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(54) **Title:** DEVICE FOR FASTENING A LOOSE OBJECT, ESPECIALLY A WHEELCHAIR, TO A VEHICLE FLOOR

(57) **Abstract:** A device (1) for fastening a loose object, especially a wheelchair (11), onto the floor (17) of a vehicle consisting of a winch drum (2) equipped with a latch arranged under the floor (17) in a cavity fitted with a lid, and of a tension strap (3) woundable at one end onto the winch drum (2) and fitted at the other end with a fastening means. To reduce the demand for vehicle space and for easy handling, the winch drum (2) is formed by a self-winding retractor, and the device (1) is equipped with a guiding means (8) for the tension strap (3), which is arranged parallel to the axle (26) of the winch drum (2) on the output side of the strap (3) from the winch drum (2). The strap is led through a guiding means (8) counter-directionally back towards the winch drum (2), whereby when exiting from the device (1) it passes over the winch drum (2) along a vertical plane that includes the axle (26) of the winch drum (2).



Device for fastening a loose object, especially a wheelchair, to a vehicle floorField of the invention

The invention relates to a device which forms a fastening module usable for fastening loose objects onto the floor of vehicles, especially automobiles. Specifically, this is a fastening module particularly suitable for a wheelchair restraint system for the transport of persons with physical disabilities.

Background of the invention

For holding loose items of larger dimensions, for example wheelchairs, universal safety straps are most frequently used. These are designed so that one free end of a fixed tension strap is equipped with a head with a recess which is pushed onto an anchoring pin projecting from the floor of the car. The other end of the fixed tension strap is fastened to a winch equipped with a ratchet and winch drum. Onto the winch drum is attached one end of the movable tension strap, while the second end of the movable tension strap is terminated by a hook or clasp that latches over the frame or some other part of the wheelchair. Turning the ratchet that forms the pawl to the gear wheel of the winch drum shortens the length of the movable tension strap, and the wheelchair or other object is tightened to the floor of the car. Usually four fastening straps are used, placed on several sides of the object in order to ensure that the object is safely fastened.

Document CN 102727349 describes a similar device with reverse function of a fixed and movable tension strap. The strap is tightened using a handwheel on the side of the winch. The described device has several disadvantages. First, a large space is required for tightening, necessitating a large load area on the floor of the vehicle. Several straps need to be installed around the wheelchair or other object, the length of which is the sum of the length of the movable fastening strap with hook, the fixed tension strap with head, and the winch, which leads to the fact that only supply vans, multivans, and other vehicles with a large floor area may be used for the transport of wheelchairs with this fastening device. Further disadvantages lie in the fact that anchoring pins permanently protrude from the floor in the modified vehicle, and that the tension straps are lying loose on the floor of the vehicle when the wheelchair is

not being transported and the vehicle is being used for conventional purposes, or it is necessary to store them in special separate box.

Other fastening device designs are known which partially eliminate the aforementioned drawbacks. For example, document GB 2419572B describes a floor fastening device for vehicles, also comprising a retracting tension strap for securing the wheelchair, but with the difference that the strip passes through a hole in the floor and is wound by a winch located in a cavity in the vehicle floor, respectively in a separate floor part containing the cavity. This design does not shorten the length of the tension strap, because the winch is provided with an anchoring mount which replaces the fixed tension strap, and the movable tension strap extends from the winch on the side facing the wheelchair, so the floor projection of the tightening length is substantially the same as in the previous design. The tightening area would be reduced only if the cavity with the winch were located in a layout plan outside the floor of the vehicle into its frame, which is not possible because the the ratchet of the winch must extend through the hole in the floor for tightening the tension strap.

Another document EP 1701860 describes a floor tightening device which in most characteristics is the same as the design described in the preceding paragraph, except that the floor cavity where the winch is located is covered by a lid which is pivotally mounted and serves at the same time as a ratchet for the winch. Lifting and placing the lid, with the use of a gear wheel, rotates the winch and tightens the tension strap. The wheel is released by a sliding component in the lid by hand, which is difficult and inconvenient. The device according to EP 1701860 is advantageous in that when the lid is positioned, neither the anchoring pin nor the ratchet of the winch protrude above the floor as in the previous designs. Nonetheless, even this design does not eliminate the disadvantage of the need for a large surrounding space for fastening the object, e.g. the wheelchair.

The invention aims to eliminate the aforementioned disadvantages of the known designs of the fastening device and to create a fastening device that would minimize the need for free surrounding space for fastening a wheelchair or similar object so that even cars with a smaller loading surface may be used for the transport of wheelchairs. Another object of the invention is to improve and facilitate control of the fastening device both during the fastening and during the release of the wheelchair or other similar object.

Summary of the Invention

This objective is achieved by a device for fastening a loose object, especially a wheelchair, on the floor of a vehicle, consisting of a winch drum located under the floor in a cavity equipped with an openable cover, of at least one tension strap woundable on the winch drum and equipped on its free end with a tightening means, and of a latching means for locking and unlocking the rotation of the winch drum. The essence of the invention lies in the fact that the winch drum is formed by a self-winding retractor, the device is equipped with a guiding means for the tension strap arranged parallel to the axle of the winch drum on the output side of the tension strap from the winch drum, and the tension strap is led from the winch drum through the guiding means in the opposite direction back towards the winch drum, whereby upon leaving the device it passes over the winch drum on a vertical plane which includes the axle of the winch drum. The guiding means preferably comprises a rotatably mounted cylindrical axle or a pulley.

The advantage of the described arrangement of the device according to the invention is characterized in that the entire functional part of the device can be stored in the floor from the edge of the floor towards the wheelchair or other fastened object, while at the same time the space needed for fastening and for leading the tension strap is reduced by the length of the entire device. Presently known constructions of fastening modules have been designed so that the space necessary for fastening has, on the contrary, been increased by the entire installation length of the fastening device.

In a preferred embodiment of the device according to the invention, the winch drum and the guiding means are arranged in an integrated cartridge fitted with a peripheral flange and fastening mounts for integration into the floor of the vehicle. The fastening module in this embodiment has universal usability not only for fastening wheelchairs; it is essentially a stand-alone product usable in many applications requiring the fastening of objects.

The axle forming the guiding means is preferably cylindrical and stored in the side walls of the cartridge. The sides may be provided with guide flanges for the directional guidance of the tension strap. The distance between the flanges corresponds to the width of the tension strap. The guiding means may be equipped with a continuing guiding frame defining the maximum output angle of the tension strap from the device.

A further preferred embodiment of the invention is characterized in that the latching means for locking and unlocking the rotation of the winch drum is formed by a latching lever, one end of which is rotatably mounted on an axle forming the guiding means, while the underside of its second end engages with the lever of the winch drum while its upper side is provided with an unlocking protrusion which extends from the cartridge. In this embodiment, it is possible to release the tension strap simply by stepping on the unlocking protrusion without the need for manual handling. The tension strap is self-winding; after pressing the unlocking protrusion, it automatically winds itself onto the winch drum.

