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(54) ELECTRONIC KEY AND PUSH PIECE FOR AUTOMOTIVE VEHICLE

(57) The disclosure provides an electronic key (150) for an automotive vehicle comprising a housing (120) comprising a face (123) having a hole (117), a button mechanism including a push piece (118), a support section (119) relative to which the push piece (118) is fixed, and an elastic membrane arranged fixedly inside the housing (120). The elastic membrane comprises one or more pins (104a, 104b) protruding in a direction opposite to the pushing direction, each pin (104a, 104b) being arranged so as to apply a force (F) to the support section (119) in a direction perpendicular to the pushing direction, thereby reducing movement of the push piece (118) relative to the housing (120) in at least one direction. This forms an improved electronic key for an automotive vehicle.

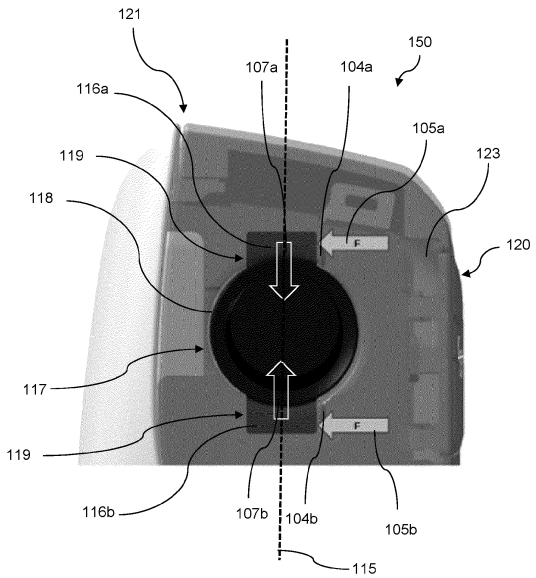

FIG. 5

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Description

Technical field

[0001] The present disclosure relates to the field of automotive vehicles, and more specifically to the field of electronic keys for automotive vehicles.

Technical background

[0002] Keys for automotive vehicles are often capable of both manually and automatically locking and unlocking the vehicle (remote keyless entry), and often for manually and automatically starting an automotive vehicle. For the automatic locking, unlocking, and/or starting (remote keyless ignition), the key generally comprises a transmitter for transmitting a code to a receiver in the vehicle to which the key is associated, the vehicle locking or unlocking the doors of the vehicle, or starting the vehicle, upon receipt of the correct code.

[0003] Keys for automotive vehicles commonly come equipped with a button, such as a press button, to execute an action, such as, the locking and unlocking of the vehicle. Many car manufacturers also use the button as a means for displaying a logo. With repeated pushing of the button by a vehicle user, the button can tend to become loose in the rotational direction, and may become loose in the translational direction (i.e. the direction of pushing). Consequently, the button can involuntarily twist or rotate about its axis (and in some cases where the button becomes loose in the translational direction, can take on a tilted or lopsided form along the surface of the key), the orientation of the button therefore falling outside its desired tolerance. This can result in an aesthetically displeasing arrangement of the key surface, and can in some cases affect the correct technical functioning of the button.

[0004] Within this context, there is still a need for an improved electronic key for an automotive vehicle.

Summary of the invention

[0005] It is therefore the object of this disclosure to provide an electronic key for an automotive vehicle, wherein the electronic key comprises:

- a housing comprising a face having a hole,
- a button mechanism including:
    - a push piece arranged such that the push piece is accessible through the hole for being pushed in a pushing direction toward the inside of the housing,
    - a support section relative to which the push piece is fixed, and
- an elastic membrane arranged fixedly inside the housing so as to present a portion pressable by pushing the push piece in the pushing direction, thereby actuating the button mechanism, the elastic membrane comprising one or more pins protruding in a direction opposite to the pushing direction, each pin being arranged so as to apply a force to the support section in a direction perpendicular to the pushing direction, thereby reducing movement of the push piece relative to the housing in at least one direction.

[0006] According to some examples, the one or more pins may comprise at least two pins.

[0007] According to some examples, the at least one direction may be a rotational direction relative to the axis of the pushing direction.

[0008] According to some examples, each respective pin may apply a force opposite in direction to the pushing force so as to limit translational displacement of the push piece towards or away from the face of the housing.

[0009] According to some examples, the one or more pins may be each in an elastic material and/or integrally formed with the elastic membrane.

[0010] According to some examples, the push piece push piece may be circular.

[0011] According to some examples, the hole may be circular.

[0012] According to some examples, the support section may comprise at least two wings extending away from the push piece, each respective wing being in contact with at least one of the at least two pins.

[0013] According to some examples, the pressable portion may comprise a raised portion arranged so as to push away the push piece.

[0014] According to some examples, each respective pin may be chamfered.

[0015] According to some examples, the elastic membrane may be made of silicone.

[0016] According to some examples, the push piece may comprise a logo.

[0017] According to some examples, each wing may comprise a transverse cross-sectional U-shape.

[0018] The membrane may comprise sidewalls for surrounding one or more electronic components of the key so as to seal the electronic components.

[0019] It is also provided a method for assembling an electronic key for an automotive vehicle, wherein the method comprises:

- providing a housing comprising a face having a hole;
- providing a button mechanism including:
    - o a push piece arranged such that the push piece is accessible through the hole for being pushed in a pushing direction toward the inside of the housing;
    - o a support section relative to which the push piece is fixed;
- providing an elastic membrane comprising one or

more pins protruding in the direction opposite to a pushing direction;

- assembling the elastic membrane inside the housing and the push piece inside the housing upon the membrane with the push piece accessible through the hole; and
- positioning the support section against the one or more pins, each pin being arranged so as to apply a force to the support section in a direction perpendicular to the pushing direction, thereby reducing movement of the push piece relative to the housing in at least one direction.

Brief description of the drawings

[0020] Non-limiting examples will now be described in reference to the accompanying drawings, where:

FIG. 1 and FIG. 2 show examples of a perspective view of a front surface of the elastic membrane according to one example;

FIG. 3 shows an example of a plan view of a front surface of the elastic membrane according to one example;

FIG. 4 shows an example of a perspective view of a back surface of the elastic membrane according to one example;

FIG. 5 shows an example of a plan view of a front surface of part of an electronic key according to one example;

FIG. 6 shows an example of a perspective view of a transverse (XZ) section view of part of the electronic key according to one example;

FIG. 7 shows an example of a plan view of a side surface of the elastic membrane according to one example;

FIG. 8 shows an example of a plan view of a longitudinal (ZY) section view of the membrane according to one example;

FIG. 9 shows an example of a plan view of a transverse (XZ) section view of the membrane according to one example;

FIG. 10 shows an example of an exploded perspective view of the electronic key according to one example.

Detailed description

[0021] The present disclosure makes it possible to address the need mentioned above. It is provided an electronic key for an automotive vehicle, wherein the electronic key comprises a housing comprising a face having a hole. The electronic key comprises a button mechanism including a push piece arranged such that the push piece is accessible through the hole for being pushed in a pushing direction toward the inside of the housing. The button mechanism includes a support section relative to which the push piece is fixed. The electronic key comprises an elastic membrane arranged fixedly inside the housing so as to present a portion pressable by pushing the push piece in the pushing direction, thereby actuating the button mechanism. The elastic membrane comprises one or more pins protruding in a direction opposite to the pushing direction. Each pin is arranged so as to apply a force to the support section in a direction perpendicular to the pushing direction, thereby reducing movement of the push piece relative to the housing in at least one direction.

[0022] In particular, it is provided electronic key for an automotive vehicle. The electronic key comprises a housing (e.g. an exterior cover of the key). The housing comprises a face having a hole (e.g. a tubular hole). The electronic key comprises a button mechanism. The button mechanism includes a push piece (e.g. provided as a logo of the brand of the vehicle). The push piece is arranged such that the push piece is accessible (e.g. to a user holding the electronic key) through the hole for being pushed (e.g. finger-pressed) in a pushing direction. The pushing direction is toward the inside of the housing. The push piece can therefore act as an interface between a user and the key, e.g. to cooperate with other button mechanism components inside the key. The button mechanism may be a pushbutton mechanism. The button mechanism may execute an action upon receiving a pushing force. The button mechanism may command actions of the vehicle (for example to lock and/or unlock the vehicle). The button mechanism also includes a support section (also referred to as a "base plate"). The push piece is fixed (i.e. unable to move) relative to which the push piece. The support section may be a rigid support.

[0023] The electronic key comprises an elastic membrane (e.g. made of silicone or another elastic material) arranged fixedly (i.e. securely, for example, not loose) inside the housing so as to present a portion pressable (also referred to as "pressable portion") by pushing the push piece in the pushing direction, thereby actuating the button mechanism. The push piece may lie upon the pressable portion. The actuating may for example activate a command to the vehicle, or may deactivate a command to the vehicle, for example locking and unlocking the vehicle, or vice versa. Actuating the button mechanism may be configured for performing either action, or alternatively for performing both actions, for example depending on a state of the vehicle (e.g. for performing activating/locking when the vehicle is in a deactivated/unlocked state, and for performing deactivating/unlocking when the vehicle is on the contrary in an activated/locked state). The button mechanism may be configured for being pressed more than once for performing an action. For example, the button mechanism may be configured for being pressed twice to perform an action. The button may be configured for being pressed multiple times (e.g. successively and/or repeatedly) to perform an action. This may be due to the pushing force moving through the push piece and membrane onto an electronic component beneath the membrane that can execute the instruction,

such as for example a microswitch, provided for example on a printed circuit board assembly (PCBA).

