



(12) **EUROPEAN PATENT APPLICATION**  
published in accordance with Art. 153(4) EPC

(43) Date of publication:  
**17.03.2021 Bulletin 2021/11**

(51) Int Cl.:  
**B61D 19/00** (2006.01) **E05D 15/10** (2006.01)  
**E05F 15/652** (2015.01) **E05F 15/655** (2015.01)  
**E05F 15/662** (2015.01) **E05B 83/40** (2014.01)

(21) Application number: **18917846.0**

(22) Date of filing: **11.05.2018**

(86) International application number:  
**PCT/ES2018/070352**

(87) International publication number:  
**WO 2019/215353 (14.11.2019 Gazette 2019/46)**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**  
Designated Extension States:  
**BA ME**  
Designated Validation States:  
**KH MA MD TN**

(72) Inventors:  
• **CARRIÓN ESPELTA, Juan**  
43350 Les Borges Del Camp (Tarragona) (ES)  
• **FERNÁNDEZ SOLER, Rafael**  
43350 Les Borges Del Camp (Tarragona) (ES)

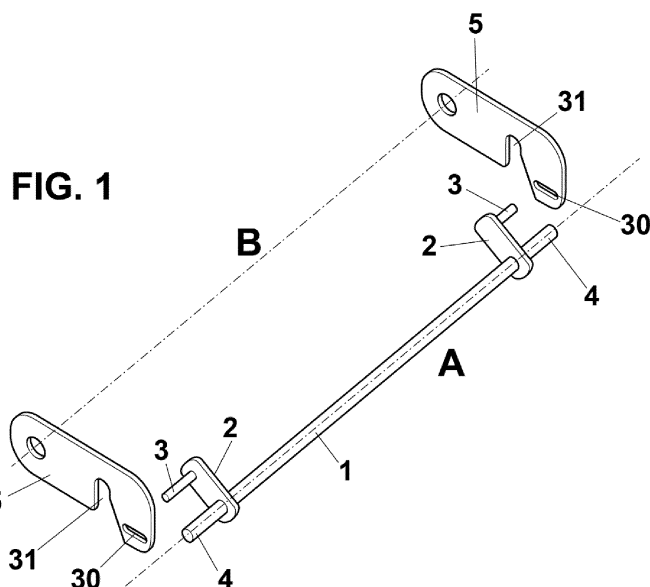
(74) Representative: **Herrero & Asociados, S.L.**  
**Cedaceros, 1**  
**28014 Madrid (ES)**

(71) Applicant: **JC Disseny Ingenieria i Aplicacions S.L.**  
**43350 Les Borges del Camp (Tarragona) (ES)**

(54) **DEVICE FOR OPENING AND CLOSING DOORS OF PUBLIC TRANSPORT VEHICLES**

(57) The device comprises a locking system that locks the door, comprising a connecting rod (1), the connecting rod (1) comprising at each of its two ends an actuating element (2; 32) being provided with a first shaft (4) and a second shaft (3); and a locking element (5) provided with a slot (31) and an elongated hole (30), wherein said first shaft (4) is housed inside the slot (31)

in the locking position and is outside the slot (31), and wherein said second shaft (3) is housed inside the elongated hole (30), being at a first end of the elongated hole (30) in the locking position of the locking element (5) and being at the second end of the elongated hole (30) in the unlocking position of the locking element (5).



## Description

[0001] The present invention relates to a device for opening and closing the doors of public transport vehicles, for example, the doors of railway vehicles, which allows the doors to be locked.

## Background of the invention

[0002] A vast majority of railway vehicles and, in general, many motor vehicles intended for the transport of people, are equipped with a type of door for accessing them, which are of the embeddable-sliding type, that is, in the closed door position the door leaves are perfectly aligned with the outer surface of the railway vehicle and in the open position they are located on the outer side of the vehicle, leaving the gap free for the passage of people.

[0003] It is for this reason that these doors are provided with a mechanism that produces a double movement on the leaves, an ejecting or embedding movement perpendicular to the surface of the vehicle and another sliding or slide movement parallel to the surface of the vehicle on the outside.

[0004] Currently the mechanisms of these doors have different functions:

- Supporting the weight of the leaves;
- Carrying out the embedding and sliding movements parallel to the vehicle body;
- Securing the closed and locked door position.

[0005] These functions can be carried out using different solutions both with regard to the leaf suspension system, as well as the system in charge of the movement such as the system to ensure the closed and locked door position.

[0006] Although all functions are important, it is the function of ensuring the closed and locked door position that is most relevant at the security level, since it must ensure that a door does not open improperly (train running, track side, etc.).

[0007] Normally, depending on the type of suspension and the type of transmission of movement, different types of locking systems are applied. Many of the locking systems use properties such as the "neutral position step". This system consists of a series of cams or levers that use the property of the neutral passage to block the ejection movement (transverse direction).

[0008] Other systems use the locking of the movement transmission system, that is, they lock the movement in the longitudinal direction and other systems use independent locks, such as hooks or cams that lock axes located in moving parts of the mechanism (suspension arm, drag, slides, etc.).

