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(54) **AN ASSEMBLY COMPRISING A SWITCH DEVICE AND A HOUSING**

ANORDNUNG MIT EINER SCHALTERVORRICHTUNG UND GEHÄUSE

ENSEMBLE COMPRENANT UN DISPOSITIF DE COMMUTATION ET UN BOÎTIER

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EP 3 404 684 B1

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Description

Field of invention

[0001] The present invention relates to a switch device, for automotive, more particularly for a dome control module and the like.

Description of the Related Art

[0002] Push-type switches with a manually operated push component through which, in turn, a switching component itself is actuated are commercially available as push buttons and as on/off switches or selector switches.

[0003] It is known push type switches comprising a push component that can pivot around a hinge and providing, between the push component and the switching component, a force-transmission component. This force transmission component may have the form of a plunger.

[0004] Whatever the location of the push component point the manual force is applied on and whatever the location of the point along the push component the plunger is in contact with, the push component will pivot around the hinge. In so doing the push component pushes the plunger which pushes the switch-component downwards.

[0005] In particular, switch devices are known in which the switch device comprises a plunger in contact with the middle of a knob pivotally connected to a housing such that a manual compression of the knob causes the knob to pivots from the outside of the housing of the switch toward the inside and the plunger to move in the same direction. As the plunger is in contact with the middle of the knob, the course of the middle of the knob in a first direction is equal to the course of the plunger in the same direction.

[0006] However, switch devices, in particular for automotive, can be subject to many customer requirements. These requirements may concern for example the knob shape, the housing shape, the place of the switching component relative to the knob and/or the housing and so on.

[0007] Thus, in this case, a solution is to shift the plunger relative to the knob. However, the plunger displacement in response to the knob displacement may remain an issue, especially in respect with the device packaging taken as a whole.

Such switch devices are already known for example from documents US 2014/102866 A1 and US2001/031671 A1. US 2014/102866 A1 discloses an assembly according to the preamble of claim 1.

Summary of the invention

[0008] Consequently, the invention aims to solve the technical problem of providing an assembly comprising a switch device that will operate respecting customer requirements, and that requires as little built-in space as

possible.

[0009] The invention relates accordingly to an assembly comprising a switch device and a housing, said switch device being disposed relatively to the housing and comprising:

- a switch,
- a plunger, said plunger extending along a first longitudinal axis, and having a plunger's head,
- a knob pivotally connected to the housing such that the knob pivots around a first rotational axis, said knob having a knob's head and an actuation zone which is remote from the first longitudinal axis, said knob's head remaining in contact with said plunger's head at any position of the knob,

wherein a manual compression of the knob in a first direction around the first rotational axis on said actuation zone causes the knob to move at a first speed from a first position to a second position in which the plunger actuates the switch, said manual compression of the knob causing the plunger to move at a second speed lower than the first speed of the knob, wherein the plunger comprises a head and a body and the plunger's head is curved and comprise a distal end having a shape of a ball joint, the plunger's head and the knob remaining in contact by a ball joint connection, the knob's head having a first outgrowth representing a first contact point between said plunger's head and said knob's head, the knob's head not being in moving abutment against the plunger's head, said first contact point causing friction forces.

[0010] In such an assembly, the plunger 20 moves from a first position to a second position at a second speed lower than the first speed of the knob 10. Thus, a potential course difference between the actuation zone of the knob and the plunger is compensated by the present assembly.

[0011] In particular, a ratio one to one between the course of the middle of the knob and the course of the plunger can be respected by this assembly.

[0012] The assembly may thus be in conformity with design specification coming from various constraints like packaging constraints dictating the location of the knob actuation zone, security constraints dictating the location of the switch and standardization constraints dictating the relative movement of the plunger and the switch.

[0013] The invention can also comprise any of the following features taken individually or in any technically possible combination:

- the knob is disposed at a surface of the housing,
- the switch and the plunger are disposed inside the housing,
- the knob comprises a head and a body,
- the knob, especially the knob's head, has a second

outgrowth, said first and second outgrowth forming a groove,

- the ball joint is articulated inside the groove,
- the plunger's head and the groove have a complementary form,
- the plunger is made of one single component,
- the plunger's head is integral with plunger body,
- the assembly comprises a support, especially a PCB,
- the switch is a push switch,
- the switch is in connection with the support,
- the switch is in electrical connection with the support,
- a longitudinal distance between the first rotational axis and an upper surface of the PCB is comprised between 10mm and 20mm,
- a longitudinal distance between the first rotational axis and an upper surface of the PCB is comprised between 13mm and 15mm,
- the plunger is located inside a shaft located remotely from a second longitudinal axis,
- the first rotational axis is defined by a hinge,
- the actuation zone M comprises a point M at the middle of the knob,
- in a first position of the plunger, the point M is on a second longitudinal axis parallel to the first longitudinal axis,
- an intersection point I between the second longitudinal axis and the PCB is at most at 3mm from the closest edge of the housing,
- the knob is returned to his first position by a return force transmitted by a return spring,
- the distance between the point M in the first position and the orthogonal projection of the point M on the second longitudinal axis in the second position is the same distance that the distance between the orthogonal projection of a point of the plunger in the first and the second position.

[0014] The invention also relates to a dome control module comprising said assembly.

[0015] The invention will be better understood on the light of the following description which is only indicative and which is not intended to limit said invention, accompanied with the following figures:

- Figure 1 is a sectional view of an assembly according to a preferred embodiment of the invention, wherein the knob is in a first position,
- Figure 2 is a sectional view of an assembly according to the same embodiment of the invention, wherein the knob is in a second position,
- Figure 3 represents a dome control module according to the invention.

Detailed Description

[0016] As illustrated in figure 1 and 2, the invention relates to an assembly 1 comprising a switch device 3

and a housing 5. The switch device 3 is disposed relatively to the housing 5. The switch device 3 comprises a switch 30, a plunger 20 and a knob 10.

[0017] The plunger 20 extends along a first longitudinal axis.

[0018] The knob 10 is pivotally connected to the housing 5 in such way that the knob pivots around a first rotational axis perpendicular to the sketches on figures 1 and 2.

[0019] An actuation zone (M) of the knob 10 is remote from the first longitudinal axis (A).

[0020] In a first position illustrated in figure 1, the knob 10 is in contact with the plunger 20.

[0021] The knob 10 comprises a head 12 and a body 14. The plunger 20 comprises a head 22 and a body 24. The knob's head 12 is the part of the knob in contact with the plunger's head 22.

[0022] A manual compression of the knob in a first direction around the first rotational axis (C) on the actuation zone M causes then the knob to come from a first position to a second position. In said second position illustrated in figure 2, the plunger actuates the switch.

[0023] The course of the knob's head 12 between the first and the second position is longer than the course of the plunger's head 22 between the first and the second position.

[0024] As one will have understood, the compression of the knob 10 between the first and the second position is transmitted to the plunger 20 but the second speed of the plunger 20 is lower than the first speed of the knob 10 in order to compensate the difference of length of their respective course.

[0025] In absence of manual compression, the knob returns advantageously to its first position. The knob may return to its first position by a return force transmitted by a return spring.

[0026] The switch device 3 may be comprised inside the housing 5. The plunger 20 and the switch are inside the housing.

[0027] The assembly may comprise a bezel 6 such that the upper surface of the knob 10 flushes the surface of the bezel 6.

[0028] In the illustrated embodiment, the knob's head has a first outgrowth 16 such that the plunger's head 22 and the knob's head 12 remain in contact at any position of the knob. This allows a better stability of the knob 10 between the first and the second position.

[0029] Said first outgrowth 16 represent a first contact point between the plunger's head 22 and the knob's head 12 but the knob's head 12 is not in moving abutment against the plunger's head 22. Said first contact point causes friction forces. It is the said friction forces that cause the plunger 20 to move from a first position to a second position at a second speed lower than the first speed of the knob 10.

[0030] The knob's head may also have a second outgrowth 18, said first and second outgrowth forming a groove. Said second outgrowth 18 represent a second

contact point between the plunger's head 22 and the knob's head 12.

[0031] In such embodiment, the plunger's head 22 slides within the groove and moves from the first position to the second position under the action of the friction forces caused by the first and the second outgrowth. The groove allows an even more enhanced stability of the knob 10 between the first and the second position.

[0032] The plunger's head 22 is curved. As described in figures 1 and 2, the plunger's head 22 comprises a distal end having the shape of a ball joint. Said ball joint is articulated inside the groove formed by the two outgrowths 16, 18 such that the plunger's head 22 and the knob's head 12 remain in contact by a ball joint connection.

[0033] In a preferred embodiment, the plunger's head has a complementary form to said groove.

[0034] In the embodiment described on the figures, the plunger is made of one single component. More precisely, the plunger's head and is here integral with plunger body.