[0024] The elastic membrane comprises one or more pins protruding in a direction opposite to the pushing direction. The pins may be integrally formed with the membrane, and therefore may be of the same material as the membrane, such as, for example, silicone. This facilitates manufacturing. Alternatively, the pins may be formed separately to the membrane. In such a case the pins may be of the same material as the membrane or of a different material as the membrane. Each pin is arranged so as to apply a force to the support section in a direction perpendicular to the pushing direction, thereby reducing movement of the push piece relative to the housing in at least one direction. This can enable maintaining the push piece in the position in which it was manufactured. The push piece may comprise an image, emblem or logo. Such a graphical feature may be printed or painted on a surface of the push piece or alternatively formed of a separate piece attached to (e.g. engraved on) such a surface. The surface may be a surface offering access to the user for actuating the button mechanism by pressing the push piece. Said surface is thus oriented toward the outside of the housing, such that the logo is visible e.g. to the user. The surface protrude in a direction opposite the pushing force (e.g. may be a rounded surface so as to form a 3-dimensional spherical portion on the key) so as to become more visible and/or more tactile (. e. more easy to notice by touch) e.g. to the user. Alternatively, the surface may be oriented toward the inside of the housing, such that the logo remains visible (e.g. to the user) while at the same time forms an indent along the surface of the key, making the surface more tactile, i.e. more easy to notice by touch e.g. to the user. The reducing movement of the push piece relative to the housing may comprise blocking the push piece altogether in at the at least one direction. The support section and one or more pins may therefore be considered to form a hard stop. Therefore, the disclosure allows for the image, logo or emblem to also remain within a desired tolerance range.

[0025] The membrane is elastic, and can therefore act as a spring, being able to return to its original form. The membrane and/or the one or more pins may be of a soft material. The fact that the membrane is elastic enables the membrane to deform with the movement of the push piece and support during application of a pushing force. The membrane can therefore deflect so as to enable the button mechanism to continue to carry out its function (e. g. activating a microswitch so that the button can execute a command). Being elastic also enables the membrane to recover from the deformation upon removal of the pushing force and return to its initial position and form. The one or more pins may also be elastic, and thus also act as a spring, so as to exert a permanent force to the support section which is thereby maintained fixedly in place.

[0026] By the one or more pins being elastic, can enable pins, when in contact with the support section, to deform with the movement of the push piece and support section during application of a pushing force. Therefore not only can the pins maintain a positioning of the push piece, they can deflect (in the direction of the pushing direction) so as to enable the button mechanism to continue to carry out its function (e.g. activate a microswitch so that the button can execute a command). Being elastic also enables the pins to recover from the deformation, i. e. being elastic facilitates making the pins resistant to any permanent deformation that might be caused by the pushing force (and multiple, for example repeated, pushing forces).

[0027] By the and one or more pins being elastic, they can return to their original position and form upon removal of the pushing force. Consequently, the pins can once again be arranged so as to reduce movement of the push piece relative to the housing in at least one direction. This may include for example reducing movement of the push piece in a rotational direction, such as a clockwise or an anti-clockwise direction. In other words, by applying a force to the support section in a direction perpendicular to the pushing direction, the support section can in turn apply a force to the push piece in a direction opposite to the direction of rotational force of the push piece. This can allow the push piece to remain within the desired tolerance range in the rotational direction. Such a tolerance range may be, for example, within +/- 5° of the initial orientation of the push piece, such as, for example, within +/- 1° of the initial orientation of the push piece. By "being arranged so as to" reduce movement of the push piece, the pins may not be permanently applying a force to the support section. The pins may not be in permanent contact with the support section. Rather, at least one of the one or more pins may apply a force to the support section only when the support section comes into contact with the at least one pin, for example if the push piece starts to rotate in a direction relative to the axis of the pushing direction thereby pushing the support section into the at least one pin.

[0028] The button mechanism may be connected to a microswitch and/or other electronic components so as to send an instruction to the vehicle when actuated. The push piece is arranged such that the push piece is accessible through the hole for being pushed in a pushing direction toward the inside of the housing The inside of the housing may refer to a part or all of the inside of the electronic key. The inside of the housing may comprise a microswitch (for example disposed on a printed circuit board (PCB)), a battery, sealing elements, a battery cover, and/or a battery housing. By being pushed in a pushing direction, the push piece may apply a compressive force on the support section and the pressable portion of the membrane.

[0029] The pushing in the pushing direction may apply a pushing or compressive force (via the pressable portion of the membrane) to an electronic component for sending an instruction to the vehicle. A pushing direction toward

the inside of the housing may allow a force applied from outside of the housing, i.e. external to the housing, (and partially inside the housing depending on the extent of displacement of the push piece into the housing) to reach an actuating element, such as a microswitch. The push piece may be circular. The push piece may have a generally tubular, e.g. cylindrical shape. Alternatively, the push piece may have any other shape, such as for example a tube with a transverse cross section of an oval, rhombus, a rectangle, a square, or a hexagon. The hole may be a generally tubular hole, e.g. cylindrical. The hole may be circular. The hole may be a through hole. The hole may have a shape corresponding to that of the push piece, i.e. the hole may comprise a wall matching the outline of the shape of the push piece. The push piece may be a cylindrical piece in a cylindrical hole. The push piece and the hole may both be generally tubular (e.g. cylindrical), such that the push piece can rotate in the through hole and/or be mounted with a rotational tolerance inside though hole. Each pin of the one or more pins can reduce this movement or prevent it altogether by applying a force to the support section which in turn constrains the push piece in the direction of rotation. Alternatively, the hole may not have a shape corresponding to that of the push piece. For example, the push piece may be a cylindrical push piece in a tubular hole with a rhombic, hexagonal, oval, rectangular or square cross section. Therefore, if the push piece is cylindrical and regardless of the shape of the hole, the one or more pins can reduce movement of the push piece relative to the housing. According to another example, the push piece may be a tube with a transverse cross section of an oval, a rectangular, a square, or a hexagonal and the hole may be a cylindrical hole. Therefore, if the push piece is of a shape other than a cylindrical shape and the hole is a cylindrical hole, the one or more pins can reduce movement of the push piece relative to the housing. In other words, regardless of the shape of the push piece and/or support section, each pin of the one or more pins can reduce the movement or prevent it altogether by applying a force to the support section which in turn constrains the push piece in the direction of rotation. This can enable the orientation of the push piece to remain within a predefined tolerance. Even if the push piece comprises a shape other than a cylinder, for example a cuboid, and the hole comprises a shape other than a cylinder, for example a cuboid, there may be a space sufficient for the push piece to drift outside of its tolerance in a rotational direction. The pins can therefore also in such a case reduce the movement of the push piece relative to the housing in a rotational direction.

[0030] The button mechanism comprises a support section relative to which the push piece is fixed. The support section can therefore effectively transfer the force (i.e. a component of the force) to the push piece, if the push piece is a separate component to the support section. The push piece may be fixed to the support section such that sufficient contact is established between the push piece and support section for effective application of the force of the support section (through the one or more pins) on the push piece. The support section may act as a platform for the push piece. The push piece may be fixed at a center point of the support section. The support piece may be fixed to an underside of the push piece (the underside of the push piece being that opposite to which the side of the press piece which is pushed). Alternatively, the support piece may extend from one or more sides (for example if the push piece is tubular, and therefore comprises a wall, the support piece may extend from the wall) of the push piece. The support section may be concealed from the hole. In other words, only the push piece may be visible through the hole. The push piece and support piece may be two separate components. For example, the push piece may be press fitted into the support piece, so as to be fixedly connected to the push piece. This can also allow for the support section experiencing an applied force from the pins to effectively transmit the force to the push piece.

[0031] The elastic membrane is arranged fixedly inside the housing so as to present a portion pressable by pushing the push piece in the pushing direction. In other words, the push piece can press the portion (also referred to as "pressable portion") by pushing the push piece in the pushing direction. The pressable portion can deform during the pushing so as to transfer the pushing force to actuate the button mechanism. The material (for example, silicone) and geometry of the membrane (for example, the thickness) can permit an effective pressing of the pressable portion. The geometry of the pressable portion may therefore differ from the rest of the membrane to facilitate the pressing action.

[0032] The elastic membrane comprises one or more pins protruding in a direction opposite to the pushing direction each pin being arranged so as to apply a force to the support section in a direction perpendicular to the pushing direction, thereby reducing movement of the push piece relative to the housing in at least one direction. The support section may push into the one or more pins, the one or more pins applying a reaction force on the support section. The one or more pins may be arranged adjacent to the support section. The pins may be arranged so that, upon movement of the support section in a lateral direction, the pins come into contact and apply a force to the support section. At least one of the one or more pins may come into contact with an edge or side of the support section, i.e. a portion of the support section perpendicular to the direction of the push force. The one or more pins may comprise at least two pins. The one or more pins may comprise more than two pins. Each pin may be located along the same plane as the support section and on one side of the support section. Each pin may be located at a different position along the side of the support section. The support section may comprise one or more wings extending away from the push piece, at least one of the one or more respective wings being in contact with at least one of the one or more pins. The

membrane may for example comprise two pins and the support section may comprise two wings. Each pin may be arranged so as to apply a force to a respective wing of the two wings. Both pins, arranged along the same plane as both wings, may be located on the same side of both wings. Each wing may act as a beam that comes into contact with each of the one or more pins. Each wing may have a generally rectangular shape. Each wing may be curved. Each wing may comprise a transverse cross-sectional U-shape. This may facilitate interaction of the support piece with the one or more pins. Alternatively, each wing may be flat or planar.

[0033] The at least one direction may be a rotational direction relative to the axis of the pushing direction. The one or more pins may apply a force in the rotational direction. Therefore, a turning or spinning of the push piece on a plane parallel to the face of the hole (if for example comprising an image, emblem or logo making the image, emblem or logo appear lopsided to a user) can be reduced, and prevented altogether. Consequently, the push piece can retain its position with respect to the housing. The one or pins may apply a lateral force to the support section. In other words, when the support section comes into contact with the one or more pins, and presses against the one or more pins, the one or more pins may apply a force in a direction perpendicular to that that of the pushing force upon the support section, or a tangent to the push piece (if for example the push piece is cylindrical). As the push piece is fixed relative to the support section, the support section can effectively transfer the lateral force (i.e. a component of the lateral force) to the push piece, i.e. to a wall of the push piece if the push piece is for example a tube. This force can therefore reduce, for example slow, movement of the push piece. The force may be greater than a force applied by the push piece and acting on the support section as the push piece turns. The support section may therefore, by the pins, block all movement of the push piece in this direction. The direction may for example be in a clockwise or anti clockwise direction. The membrane may comprise at least two pins. At least one pin may be positioned so as to reduce movement of the push piece in a clockwise rotational direction. At least one pin may be positioned so as to reduce movement of the push piece in an anticlockwise rotational direction. Applying a pin to reduce movement of the pin in a clockwise rotational direction and applying a pin so as to reduce movement in an anticlockwise direction can enable reducing all movement in the rotational direction and can even enable preventing all movement in the rotational direction. The support section and one or more pins may therefore be considered to form a lateral hard stop.