To avoid possible blockage of the latching lever inside the cartridge, the end of the axle forming the guiding means extends from the side wall of the cartridge, and the latching lever is arranged on the outer side of the side wall of the cartridge and is provided with a pusher arm extending through the side wall of the cartridge into engagement with the lever of the winch drum. The unlocking protrusion is arranged in a recess in the peripheral rim of the cartridge. Movement of the latching lever is thus independent of the position of the mechanisms inside the cartridge and can not be blocked.

In another preferred embodiment, the device according to the invention consists of at least one pivoting fastening arm which is equipped at its end with an anchoring pin for the fastening means. This is an additional fastening element which may or may not be used, e.g. in combination with a fastening means formed by conventional rubber tension straps with hooks. An embodiment with a pivoting fastening arm reduces the number of floor fastening modules which must be built into the floor. The pivoting fastening arm is preferably arranged inside the cartridge and rotatably mounted on the axle forming the guiding means. In a preferred embodiment, there are two pivoting fastening arms inside the cartridge, mounted on the ends of the axle forming the guiding means and extending along the tension strap. Each of the arms is equipped at its end with a fastening pin. The arms are interconnected by a crossmember which presses the tension strap into a storage position behind the winch drum.

In another preferred embodiment of the invention, the integrated cartridge contains a space for storing the fastening means of the tension strap, wherein the space is formed on the opposite side from the winch drum than where the guiding means is arranged. Safe storage of the

fastening means (usually a metal hook) in its designated space prevents the possibility of injury.

It is also advantageous when the cartridge is equipped with two lids mounted in opposite directions, each of which is mounted rotatably on the opposite side of the cartridge.

The lid arranged above the space for storing the fastening means is equipped with a recess for opening. This lid opens first, then after pulling the tension strap by the fastening means the second lid automatically opens and the first lid closes again due to the tension of a spring. The second lid can also be equipped with a spring. The fastening module, after the tension strap is wound, thus automatically closes the lids and forms a single surface with the floor.

Finally, it is advantageous that the end of the axle of the winch drum extends out of the side wall of the cartridge and may be equipped with a means for mechanical rotation in the event of failure of the self-winding retractor.

The advantages of the device according to the invention lie especially in that it minimizes the need for free surrounding space for fastening a wheelchair or similar object, so a smaller loading or floor space of the vehicle can be used for fastening a standard wheelchair. Another advantage is the possibility of using additional fastening means with the help of the pivoting fastening arm as well as the comfortable handling of the device both during fastening and removal.

Description of the drawings

The invention is illustrated in more detail by drawings which show:

- Fig. 1 perspective view of the device in an integrated cartridge with closed lids;
- Fig. 2 perspective view of the device in an integrated cartridge with open lids;
- Fig. 3 perspective view of the device in an integrated cartridge without lids;
- Fig. 4 perspective view of the device in an integrated cartridge without lids and without a peripheral flange, with two pivoting fastening arms;
- Fig. 5 side view of the device into the integrated cartridge without side walls, with pivoting fastening arm in a raised position;

- Fig. 6 side view of the device according to Figs. 1-5 into the integrated cartridge built into the floor of the vehicle, with wheelchair fastened using the tension strap with the fastening means, and the pivoting fastening arm in folded position;
- Fig. 7 side view of the device according to Figs. 1-5 into the integrated cartridge built into the floor of the vehicle with a wheelchair fastened using the tension strap with the fastening means and also using a fastening means anchored to the pivoting fastening arm in a raised position;
- Fig. 8 perspective view of the device in the integrated cartridge without lids and without the peripheral flange, with two pivoting fastening arms connected by a crossmember;
- Fig. 9 side view of the device according to Fig. 8, with pivoting fastening arms in a raised position;
- Fig. 10 perspective view of the device according to Figs. 8 and 9, without lids.

Examples of the preferred embodiments of the invention

It is understood that the hereinafter described and illustrated specific examples of the realization of the invention are presented for illustrative purposes and not as a limitation of the examples of the realization of the invention to the cases shown herein. Experts who are familiar with the state of technology shall find, or using routine experimentation will be able to determine, a greater or lesser number of equivalents to the specific realizations of the invention which are specifically described here. These equivalents shall also be included into the scope of the patent claims.

A device 1 for fastening an object, especially a wheelchair 11, is formed as an integrated cartridge 6 consisting of cast stainless steel. The cartridge 6 is equipped with a peripheral flange 5 and in the bottom part has two extended mounts 7 for attaching into an opening in the floor 17 of the vehicle. In the cartridge 6 is arranged a winch drum 2 formed by a self-winding retractor which is used for unwinding the tension strap 3 fitted at the end of the fastening means 4 and to its independent winding. To secure the position of the winch drum 2, a latching means is used which is formed by a latching lever 9. The latching lever 9 is fastened on the axle forming the guiding means 8. From here, the latching lever 9 is led to the winch drum 2, where its upper part comprises an unlocking protrusion 19 extending through the hole 21 in the peripheral flange 5 of the cartridge 6. The lower part of the end of the latching lever 9 is connected via a pusher arm 20 with the lever 18 of the winch drum 2, which is secured in

its initial position and is unlocked by pressing the unlocking protrusion 19 of the latching lever 9, which mechanically pushes the pusher arm 20 on the lever 18, thereby unlocking the winch drum 2 and allowing for the unwinding of the tension strap 3.

The tension strap 3, before exiting from the cartridge 6, is led through the guiding means 8 formed by a cylindrical axle. The guiding means 8 in the cartridge 6 is rotatably mounted on the opposite side from the winch drum 2 than the direction of pulling the tension strap 3 from the cartridge 6 is. The tension strap 3 is led to the guiding means 8 from below and around the guiding means 8 on its top side, from where the tension strap 3 is guided at a slight angle upward back towards the winch drum 2 until it passes over its axle 26. This construction achieves a shortening of the floor projection of the fastening distance L, which is not extended by the installation length of the device 1.

The tightening means 4 is mounted at the free end of the tension strap 3 and in its rest position is stored in a recess 16 in a compartment of the cartridge 6. The tightening means 4 consists of a hook or similar element.

Part of the device 1 is also a pivoting fastening arm 10. This is pivotally mounted on an axle forming the guiding means 8 on the side opposite the latching lever 9. At the end of the pivoting fastening arm 10 is an anchoring pin 12 to which, after tilting the arm 10 out of the cartridge 6, can be attached additional fastening means 13, such as another tension strap. The anchoring pin 12 is formed by a head, to which are mounted additional fastening means 13. There may be more anchoring pins 12 on the pivoting fastening arm 10.

The moving mechanism of the winch drum 2 is mounted to the cartridge 6 by a bolt 15 and nut 16 at the bottom of the cartridge 6. The axle 26 of the winch drum 2 extends through a slot in the side wall of the cartridge 6 and extends out of the cartridge 6, and is equipped with a means for mechanical rotation formed by a groove 28 for inserting a screwdriver or other attachment.

The cartridge 6 is equipped with two counter-directional lids 22, 22' pivotally mounted on opposite sides of the cartridge 6, by which the cartridge 6 closes and the floor 17 of the vehicle thus remains as an integral surface, and the device 1 does not obstruct the use of the vehicle for other purposes. The lid 22 is automatically maintained in a closed position by a

spring 23, as shown in Fig. 2, and opens through a recess 24 in the front edge of the lid 22. The recess 24 may be replaced by embossment or a plastic clip. The lid 22' is also fitted with a spring 23, as shown in Fig. 10.