[0035] The switch 30 may be a push switch. Said switch is in contact with a support. In a preferred embodiment, the switch 30 is in electrical connection with a PCB (Printed Circuit Board) 40. Said PCB may define a plan, said plan being orthogonal to the first longitudinal axis (A).

[0036] A second longitudinal axis (B) is parallel to the first longitudinal axis (A) and passes by the middle of the knob 10. The plunger may be located inside a shaft 52 located remotely from the second longitudinal axis (B). Said shaft helps to control the translation movement of the plunger between the first and the second position and to improve the stability of the assembly.

[0037] Said plunger body is located in said shaft 52. Said shaft 52 is a part of the housing 5. Said plunger body comprises an end in abutment on said switch.

[0038] The first rotational axis (C) may be defined by protrusions on both sides of the knob 10 cooperating with holes formed on lateral sides of the housing. Alternatively, said first rotational axis (C) may be defined by a hinge 54. Said hinge helps to prevent any removing of the knob 10 from the housing 5.

[0039] The knob extends in a longitudinal direction which defines its length. The middle of the knob is defined by a point in the middle of its length. The actuation zone M is centered on said point M at the middle of the knob. The activation zone may be evidenced by any kind of visualization means like a logo, a small recess or protrusion, especially of the size of a fingertip located on point M.

[0040] As shown in figure 2, between the first and the second position of the knob, each point of the knob is moving along a circle whose center is defined by the first rotational axis (C). The radius of the circle depends on the distance between the first rotational axis (C) and the point of the knob. The farther the point of the knob is from the rotational axis (C), the larger the radius of the circle.

[0041] For a same angular stroke, the relative displacement

of the point M on the middle of the knob will be inferior to the relative displacement of a second point on the head of the knob.

[0042] As shown in figure 1, when the knob is in the first position, the point M is on a second longitudinal axis (B) parallel to the first longitudinal axis (A). As shown in figure 2, when the knob 10 is in the second position, the point M is shifted from the second longitudinal axis (B).

[0043] The distance between the point M in the first position and the orthogonal projection of the point M on the second longitudinal axis (B) in the second position is inferior to the distance between a point on the knob's head 12 in the first position and the orthogonal projection of said knob's head point on the first or second longitudinal axis in the second position.

[0044] The depth of the groove formed by the two outgrowths 16, 18 allows compensating the course difference between the actuation zone M of the knob 10 and the plunger 20. In other words, the distance between the point M in the first position and the orthogonal projection of the point M on the second longitudinal axis (B) in the second position is the same distance as the distance between the orthogonal projection of a point of the plunger in the first and the second position. This allows keeping a ratio one on one between the course of the middle M of the knob 10 and the course of the plunger 20.

[0045] The intersection between said second longitudinal axis (B) and the PCB defines an intersection point I.

[0046] In the case of the invention, said intersection point I is at most at 3mm from the closest edge of the PCB according to electrical circuitry security rules.

[0047] In parallel, a longitudinal distance between the first rotational axis and an upper surface of the PCB is comprised between 10mm and 20mm, more preferably between 13mm and 15mm.

[0048] This makes it possible to reduce the longitudinal packaging of the device.

[0049] The stroke of the plunger along the first longitudinal axis (A) may be equal to 0.5mm to 1.5mm. In the same way, the distance between the point M in the first position and the orthogonal projection of the point M on the second longitudinal axis (B) in the second position may be equal to 0.5mm to 1.5mm.

[0050] Figure 3 shows a dome control module 2 according to the invention. Said dome control module comprises an assembly 1 according the invention. The switch device of said assembly may comprise any of the technical features described hereinabove.

[0051] The bezel 6 may represent the largest part of the dome control module seen by a user. Thus, the bezel 6 may be made of a material nobler than the rest of the housing 5 so as to improve the finish of the dome control module perceived by a user.

[0052] The dome control module may be located on the ceiling of a vehicle, between the two front seats and aligned with the central mirror.

[0053] The invention has been described above with the aid of embodiments shown in the figures, without lim-

itation of the general inventive concept.

[0054] Many other modifications and variations are suggested by those skilled in the art, after reflection on the various embodiments illustrated in this application. These embodiments are given by way of example and are not intended to limit the scope of the invention, which is determined exclusively by the claims below.

