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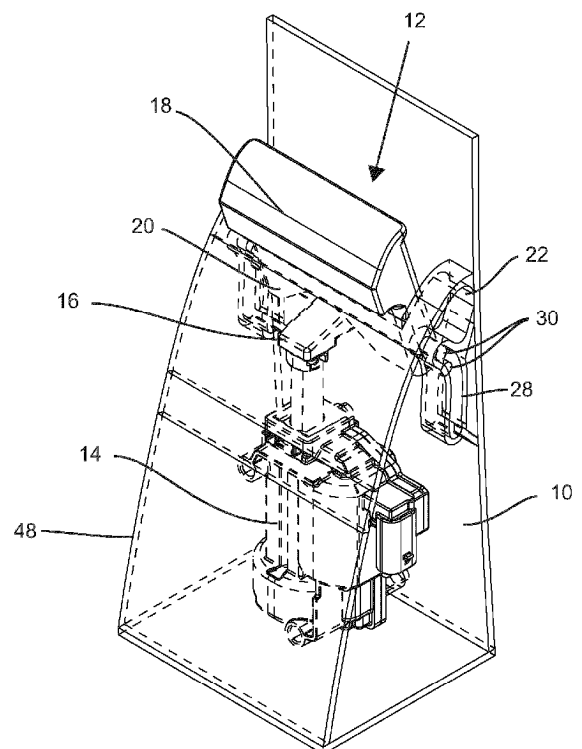
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(54) **VEHICLE DOOR HANDLE WITH AN EXTENDABLE HANDGRIP AND A VEHICLE DOOR WITH SUCH A VEHICLE DOOR HANDLE**

(57) The invention relates to a vehicle door handle (1) with a base (10), wherein a handgrip (12) and an actuator (14) are accommodated on the base (10). The handgrip (12) is coupled to the actuator (14), wherein the handgrip (12) can be adjusted by the actuator (14) between a rest position and an operating position relative to the base (10). The handgrip (12) has an operating section (18) and a coupler section (20) connected to the operating section (18). Further, the actuator (14) has a linear displacement means (16), wherein the coupling section (20) of the handgrip (12) engages the linear displacement means (16) to drive the handgrip (12) during a linear displacement of the linear displacement means (16). Guiding means (22) are formed, which are in engagement with the coupler section (20), wherein the guiding means comprise a guiding path (24) which is curved in sections, and wherein the coupler section (20) is guided in the guiding means (22) along the guiding path during entrainment by the displacement means (16).

Fig. 3b



Description

[0001] The present invention relates to a vehicle door handle for use on vehicle doors or vehicle flaps. Vehicle door handles are used to operate door or flap locks and must ensure safe and comfortable handling.

[0002] Vehicle door handles are increasingly being equipped with electrical or mechanical assistance systems to increase user-friendliness and safety. In particular, actuators are used that enable automatic or semi-automatic movement of the handle. This allows various comfort and safety functions to be realised, such as making it easier to open the door or a retractable arrangement of the handle to reduce aerodynamic drag.

[0003] The vehicle door handle as known per se comprises a base designed for attachment to a vehicle door or hatch. A handgrip and an actuator are attached to this base. The handgrip is coupled to the actuator and can be adjusted by it between a rest position and an operating position.

[0004] The handle comprises an operating section that is grasped by the user and a coupler section that connects the handle to the actuator. The utility model DE 20 2020 101 001 U1 describes a vehicle door handle with a motorised extension function and integrated lighting. The handle comprises a housing that defines a cavity in the vehicle door and an extendable handle body that can be moved between a rest position in the cavity and an operating position outside the cavity. In addition, the handle body is provided with light sources that can illuminate various areas, including the cavity of the housing, the floor near the vehicle and the vehicle door. In addition, the handle can be equipped with a proximity sensor that detects user input and controls the light sources. The handle can be equipped with an electric motor to enable extension and retraction and can be operated by gesture recognition or button input.

[0005] The patent application DE 10 2021 130 595 A1 relates to a vehicle door handle with an adjustable handgrip that can be moved between a rest position and an operating position. The handgrip is mechanically coupled to a handle carrier that is fixed to the vehicle door or tailgate. The movement is achieved by a guide mechanism that ensures the handgrip is guided along a defined path. An actuating lever transfers the force required to move the handgrip. The system includes a return spring that automatically returns the handle to the rest position and a release spring that assists movement to the operating position. The design allows for a power-off operation in which a single operation of the handle causes both extension and retraction of the handgrip. The coupling between the adjustment lever and the cam lever is provided by a mechanical linkage that uses axial movement of the cam lever to automatically retract the handgrip after operation.

[0006] The invention is based on the problem of providing a vehicle door handle that enables reliable and

user-friendly operation while also having a robust operating and opening mechanism.

[0007] The problem is solved by a vehicle door handle according to claim 1.

[0008] The door handle according to the invention has an actuator which in turn has a linearly movable displacement means. The displacement means is coupled to the coupler section of the handgrip for the purpose of entraining the handgrip when the displacement means is linearly displaced by the actuator. This linear translational movement of the displacement means, i.e. along a straight line, is particularly easy and reliable to achieve mechanically. The handgrip is entrained in the area in which the handgrip is coupled to the linearly movable displacement means by means of its coupler section, along a straight, linear path. According to the invention, guiding means are formed which are also engaged with the coupler section. While the coupler section is moved along the guiding means in the guiding means when it is carried by the displacement means, the coupler section is guided along a curved guiding path, at least in sections, in the sections in which it is engaged with the guiding means.