Fig. 6 shows the device 1 fastening a wheelchair 11 using only the tension strap 3. The tension strap 3 is led from the winch drum 2 through the guiding means 8 counter-directionally to the fastening location of the wheelchair 11. The lid 22' is opened roughly below the angle below which the fastening strap 3 is led out of the cartridge 6. The lid 22 is closed.

Fig. 7 shows the device 1 fastening the wheelchair 11 also using a single pivoting fastening arm 10. The tension strap 3 here, as in the previous illustration, is led from the winch drum 2 through the guiding means 8 towards the fastening location of the wheelchair 11, but the pivoting fastening arm 10 is also lifted from the cartridge 6, as shown in Figs. 3, 4, 5, towards the end of which is fastened an additional fastening means 13 with an anchoring pin 12, while the other end is attached to the wheelchair 11. The lid 22' in this case is open below the angle below which the pivoting fastening arm 10 is tilted open. The lid 22 is closed.

Figures 8, 9, and 10 show an example of an embodiment in which there are two parallel pivoting fastening arms 10 in the cartridge 6. Both are rotatably mounted on an axle forming the guiding means 8 behind the guiding flanges 25 for directionally guiding the tension strap 3. The pivoting fastening arms 10 extend along the tension strap 3 to behind the winch drum 2, where they are connected by a crossmember 29 which, in the closed position of the cartridge 6, pushes the tension strap 3 inside. Behind the crossmember 29, both pivoting fastening arms 10 are bent inwardly towards the cartridge 6, and the ends are fitted with fastening pins 12 for attaching additional fastening means 13. The embodiment with two parallel arms 10 firstly increases the number of fastening points and secondly has a higher stiffness to prevent bending the pivoting fastening arms 10.

The device 1 according to the invention is operated in such a way that when securing the object on the floor 17 of the vehicle, the lid 22 is opened outwards and the tightening means 4 is removed from the space 16 where it is stored. Subsequently, the unlocking protrusion 19 of the latching lever 9 is pressed, thereby unlocking the winch drum 2 and enabling one to unwind the tension strap 3 to the desired length and fasten it using the fastening means 4 to

the secured object. If necessary, the object can be further fastened using the pivoting fastening arm 10 and an additional fastening means 13. To disconnect the object, the tension strap 3, after pressing the unlatching lever 9, is unfastened from the object and is subsequently self-wound back onto the winch drum 2. Afterwards, the fastening means 4 is stored back into the space 16 in the cartridge 6 and the lid 22' is closed. Another variant of the embodiment is also possible in which the latching lever 19 is not used to unlock the winch drum 2 when pulling out the tension strap 3, and the tension strap 3 can be pulled out from its initial position automatically. The unlatching lever 9 is used for unlocking the winch drum 2 after the fastening position has been unlocked.

Industrial applicability

The device according to the invention can be used for fastening a loose object, especially a wheelchair, to the floor of a vehicle.

Overview of reference symbols used in the drawings

- 1 device
- 2 winch drum
- 3 tension strap
- 4 tightening means
- 5 peripheral flange of the cartridge
- 6 integrated cartridge
- 7 cartridge fastening mount
- 8 guiding means for the tension strap
- 9 latching lever
- 10 pivoting fastening arm
- 11 wheelchair
- 12 anchoring pin
- 13 fastening means
- 14 nut
- 15 bolt
- 16 space for storing the tightening means
- 17 vehicle floor
- 18 winch drum lever
- 19 unlocking protrusion of the latching lever
- 20 pusher arm
- 21 opening in the peripheral flange of the cartridge
- 22 lid
- 22' lid
- 23 spring
- 24 recess for opening the lid
- 25 guiding flange
- 26 axle of the winch drum
- 28 groove in the axle of the winch drum
- 29 crossmember
- L floor projection fastening distance

