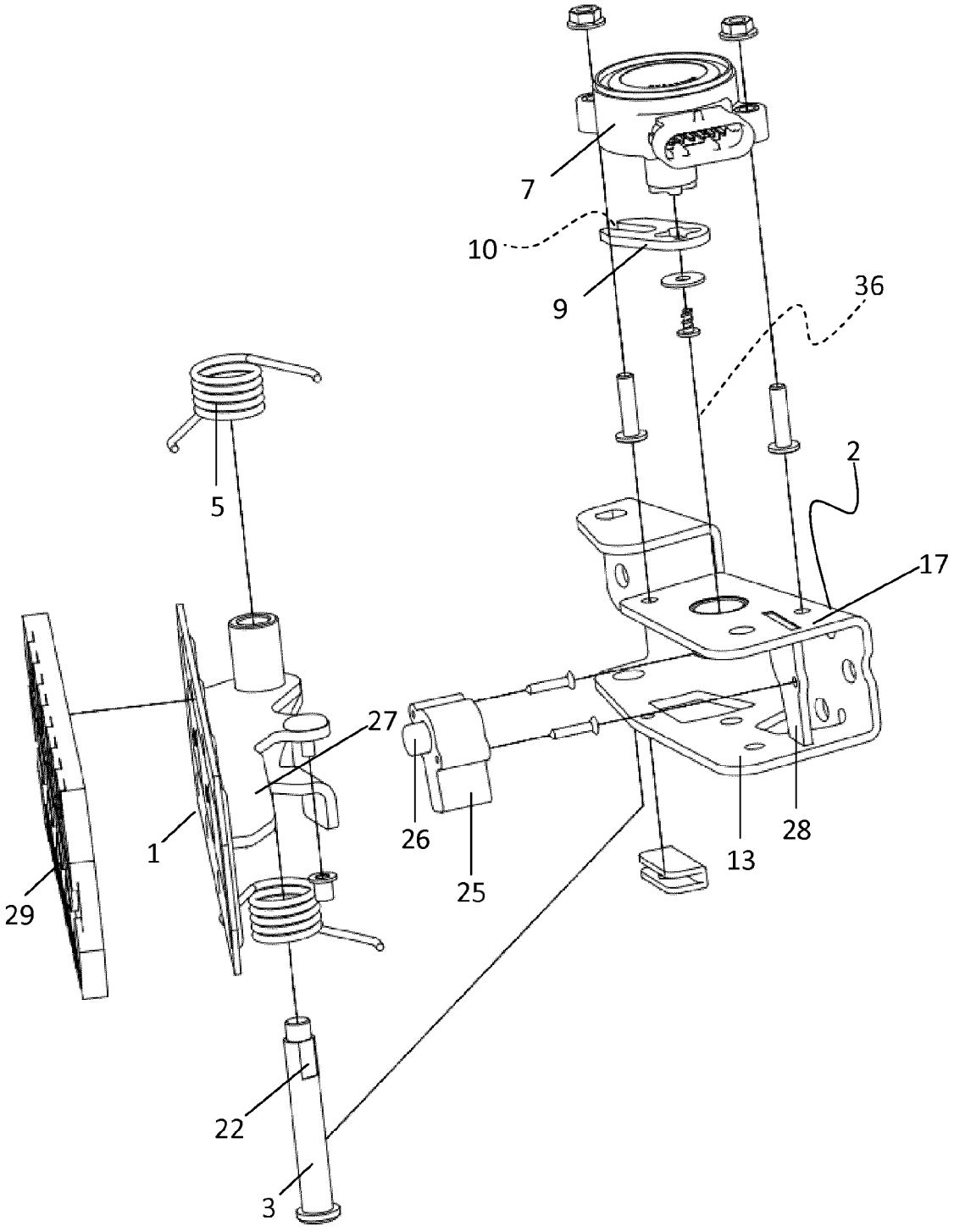


FIG. 14