[0009] This design according to the invention thus provides for the displacement means to be linearly and straightly moved in a translatory motion and for a linear entrainment to also occur at the coupling point of the coupler section of the handgrip, while the handgrip itself is guided in the guiding means in sections along a curved guiding path. This guidance along a curved guiding path is achieved by means of a guide on the handgrip that is offset with respect to the straight guidance by the displacement means. The curvature of the guiding path makes it possible to adjust the handgrip to an operating position despite the linear drive, while simultaneously pivoting the handgrip with respect to the base. The movement is comparable to several wagons coupled on a rail in front of a curve, so that a linear drive of the last wagon, which is on a straight line before the curve, leads to a movement of the first wagons along the curve. The displacement means thus provides linear movement in one section while the remainder of the handgrip is pulled or pushed along the guiding means and follows the movements of the guiding path in these sections to displace the handgrip. In this way, the handgrip can be moved precisely between its inconspicuous, flush-mounted rest position and an ergonomically favourable, inclined operating position. The inclination can, for example, be between 5 and 45 degrees, although smaller or larger angles are also possible. Over the full travel distance the handgrip makes along the guide path, the movement is effected by the linear movement of the displacement means.

[0010] In a preferred embodiment, the guiding path can be configured as a parameterised curve, in particular as a Bézier curve or B-Spline. In this case, sections of the guiding path, in particular the starting and end points of the curve, define the position of the handgrip

in the rest and operating position. A linear section can be connected to the curved sections of the guiding path.

[0011] Preferably, the guiding means can be designed with slots in which the handgrip is guided. This design as slots enables secure guidance and simple production, in particular if the guides are designed as part of the base.

[0012] It is preferred if the coupler section has guiding projections that are guided in associated slots. This guidance can be multi-sided, i.e. in particular on sides of the coupler section that face away from each other, so that the coupler section of the handgrip is guided on both sides without the risk of jamming and with a small amount of freedom of movement.

[0013] Preferably, the displacement means is coupled to the coupler section in a manner that allows it to pivot, in order to allow flexible movement. The displacement means may, for example, comprise a hub that rotatably receives a shoulder of the coupler section. The hub may be configured as an elongated hole or with freedom of movement relative to the received part of the coupler section, so that the received part can move within the hub and can rotate and slide along the guiding path according to the guiding means, without the linear adjustment being affected by the displacement means. The displacement means can engage the coupler section of the handgrip at any point, e.g. in the centre, while the handgrip is guided laterally. However, the displacement means can also be arranged laterally next to the coupler section and also outside the guides, if, for example, guide protrusions are formed from the coupler section, which pass through the slots of the guiding means and are coupled on the outside to the displacement means for entrainment.

[0014] The guiding means may also be provided with damping elements to gently decelerate the movement of the handgrip and to stabilise its end positions.

[0015] The actuator can preferably use one of various drive concepts to realise the linear movement of the displacement means. The first variant involves an electric motor with a reduction gear. The reduction gear allows the high motor speed to be adapted to the desired slower movement of the displacement means, while simultaneously increasing the available torque. This is advantageous for a smooth and powerful movement of the handgrip.

[0016] Alternatively, a spindle drive can be used, in which the rotational movement of the motor is converted directly into a linear movement via a threaded spindle. This solution is characterised by a compact design and high precision. The spindle drive also allows for a self-locking design that prevents unintentional adjustment of the handgrip.

[0017] The third preferred option is a rack and pinion combination. This solution offers the advantage of direct conversion of the rotational movement into a linear movement, while also being cost-effective to manufac-

ture. The rack solution also allows for easy integration of end stops.

[0018] To improve user comfort, sensors with one or more of the following sensor technologies are preferably provided in the handgrip: Capacitive sensors are particularly suitable for contactless detection of an approaching hand by changing the electrical field. Inductive sensors could be used in addition or as an alternative in the handgrip. Resistive strain sensors can detect a mechanical deformation of the handgrip.

[0019] The sensors can be arranged at positions on the handgrip that are accessible both in the rest position and in the operating position, as well as at positions that are only accessible when the handgrip is in the operating position. The sensors can initiate an operation of the movement of the handgrip itself between the positions by means of signals from the sensors, or they can also be assigned to other functions in the vehicle.

[0020] Further training may include a sensor-based force measurement on the displacement means itself. This enables precise measurement of the operating forces and can also be used to distinguish between intentional operation and unintentional contact. The force measurement can also be used to monitor the drive mechanism and to detect faults.

[0021] When a vehicle door is designed with a vehicle door handle according to the invention, the vehicle door has an outwardly facing panel in which a recess is formed. The vehicle door handle is accommodated in this recess in such a way that, in the rest position, the handgrip fills the recess and is flush with the outwardly facing panel, and the actuator is arranged on the inside of the outwardly facing panel.

[0022] The flush arrangement in a recess of the outwardly facing panel offers both aerodynamic and aesthetic advantages. Mounting the actuator on the inside of the outwardly facing panel ensures good protection against environmental influences.

[0023] The guiding means and the coupler section of the handgrip are preferably designed in such a way that the handgrip is moved along the guiding path when adjusting to the operating position, in such a way that the handgrip is first moved straight up out of the outwardly facing panel from its rest position and then along the curved guiding path into the tilted operating position.

[0024] The tilted position in the operating position improves the ergonomics when gripping and pulling. The defined guiding path ensures that the movement is controlled and reproducible.

[0025] Preferably, the recess is located on the upper door edge, adjacent to a window opening, so that the handgrip in its rest position is essentially formed as an extension of an upper door edge. This arrangement at the upper door edge near the window opening is particularly advantageous for aerodynamics and design. In the rest position, the handgrip practically forms an ex-

tension of the door edge, which contributes to a harmonious overall appearance and allows improved accessibility.

[0026] It is particularly advantageous if a sealing or decorative strip is arranged in the area of the upper door edge, which is flush with the handgrip when it is in the rest position and seals the transition between the handgrip and the upper edge of the vehicle door. The integration of a sealing or decorative strip in the area of the upper door edge seals the transition between the handgrip and the upper door edge and prevents the ingress of water or dirt.