[0034] Each respective pin may apply a force opposite in direction to the pushing force so as to limit translational displacement of the push piece towards or away from the face of the housing. In other words, each pin may be arranged so as to apply a force to the support section that reduces movement of the push piece towards the interior of the housing (and away from the face) or that reduces movement of the push piece towards the face of the housing (for example fixing the push piece along the surface of the housing). The form of each pin may facilitate applying such a force. Each pin may be chamfered. The chamfering may only be along the part of the pin applying a force to the support section. Alternatively, the chamfering may be along the whole pin. The chamfering can enable the pin to have a wider part towards its base (i.e. the part of the pin connected directly to the rest of the membrane), and a narrower part towards its tip (i.e. extremity of the protruding end of the pin). The support section may therefore sit into the sloping surface of the pin formed by the chamfering, that is to say, a part of the support section (for example a bottom surface of the support section) may sit on the wider part of the pin, and a part of the support section (for example an edge of the support section) may fit alongside the narrower part of the pin. The pin may therefore apply a force in both a lateral direction and a direction opposite to that of the pushing.

[0035] The membrane may comprise a main portion that is equal to the part of the membrane excluding the pressable portion, i.e. the part of the membrane that the pushing piece does not press, at least not directly, during the pushing. The pressable portion may comprise a raised portion arranged so as to push away the push piece. In other words, the raised portion may maintain the positioning of the push button in the pushing direction when there is no pressing on the button mechanism. The raised portion may therefore also reduce movement of the push button in the pushing direction. Unlike the pins, the raised portion may be in constant (direct or indirect) contact with the push piece. The pins may only come into contact with the push piece as a preventative measure, i.e. when the push piece starts to move (i.e. drift) outside of its tolerance position, particularly in the direction perpendicular to the pushing direction. The push piece may lie upon the raised portion. The raised portion may act as a compression spring. It may be compressed with the pushing force, and upon removal of the pushing force may then extend back to its original position and form, thus sending back the push piece to its original position, i.e. non-actuated position. The raised portion may be of a shape similar to or the same as the push piece. This may facilitate having good contact between the membrane and the push piece. The raised portion may alternatively have a shape different to that of the push piece. The raised portion may provide a space (between the surface of the raised portion in contact with the push piece and the main portion of the membrane) through which the push piece can move through during the pushing, providing a button effect. The pressable portion may comprise one or more grooves on the inside of the portion (i.e. the side of the portion opposite to that experiencing the pushing). The grooves may be around an outer perimeter of the pressable portion. The grooves may facilitate maintaining the structure of the pressable portion if

the pressable portion comprises a raised portion.

[0036] A user may push the push piece, forcing it down onto the membrane and deforming the pressable membrane, until the force achieves an actuating of the button mechanism. The pushing may apply a force to an electronic component (for example a microswitch) in the key, for example beneath the membrane. The electronic component may then send an instruction to the vehicle (for example to unlock, lock the vehicle, open the vehicle trunk). If the pressable portion comprises a raised portion, the raised portion may comprise a hollow part in its center, so as to form a ridge around the center hollow part. The hollow part may enable the raised portion to more easily fall in on itself during the pushing.

[0037] The membrane may act as a sealing feature for components of the key. The membrane may be made of silicone. This may improve the sealing performance of the membrane. Silicone may also be selected to improve the durability of the membrane. The membrane may comprise sidewalls. The sidewalls may surround one or more electronic components of the key so as to seal the electronic components. The membrane may therefore protect key components sensitive to liquid, for example water damage. The membrane may comprise one or more plugs so as to assist fixedly connecting the membrane in the key. The membrane may comprise plugs along one or more of the sidewalls of the membrane, for example one or more plus on one side and one or more plugs on an opposite side, such as three plugs on one side and two plugs on an opposite side. The one or more plugs may fit into one or more grooves or slots inside the housing. The plugs may therefore also act as a sealing feature, fitting into the grooves or slots so as to prevent any passing of liquids. The geometry of the plugs may be larger than that of the grooves or slots to further facilitate the sealing and/or fixing. The one or more plugs may be along the exterior of the membrane. Additionally or alternatively, the membrane may comprise one or more protruding parts along the inside of the membrane. The protruding parts may interact with the housing or other components of the key, such as for example other housings, PCB (printed circuit board), and/or PCBA so as to fix the position of the membrane and/or the other components within the key.

[0038] The electronic key may comprise an intermediate housing between the membrane and the support section (and, for example the push piece). The intermediate housing may comprise a hole around the pressable portion of the membrane, so as to allow for the pushing. The housing may also comprise one or more smaller holes for incorporating each of the one or more pins. Each pin may therefore protrude through the respective hole of the intermediate housing. Each pin can therefore still be arranged so as to apply a force to the support section in a direction perpendicular the pushing direction.

[0039] It is also be provided a method for assembling such an electronic key for an automotive vehicle.

[0040] The method comprises providing a housing comprising a face having a hole. The method comprises providing a button mechanism. The button mechanism includes a push piece arranged such that the push piece is accessible through the hole for being pushed in a pushing direction toward the inside of the housing. The button mechanism includes a support section relative to which the push piece is fixed. The method comprises providing an elastic membrane comprising one or more pins protruding in the direction opposite to a pushing direction. The method comprises assembling the elastic membrane inside the housing and the push piece inside the housing upon the membrane with the push piece accessible through the hole. The method comprises positioning the support section against the one or more pins, each pin being arranged so as to apply a force to the support section in a direction perpendicular to the pushing direction, thereby reducing movement of the push piece relative to the housing in at least one direction. Positioning the support section against the pins may comprise press-fitting the support section so as to, for example, deform the pins. This may facilitate connection between the support section and the one or more pins so as to facilitate application (by the pins) of the force against the support section, and consequently against the push piece.

[0041] The method may comprise forming (e.g. molding) a housing comprising a face having a hole. The method may comprise forming a button mechanism (e.g. molding). Forming a button mechanism may include forming a push piece arranged such that the push piece is accessible through the hole for being pushed in a pushing direction toward the inside of the housing. Forming a button mechanism may include forming a support section relative to which the push piece is fixed. In other words, the method may comprise fixing the push piece relative to the support section. The method may comprise forming an elastic membrane arranged fixedly inside the housing so as to present a portion pressable by pushing the push piece in the pushing direction, thereby actuating the button mechanism. The method may comprise forming the elastic membrane to comprise one or more elastic pins protruding in a direction opposite to the pushing direction. The method may comprise forming each pin to be arranged so as to apply a force to the support section in a direction perpendicular to the pushing direction, thereby reducing movement of the push piece relative to the housing in at least one direction.

[0042] The method may comprise forming the push piece to be circular, i.e. to have a circular shape when positioned along the face of the housing. The method may comprise forming the push piece to be cylindrical. The method may comprise forming the hole to be circular, for example cylindrical. The method may comprise forming the support section to comprise one or more wings extending away from the push piece, at least one of the one or more respective wings being in contact with at least one of the one or more pins. The method may comprise forming each wing to comprise a transverse cross-sectional U-shape. The method may comprise forming

the pressable portion to comprise a raised portion arranged so as to push away the push piece. The method may comprise forming the membrane to comprise sidewalls for surrounding one or more electronic components of the key so as to seal the electronic components. The method may comprise chamfering each respective pin. The method may comprise forming the elastic membrane out of silicone. This The method may comprise forming a logo, image or emblem on the push piece.

[0043] Manufacturing the membrane may comprise forming the membrane by injection molding. The manufacturing may comprise forming the pins integrally with the membrane. The manufacturing may therefore comprise also forming the pins by injection molding. The manufacturing may comprise using silicone to integrally form the membrane and pins. This may facilitate manufacturing due to the flow properties of the material, and/or because the material may be easily combined with other materials, and/or because use of the material may result in a more accurately formed part (i.e. reduces quantity of scrap parts or byproducts). Alternatively, the manufacturing may comprise forming the membrane and pins in two steps, for example forming the pins separately to the membrane and subsequently fixing the pins to the membrane. The manufacturing may comprise forming the pins separately by injection molding. Alternatively, the manufacturing may comprise forming the pins by a method other than injection molding, such as for example, 3D-printing. The manufacturing may comprise creating a 3D model of the membrane and using the 3D model as a basis for forming the membrane. For the manufacturing may comprise forming a mold of the 3D model. The injecting molding may comprise injecting a material, such as for example silicone, into the mold of the model, thereby forming the membrane.

[0044] The manufacturing may comprise forming the push piece and support section as one integral part. Therefore, when the one or more pins apply a force to the support section, the movement at the push piece can reduce directly. Alternatively, the manufacturing may comprise forming the push piece and support section as two separate parts. Assembly of the electronic key may then comprise fixing the push piece relative to the support piece so as to ensure a stable contact between the push piece and support section. This can enable the support piece effectively transferring the force from the pins to the push piece. Alternatively, the manufacturing may comprise forming the push piece and support section as two separate parts and fixing the push piece to the support section so that the push piece and support section form one part. This may facilitate assembly constraints. Assembling the key may comprise fitting the membrane, support section and press piece as layers. This may comprise placing an electronic component for executing the instruction to the vehicle as a bottom or lower layer beneath the push piece, support section, and membrane (in a layer in that order). The assembling may comprise inserting different layers at different stages of the assembly process. For example, assembling may comprise placing the push piece and support structure before the membrane, or vice versa. The assembly may comprise placing components such as, for example a battery and battery housing beneath the push piece, support section, and membrane.