[0009] These locking systems are actuated by the motorization of the transmission mechanism itself or by the independent motorization system.

[0010] Systems that use the "neutral position step" have the disadvantage that they must overcome a significant stress to pass that neutral position (especially when opening) and during manual closing of the door, rebounds occur that make locking difficult.

[0011] The systems that lock transmissions (control screw, belt) lock the longitudinal direction and, therefore, they do not lock the ejection movement by themselves, and guides are necessary that convert the longitudinal movement into transversal, and with this combination closing is ensured.

[0012] Therefore, an objective of the present invention is to provide a device for opening and closing the doors of public transport vehicles that solves the above-mentioned drawbacks.

## Description of the invention

[0013] With the device for opening and closing the doors of public transport vehicles of the invention, the aforementioned disadvantages are solved, presenting other advantages that will be described below.

[0014] The device for opening and closing the doors of public transport vehicles according to the present invention comprises a locking system that locks the door in its closed position, and is characterized in that said locking system comprises:

- a connecting rod defining a first axis of rotation, the connecting rod comprising at each of its two ends an actuating element provided with a first shaft and a second shaft; and
- a locking element provided with a slot and an elongated hole, and movable between a locking position and an unlocking position,

wherein said first shaft is housed inside the slot in the locking position of the locking element and is outside the slot in the unlocking position of the locking element, and wherein said second shaft is housed inside the elongated hole, being at a first end of the elongated hole in the locking position of the locking element and being at the second end of the elongated hole in the unlocking position of the locking element.

[0015] According to a first embodiment, said actuating element is a suspension arm, wherein the first shaft is aligned with the first axis of rotation and the second shaft is offset with respect to said first axis of rotation.

[0016] According to a second embodiment, said actuating element is a drive wheel, wherein the first shaft is arranged in the center of the drive wheel and the second shaft is offset from the center of the drive wheel.

[0017] Advantageously, the locking element is rotatable at one of its ends around a second axis of rotation, which is parallel to the first axis of rotation.

[0018] Furthermore, the locking element is connected to a base plate, and the connecting rod is mounted at its ends on respective supports, said supports being mov-

able with respect to said base plate.

**[0019]** According to a preferred embodiment, said connecting rod is mounted inside a suspension tube, a suspension arm being movable along said suspension tube.

**[0020]** In this embodiment, the movement of the suspension arm along the suspension tube is driven by a motor, which drives the rotation of a worm gear, which is connected to said suspension arm by means of a towing fork.

**[0021]** Furthermore, a threaded nut is moved on the worm gear which is integral with the suspension arm by means of the towing fork, and a joint is advantageously arranged between the towing fork and the suspension arm.

**[0022]** Advantageously, said actuating element is rotated by the action of a motor and a pinion.

**[0023]** According to an alternative embodiment, the connecting rod is housed inside a beam fixed to the supports, and said beam comprises at least one slide, along which a guide moves, which is fixed to a leaf of a door.

**[0024]** Preferably, said beam comprises two slides, one being placed above the other or one being movable within the other in a telescopic manner.

**[0025]** The following advantages are achieved with the device for opening and closing the doors of public transport vehicles:

- The system is valid for different types of doors, single, double, high speed, etc.
- The connecting rod system attached to the hook provides supplementary entry and exit forces at key moments of the journey (ejecting and / or embedding).
- The locking is carried out directly between the hooks fixed to the body and the shaft of the suspension system, so the loads that the leaf supports with the door closed pass directly to the body, without many intermediate elements.
- - The turning point is not used for locking, which means that it is not necessary to compress the door before opening, eliminating the additional stress that this entails.
- Locking is carried out on both sides and the shaft itself is used to combine the movement between the two sides of the system, avoiding adding other parts to perform this function.

### Brief description of the drawings

**[0026]** For a better understanding of what has been stated, some drawings are attached in which, schematically and only as a non-limiting example, a practical case of embodiment is represented.

Figure 1 is a schematic perspective view of the essential components of the locking system of the door opening and closing device according to the present invention;

Figures 2a-2e are side elevation views of a hook with first and second shafts, showing the unlocking process from its locked position to its unlocked position;

Figures 3a and 3b are perspective views of the suspension system of the door opening and closing device according to the present invention, in the unlock position and in the lock position of the locking system, respectively;

Figure 4 is a perspective view of a part of the suspension system of the opening and closing device according to the present invention, wherein the movement of the sheave within its guide is shown;

Figure 5 is a perspective view of the transmission system of the opening and closing device according to the present invention;

Figure 6 is a perspective view of the motorization system of the opening and closing device according to the present invention, according to a first embodiment;

Figure 7 is a front elevation view of the motorization system of the opening and closing device according to the present invention, according to a first embodiment;

Figure 8 is a perspective view of the motorization system of the opening and closing device according to the present invention, according to a second embodiment;

Figure 9 is a perspective view of the motorization system of the opening and closing device according to the present invention for a double door;

Figure 10 is a perspective view of the suspension system of the opening and closing device according to the present invention for a double door;

Figure 11 is a cross-sectional view of the suspension system depicted in Figure 10;

Figure 12 is a plan view of the suspension system shown in Figure 10;

Figure 13 is a perspective view of the motorization system used with the suspension system shown in Figure 10;

Figure 14 is a perspective view of an alternative telescopic suspension system for single doors; and

Figure 15 is a plan view of the suspension system represented in Figure 14.