Figure 1a shows a vehicle door with a vehicle door handle according to the invention, wherein the handgrip is located in a recess of the outer door panel in a rest position.

Figure 1b shows the vehicle door according to Figure 1a, wherein the handgrip has been moved out of the outer door panel and a coupler section is visible.

Figure 2a shows a view of the vehicle door handle in the direction of the door case with the handgrip in the rest position, with the operating section aligned with the vehicle panel.

Figure 2b shows the view according to Figure 2a, with the handgrip with its operating section extended out of the door panel and angled.

Figure 3a shows a perspective view of the vehicle door handle with the outer door panel shown in transparent form in the rest position of the handgrip.

Figure 3b shows the view according to Figure 3a with the handgrip in the operating position, whereby the displacement means is maximally linearly extended.

Figures 4a, 4b and 4c show the vehicle door handle without the door outer panel and mounting hardware to illustrate the coupling between the displacement means and the guide projections.

Figures 5a and 5b schematically show the arrangement of sensors for detecting operations in the handgrip.

[0027] Figures 1a and 1b show a first embodiment of a vehicle door 46 with a vehicle door handle according to the invention. In Figure 1a, the vehicle door is shown with the vehicle door handle, wherein the handgrip 12 is located in a recess of the outer door panel 48 in the rest position. In Figure 1b, on the other hand, the handgrip of the vehicle door handle 12 has been moved out of the outer door panel 48 of the vehicle door 46, so that sections of the coupler section 20 of the handgrip 12 are also visible. It is shown that the vehicle door handle with the handgrip 12 is arranged on the upper edge 52 of the outer door panel 48, on which a decorative and sealing strip 54 also runs, so that the handgrip 12 is sealed by the decorative and sealing strip 54 in

the state according to Figure 1a, i.e. in the rest position. In the state of Figure 1a, i.e. in the rest position of the handgrip 12, the handgrip 12 is retracted into the outer door panel 48 in such a way that the top side of the operating section 18 of the handgrip 12 is flush with the outer door panel 48. This is an aerodynamically favorable design, reduces the risk of injury or getting caught on objects and seals the vehicle door against environmental influences. The arrangement of the handgrip 12 at the upper end of the outer door panel 48 offers advantages with regard to accessibility by an operator, since the handgrip is at a height that is convenient for the operator, but also the option of filling an edge section of the outer door panel 48 in alignment. Edge sections are easier to work with and to provide with cutouts than cutouts in the center of the door outer panel 48 and therefore allow for easier production.

[0028] Figures 2a and 2b show the two different positions of the vehicle door handle again. The view is in the direction of the door case, i.e. in Figures 1a and 1b from the right. Figure 2a shows the position of the vehicle door handle with a handgrip 12 in the rest position, in which the operating section 18 is aligned with the vehicle panel 48. In Figure 2b, on the other hand, the handgrip 12 with the operating section 18 has been moved out of the door panel 48 and placed at an angle in order to be offered to the user for operation.

[0029] A base 10 is arranged on the inside of the door panel 48, which is either attached to the door panel 48 itself or to the inner structure of the door. The base 10 is coupled to an actuator 14, which in the present embodiment is designed as an electric motor with a spindle drive. The actuator 14 has a displacement means 16 that can be adjusted vertically by means of the electric motor-driven spindle drive. The displacement means 16 is coupled to a guiding projection 30 that is guided in a rod-shaped manner through the handgrip 12 in its coupler section 20 (see also the following drawings). When the displacement means 16, driven by the actuator 14, moves vertically, it pulls the handgrip 12 vertically with it, with the guiding projection 30 on the handgrip 12 being guided in a guide 22 that has a slot 28. Due to the design of the slot, which follows a guiding path 24 in the centre, the handgrip 12 is first extended vertically out of the door leaf 48 despite the linear movement of the displacement means 16 and then finally pivoted into an operating position, following the guiding path 24 and the slot 28 with the guide projections 30. The displacement means 16 is coupled to the guide projections 30 in such a way that the guide projections 30 can rotate in the displacement means and that the vertical displacement means 16 and the guide projections 30 cannot become jammed. To this end, there is sufficient freedom of movement for a rotational movement of the coupled guiding projection 30 in the displacement means 16 as well as for any horizontal movement of the coupled guiding projection 30 in the hub of the displacement means 16 that may be

required.

[0030] Figures 3a and 3b show the arrangement from a different perspective, namely in a perspective view, with the outer door panel 48 being depicted as transparent. Otherwise, the same state as in Figures 2a and 2b is shown in Figures 3a and 3b. Figure 3a accordingly shows the rest position of the handgrip 12, with the displacement means 16 being maximally retracted with respect to the actuator 14. Figure 3b accordingly shows the operating position of the handgrip 12, with the displacement means 16 being maximally linearly extended with respect to the actuator 14. In these illustrations, it can be seen that the displacement means 16 acts centrally, i.e. between the lateral boundaries of the handgrip 12, on the guiding projection 30, for which a recess is formed in the coupler section 20 of the handgrip 12. In this embodiment, the guiding projection 30 is formed as two pins guided by the coupler section. These slide in the slot 28 of the guiding means 22 in order to execute the desired path of movement of the handgrip 12 along the guiding path.

[0031] To further illustrate the coupling and movement, Figures 4a, 4b and 4c show the vehicle door handle without the exterior door panel and portions of the mounting. In these figures, the coupling between the displacement means 16 and the guide projections 30, which are formed as continuous pins through the handgrip 12 in its coupler section 20, can be clearly seen.