[0045] FIG. 1 and FIG. 2 show perspective views and FIG. 3 a plan view of the membrane 100 according to an example. The figures provide views of the front surface of the membrane 100, i.e. the part of the membrane facing the pushing force. The membrane 100 has a mostly rectangular shape, with a main portion 106 that is largely flat apart from a first main portion 106a that is raised to a height above a second portion 106b of the main portion. This may facilitate the overall shape of the key and the manner in which the key components are positioned inside the key. The membrane 100 comprises a pressable portion 102 for undergoing the pushing. The pressable portion comprises a raised portion 108 in the form of a circular ridge with a hollow portion 110, forming a doughnut or ring shape at the pressable portion. The raised portion may be arranged so as to push away the push piece. The membrane comprises two pins 104a, 104b. The membrane may comprise at least two pins 104a, 104b, for example more than two pins 104a, 104b. The pins are protruding in a direction opposite to a pushing direction represented by arrow 129. The membrane 100 and pins 104a, 104b may be made of silicone. Two pins 104a, 104b are placed to the side (right) of a center line 115 that runs through the diameter of the pressable portion. The pins 104a, 104b are aligned with one another and are spaced a predetermined distance from the pressable portion. Each pin is chamfered, so as to be wider along the base and narrower along the top. Each pin has a triangular (isosceles) longitudinal cross section. Each pin has a shape of an extruded triangle. It is possible that only one side of each pin is chamfered (i.e. the side that will meet the support section). This can provide a sliding surface when mounting the support section, so as to facilitate engagement between the support section and one or more pins. The membrane comprises side surfaces 101 which may facilitate enclosing key components underneath and partly within the membrane. The membrane also comprises plugs 111 which may assist in fixedly connecting the membrane to a key housing, for example via grooves or slots, thereby assisting in providing a mechanical stability to the membrane and a sealing to sensitive key components. The membrane 100 also comprises a plurality of protruding parts 114 on the interior of the membrane 100 (the plugs 111 in this example being on the exterior of the membrane 100). Like the plugs 111, these protruding parts 114 may also assist in fixing the membrane in its desired position within the key 150. Other components of the key 150, such as housings, or a PCB or PCBA may also interact with such protruding parts 114 so as to assure the positioning of the membrane within the key 150, and to assist the fixing of these other components within the key 150.

[0046] FIG. 4 shows a perspective view of a back surface of the membrane, i.e. the face opposite to that of the pushing force. The reverse end of the pressable portion can be seen to comprise an inverted part 109, which enables the forming of the hollow part 110 on the other side of the membrane, as seen in FIG. 1 to 3. The pressable portion can also be seen to comprise three grooves 112a, 112b, 112c. Each groove is formed in a direction opposite to the hollow portion 110 (and hence inverted part 109). However, the grooves are not viewable from the top surface of the membrane. The grooves may act support structures for the raised portion 108 while it is not being pushed, i.e. they can assist in preventing the raised portion from collapsing in on itself.

[0047] FIG. 5 shows a 3D model of an exterior part of the key 150. The key 150 comprises a housing 120. The housing 120 is part of a complete housing 121 of the key. Alternatively, the housing may be a complete housing of the key, i.e. it may withhold all interior key components. The housing 120 comprises a face 123 comprising a hole 117. A push piece 118 that is part of a push button mechanism can be seen through the hole 117. The push piece 118 may comprise a logo. The face of the housing 120 having the hole 117may be a surface of the housing 121 with a surface area larger than other surfaces of the housing 121 (e.g. a top or bottom surface of the housing 120), or surface of the housing 121 with a surface area smaller than other surfaces of the housing 121 (e.g. a side or end surface of the housing 121). The hole 117 may be a through hole 117in the face of the housing 120 (or in a face of the complete housing 121). The hole 117, as can be seen from the figure, has a circular shape. The hole 117 may have a tubular, for example cylindrical, form. In other words, the hole 117 may comprise a hole wall. The face 123 is represented transparently to display components of the key 150 underneath the housing 120. As in the geometries of FIG. 1 to 3, pins 104a, 104b are disposed adjacent to a center line running through the diameter of the push piece 118 and hole. The elastic membrane may be arranged fixedly inside the housing 120 so as to present a portion pressable by pushing the push piece in the pushing direction, thereby actuating the button mechanism. Each pin 104a, 104b is arranged so as to apply a force to the support section in a direction perpendicular to the pushing direction, thereby reducing movement of the push piece 118 relative to the housing 120 in at least one direction. The at least one direction may be a rotational direction relative to the axis of the pushing direction. Each respective pin 104a, 104b may apply a force opposite in direction to the pushing force so as to limit translational displacement of the push piece towards or away from the face of the housing 120. T he one or more pins may each be in an elastic material and/or integrally formed with the elastic membrane.

[0048] The pins 104a, 104b are both facing a support section 119 comprising wings 116a, 116b extending away from the push piece 118. The support section 119 may comprise at least two wings extending away from the push piece, each respective wing being in contact with at least one of the at least two pins.

[0049] Arrows 105a, 105b indicate application a force from each respective pin 104a, 104bto each respective wing 116a, 116b of the support section 119. Arrows 107a, 107b indicate the direction of force that the pins apply to the push piece 118 via the support piece so as to reduce its movement.

[0050] Referring to FIG. 6, the positioning of the pins in such a manner permits reducing movement of the force in a direction perpendicular to that of a push force 129, as can be seen in FIG. 6. This perpendicular force can reduce and even prevent altogether rotation of the push piece 118 in both clockwise and anticlockwise directions. Each wing may comprise a U-shape, as can be seen from wing 116b. The one or more pins, and as can be see from pin 104b, may protrude through a housing 122. The key may comprise a PCBA 126, a battery 124 and battery cover 126 beneath the membrane 100.

[0051] FIG. 7 shows a side view of the membrane 100. The pins 104a, 104b can be seen to protrude a predetermined distance in a direction opposite to that of the pushing force depicted by arrow 129. Each pin 104a, 104b protrudes further than a raised portion of the pressable portion 102.

[0052] FIG. 8 provides longitudinal section view of FIG. 7. Here, the inside portion 132 of the membrane can be seen, and can be filled with components of the key so as to seal them. The membrane a thickness 130.

[0053] FIG. 9 provides a transverse section view of the membrane in the (XZ) direction. Here it can be seen that the ridge portion may not have a consistent height but may rather have a sloped surface. This surface may be clean with the remaining geometry of the membrane. This may be to facilitate the overall shape of the housing and therefore design of the key itself. The pins (in this case only pin 104a is viewable) may however continue to protrude away from the membrane, regardless as to its overall form. As the pins are elastic, they may be constrained in the housing (for example at the top of the pin by the housing itself; although not shown in this figure) without becoming damaged. This may enable each pin to more effectively apply a force to the support section.

[0054] FIG. 10 shows an example of a perspective exploded view of an example of the electronic key 150. According to this example, the push button 118 has a rectangular shape, forming a cuboid. The membrane 100 however still comprises a pressable portion 102 and ridge portion 108 which is circular. The arrow 129 indicates the pushing direction onto the push piece 118 and hence the pressable portion 102 and its ridge 108. The housing 120 is, due to the exploded view, displayed underneath the membrane 100. Other components of the key 150 can be viewed as being layered within the key (i.e. beneath the push piece 118 and the membrane 100), such as a mechanical key (emergency key) 140, a generic upper case 148 a PCBA 146 (the upper case 148 may act as a protection for the PCBA 146), a lower case 142 a battery

(not shown, the lower case 142 may act as a protection for the battery), a back cover 144 forming with the housing 120 a complete housing of the key 150, along with buttons 150a, 150b, 150c which may for example enable the actuation of functions different to that actuated by the button mechanism.

Claims

1. An electronic key (150) for an automotive vehicle, wherein the electronic key (150) comprises:

   - a housing (120) comprising a face (123) having a hole (117),
   - a button mechanism including:

     ◦ a push piece (118) arranged such that the push piece (118) is accessible through the hole (117)for being pushed in a pushing direction (129) toward the inside of the housing (120),
     ◦ a support section (119) relative to which the push piece (118) is fixed, and

   - an elastic membrane (100) arranged fixedly inside the housing (120) so as to present a portion pressable by pushing the push piece (118) in the pushing direction, thereby actuating the button mechanism, the elastic membrane (100) comprising one or more pins (104a, 104b) protruding in a direction opposite to the pushing direction (129), each pin (104a, 104b) being arranged so as to apply a force to the support section (119) in a direction perpendicular to the pushing direction, thereby reducing movement of the push piece (118) relative to the housing (120) in at least one direction.

2. The key (150) according to claim 1, wherein the one or more pins comprise at least two pins (104a, 104b).

3. The key (150) according to claim 1 or 2, wherein the at least one direction is a rotational direction relative to the axis of the pushing direction (129).

4. The key (150) according to claim 3, wherein each respective pin applies a force opposite in direction to the pushing force so as to limit translational displacement of the push piece (118) towards or away from the face (123) of the housing (120).

5. The key (150) according to any one of claims 1 to 4, wherein the one or more pins (104a, 104b) are each in an elastic material and/or integrally formed with the elastic membrane (100).

6. The key (150) according to any one of claims 1 to 5, wherein the push piece (118) is circular.

7. The key (150) according to any one of claims 1 to 6, wherein the hole (117) is circular.

8. The key (150) according to any one of claims 1 to 7, wherein the support section (119) comprises at least two wings (116a, 116b) extending away from the push piece (118), each respective wing (116a, 116b) being in contact with at least one of the at least two pins (104a, 104b).

9. The key (150) according to any one of claims 1 to 8, wherein the pressable portion comprises a raised portion (108) arranged so as to push away the push piece (118).