Claims

1. An assembly (1) comprising a switch device (3) and a housing (5), said switch device being disposed relatively to the housing and comprising:

- a switch (30),
- a plunger (20), said plunger extending along a first longitudinal axis (A) and having a plunger's head (22),
- a knob (10) pivotally connected to the housing (5) such that the knob (10) pivots around a first rotational axis (C), said knob (10) having a knob's head (12) and an actuation zone M which is remote from the first longitudinal axis (A), said knob's head (12) remaining in contact with said plunger's head (22) at any position of the knob (10),

wherein a manual compression of the knob (10) in a first direction around the first rotational axis (C) on said actuation zone M causes the knob (10) to move at a first speed from a first position to a second position in which the plunger (20) actuates the switch (30), said manual compression of the knob (10) causing the plunger (20) to move at a second speed lower than the first speed of the knob (10),

characterized in that the plunger (20) comprises a head (22) and a body (24) and the plunger's head (22) is curved and comprise a distal end having a shape of a ball joint, the plunger's head (22) and the knob (10) remaining in contact by a ball joint connection, the knob's head (12) having a first outgrowth (16) representing a first contact point between said plunger's head (22) and said knob's head (12), the knob's head (12) not being in moving abutment against the plunger's head (22), said first contact point causing friction forces.

2. An assembly (1) according to claim 1, wherein the knob (10) has a second outgrowth, said first and second outgrowth forming a groove.
3. An assembly (1) according to any preceding claims, wherein the plunger's head (22) and the knob (10) have a complementary form.
4. An assembly (1) according to any of the preceding

claims, wherein the switch (30) is a push switch.

5. An assembly (1) according to any of the preceding claims, comprising a PCB (40), said switch (30) being in electrical connection with said PCB (40).
6. An assembly (1) according to any of the preceding claims, wherein a longitudinal distance between the first rotational axis (C) and an upper surface of the PCB (40) is comprised between 10mm and 20mm.
7. An assembly (1) according to claim 5 or 6, wherein the actuation zone M comprises a point M at the middle of the knob (10), a second longitudinal axis (B) being parallel to the first longitudinal axis (A) and passing by said point M, such that an intersection point I between said second longitudinal axis (B) and the PCB (40) is at most at 3mm from a closest edge of the PCB (40).
8. An assembly (1) according to claim 7, wherein the plunger (20) is located inside a shaft (52) located remotely from the second longitudinal axis (B).
9. An assembly (1) according to any of the preceding claims, wherein the distance between the point M in the first position and the orthogonal projection of the point M on the second longitudinal axis (B) in the second position is the same distance that the distance between the orthogonal projection of a point of the plunger (20) in the first and the second position.
10. A dome control module (2) comprising the assembly (1) according to any of the preceding claims.

Patentansprüche

1. Baugruppe (1), umfassend eine Schaltervorrichtung (3) und ein Gehäuse (5), wobei die Schaltervorrichtung relativ zu dem Gehäuse angeordnet ist und Folgendes umfasst:
 - einen Schalter (30),
 - einen Stößel (20), wobei sich der Stößel entlang einer ersten Längsachse (A) erstreckt und einen Stößelkopf (22) hat,
 - einen Knebel (10), der schwenkbar mit dem Gehäuse (5) verbunden ist, so dass der Knebel (10) um eine erste Rotationsachse (C) herum schwenkt, wobei der Knebel (10) einen Knebelkopf (12) und einen Betätigungsbereich M hat, der von der ersten Längsachse (A) abgesetzt ist, wobei der Knebelkopf (12) in jeder Position des Knebels (10) in Kontakt mit dem Stößelkopf (22) bleibt, wobei durch manuellen Druck auf den Knebel (10) in eine erste Richtung um die erste Rotati-