[0032] Figures 5a and 5b schematically show the arrangements of sensors for detecting operations in the handgrip 12. A touch sensor 42 can be designed as a capacitive sensor or as an inductive sensor. For example, it can detect contact with the operating section of the handgrip to initiate opening of a door, or, when retracted to the rest position, it can detect activation of the sensor 42 to extend the handgrip. A resistive strain sensor 44 can be arranged in the handgrip 12 in such a way that a pulling or pushing movement against the handgrip in its operating position can be detected as a signal for the deformation of the handgrip itself and can be detected as an operating action. While a selection of sensors is shown in this example, any other combinations of known sensors, i.e. combinations of capacitive, inductive and resistive sensors as well as radar sensors, can be arranged in the handgrip. Sensors 42 and 44 are coupled to a sensor control 40, which can be located in the same housing as the actuator 14 or at a different location, coupled to the base 10.

[0033] Furthermore, a sensor, in particular a force transducer, can also be arranged on the displacement means 16 or the actuator 14 itself, which detects an operation of the handgrip, for example pressure on the handgrip or a movement in its operating position by pulling or deflecting.

Claims

1. Vehicle door handle (1) with a base (10), wherein the base (10) is designed for attachment to a vehicle door or vehicle hatch,

wherein a handgrip (12) and an actuator (14) are accommodated on the base (10), wherein the handgrip (12) is coupled to the actuator (14), wherein the handgrip (12) can be adjusted by the actuator (14) between a rest position and an operating position relative to the base (10), the handgrip (12) having an operating section (18) and a coupler section (20) connected to the operating section (18),

characterised in that

the actuator (14) has a linear displacement means (16), wherein the coupling section (20) of the handgrip (12) engages the linear displacement means (16) to drive the handgrip (12) during a linear displacement of the linear displacement means (16), wherein guiding means (22) are formed, which are in engagement with the coupler section (20), wherein the guiding means comprise a guiding path (24) which is curved in sections, wherein the coupler section (20) is guided in the guiding means (22) along the guiding path during entrainment by the displacement means (16).

2. Vehicle door handle according to claim 1, wherein the at least partially curved guide path (24) is at least partially configured as a parameterised curve (26), in particular as a Bézier curve or B-Spline, with the starting and end points of the curve defining the position of the handgrip (12) in the rest and/or operating position.
3. Vehicle door handle according to claim 1 or 2, **characterised in that** the guiding means (22) are designed as slots.
4. Vehicle door handle according to claim 3, **characterised in that** the coupler section (20) has, on sides facing away from each other, projecting guiding projections (30) which are each guided in an associated slot (28) of the guiding means (22).
5. Vehicle door handle according to one of the preceding claims, wherein the displacement means (16) is pivotally coupled to the coupler section (20) of the handgrip.
6. Vehicle door handle according to one of the preceding claims, wherein the guiding means are provided with at least one damping element for slow-

ing down the movement of the handgrip when reaching the rest position and/or for stabilising the handgrip in the end positions.

7. Vehicle door handle according to one of the preceding claims, wherein the actuator comprises an electric motor which
 - is coupled to a reduction gear for adjusting the displacement means, or
 - is coupled to a spindle drive for adjusting the displacement means, or
 - is coupled to a rack and pinion combination for adjusting the displacement means.
8. Vehicle door handle according to one of the preceding claims, wherein at least one capacitive proximity sensor and/or one inductive sensor and/or one resistive strain sensor is/are arranged in the handgrip, preferably in the operating section, which is designed to detect the approach of a user's hand and outputs an operating signal.
9. Vehicle door handle according to one of the preceding claims, wherein the displacement means comprises at least one sensor which detects an application of force exerted on the handgrip and outputs it as an actuation signal.
10. Vehicle door (46) with a vehicle door handle (1) according to one of the preceding claims, wherein the vehicle door (46) comprises an outwardly facing panel (48) in which a recess (50) is formed, the vehicle door handle being accommodated in this recess (50) in such a way that the handgrip (12) fills the recess (50) in the rest position and is flush with the outwardly facing panel (48), and the actuator (14) is arranged on the inside of the outwardly facing panel (48).
11. Vehicle door (46) according to claim 10, wherein the guiding means (22) and the coupler section (20) of the handgrip (12) are configured such that the handgrip (12) is moved along the guiding path (24) when being adjusted into the operating position in such a way that the handgrip (12) reaches the tilted operating position with respect to its rest position.
12. Vehicle door (46) according to one of claims 10 or 11, wherein the recess (50) is arranged on the upper outer panel edge (52), adjacent to a window opening, so that the handgrip (12) in its rest position is substantially formed as an extension of an upper door edge (52).
13. Vehicle door (46) according to one of claims 10 to 12, wherein a sealing or decorative strip (54) is ar-

ranged in the region of the upper door edge (52), which sealing or decorative strip (54) adjoins the handgrip (12) in a flush manner in the rest position of the handgrip (12) and seals the transition between the handgrip (12) and the upper door edge.