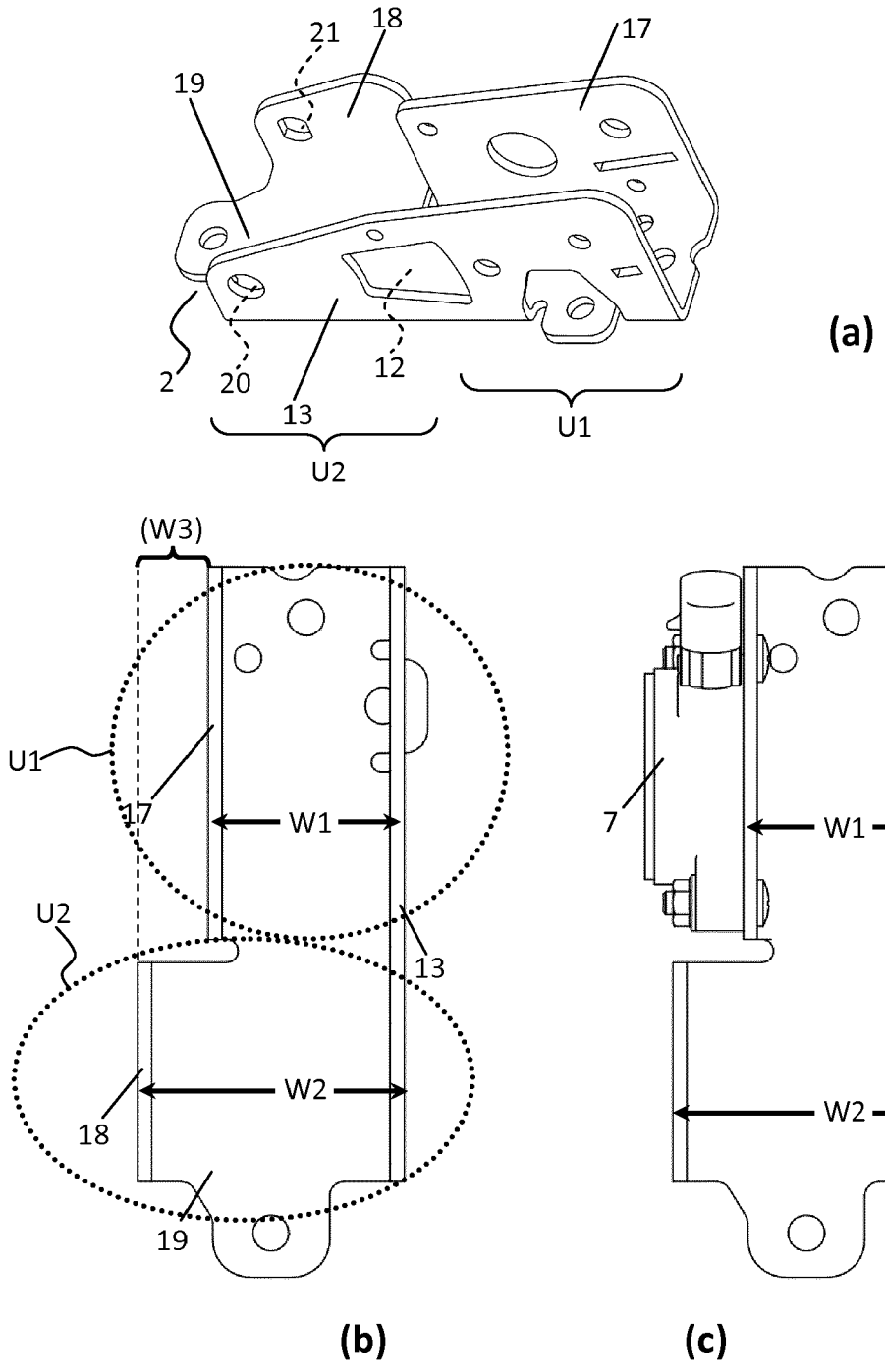


FIG. 15

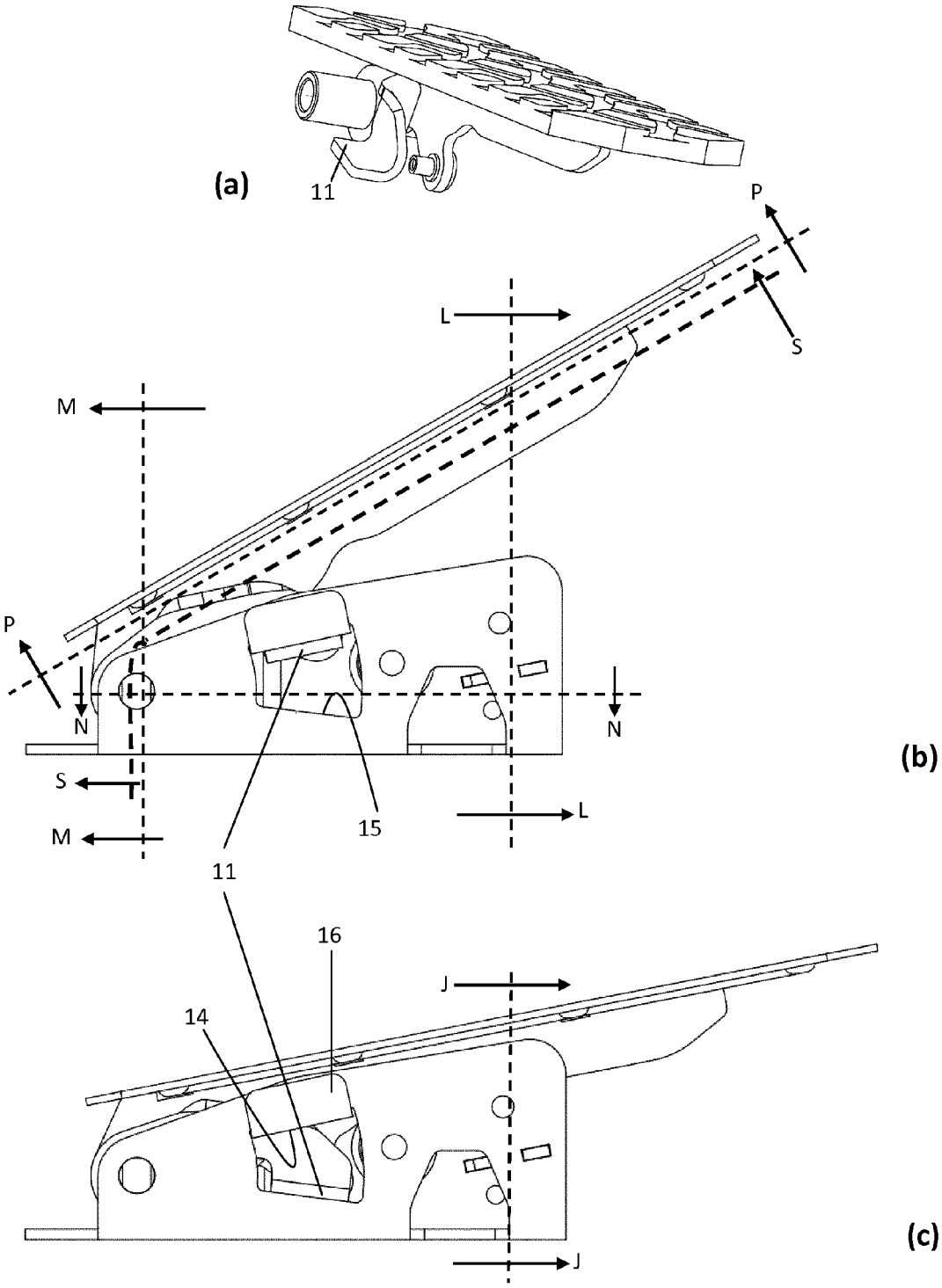