10. The key (150) according to any one of claims 1 to 9, wherein each respective pin (104a, 104b) is chamfered.

11. The key (150) according to any one of claims 1 to 10, wherein the elastic membrane (100) is made of silicone.

12. The key (150) according to any one of claims 1 to 11, wherein the push piece (118) comprises a logo.

13. The key (150) according to any one of claims 6 to 12, wherein each wing (116a, 116b) comprises a transverse cross-sectional U-shape.

14. The key (150) according to any one of claims 1 to 13, wherein the membrane (100) comprises sidewalls for surrounding one or more electronic components of the key so as to seal the electronic components.

15. A method for assembling an electronic key (150) for an automotive vehicle, wherein the method comprises:

   - providing a housing (120) comprising a face having a hole (117);
   - providing a button mechanism including:

     ◦ a push piece (118) arranged such that the push piece (118) is accessible through the hole for being pushed in a pushing direction toward the inside of the housing (120);
     ◦ a support section (119) relative to which the push piece (118) is fixed;

   - providing an elastic membrane comprising one or more pins (104a, 104b) protruding in the direction opposite to a pushing direction;
   - assembling the elastic membrane inside the housing and the push piece (118) inside the

housing upon the membrane with the push piece (118) accessible through the hole (117); and

- positioning the support section (119) against the one or more pins (104a, 104b), each pin being arranged so as to apply a force to the support section (119) in a direction perpendicular to the pushing direction, thereby reducing movement of the push piece (118) relative to the housing in at least one direction.