Fig. 1a

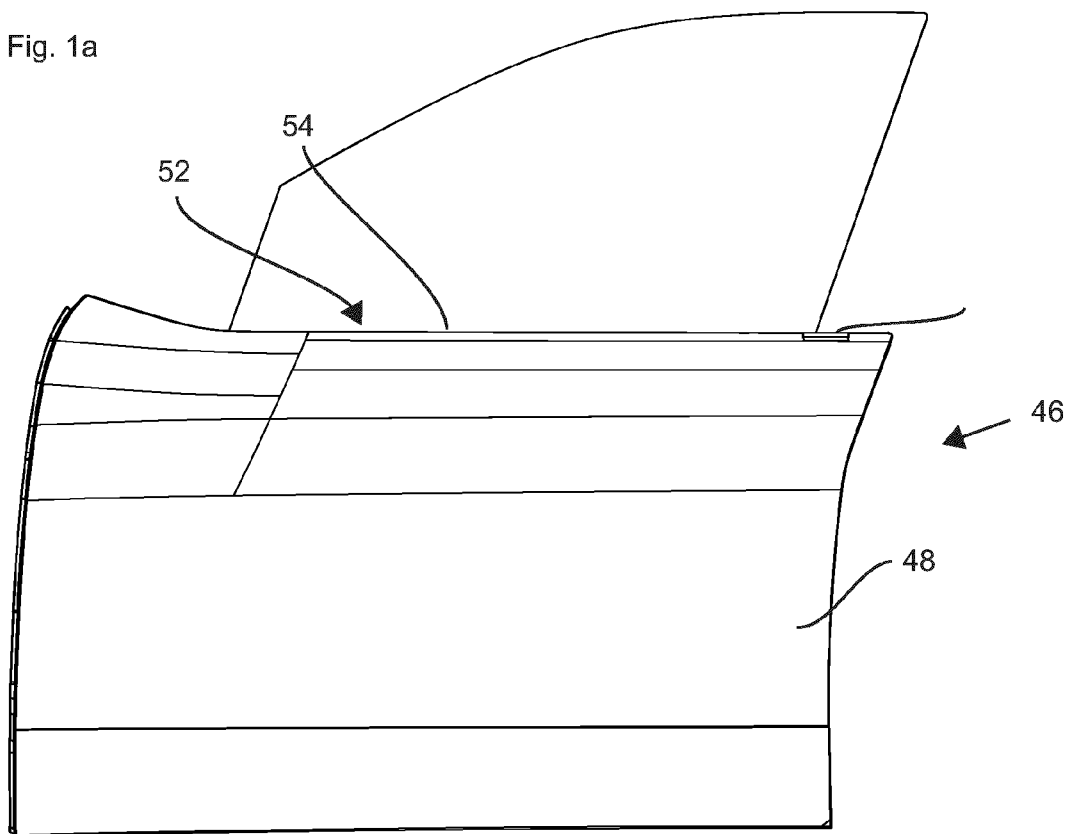


Fig. 1b

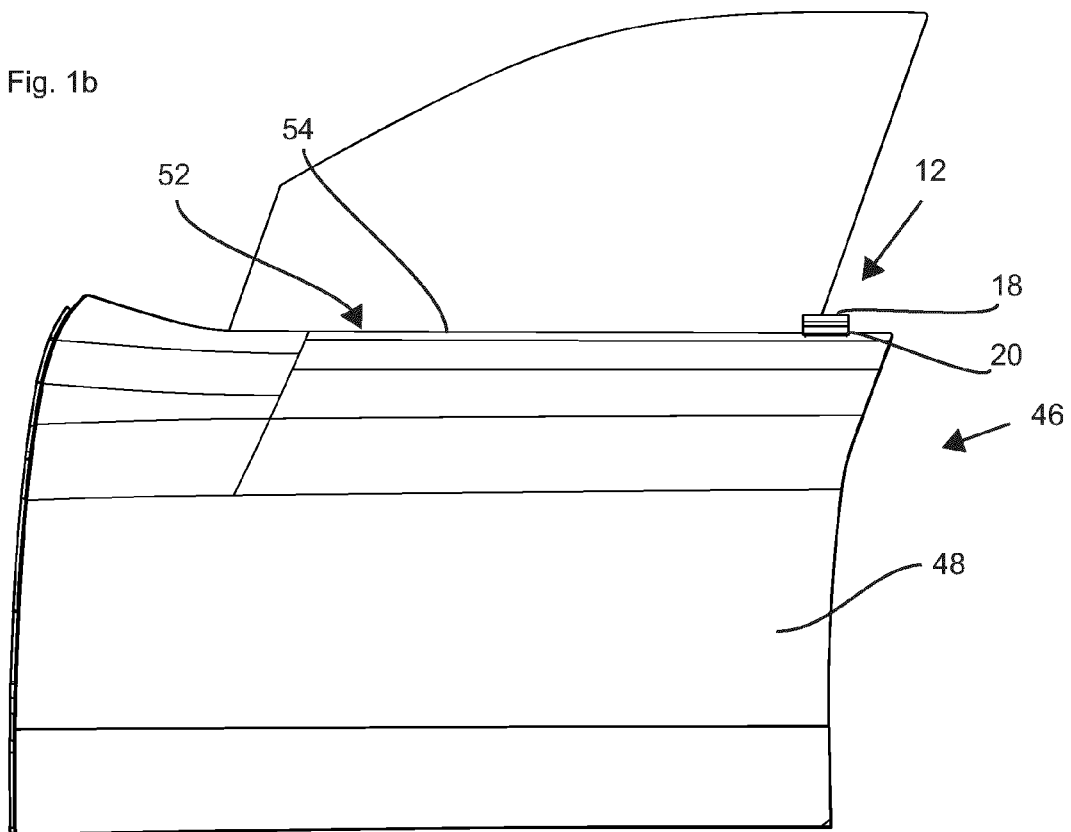


Fig. 2a

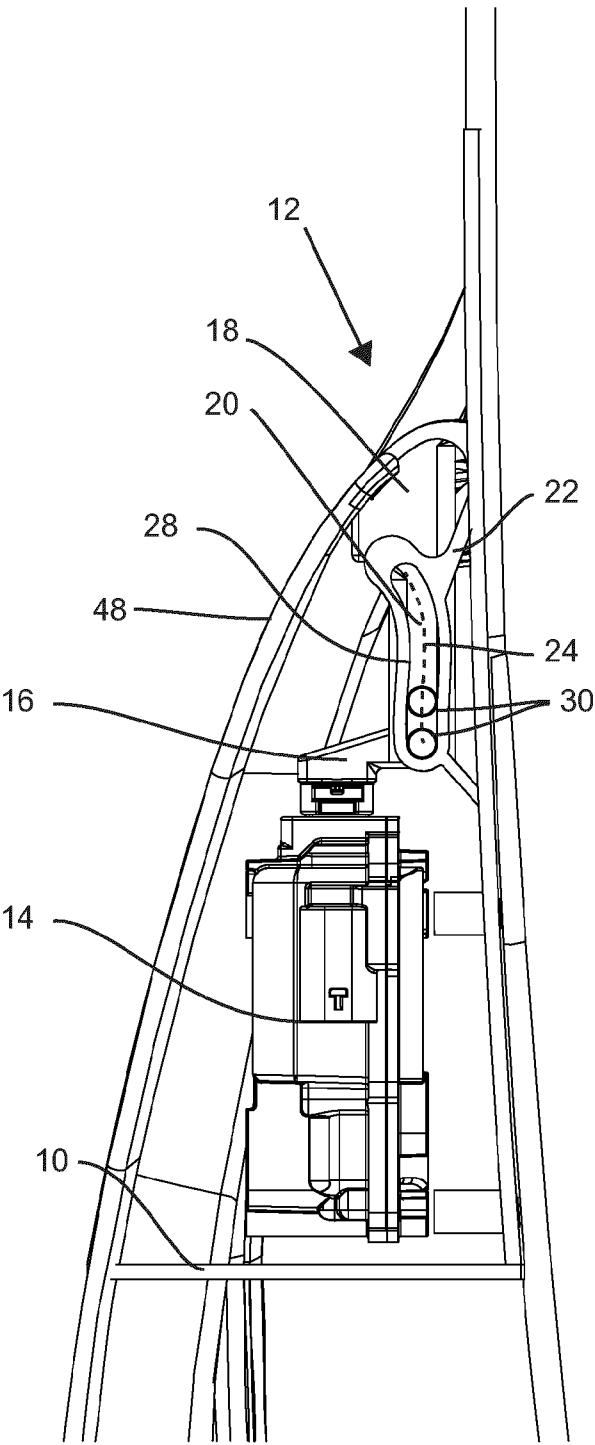