### Description of a preferred embodiment

**[0027]** The opening and closing device according to the present invention is applicable to embeddable sliding doors for public transport vehicles, for example railways, which can be single-leaf or double-leaf. This leaf or these leaves carry out an embedding movement (transverse) and external sliding (longitudinal) with respect to the hollow of the vehicle body.

**[0028]** The opening and closing device ensures the position of the leaves with the door closed, preventing their opening from the stresses to which the leaf is subjected. Furthermore, the opening and closing device itself enables the embedding movement to be carried out during the opening and closing of the leaves.

**[0029]** The device for opening and closing doors according to the present invention comprises a base plate 8 on which the following systems are mounted:

- A suspension system;
- A guiding and conjunction system between both ends of the opening and closing device;
- A longitudinal transmission system;
- A motorization system; and
- A locking system.

Through the base plate 8 the door opening and closing device is fixed to a body of a vehicle, for example a railway vehicle.

**[0030]** Figure 1 shows the locking system comprising a connecting rod 1 that can only be moved horizontally in relation to a first axis of rotation A. This connecting rod 1 includes two actuating elements, referred to as suspension arm 2 from now on, one at each end of connecting rod 1.

**[0031]** First shafts 4 concentric with the first axis of rotation A of the connecting rod 1 and second shafts 3 offset from the axis of rotation A are mounted on these suspension arms 2. The connecting rod 1 can only be moved horizontally, and can also be rotated about its own first axis of rotation A.

**[0032]** Two locking elements 5, referred to as hooks 5 hereinafter, are located at each end of the connecting rod 1 and are attached to it through the second shafts 3 as they are inserted into an elongated hole 30 of each hook 5. These hooks 5 are fixed and can only rotate about a second axis of rotation B. The second axis of rotation B of the hooks 5 and the first axis of rotation A of the connecting rod 1 are horizontally aligned, and while hooks 5 can only rotate on their second axis of rotation B, the connecting rod 1 apart from rotating on its first axis of rotation A, can move horizontally.

**[0033]** In the locking position (figure 2a), the first shaft 4 is inside a slot 31 in each hook 5. If a force is applied to separate the first shaft 4 from the hooks 5, the shape of the slot 31 prevents them from being separated (figure 2b).

**[0034]** If in this position the connecting rod 1 is rotated

around the first axis of rotation A in the counterclockwise direction (according to figures 1 and 2a-2e), the second shaft 3 of the connecting rod 1 pushes the hooks 5 upwards, producing the unlocking of the system (figure 2c), since the first shaft 4 of the connecting rod 1 is released from inside the slot 31 of the hooks 5, and if the rotation is continued, the connecting rod 1, as a consequence of the reaction of the hooks 5, moves horizontally away from the initial position (figures 2d and 2e), producing a translational movement.

**[0035]** If in this situation the connecting rod 1 is rotated clockwise (according to figures 1 and 2a-2e), the movement opposite to the previous one is caused and, therefore, it approaches the initial position. If it continues being rotated, the second shaft 3 of the connecting rod 1 pushes down the hooks 5, and causes the system to lock when the first shafts 4 of the connecting rods 1 are inserted into the slot 31 of the hooks 5.

**[0036]** Figures 3a and 3b show the suspension system of the door opening and closing device according to the present invention.

**[0037]** The function of the suspension system is to support the weight of the leaf or leaves, as well as the stresses that occur in closing in order to lock the system.

**[0038]** The suspension system comprises a suspension tube 6 arranged longitudinally along the upper hollow of a body of a door (not shown). A suspension arm 7 is mounted on the suspension tube 6 that can move longitudinally along the suspension tube 6. The door leaf will be fixed to the upper suspension arm 7 and, therefore, allows it to move longitudinally.

**[0039]** The suspension tube 6 is mounted at its ends on supports 9, which in turn are mounted on support shafts 10 located perpendicular to the suspension tube 6 and which allow the entire system to move transversely with respect to the body of the door. The support shafts 10 are mounted on a base plate 8 which is fixed directly to the door housing.

**[0040]** This arrangement allows the door leaf (which is fixed to the suspension arm 7) to carry out its two movements, the transverse and the longitudinal one.

**[0041]** Figure 5 shows the guiding and conjunction system of the opening and closing device according to the present invention, which comprises a sheave 11 integral with the suspension arm 7, said sheave 11 moves inside a guide groove 12 located on base plate 8.

**[0042]** As can be seen in Figures 3a and 3b, the connecting rod 1, which serves to perform said conjunction, is located inside the suspension tube 6 and, therefore, can be moved horizontally, and at the same time the connecting rod 1 can rotate inside the suspension tube 6.