- onsachse (C) herum in dem Betätigungsbereich M veranlasst wird, dass sich der Knebel (10) mit einer ersten Geschwindigkeit aus einer ersten Position in eine zweite Position bewegt, in der der Stößel (20) den Schalter (30) betätigt, wobei durch den manuellen Druck auf den Knebel (10) veranlasst wird, dass sich der Stößel (20) mit einer zweiten Geschwindigkeit bewegt, die geringer als die erste Geschwindigkeit des Knebels (10) ist, **dadurch gekennzeichnet, dass** der Stößel (20) einen Kopf (22) und einen Körper (24) umfasst und der Stößelkopf (22) gekrümmt ist und ein distales Ende in der Form eines Kugelgelenks umfasst, wobei der Stößelkopf (22) und der Knebel (10) über eine Kugelgelenkverbindung in Kontakt bleiben, wobei der Knebelkopf (12) einen ersten Überwuchs (16) hat, der eine erste Kontaktstelle zwischen dem Stößelkopf (12) und dem Knebelkopf (12) darstellt, wobei sich der Knebelkopf (12) nicht in beweglicher Anlage an dem Stößelkopf (22) befindet und die erste Kontaktstelle Reibungskräfte erzeugt.
2. Baugruppe (1) nach Anspruch 1, wobei der Knebel (10) einen zweiten Überwuchs hat, wobei der erste und der zweite Überwuchs eine Nut bilden.
 3. Baugruppe (1) nach einem der vorhergehenden Ansprüche, wobei der Stößelkopf (22) und der Knebel (10) eine komplementäre Form haben.
 4. Baugruppe (1) nach einem der vorhergehenden Ansprüche, wobei der Schalter (30) ein Druckschalter ist.
 5. Baugruppe (1) nach einem der vorhergehenden Ansprüche, umfassend eine Leiterplatte (40), wobei der Schalter (30) in elektronischer Verbindung mit der Leiterplatte (40) steht.
 6. Baugruppe (1) nach einem der vorhergehenden Ansprüche, wobei ein Längsabstand zwischen der ersten Rotationsachse (C) und einer oberen Fläche der Leiterplatte (40) zwischen 10 mm und 20 mm beträgt.
 7. Baugruppe (1) nach Anspruch 5 oder 6, wobei der Betätigungsbereich M einen Punkt M in der Mitte des Knebels (10) umfasst, wobei eine zweite Längsachse (B) parallel zu der ersten Längsachse (A) verläuft und durch den Punkt M geht, so dass ein Kreuzungspunkt I zwischen der zweiten Längsachse (B) und der Leiterplatte (40) höchstens 3 mm von einem nächstliegenden Rand der Leiterplatte (40) liegt.
 8. Baugruppe (1) nach Anspruch 7, wobei der Stößel (20) in einem Schaft (52) angeordnet ist, der abge-

setzt von der zweiten Längsachse (B) angeordnet ist.

9. Baugruppe (1) nach einem der vorhergehenden Ansprüche, wobei der Abstand zwischen dem Punkt M in der ersten Position und der Orthogonalprojektion des Punkts M auf der zweiten Längsachse (B) in der zweiten Position derselbe Abstand ist wie der Abstand zwischen der Orthogonalprojektion eines Punkts des Stößels (20) in der ersten und der zweiten Position.
10. Dome Control Modul (2), umfassend die Baugruppe (1) nach einem der vorhergehenden Ansprüche.

Revendications

1. Ensemble (1) comprenant un dispositif de commutation (3) et un boîtier (5), ledit dispositif de commutation étant disposé en relation avec le boîtier et comprenant :

un commutateur (30),
un piston plongeur (20), ledit piston plongeur s'étendant le long d'un premier axe longitudinal (A) et ayant une tête de piston plongeur (22),
un bouton (10) relié pivotant au boîtier (5) de sorte que le bouton (10) pivote autour d'un premier axe de rotation (C), ledit bouton (10) ayant une tête de bouton (12) et une zone d'actionnement M qui est distante du premier axe longitudinal (A), ladite tête de bouton (12) restant en contact avec ladite tête de piston plongeur (22) à toute position quelconque du bouton (10), dans lequel une compression manuelle du bouton (10) dans une première direction autour du premier axe de rotation (C) sur ladite zone d'actionnement M amène le bouton (10) à se déplacer à une première vitesse d'une première position à une seconde position dans laquelle le piston plongeur (20) actionne le commutateur (30), ladite compression manuelle du bouton (10) amenant le piston plongeur (20) à se déplacer à une seconde vitesse inférieure à la première vitesse du bouton (10),

caractérisé en ce que le piston plongeur (20) comprend une tête (22) et un corps (24) et la tête de piston plongeur (22) est courbe et comprend une extrémité distale ayant la forme d'un joint à rotule, la tête de piston plongeur (22) et le bouton (10) restant en contact par une liaison par joint à rotule, la tête de bouton (12) ayant une première excroissance (16) représentant un premier point de contact entre ladite tête de piston plongeur (22) et ladite tête de bouton (12), la tête de bouton (12) n'étant pas en butée de déplacement contre la tête de piston plongeur

(22), ledit premier point de contact provoquant des forces de frottement.