Fig. 2b

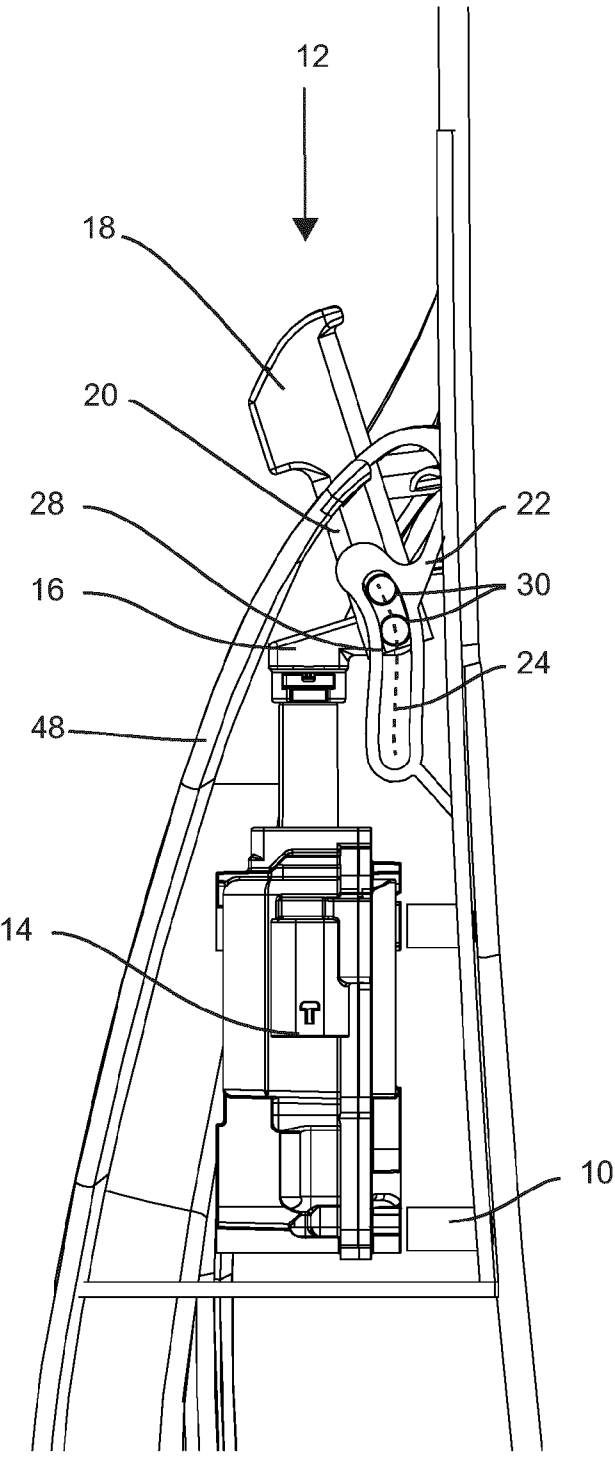


Fig. 3a

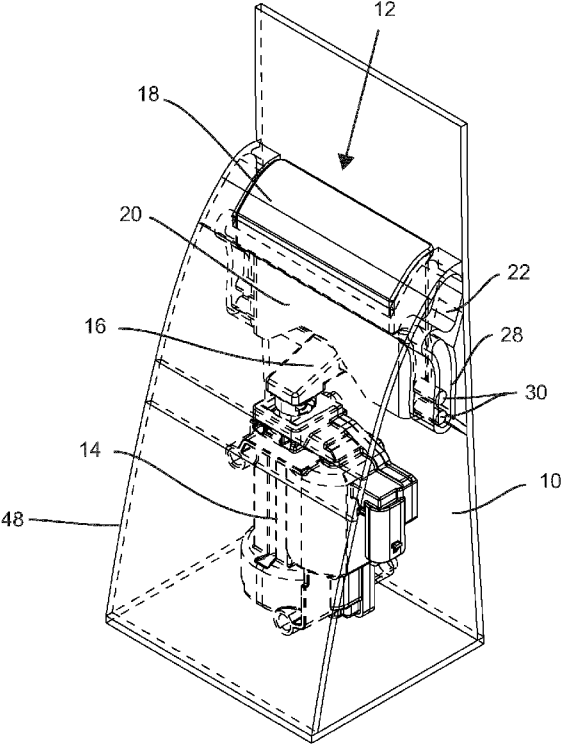
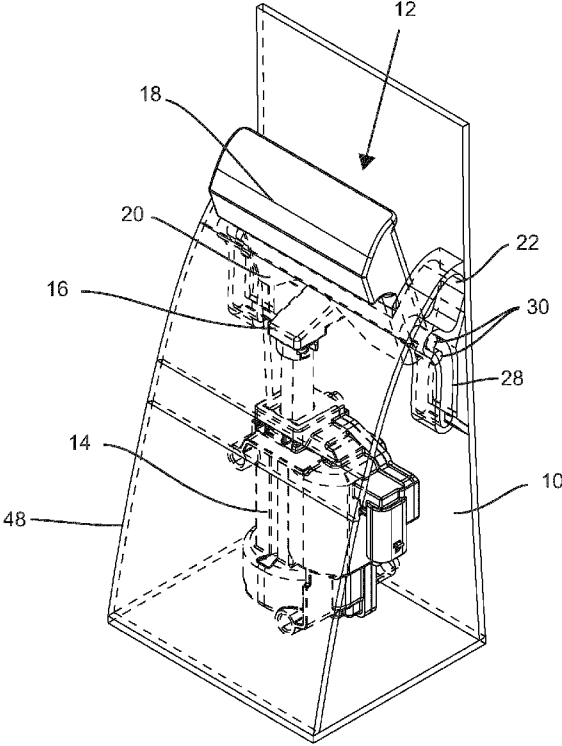