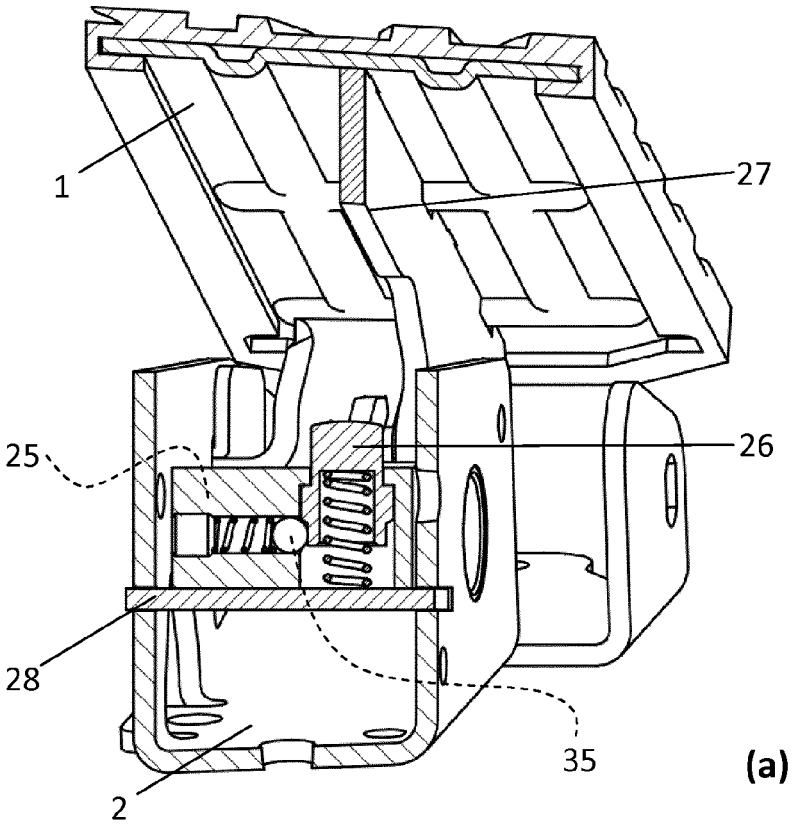