2. Ensemble (1) selon la revendication 1, dans lequel le bouton (1) a une seconde excroissance, lesdites première et seconde excroissances formant une rainure. 5
3. Ensemble (1) selon l'une quelconque des revendications précédentes, dans lequel la tête de piston plongeur (22) et le bouton (10) présentent des formes complémentaires. 10
4. Ensemble (1) selon l'une quelconque des revendications précédentes, dans lequel le commutateur (30) est un commutateur à bouton poussoir. 15
5. Ensemble (1) selon l'une quelconque des revendications précédentes, comprenant une PCB (40), ledit commutateur (30) étant en connexion électrique avec ladite PCB (40). 20
6. Ensemble (1) selon l'une quelconque des revendications précédentes, dans lequel une distance longitudinale entre le premier axe de rotation (C) et une surface supérieure de la PCB (40) est comprise entre 10 mm et 20 mm. 25
7. Ensemble (1) selon la revendication 5 ou 6, dans lequel la zone d'actionnement M comprend un point M au milieu du bouton (10), un second axe longitudinal (B) étant parallèle au premier axe longitudinal (A) et passant par ledit point M, de sorte qu'un point d'intersection I entre ledit second axe longitudinal (B) et la PCB (40) est à 3 mm au plus d'un bord le plus proche de la PCB (40). 30 35
8. Ensemble (1) selon la revendication 7, dans lequel le piston plongeur (20) est situé à l'intérieur d'un arbre (52) situé à distance du second axe longitudinal (B). 40
9. Ensemble (1) selon l'une quelconque des revendications précédentes, dans lequel la distance entre le point M dans la première position et la projection orthogonale du point M sur le second axe longitudinal (B) dans la seconde position est identique à la distance entre la projection orthogonale d'un point du piston plongeur (20) dans les première et seconde positions. 45 50
10. Module de commande de dôme (2) comprenant l'ensemble (1) selon l'une quelconque des revendications précédentes. 55