Fig. 3b



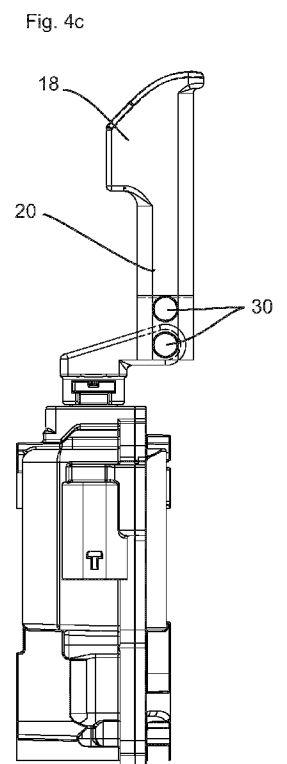
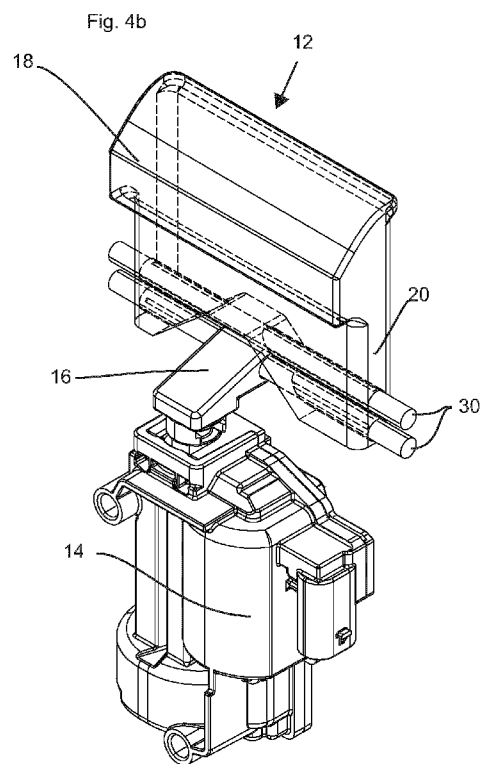
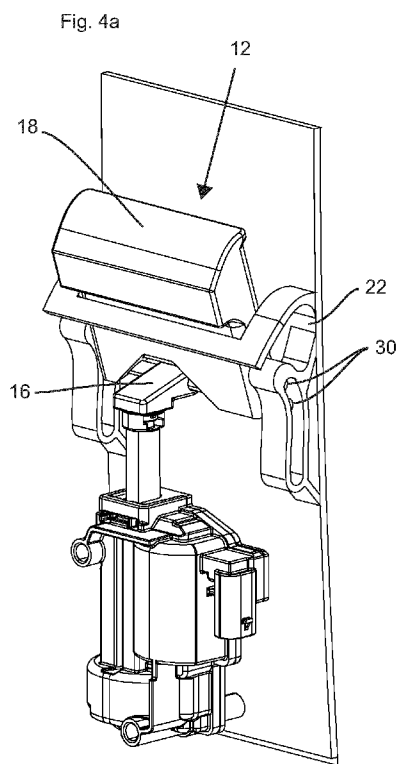