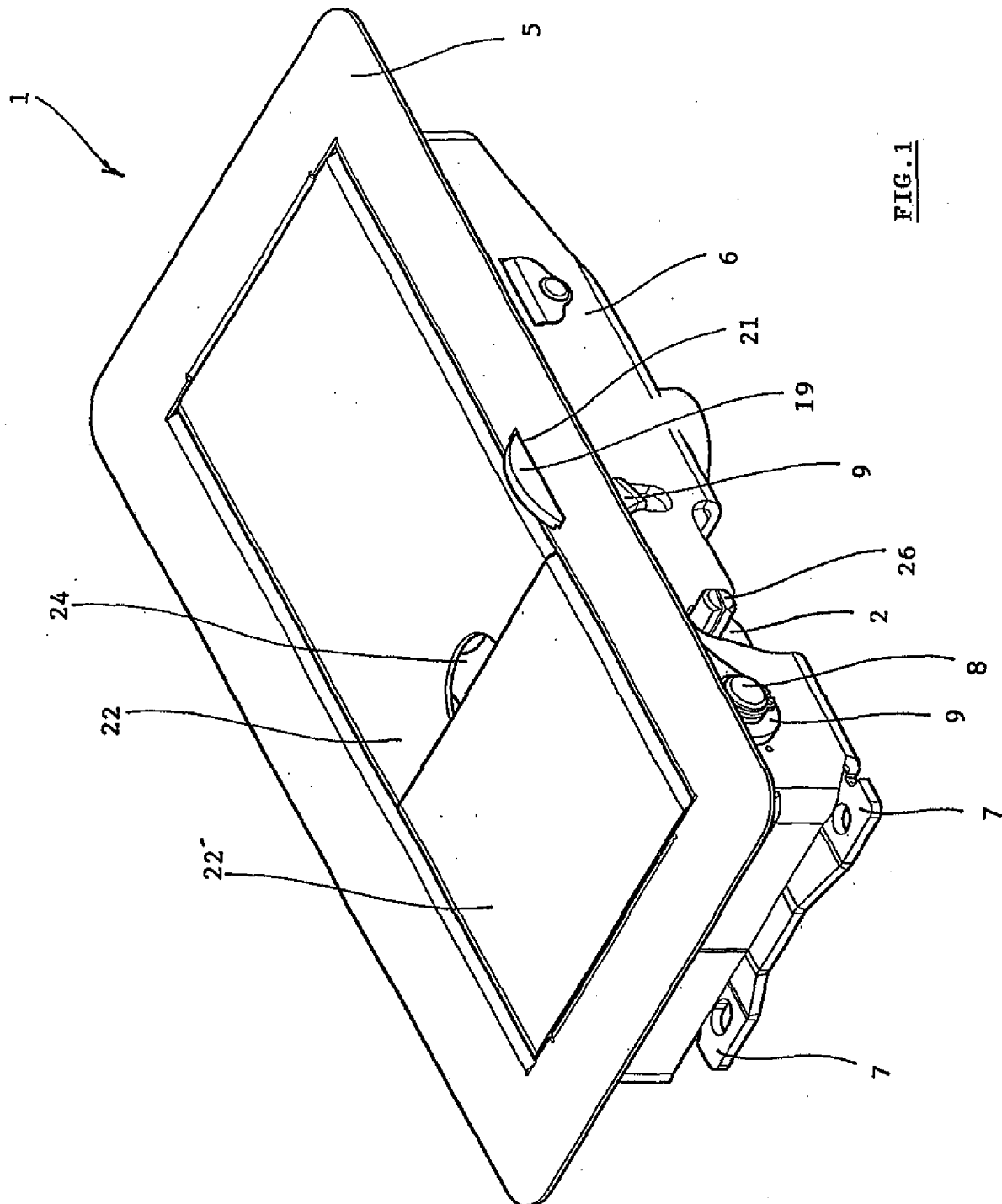
CLAIMS

1. A device (1) for fastening a loose object, especially a wheelchair (11), on the floor (17) of a vehicle, consisting of a winch drum (2) arranged under the floor (17) in a cavity fitted with an openable cover, of at least one tension strap (3) wound on the winch drum (2) and fitted at its free end with a fastening means (4), and of a latching means for locking and unlocking the rotation of the winch drum (2), **characterized in that** the winch drum (2) is formed by a self-winding retractor, the device (1) is equipped with a guiding means (8) of the tension strap (3) arranged parallel to the axle (26) of the winch drum (2) on the side of the output of the tension strap (3) from the winch drum (2), and the tension strap (3) is led from the winch drum (2) via the guiding means (8) counter-directionally back towards the winch drum (2), whereby during its output from the device (1) it passes over the winch drum (2) along a vertical plane that includes the axle (26) of the winch drum (2).
2. A device according to claim 1, **characterized in that** the guiding means (8) is formed by a rotatably mounted cylindrical axle or a pulley.
3. A device according to claims 1 or 2, **characterized in that** the winch drum (2) and the guiding means (8) are arranged in an integrated cartridge (6) equipped with a peripheral flange (5) and with mounts (7) for countersinking into the floor (17) of a vehicle.
4. A device according to claims 2 or 3, **characterized in that** the guiding means (8) consists of a cylindrical axle that is laterally fitted with guiding flanges (25) for directional guidance of the tension strap (3).
5. A device according to claims 3 or 4, **characterized in that** the guiding means (8) consists of a cylindrical axle rotatably mounted in the side walls of the cartridge (6).
6. A device according to at least one of claims 3 to 5, **characterized in that** the latching means for locking and unlocking the rotation of the winch drum (2) is formed by a latching lever (9), one end of which is rotatably mounted on an axle

forming the guiding means (8) while the underside of its other end engages with the lever (18) of the winch drum (2) and on its upper side is equipped with an unlocking protrusion (19) that extends from the cartridge (6).

7. A device according to claim 6, **characterized in that** the end of the axle forming the guiding means (8) extends from the side wall of the cartridge (6), the latching lever (9) is arranged on the outer side of the side wall of the cartridge (6) and is fitted with a pusher arm (20) that extends through the side wall into the cartridge (6) into engagement with the lever (18), and the unlocking protrusion (19) is arranged in an opening (21) in the peripheral flange (5) of the cartridge (6).
8. A device according to at least one of claims 1 to 7, **characterized in that** it is equipped with at least one pivoting fastening arm (10) which at its end is fitted with at least one anchoring pin (12) for the fastening means (13).
9. A device according to at least one of claims 2 to 5 and 8, **characterized in that** the pivoting fastening arm (10) is arranged inside the cartridge (6) and is rotatably mounted on an axle forming the guiding means (8).
10. A device according to claims 4 and 9, **characterized in that** inside the cartridge (6) there are mounted two pivoting fastening arms (10) arranged on both sides of the axle which forms the guiding means (8) behind the guiding flanges (25) for the directional guidance of the tension strap (3) which extends parallel along both sides of the tension strap (3).
11. A device according to claim 10, **characterized in that** the pivoting fastening arms (10) are interconnected by a crossmember (29) abutting in a tilted position of the pivoting fastening arms (10) on the tension strap (3) behind the winch drum (2).
12. A device according to at least one of claims 3 to 11, **characterized in that** the cartridge (6) contains a space (16) for storing the tightening means (4) of the tension strap (3), while the space (16) is formed on the opposite side of the winch drum (2) than where the guiding means is arranged (8).

13. A device according to at least one of claims 3 to 12, **characterized in that** the cartridge (6) is fitted with two counter-directionally positioned lids (22, 22'), each of which is mounted rotatably on the opposite side of the cartridge (6).
14. A device according to claims 12 and 13, **characterized in that** the lid (22) arranged above the space (16) for storing the tightening means (4) is fitted with a recess (24) for opening the lid (22), and at least one lid (22 , 22') is equipped with a spring (23) for automatically closing.
15. A device according to at least one of claims 3 to 14, **characterized in that** the end of the axle (26) of the winch drum (2) extends out of the side wall of the cartridge (6) and is equipped with a means for mechanical rotation.