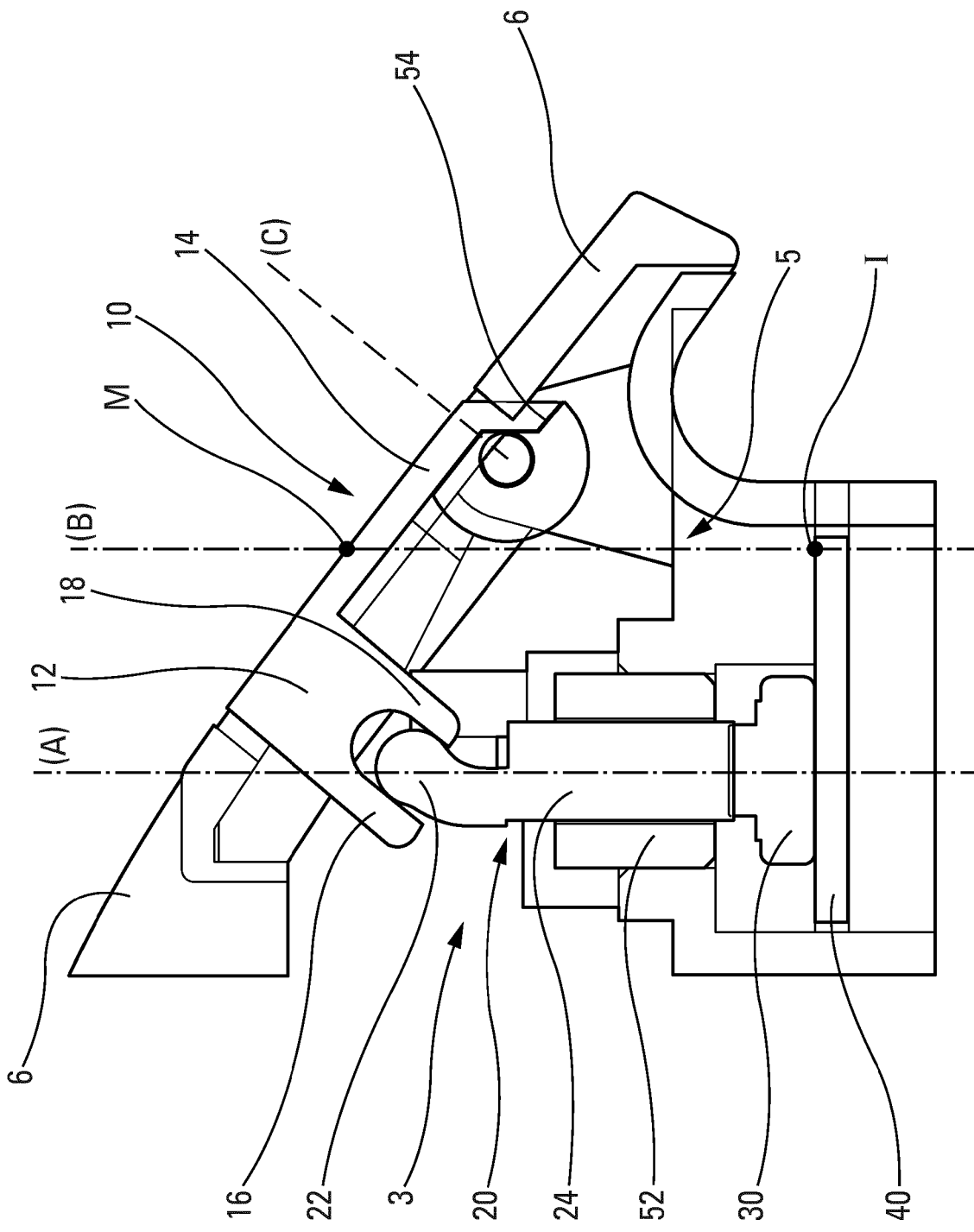
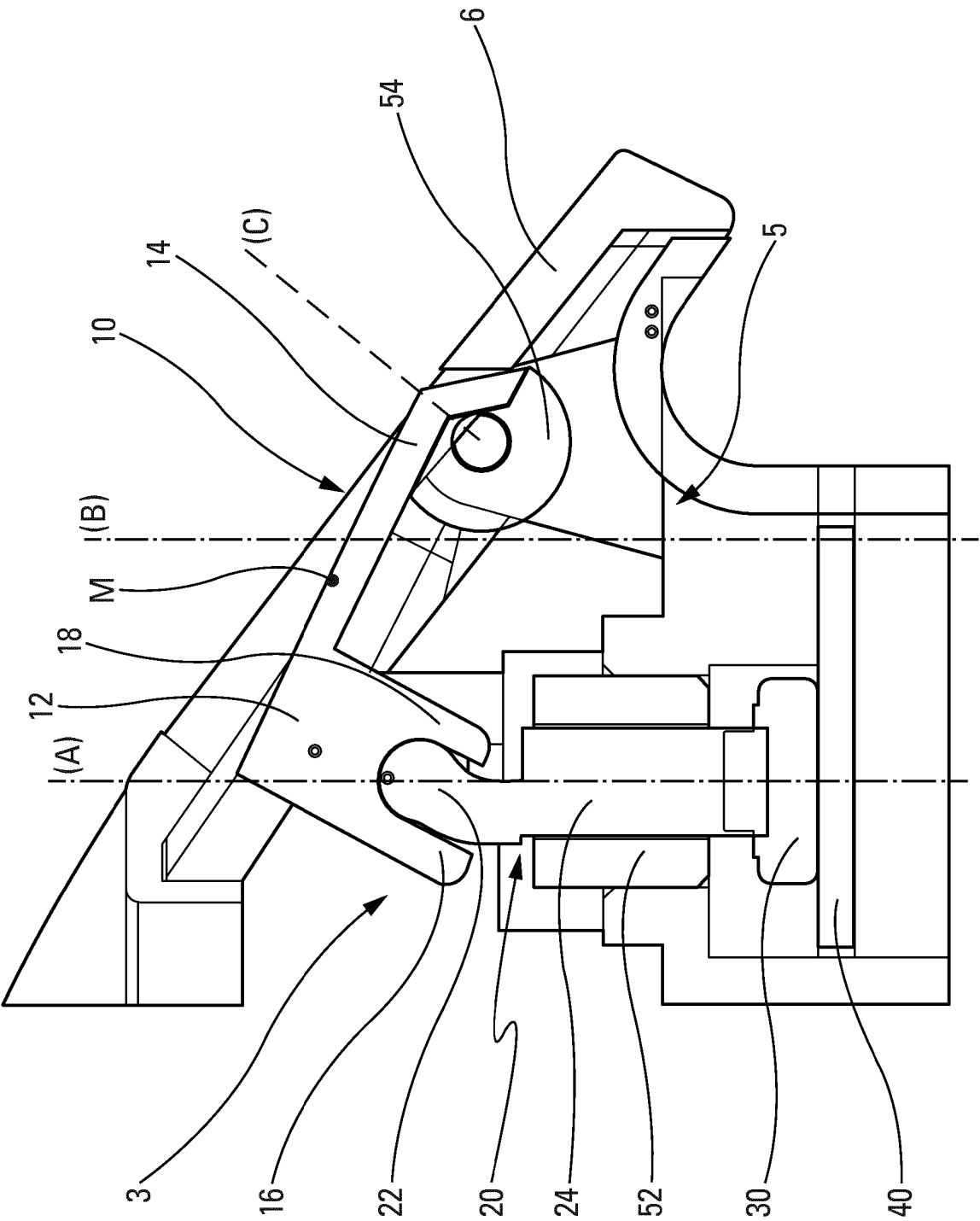