**[0043]** For their part, the hooks 5 are fixed to the base plate 8 and, therefore, to the door body.

**[0044]** The hooks 5 are connected through the second shafts 3 to the connecting rod 1, wherein the connecting rod 1 acts as a torsion bar between both ends and, therefore, the rotation of the connecting rod 1 translates into the simultaneous movement of transverse translation.

**[0045]** If at the end of the rotation, the first shaft 4 enters the groove 31 of the hook 5, the transverse translation is not possible and, therefore, the transverse translation of the suspension tube 6 is locked and the door leaf can not be moved. This position is the closed and locked door position (figure 3b).

**[0046]** In order to unlock the system, as has been described in more detail above, it is necessary to rotate the connecting rod 1 in a counter-clockwise direction (according to the embodiment shown), at that time the hook 5 is raised by the action of the second shaft 3 of the connecting rod 1 and the first shaft 4 is released. If the connecting rod 1 continues to rotate, the supports 9 move outwards, ejecting the door leaf outwards, since it is fixed to the suspension arm 7, which in turn is attached to the suspension tube 6 and this to supports 9.

**[0047]** Figure 5 shows the longitudinal transmission system of the opening and closing device according to the present invention.

**[0048]** In this transmission system, the translation of the suspension arm 7 through the suspension tube 6 is carried out through a worm gear 13. This worm gear 13 is mounted parallel to the suspension tube 6 and is supported at both ends on the suspension supports 9, in such a way that both the suspension tube 6 and the worm gear 13 are fixed to the supports 9 and kept between them always in the same position.

**[0049]** The worm gear 13 is equipped with a threaded nut 14 on the worm gear itself 13. A towing fork 15 is articulated on one side to the suspension arm 7, and is inserted through the towing fork 15 into the nut 14.

**[0050]** A joint 16 placed between the towing fork 15 and the suspension arm 7 makes it possible to absorb small inclinations of the suspension arm 7 with respect to the worm gear 13. The towing fork 15, when inserted into the nut 14, prevents it from rotating with respect to the worm gear 13.

**[0051]** The rotation of the worm gear 13 produces the translation on its axis of the nut 14, which in turn is fixed to the towing fork 15 that drives the suspension arm 7, thus producing the translation movement in one direction or the other, just changing the direction of rotation of the worm gear 13.

**[0052]** Figures 6 and 7 show the motorization system of the opening and closing device according to the present invention.

**[0053]** A toothed wheel 33 is mounted on one of the ends of the worm gear 13. An electric motor 17 is mounted on the support 9, so that it is parallel to both the worm gear 13 and the suspension tube 6. A first pinion 18 of the motor 17 is engaged with toothed wheel 33 of worm gear 13.

**[0054]** When the motor 17 is electrically powered, it turns the toothed wheel 33, since it, in turn, turns the worm gear 13, which moves the nut 14, and through the towing fork 15 it drags the suspension arm 7 to which the door leaf is fixed.

**[0055]** The electric motor 17 also comprises a reducer

19. This reducer 19 is fixed to the body of the motor 17 through bearings, which give it an additional degree of freedom with respect to the motor 17. That is, the reducer 19 can rotate with respect to the motor 17.

**[0056]** This arrangement allows us to have two outputs. The reducer 19 is equipped with said first pinion 18 fixed on its body. This first pinion 18 engages with the toothed wheel 33 of the worm gear 13. The output shaft of the reducer 19 is equipped with a second pinion 20. If the second pinion 20 is locked and the motor 17 is electrically powered, as the second pinion 20 cannot rotate, the reducer 19 rotates, which through the first pinion 18 rotates the worm gear 13.

**[0057]** According to a second embodiment shown in figure 8, wherein same reference numbers are used to indicate same elements as in the previous embodiment, the shaft of reducer 19 comprises a second pinion 20, the connecting rod 1 being located inside the suspension tube 6 equipped at each of its ends with a drive wheel 32 (actuating element) that replaces the suspension arms 2 of the embodiment described above. This drive wheel 32, with the suspension arms 2, comprises a first shaft 4 and a second shaft 3.

**[0058]** When the rotation of the reducer 19 is locked, for example, the suspension arm 7 cannot move further, at that moment, the drive wheel 32 rotates the second pinion 20, which combines the movements of both ends and locks or unlocks the hooks 5 according to the direction of rotation applied to the electric motor 17.

**[0059]** When the door is closed, the leaf is locked in translation by the locking system, the hooks 5 retain the first shafts 4 of the connecting rod 1 that is inside the suspension tube 6.

**[0060]** The hooks 5 are articulated on the base plate 8 which, in turn, is fixed to the body of the vehicle.

**[0061]** Also in this embodiment, and as shown in figure 4, the sheave 11 of the suspension arm 7 is inserted in the guide 12 of the base plate 8 and located on the slope of said guide. Since hooks 5 do not allow translation to the outside, the sheave 11 cannot move and, therefore, the suspension arm 7 is locked both in translation outward and in longitudinal translation.