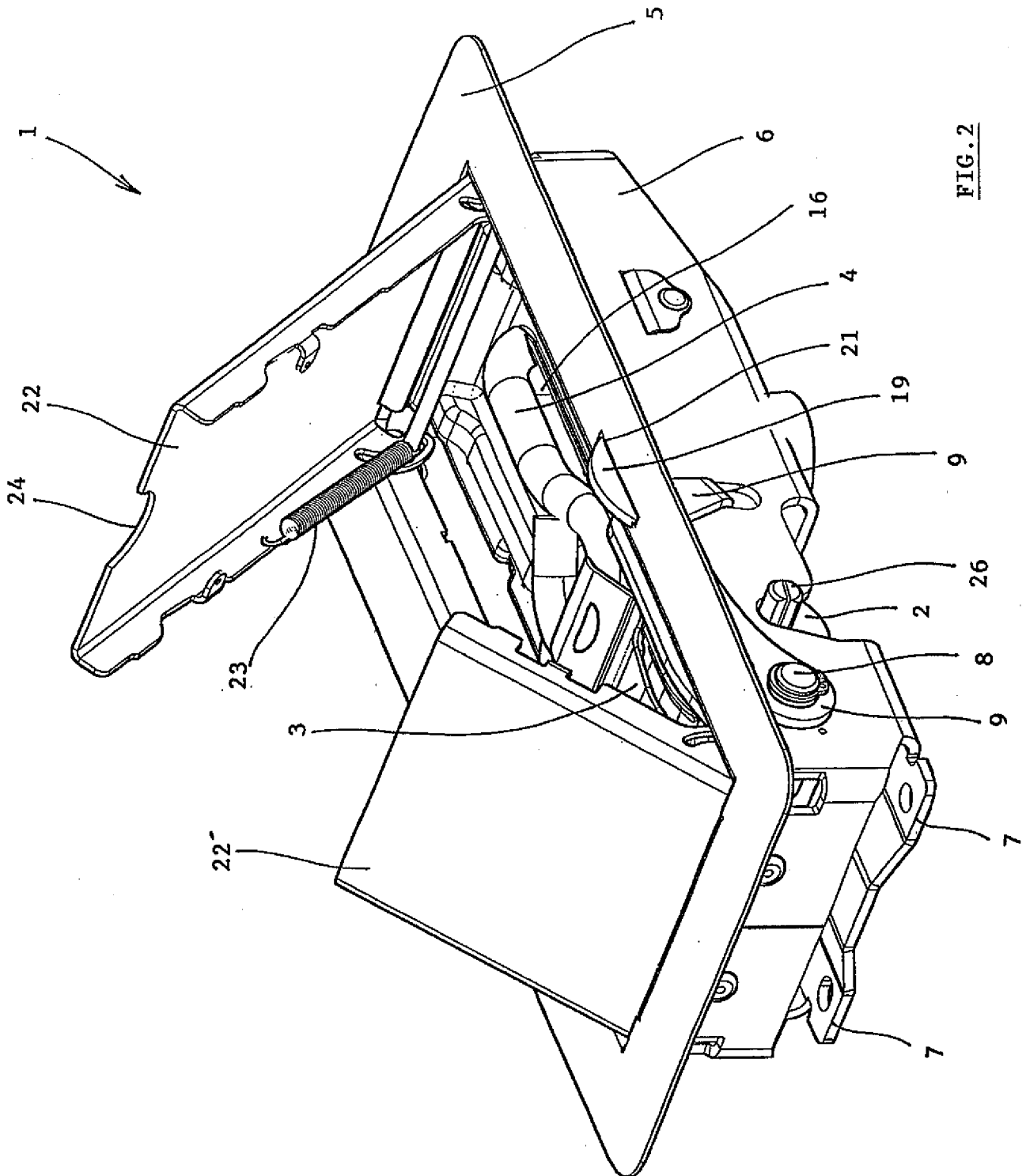
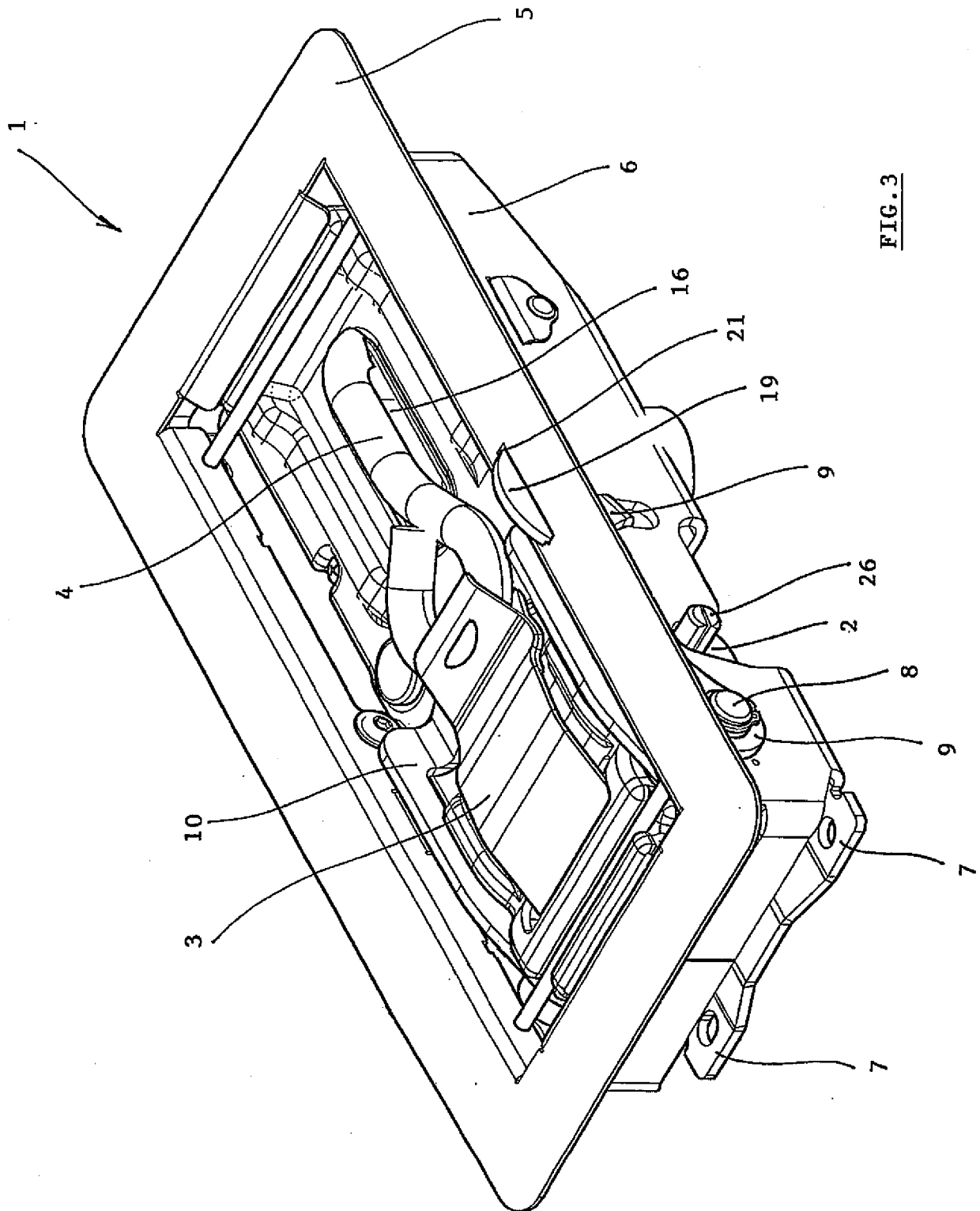