FIG. 16



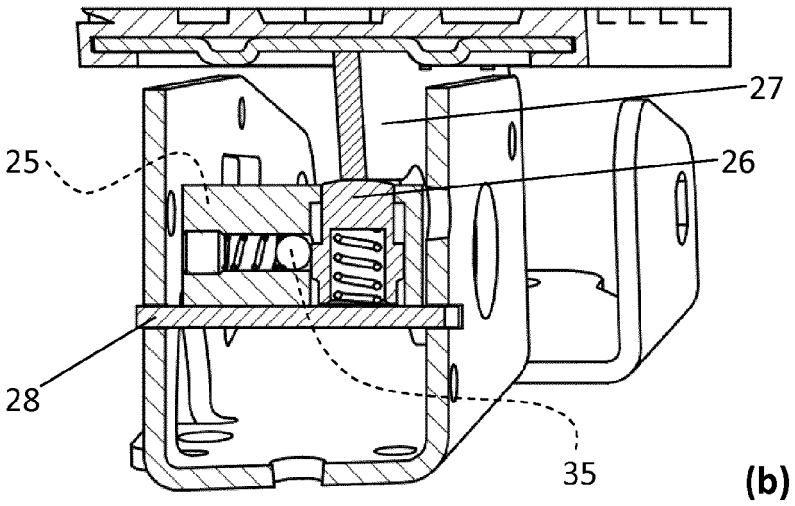


FIG. 17

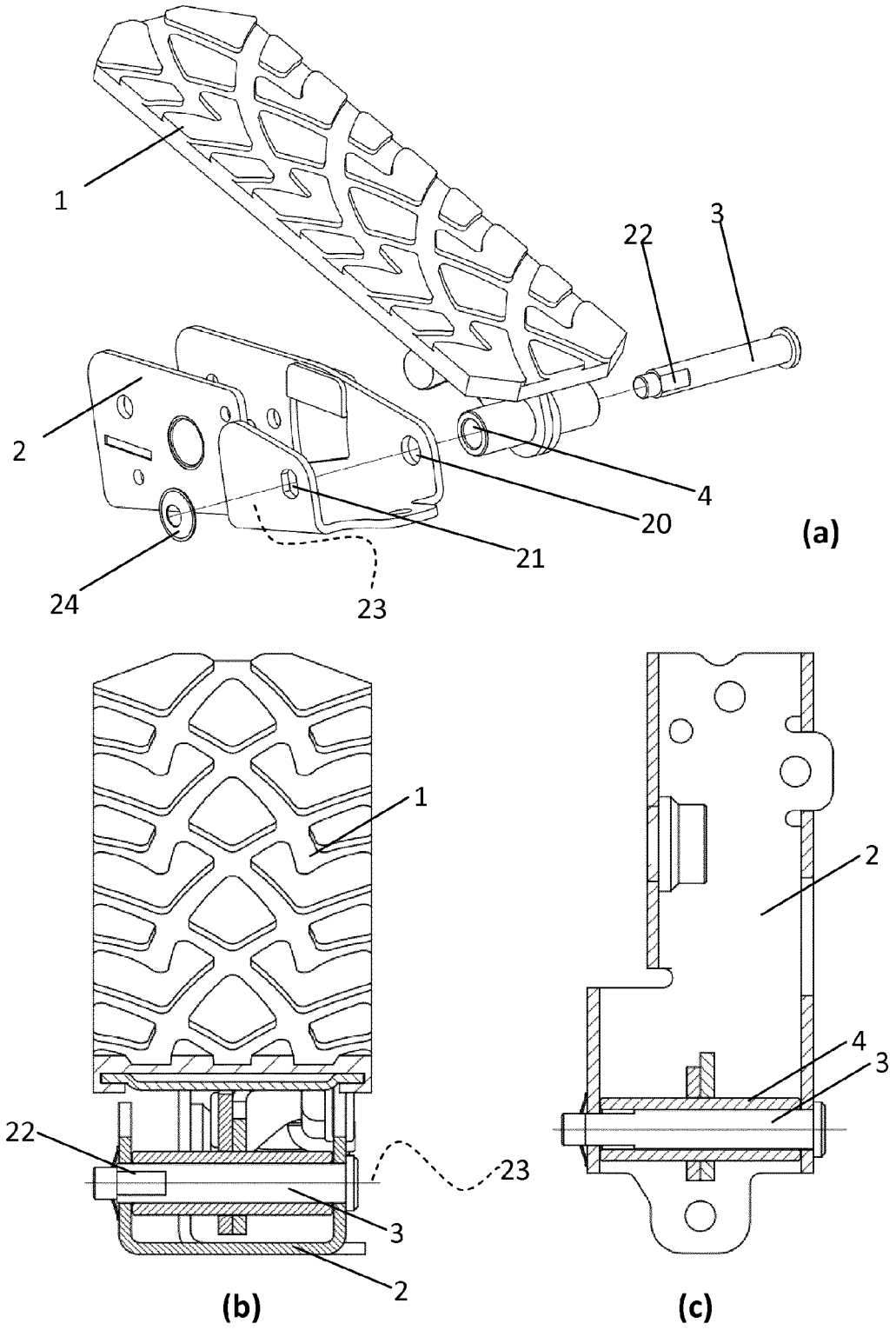


FIG. 18

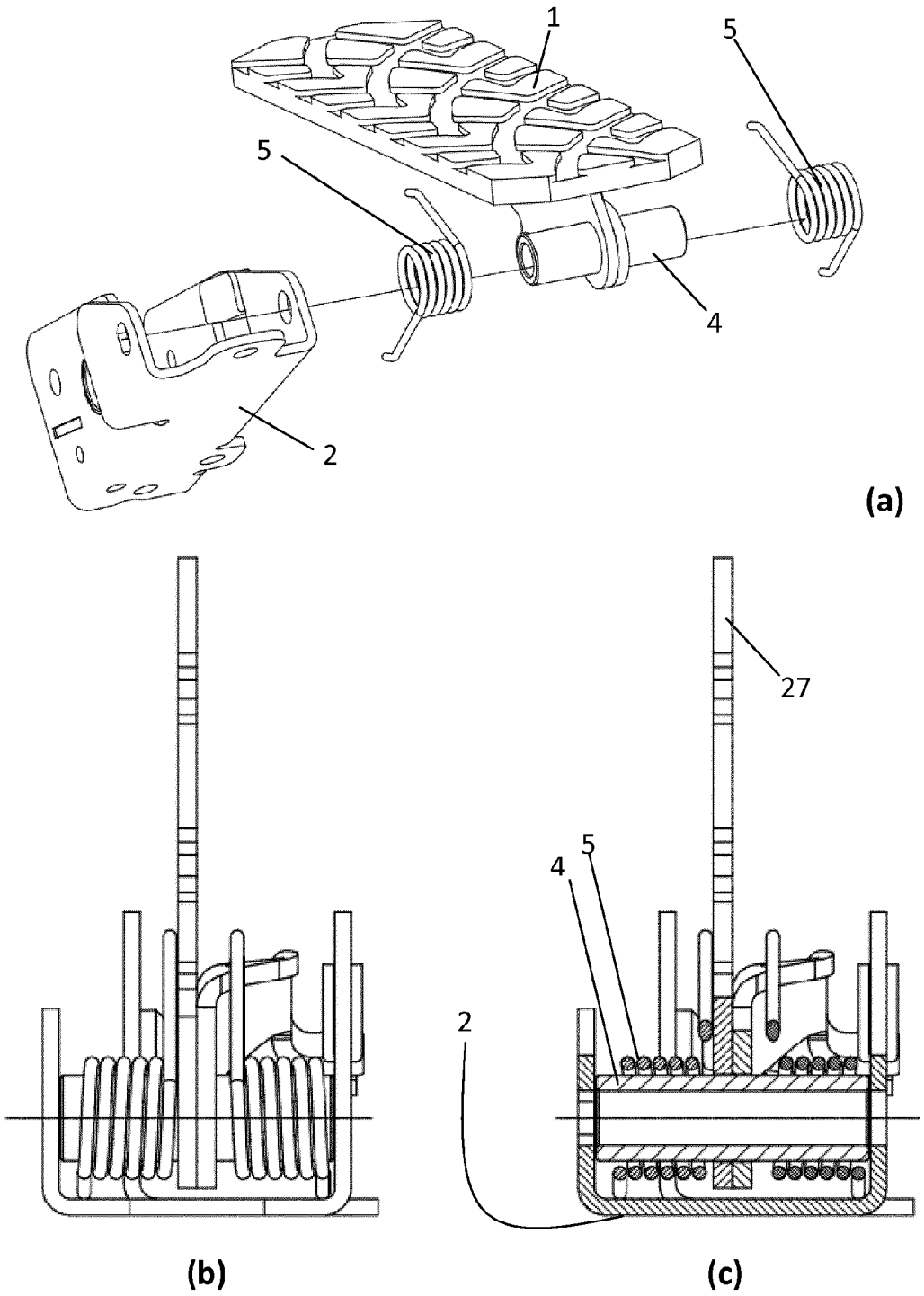


FIG. 19

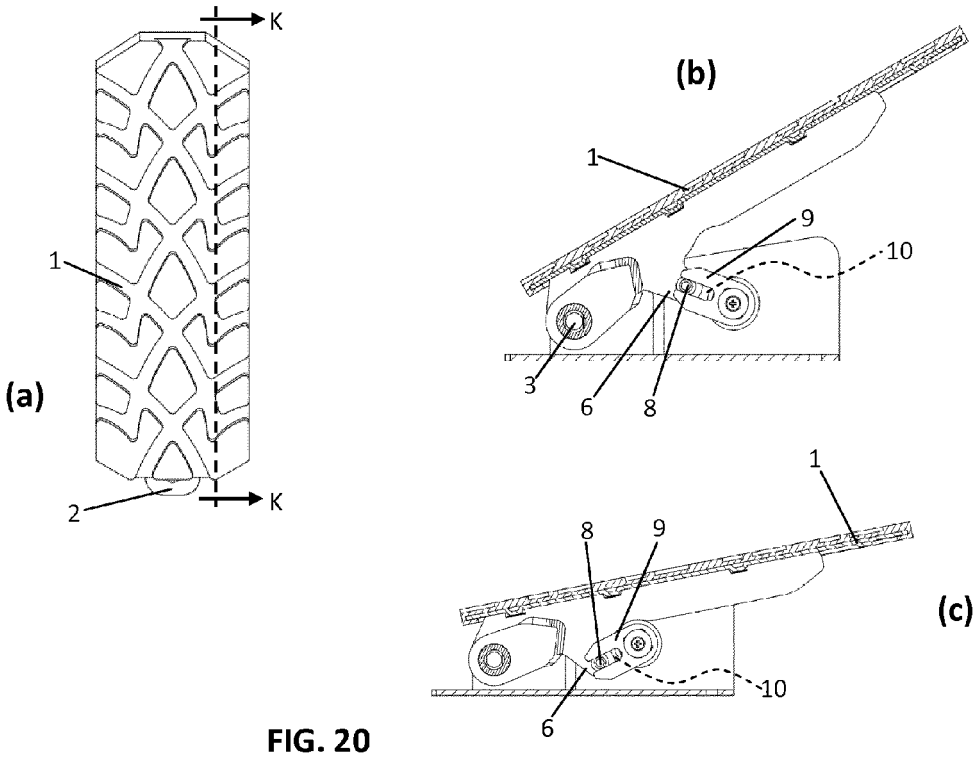