**[0062]** When the electric motor 17 is powered to open the door, the exterior of the reducer 19 that generates the rotation of the worm gear 13 cannot rotate, since the door is locked in the longitudinal direction and the shaft of the reducer 19 with the second pinion 20 can rotate causing the rotation of the drive wheel 32, which in turn rotates the hooks 5, releasing the first shafts 4 of the connecting rod 1 and therefore unlocking the locking system, which allows the suspension tube 6 to exit and the suspension arm 7 can be translated through the worm gear 13, producing the opening movement of the door leaf.

**[0063]** With the door open, the sheave 11 is inside the guide groove 12. When the electric motor 17 is powered to close the door, this sheave 11 prevents the suspension arm 7 with the suspension tube 6 from moving towards

the inside, that is, the second output pinion 20 of the reducer 19 cannot rotate and it is the exterior of the reducer 19 that makes the worm gear 13 rotate, and produces the longitudinal translation of the suspension arm 7 in the closing direction. The shape of the guide groove 12 at the end of the closing movement makes the suspension arm 7 and the suspension tube 6 perform the transverse embedding movement aided by the simultaneous turning of the connecting rod 1 through the drive wheel 32 driven by the second output pinion 20 of the reducer 19.

**[0064]** This movement combines both sides of the locking system. When the door leaf can no longer advance, the first pinion 18 of the reducer 19 that drives the worm gear 13 cannot rotate, and it is the second pinion 20 of the output of the reducer 19 that continues to rotate and drag the drive wheel 32, which in turn pushes the hooks 5 to rotate on the first shafts 4, causing them to be locked and, consequently, the door leaf is locked in the closed position.

**[0065]** In figure 9 a variation of the motorization system is shown, in which instead of a suspension arm 7, two suspension arms are provided, located next to each other, and the worm gear 13 is realized in two parts, that is, one side is reverse threaded with respect to thread on the other side. This motorization system can be used for double leaf doors, since by turning the worm gear 13, the suspension arms will move the same distance, but in opposite directions. The locking system remains identical to that described above.

**[0066]** Due to space problems, many times the suspension tube 6 and the suspension arms 7 cannot be used, since this type of suspension requires a longitudinal space greater than the door opening.

**[0067]** In these cases, the opening and closing device comprises the same systems described above, but the suspension system is replaced.

**[0068]** The suspension system described above, that is, the suspension tube 6 and the suspension arm 7 are replaced by a beam 21, for example made of aluminum, which is fixed to each of the side supports 9 at the same place occupied by the suspension tube 6, as can be seen in figure 10.

**[0069]** Two rails 22 are attached to this beam 21, one rail mounted above the other. As can be seen in figure 11, each rail 22 is formed by a slide 23 fixed to the beam 21 and by a guide 24 on which one of the door leaves is fixed.

**[0070]** The guide 24 moves linearly on the slide 23 through balls 25 that are separated from each other by a ball cage 26. Therefore, in each of these guides 24 one of the leaves is fixed, and allows each one moves longitudinally relative to the other.

**[0071]** This suspension system allows two leaves to be supported (it is valid for double doors), since with the door open, the leaves are suspended in a cantilevered way by the part of the guide 24 that remains in the fixed part of the opening and closing device, such as shown

in figure 12.

**[0072]** In this embodiment, as shown in figure 13, the door guiding system is formed as in the previous system by a sheave 11 that is fixed to a suspension arm attached to one of the guides 24 of the suspension system. As in the previous suspension system, the sheave 11 moves inside a guide groove 12 located in the base plate 8.

**[0073]** The transmission system is identical to the previous one, that is, it is realized through the worm gear 13 mounted parallel to the beam 21, a towing arm 34 is attached through a joint 16 to the towing fork 15 that moves the nut 14 that drives the drive arm 34, and this to the rail 22 to which the door leaf is fixed.

**[0074]** The locking system is identical to the previous mechanism only with the exception that the connecting rod 1 is located inside the beam 21 and, therefore, the arrangement of the motor 17, the worm gear 13 and the locking system is identical to the suspension tube configuration, only varying the suspension, but the principle is the same.

**[0075]** For simple doors (a single leaf) it is obvious that the previous suspension system cannot be used, since the principle of the suspended rail is not applicable, since the length to apply it is lacking. In these cases the solution is to mount the same system described, that is, to provide a beam 21, but instead of mounting a double slide, a double stage slide system or telescopic suspension 27 is mounted, as shown in the figure 14.

**[0076]** This is a similar system to the previous one, but here the telescopic suspension 27 is made up of three elements that can be moved relative to each other.

**[0077]** With this suspension system it is possible to suspend a single leaf door. The rest of the opening and closing device is identical to that described above.

**[0078]** Despite the fact that reference has been made to a specific embodiment of the invention, it is clear to a person skilled in the art that the opening and closing device being described is susceptible to numerous variations and modifications, and that all the mentioned features can be replaced by others technically equivalent, without departing from the scope of protection defined by the appended claims.