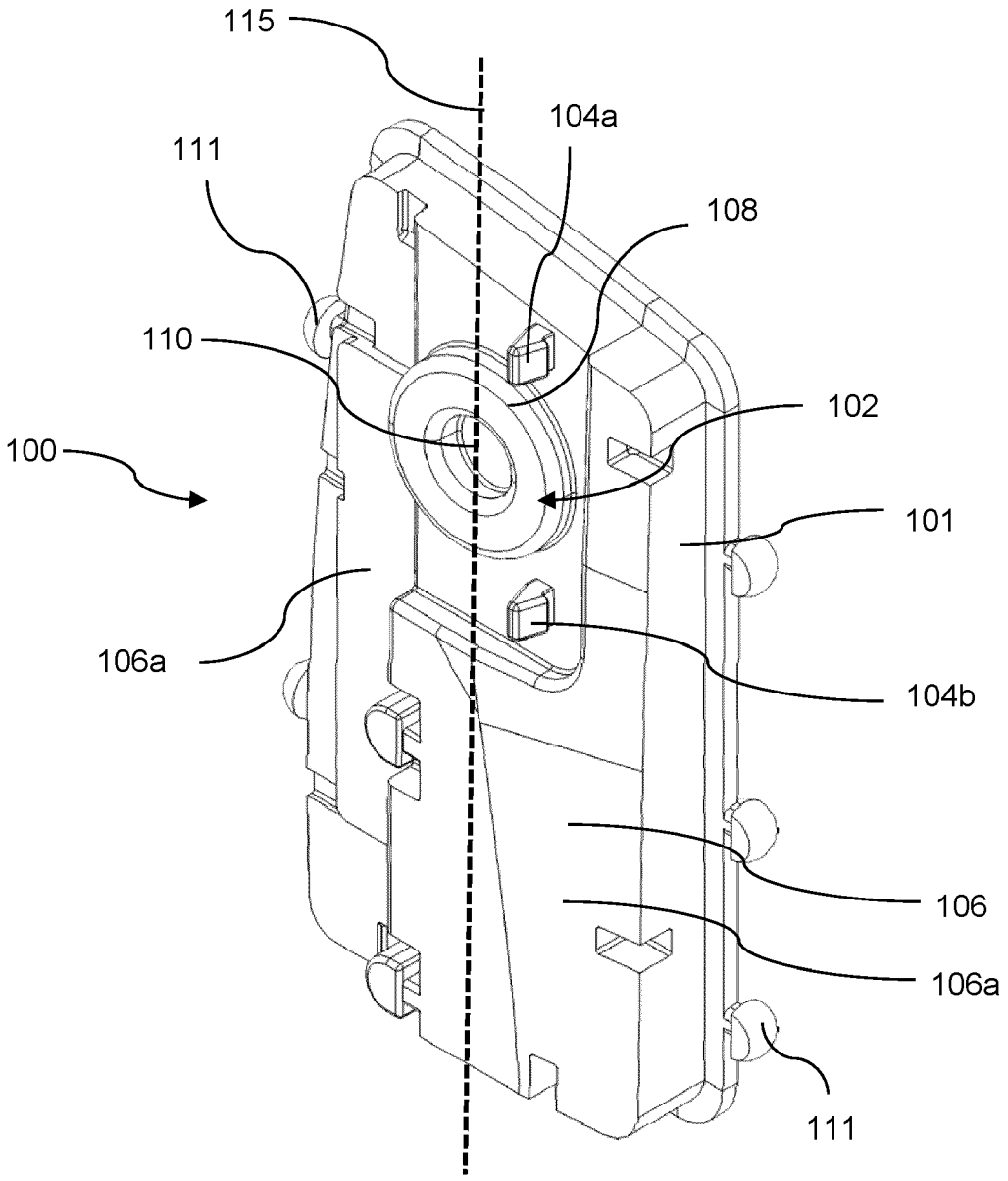

FIG. 1

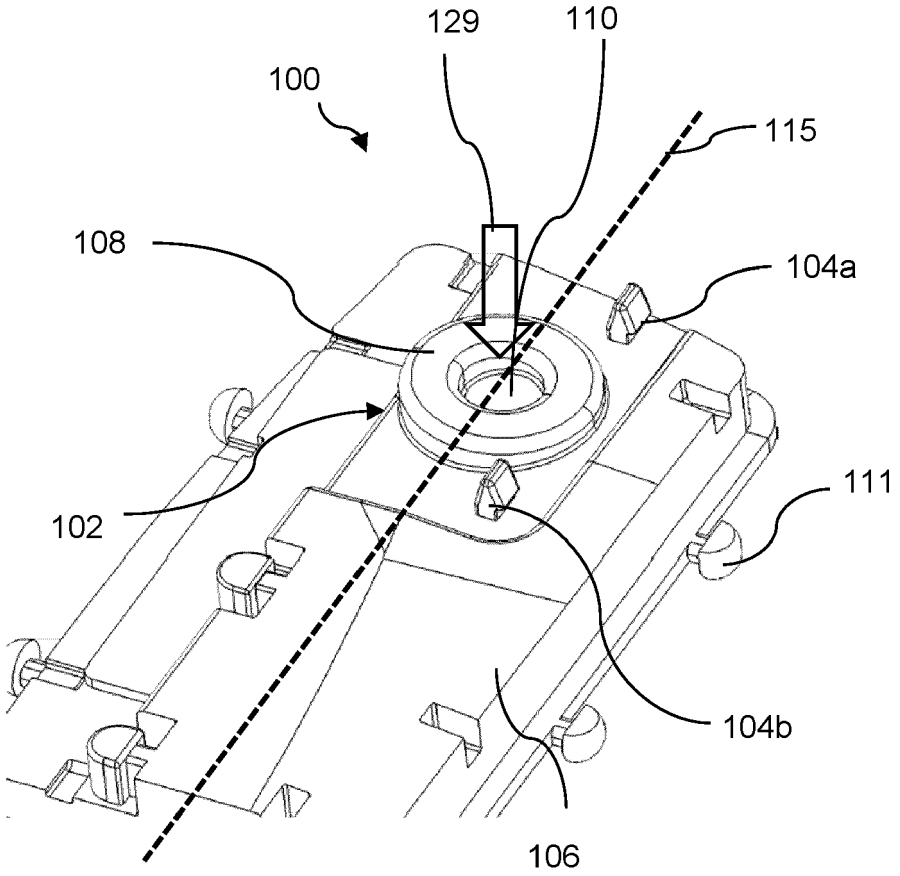

FIG. 2

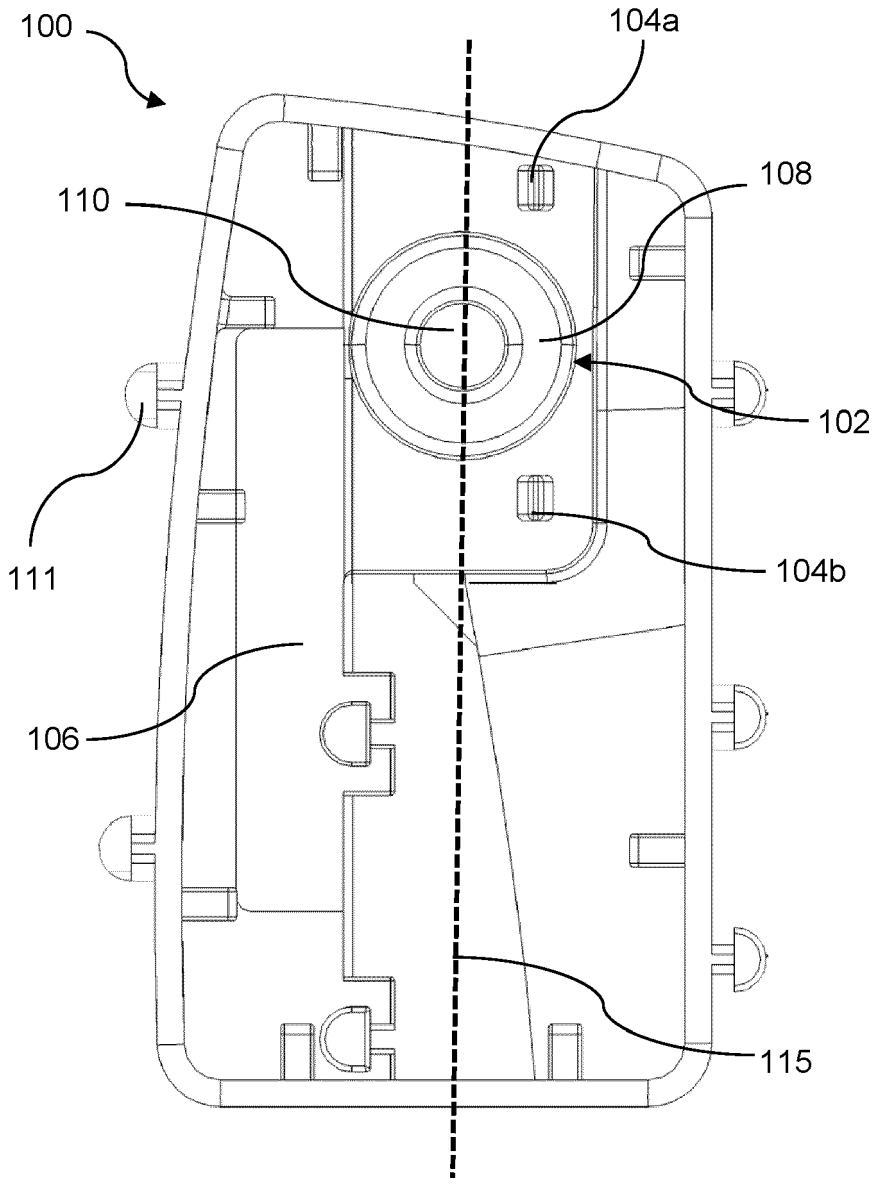

FIG. 3

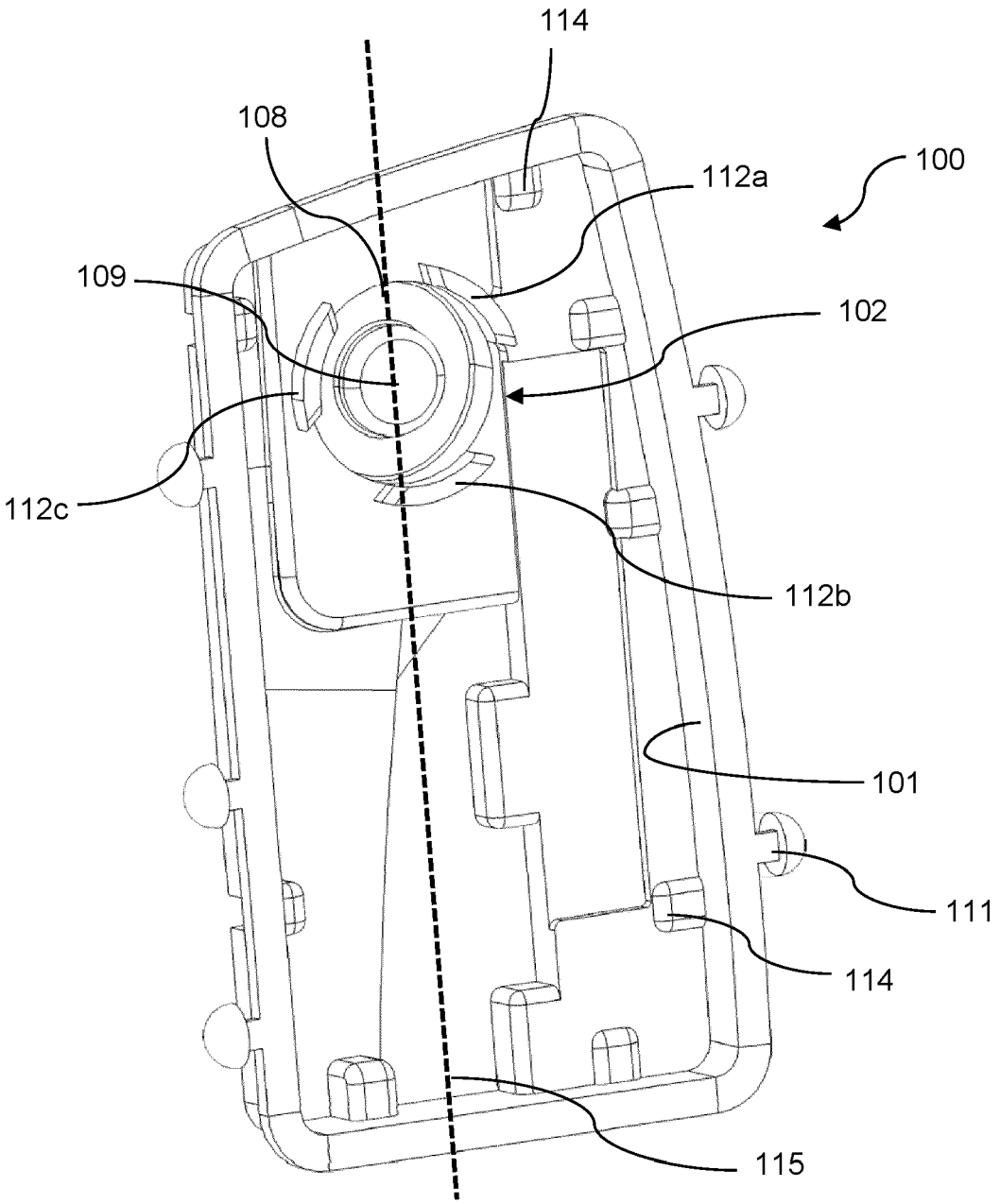

FIG. 4

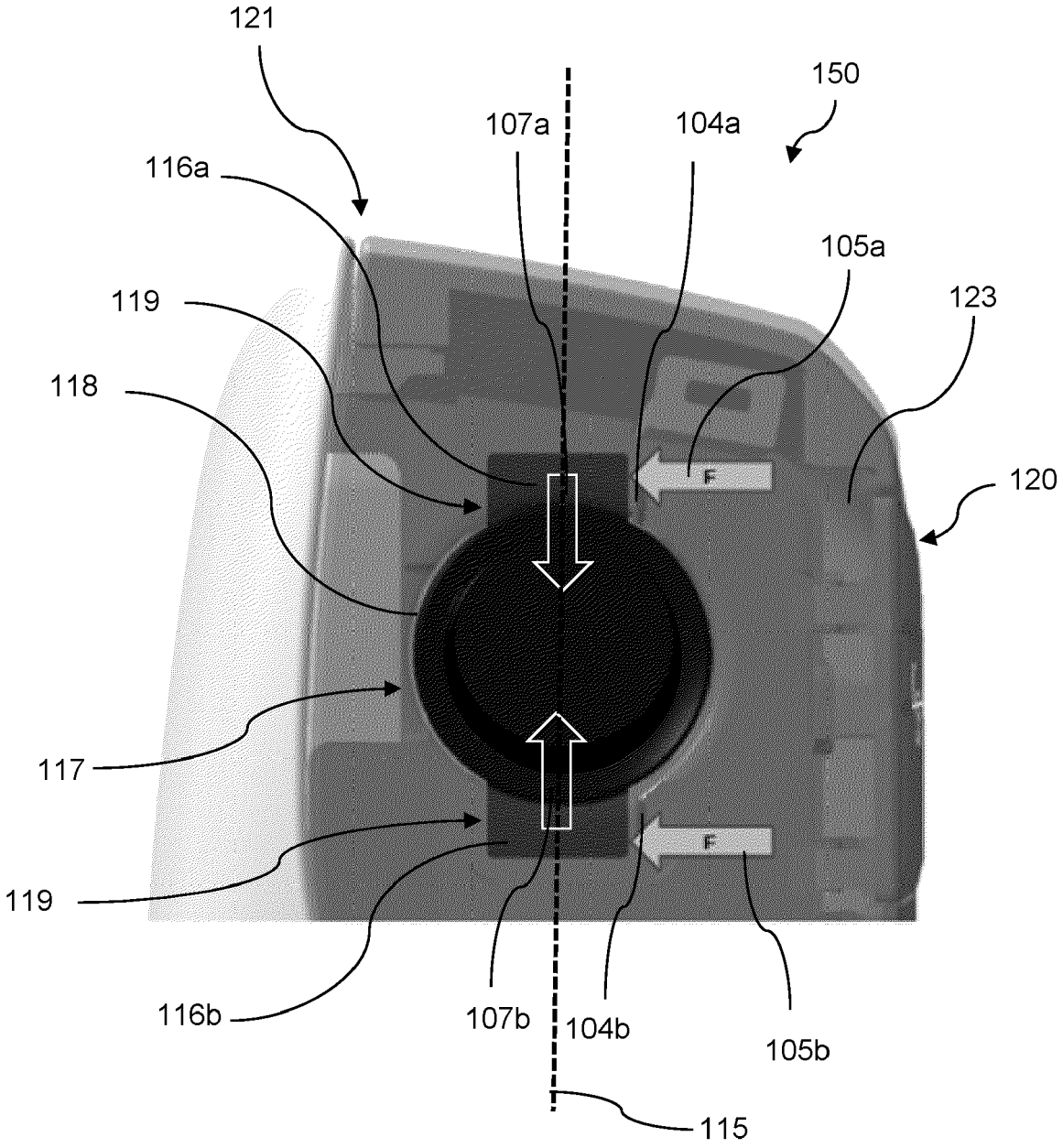
121
150
107a
104a
116a
105a
119
123
118
120
F
117
F
119
116b
107b
104b
105b
115