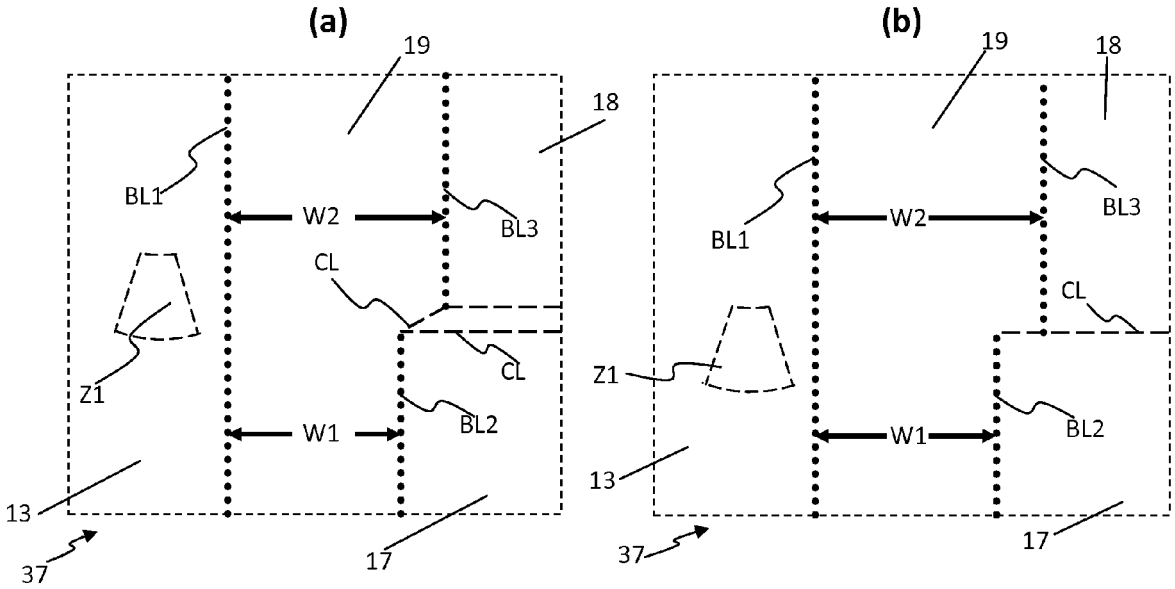

(a)
K
1
2
K
(b)
1
9
10
3
6
8
1
8
9
(c)
10
6

FIG. 20

FIG. 21


(a)
19
18
BL1
W2
BL3
CL
CL
Z1
W1
BL2
13
37
17
(b)
19
18
BL1
W2
BL3
CL
Z1
W1
BL2
13
37
17

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EUROPEAN SEARCH REPORT

Application Number
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A	WO 99/59046 A1 (IMO IND INC [US]) 18 November 1999 (1999-11-18) * figures 3,5 *	1-14	
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G05G
B60K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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