Fig. 1



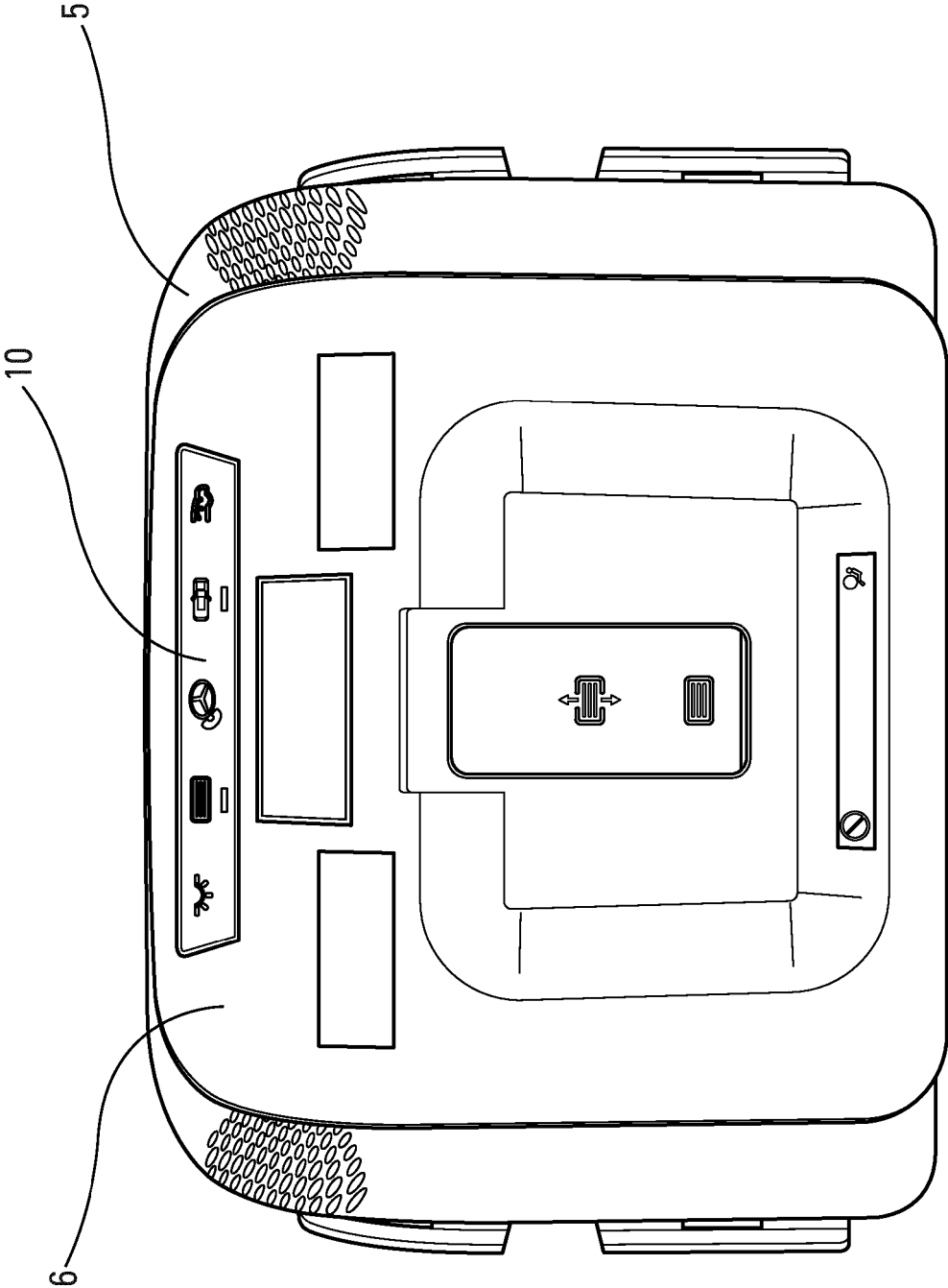


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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