FIG. 5

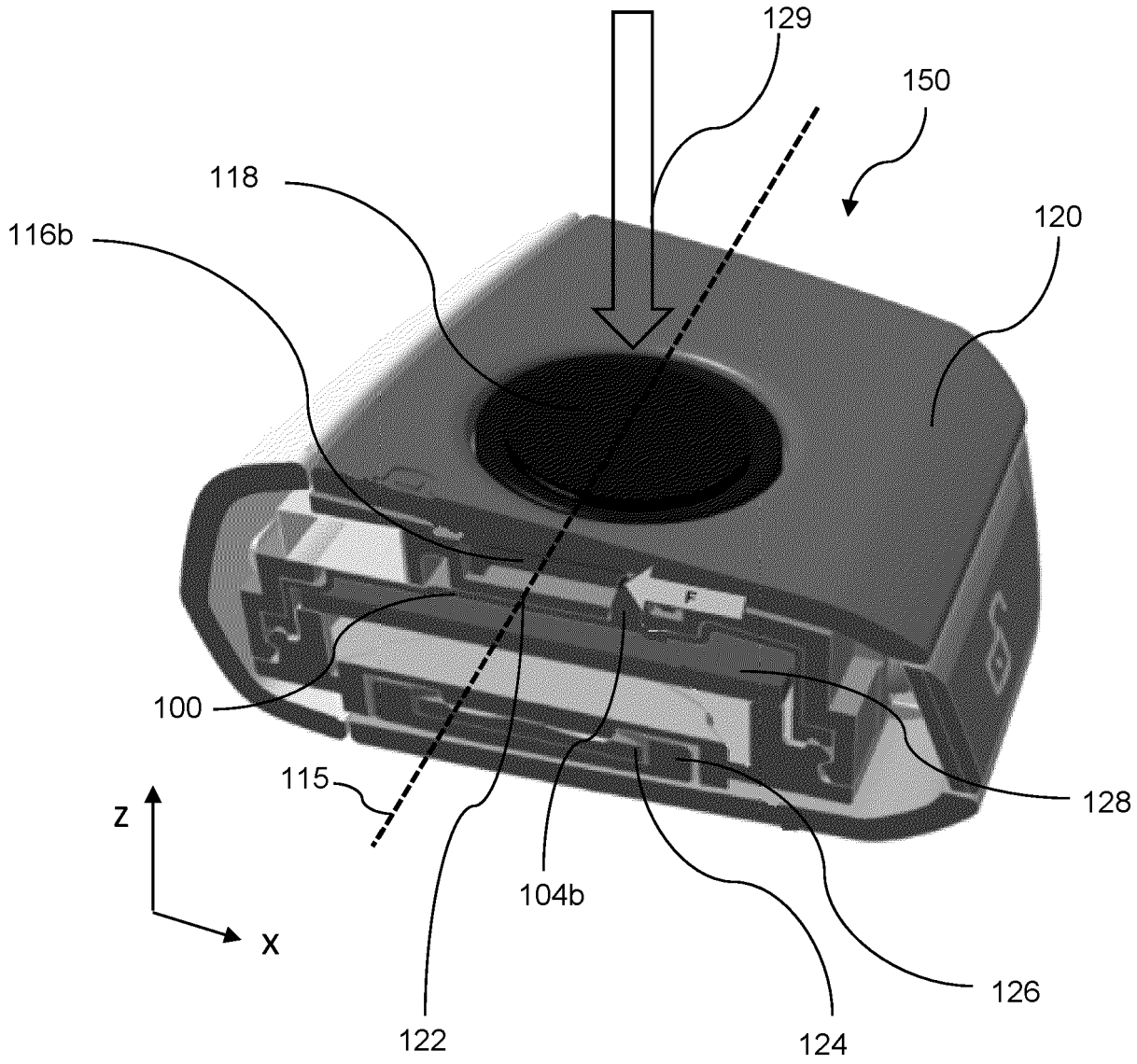

FIG. 6

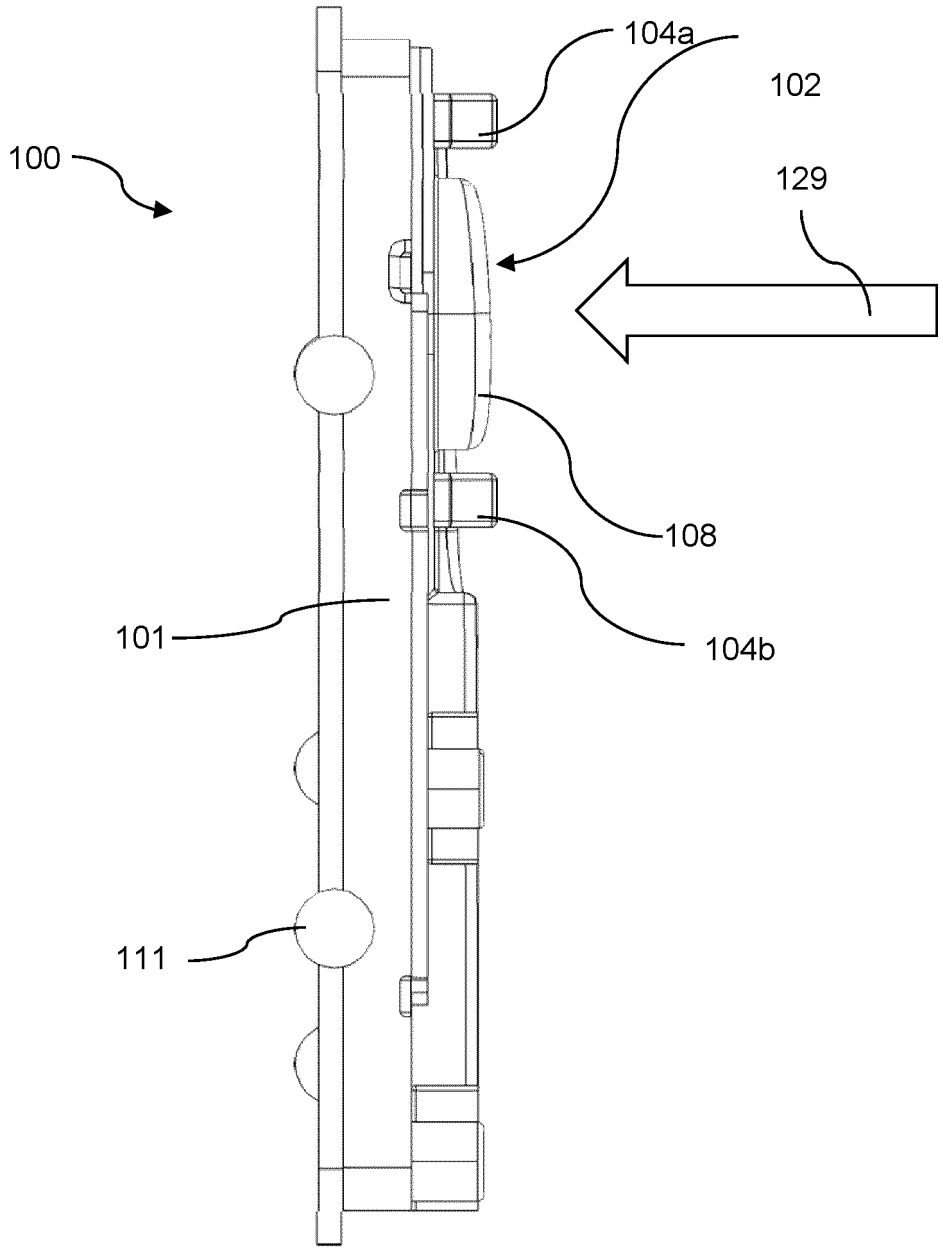

FIG. 7

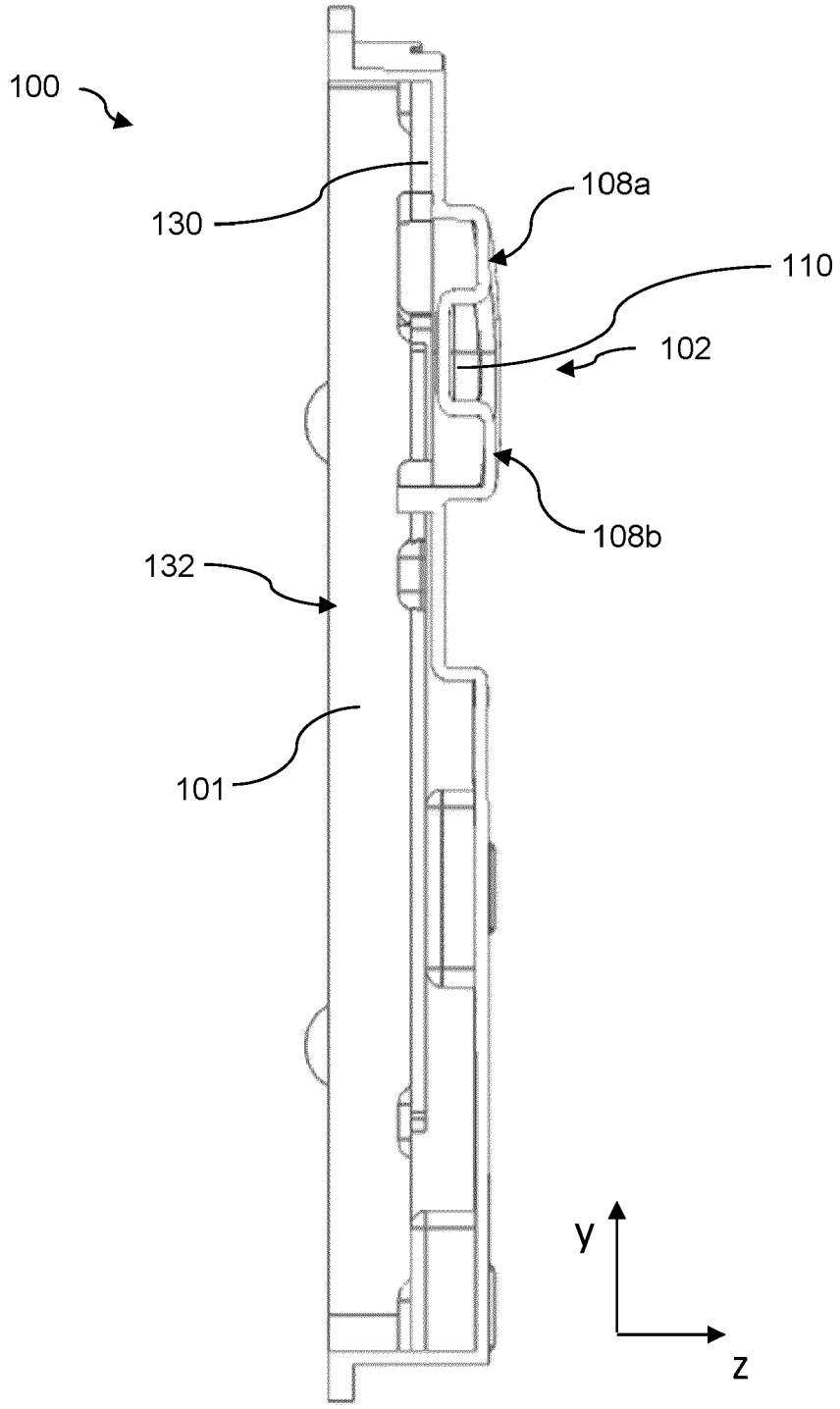

FIG. 8

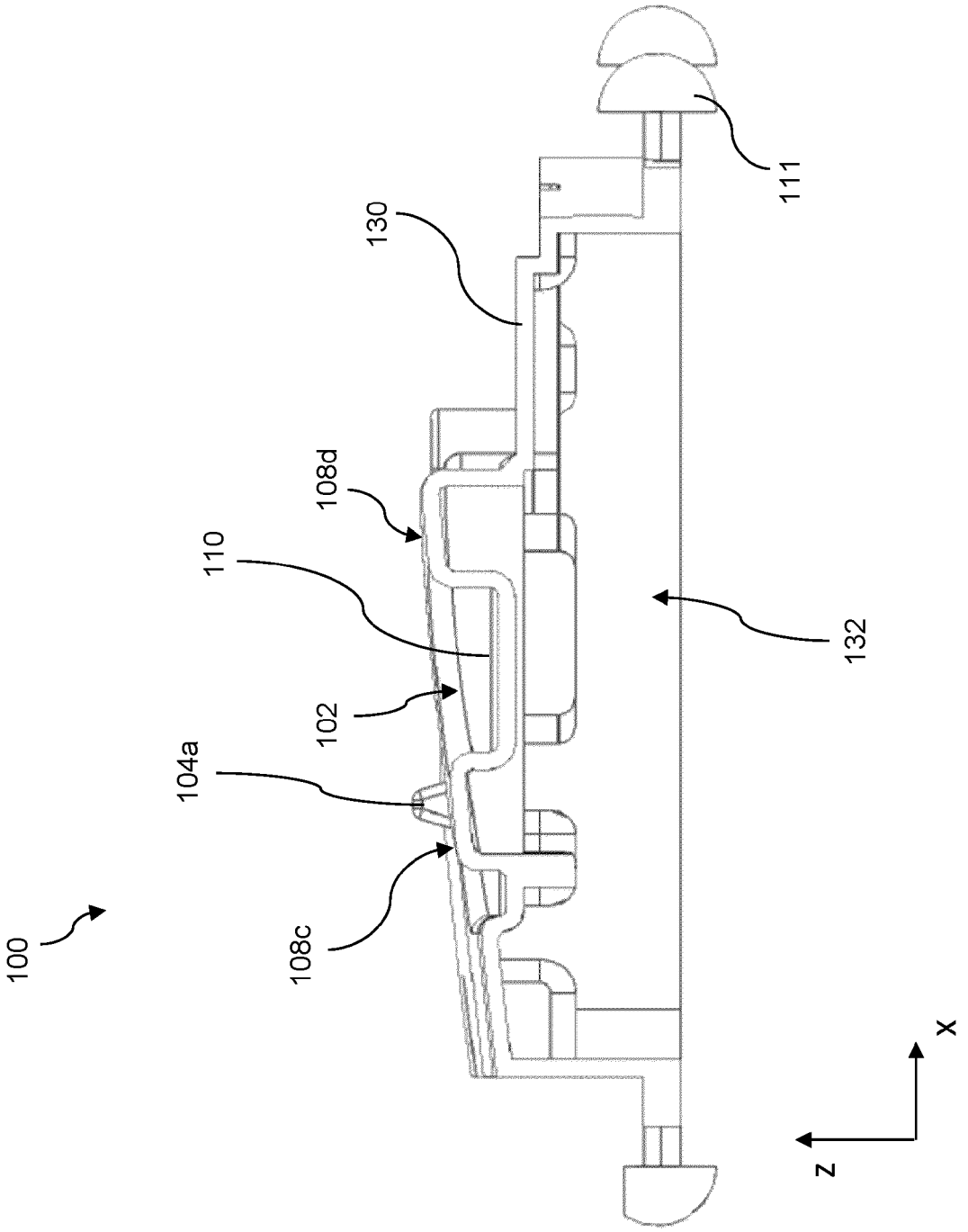

FIG. 9

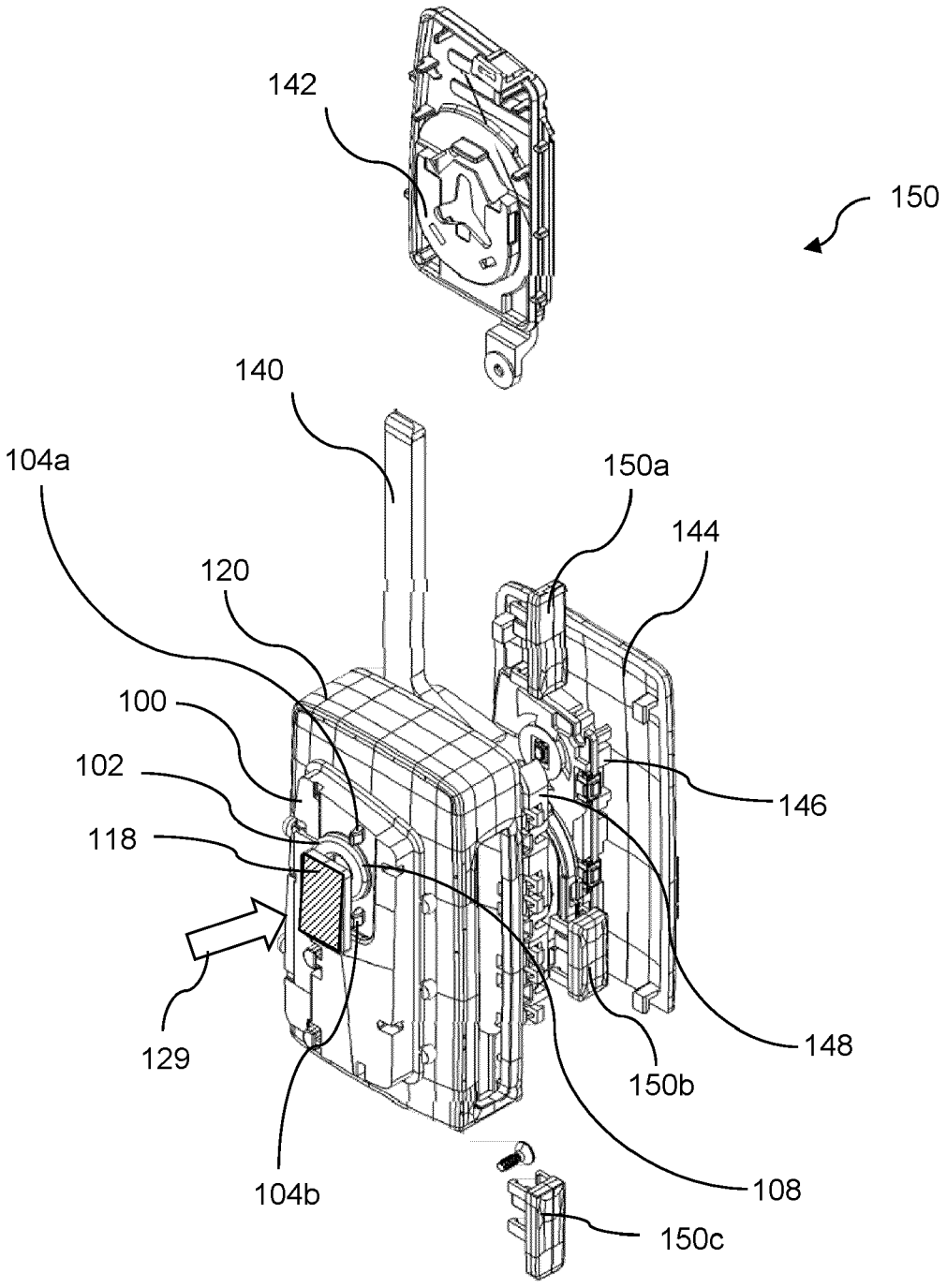
142
150
140
104a
150a
144
120
100
102
146
118
148
129
150b
104b
108
150c

FIG. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 22 21 4357

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2009/173613 A1 (GELDMACHER ALEXANDER [DE]) 9 July 2009 (2009-07-09) * abstract; figures 1-8 * * paragraph [0001] - paragraph [0025] *	1-15	INV. G07C9/00
X	US 2016/055991 A1 (KROPF THOMAS [DE] ET AL) 25 February 2016 (2016-02-25)	1-13,15	
A	* abstract; figures 1A, 1B, 2-5 * * paragraph [0002] * * paragraph [0025] * * paragraph [0032] * * paragraph [0036] - paragraph [0041] *	14	
A	FR 3 081 486 A1 (VALEO COMFORT & DRIVING ASSISTANCE [FR]) 29 November 2019 (2019-11-29) * abstract *	11	
			TECHNICAL FIELDS SEARCHED (IPC) G07C E05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 May 2023	Holzmann, Wolf

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 21 4357

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31-05-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009173613 A1	09-07-2009	AT 481543 T	15-10-2010
		CN 101133222 A	27-02-2008
		DE 102005014563 A1	07-09-2006
		EP 1853780 A1	14-11-2007
		KR 20070115920 A	06-12-2007
		US 2009173613 A1	09-07-2009
		WO 2006092250 A1	08-09-2006
US 2016055991 A1	25-02-2016	CN 105190709 A	23-12-2015
		DE 102013205689 B3	25-09-2014
		JP 6312798 B2	18-04-2018
		JP 2016514773 A	23-05-2016
		KR 20150135515 A	02-12-2015
		US 2016055991 A1	25-02-2016
		WO 2014154539 A1	02-10-2014
FR 3081486 A1	29-11-2019	NONE	

EPO FORM P0459

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