Fig. 5a

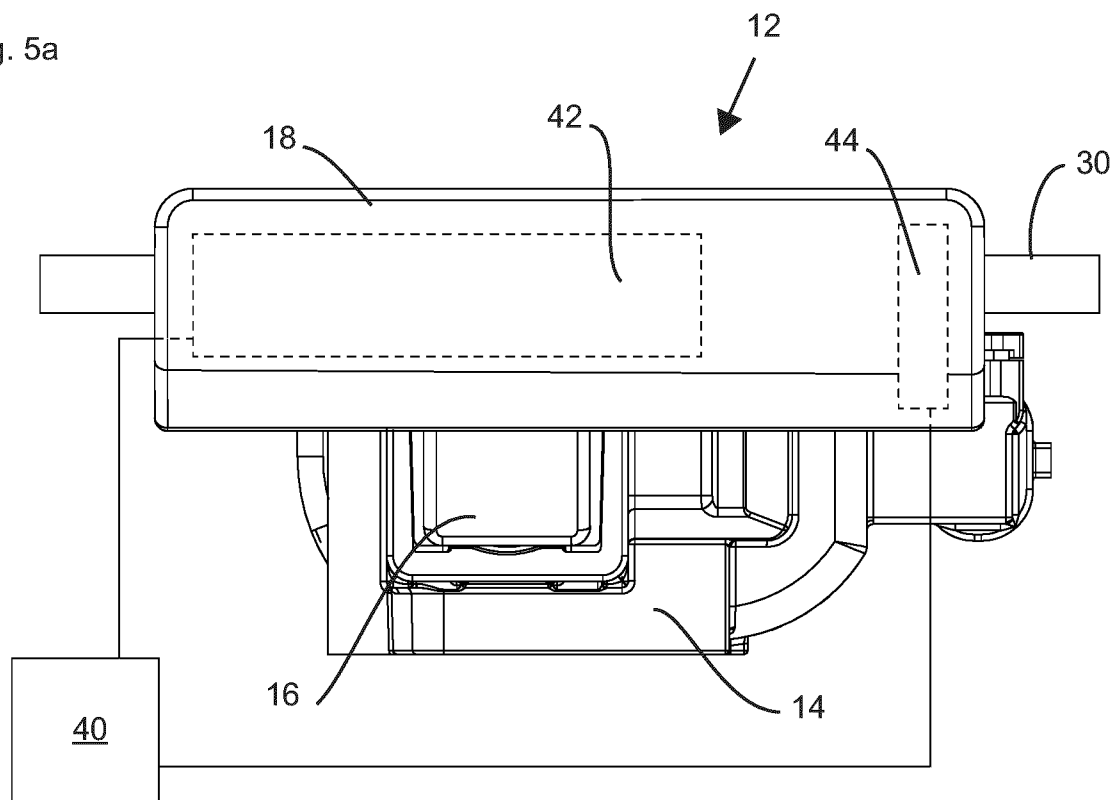
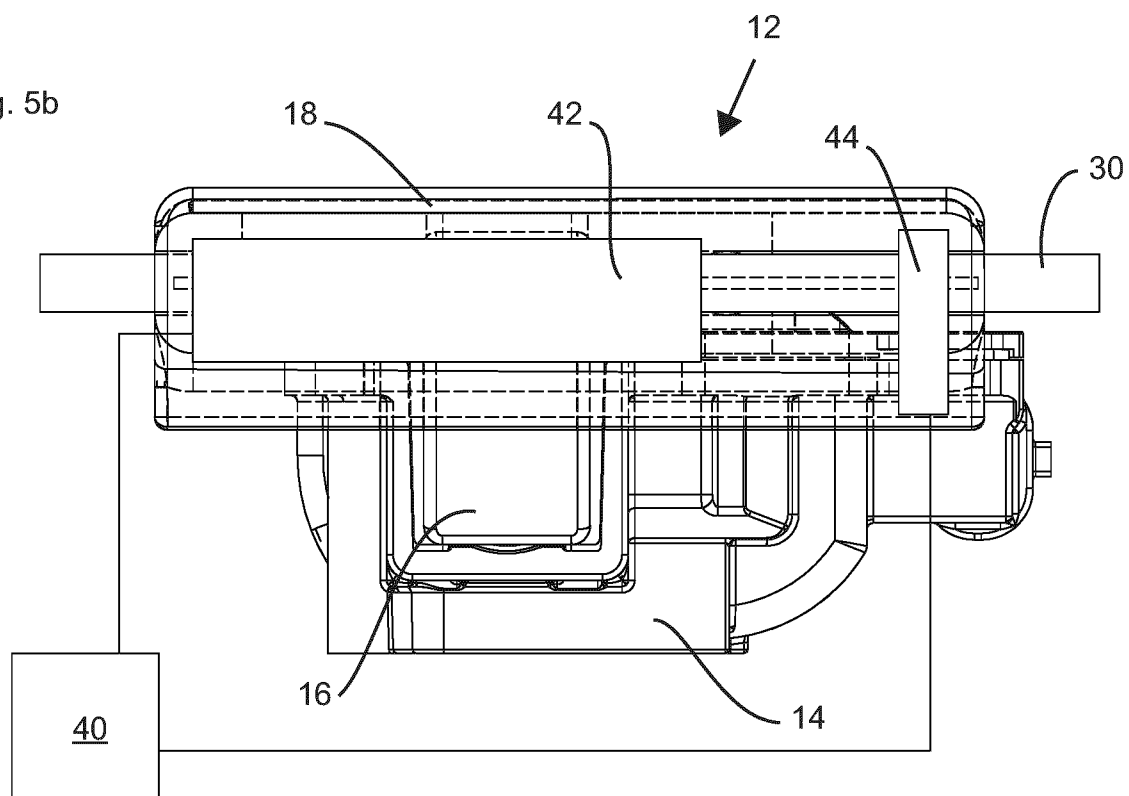


Fig. 5b





EUROPEAN SEARCH REPORT

Application Number

EP 25 17 0534

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 September 2025	Examiner Boufidou, Maria
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
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