## Claims

1. Device for opening and closing the doors of public transport vehicles, comprising a locking system that locks the door in its closed position, **characterized in that** said locking system comprises:

- a connecting rod (1) defining a first axis of rotation (A), the connecting rod (1) comprising at each of its two ends an actuating element (2; 32) being provided with a first shaft (4) and a second shaft (3); and
- a locking element (5) provided with a slot (31) and an elongated hole (30), and movable be-

tween a locking position and an unlocking position,

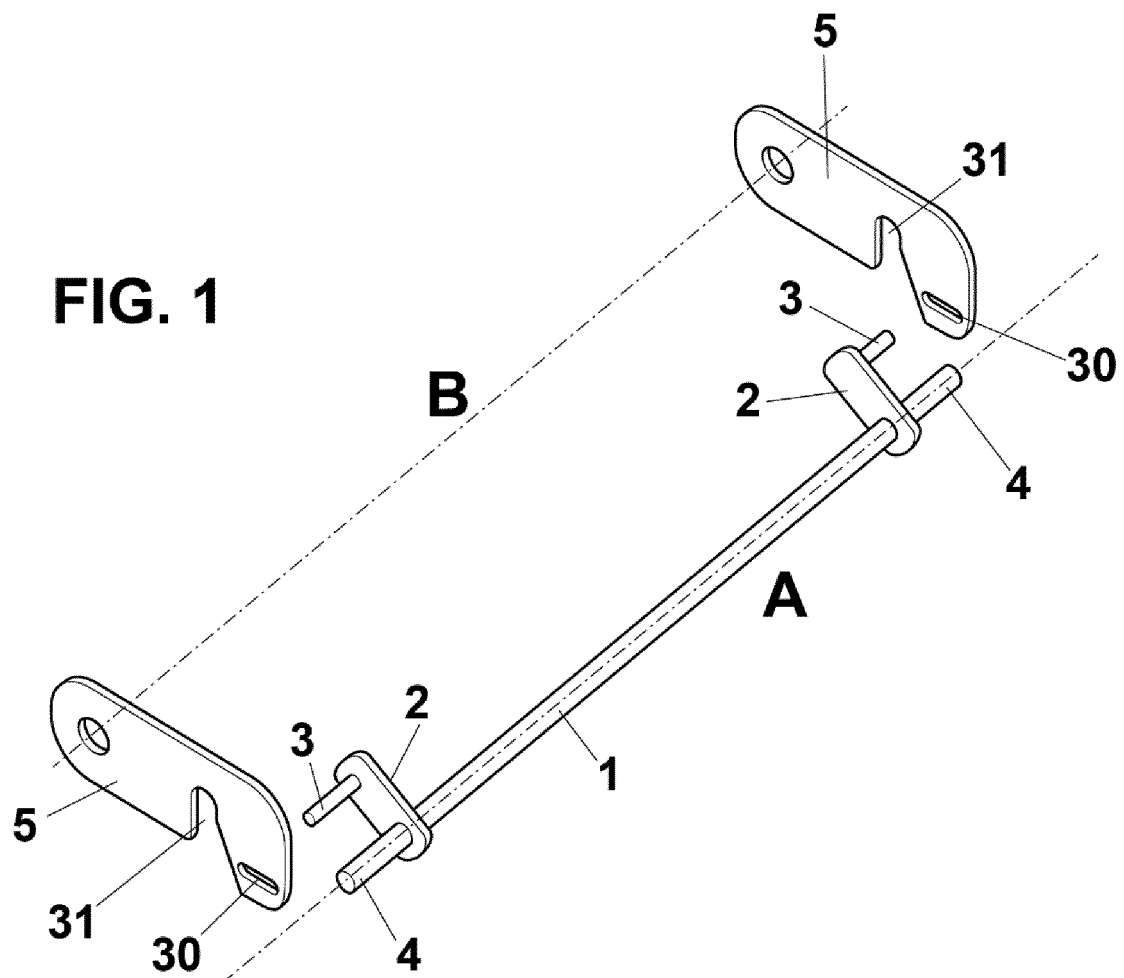
wherein said first shaft (4) is housed inside the slot (31) in the locking position of the locking element (5) and is outside the slot (31) in the unlocking position of the locking element (5), and

wherein said second shaft (3) is housed inside the elongated hole (30), being at a first end of the elongated hole (30) in the locking position of the locking element (5) and being at the second end of the elongated hole (30) in the unlock position of the locking element (5).