FIG. 2



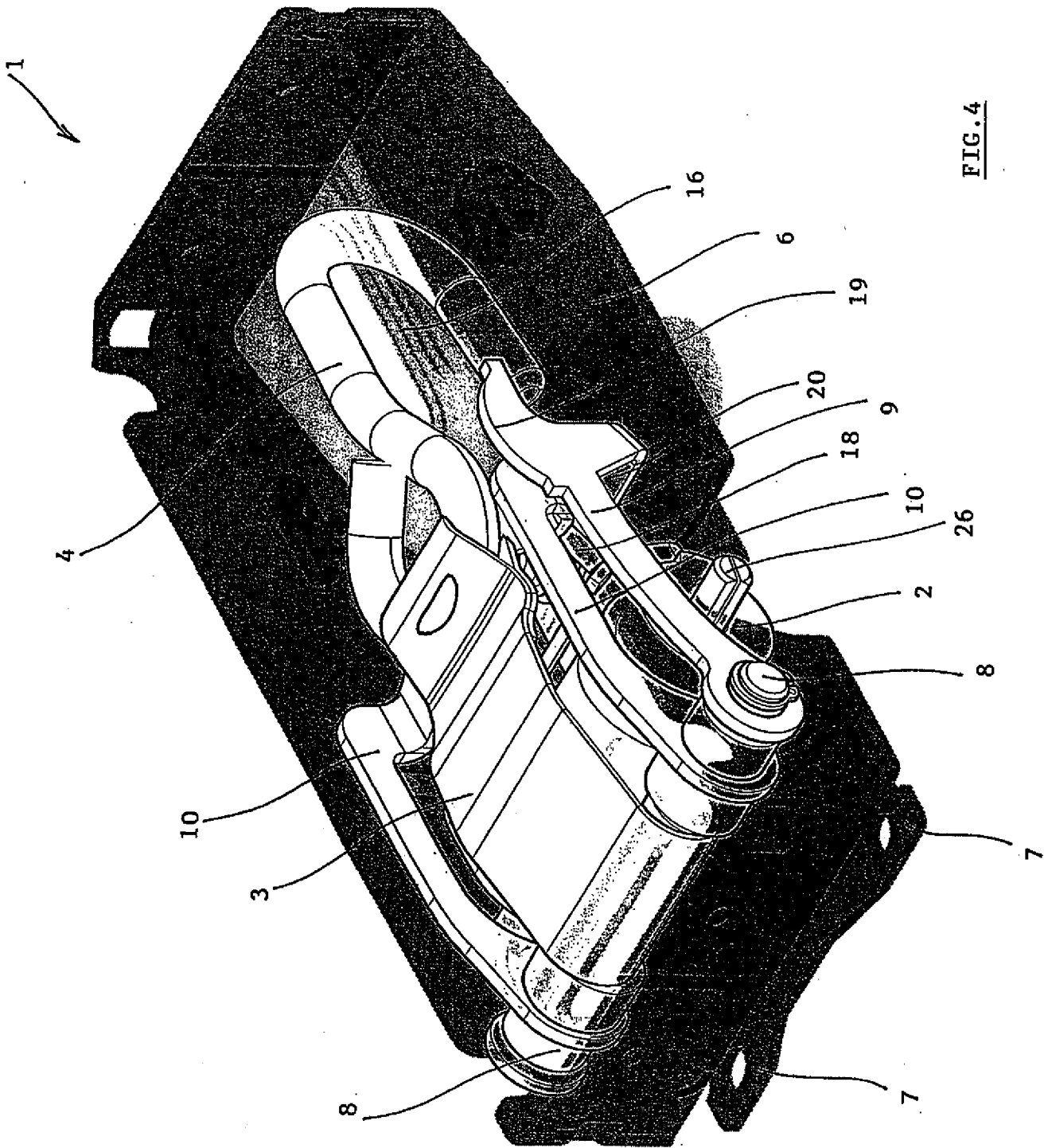
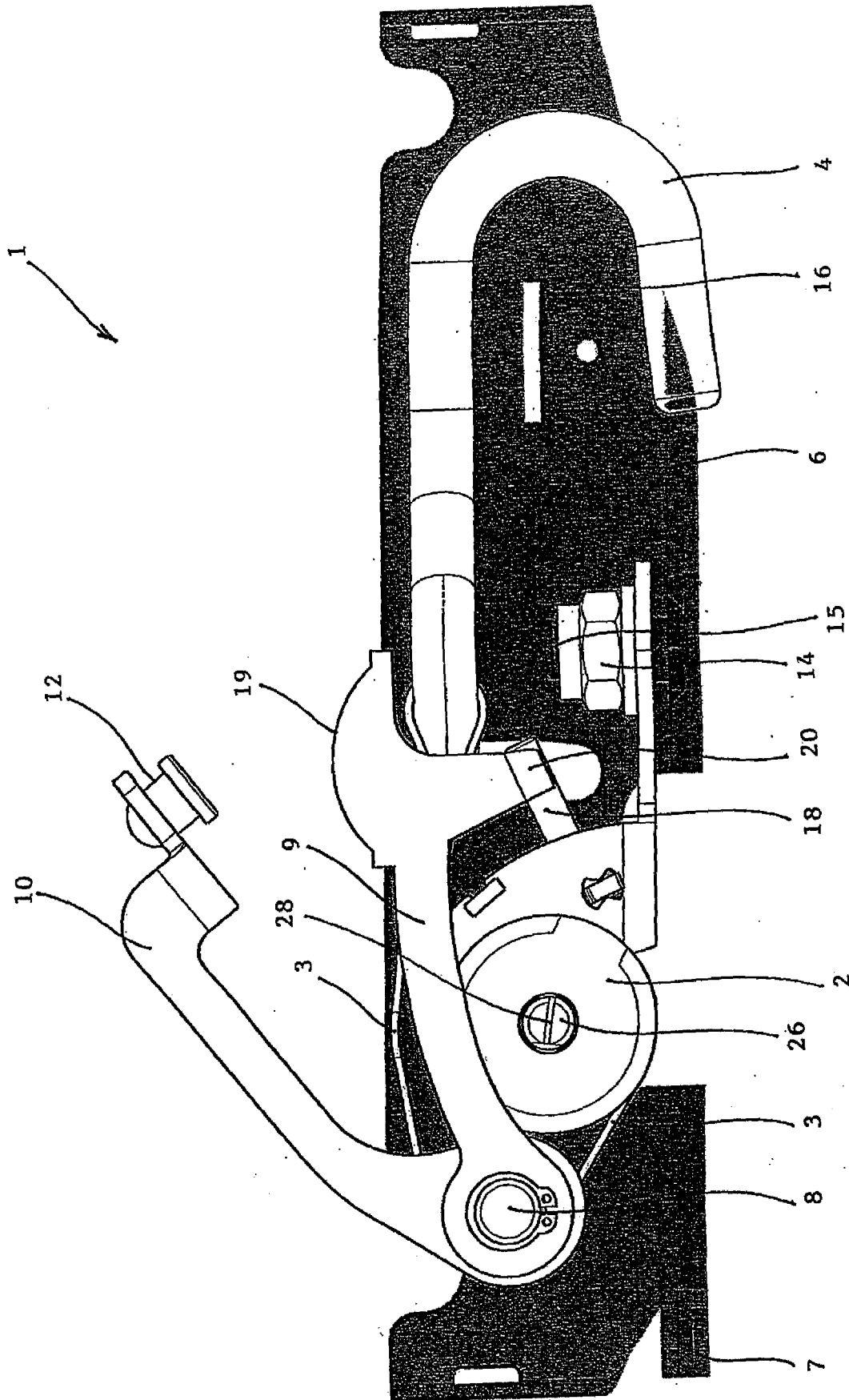
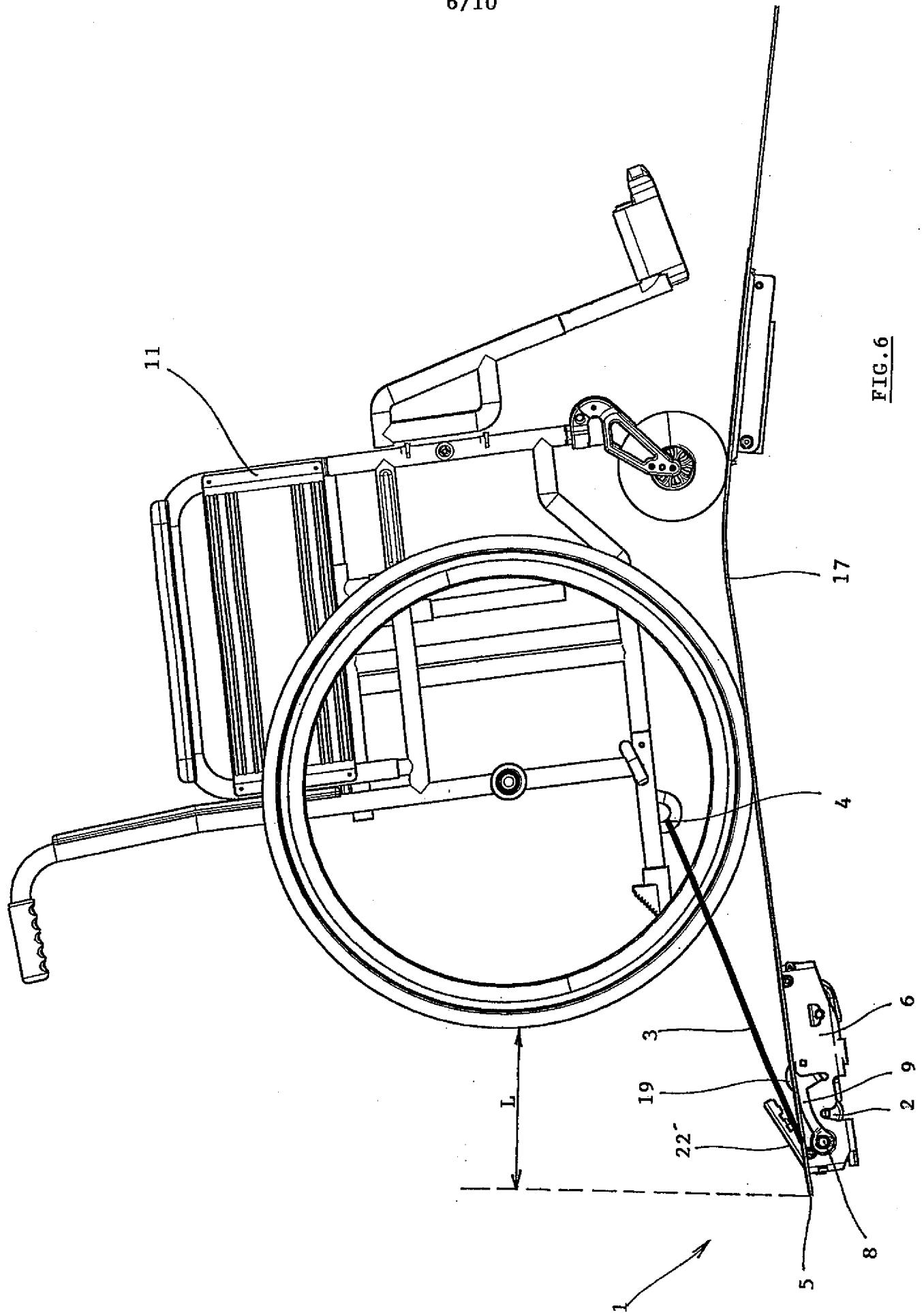