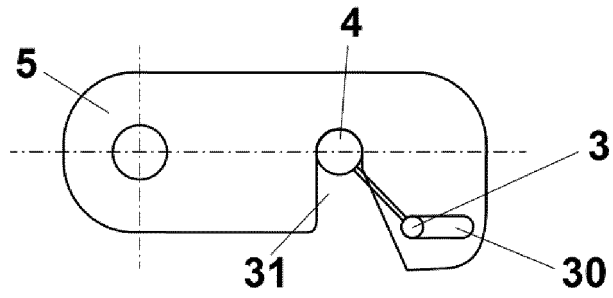
2. Device for opening and closing the doors of public transport vehicles according to claim 1, wherein said actuating element is a suspension arm (2), in which the first shaft (4) is aligned with the first axis of rotation (A) and the second shaft (3) is offset with respect to said first axis of rotation (A). 5
3. Device for opening and closing the doors of public transport vehicles according to claim 1, wherein said actuating element is a drive wheel (32), wherein the first shaft (4) is arranged in the center of the drive wheel (32) and the second shaft (3) is offset relative to the center of the drive wheel (32). 10
4. Device for opening and closing the doors of public transport vehicles according to claim 1, wherein the locking element (5) is rotatable at one of its ends around a second axis of rotation (B). 15
5. Device for opening and closing the doors of public transport vehicles according to claims 1 and 2, wherein said second axis of rotation (B) is parallel to the first axis of rotation (A). 20
6. Device for opening and closing the doors of public transport vehicles according to claim 1, wherein the locking element (5) is connected to a base plate (8). 25
7. Device for opening and closing the doors of public transport vehicles according to claims 1 and 6, wherein the connecting rod (1) is mounted at its ends on respective supports (9), said supports (9) being movable with respect to said base plate (8). 30
8. Device for opening and closing the doors of public transport vehicles according to claim 1, wherein said connecting rod (1) is mounted inside a suspension tube (6), a suspension arm (7) being movable along said suspension tube (6). 35
9. Device for opening and closing the doors of public transport vehicles according to claim 8, wherein the movement of the suspension arm (7) along the suspension tube (6) is driven by a motor (17), which 40

drives the rotation of a worm gear (13), which is connected to said suspension arm (7) by means of a towing fork (15).

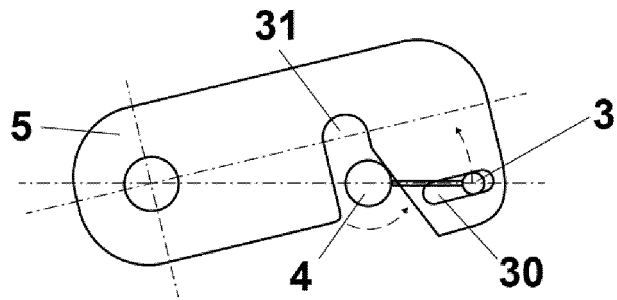
10. Device for opening and closing the doors of public transport vehicles according to claim 9, wherein a threaded nut (14) is moved over the worm gear (13) that is integral with the suspension arm (7) by means of the towing fork (15). 45
11. Device for opening and closing the doors of public transport vehicles according to claim 9 or 10, wherein an joint (16) is arranged between the towing fork (15) and the suspension arm (7). 50
12. Device for opening and closing the doors of public transport vehicles according to claim 1, wherein said actuating element (2; 32) is rotated by the action of a motor (17) and a pinion (20). 55
13. Device for opening and closing the doors of public transport vehicles according to claim 7, wherein the connecting rod (1) is housed inside a beam (21) fixed to the supports (9).
14. Device for opening and closing the doors of public transport vehicles according to claim 13, wherein said beam (21) comprises at least one slide (23), along which a guide (24) moves, which is fixed to a door leaf.
15. Device for opening and closing the doors of public transport vehicles according to claim 14, wherein said beam (21) comprises two slides (23), one being placed over the other or one being movable within the other in a telescopic manner.