FIG. 4

FIG. 5





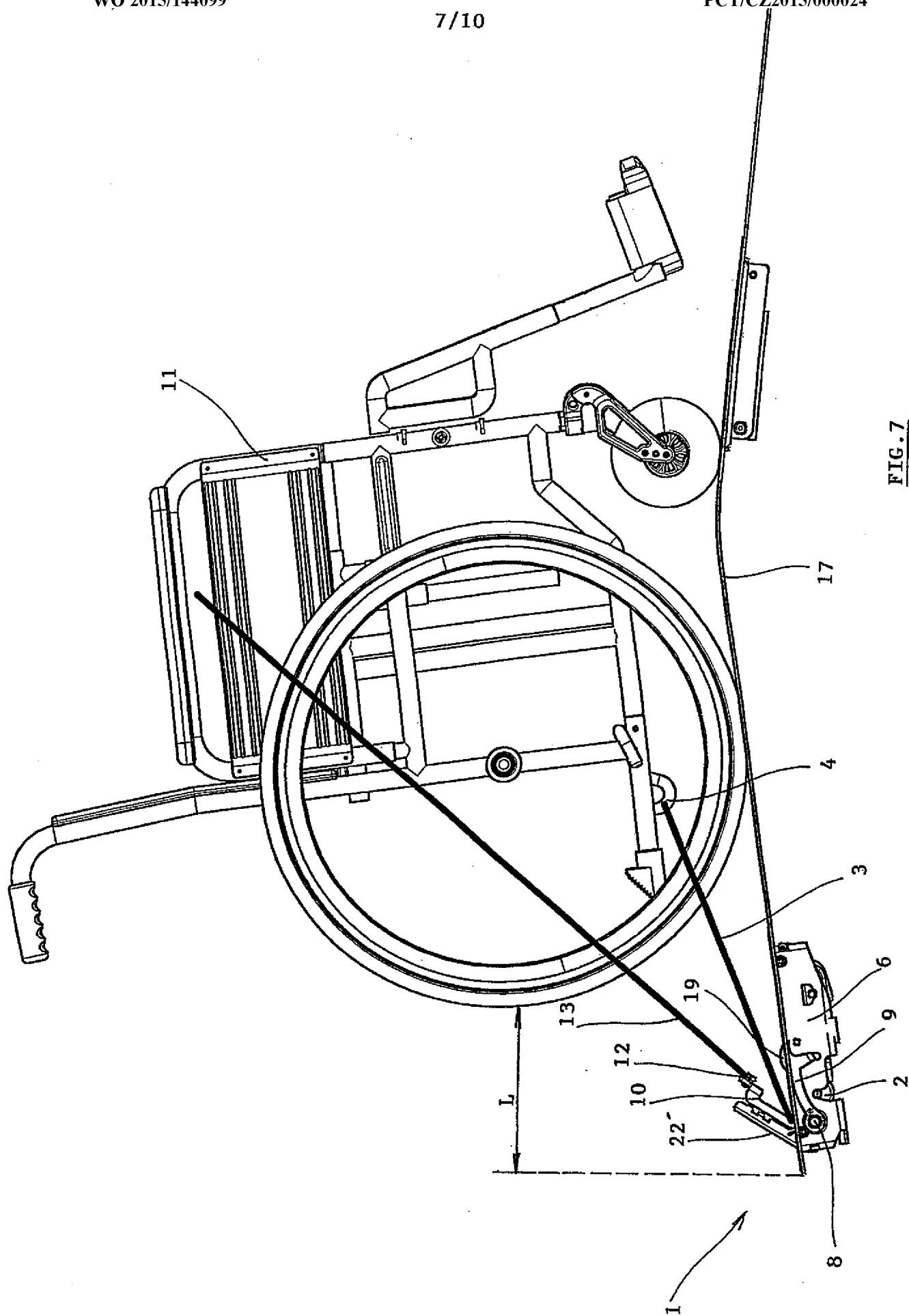
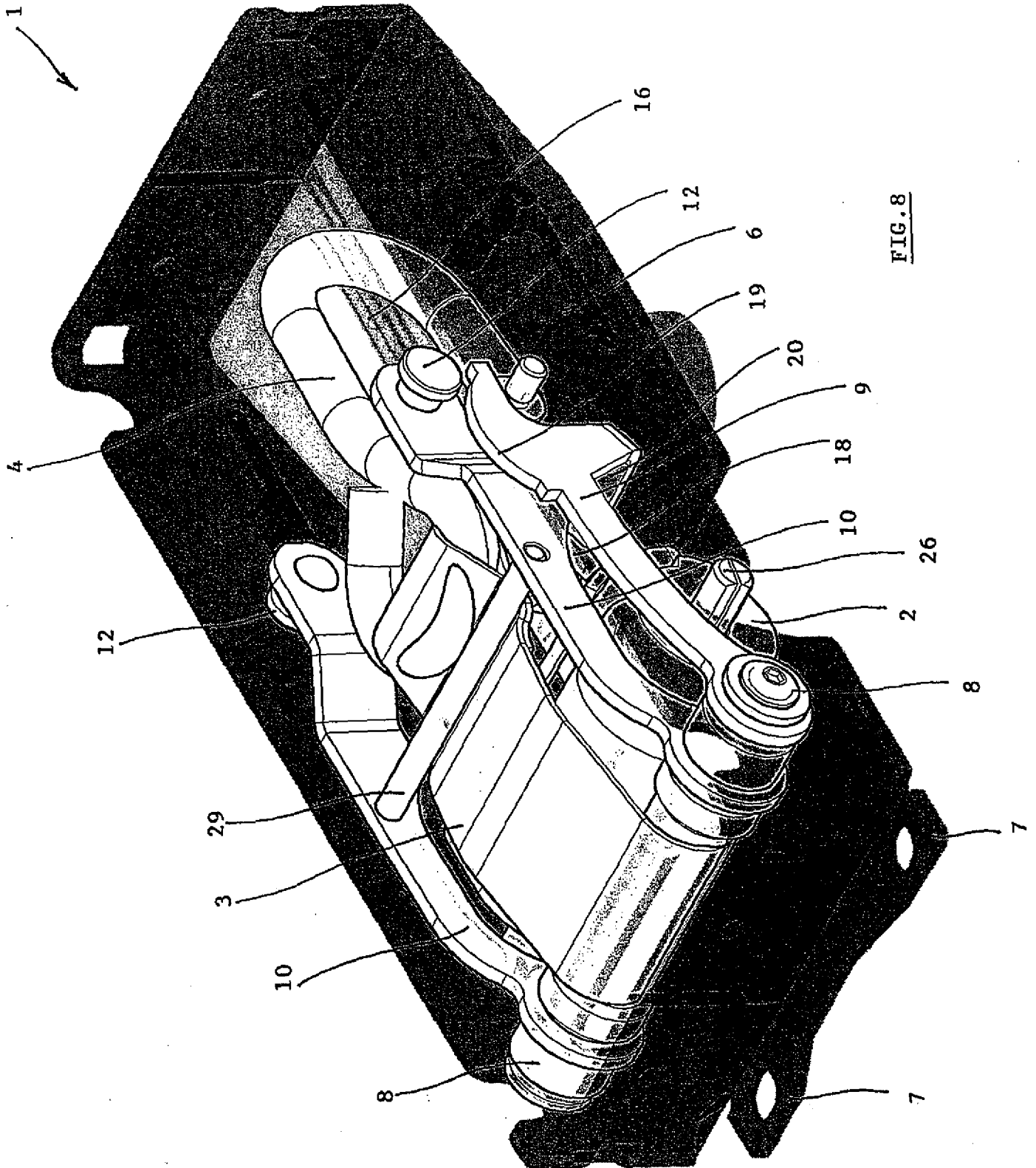


FIG. 7



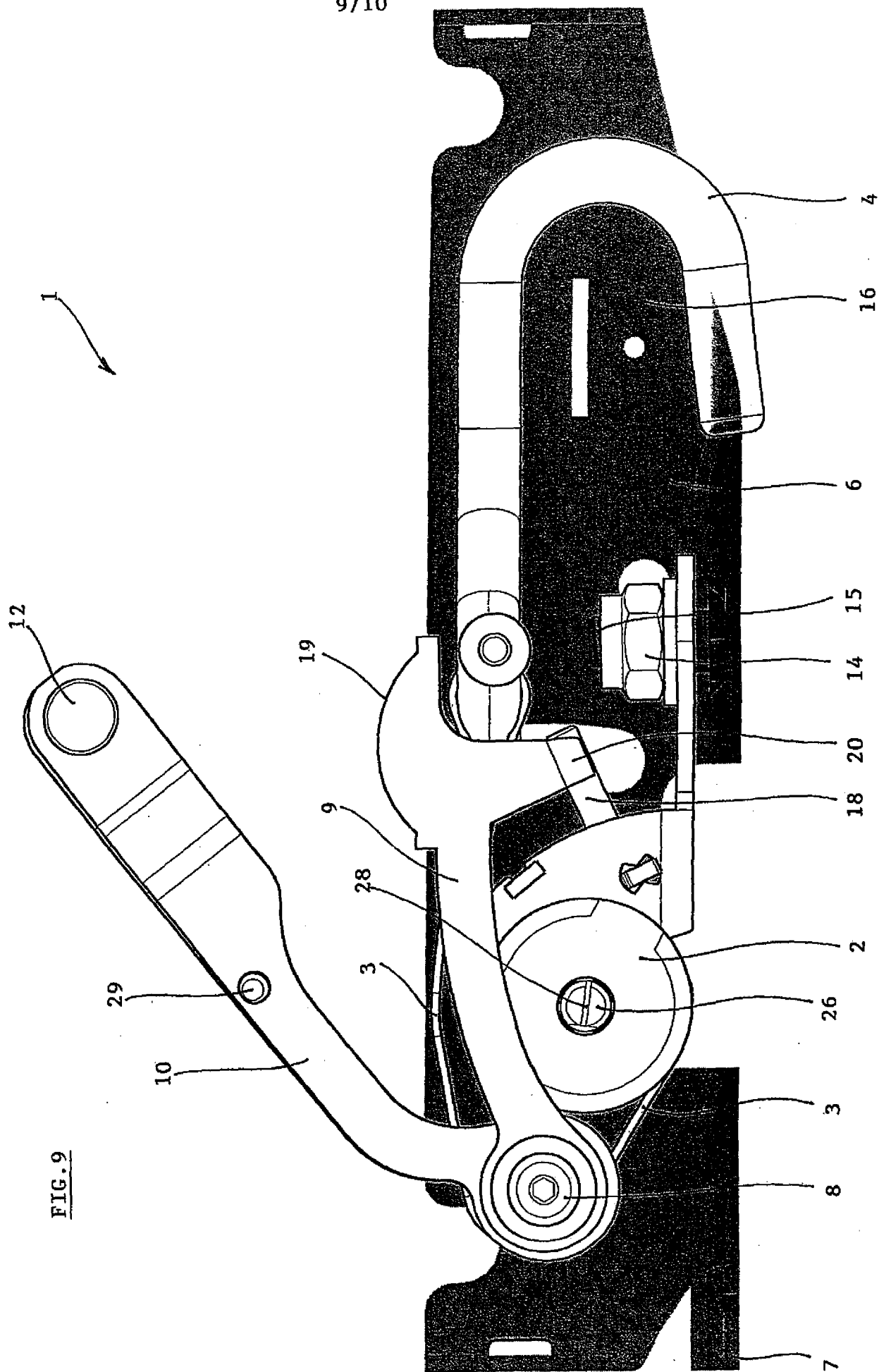


FIG. 9