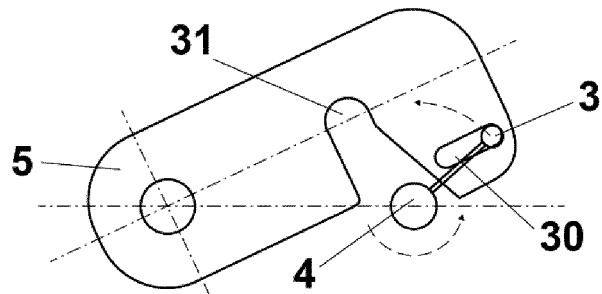
**FIG. 2a**



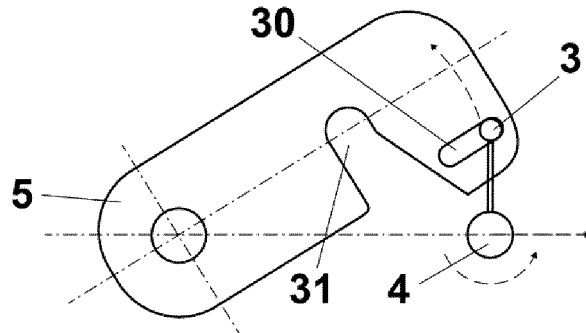
**FIG. 2b**



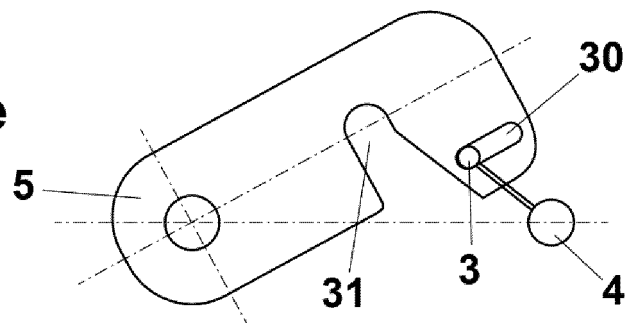
**FIG. 2c**



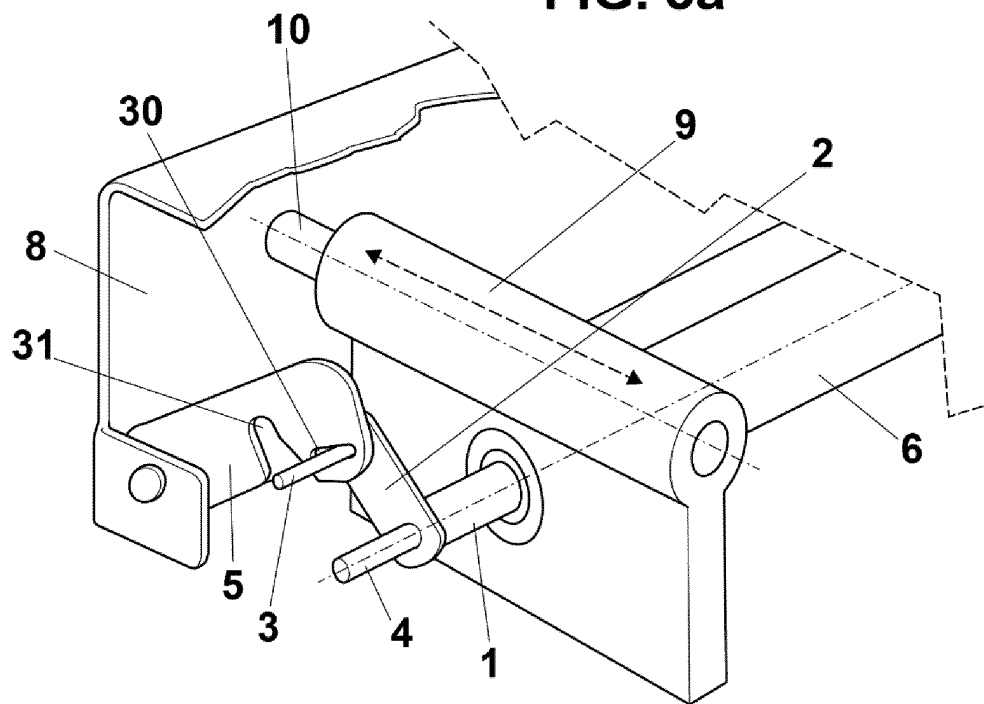
**FIG. 2d**



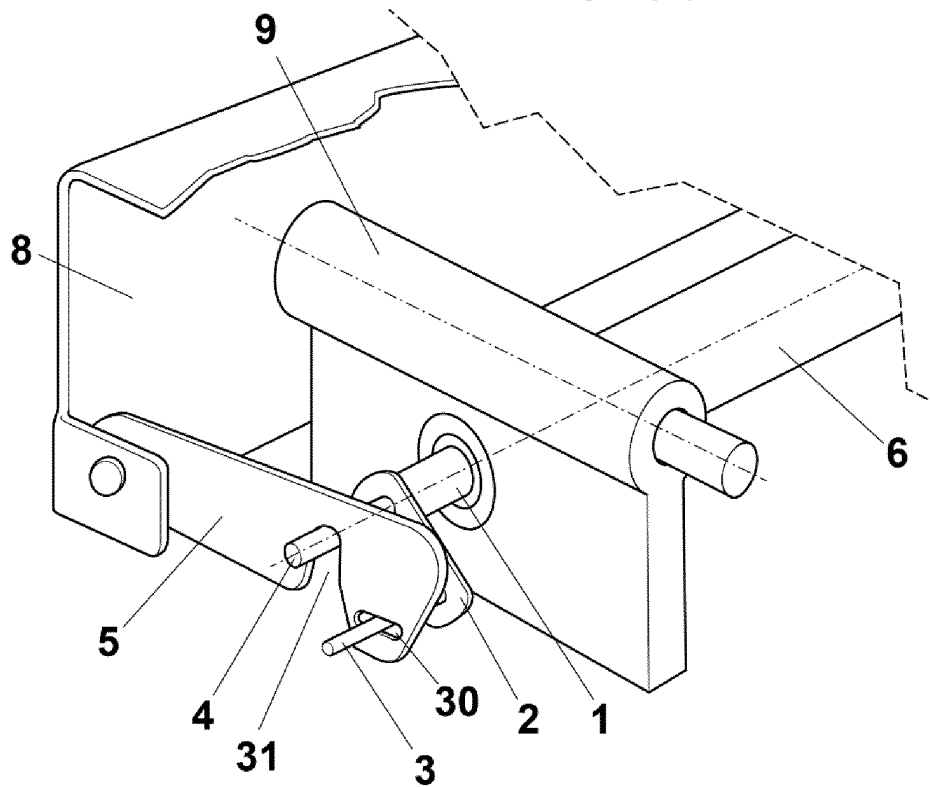
**FIG. 2e**



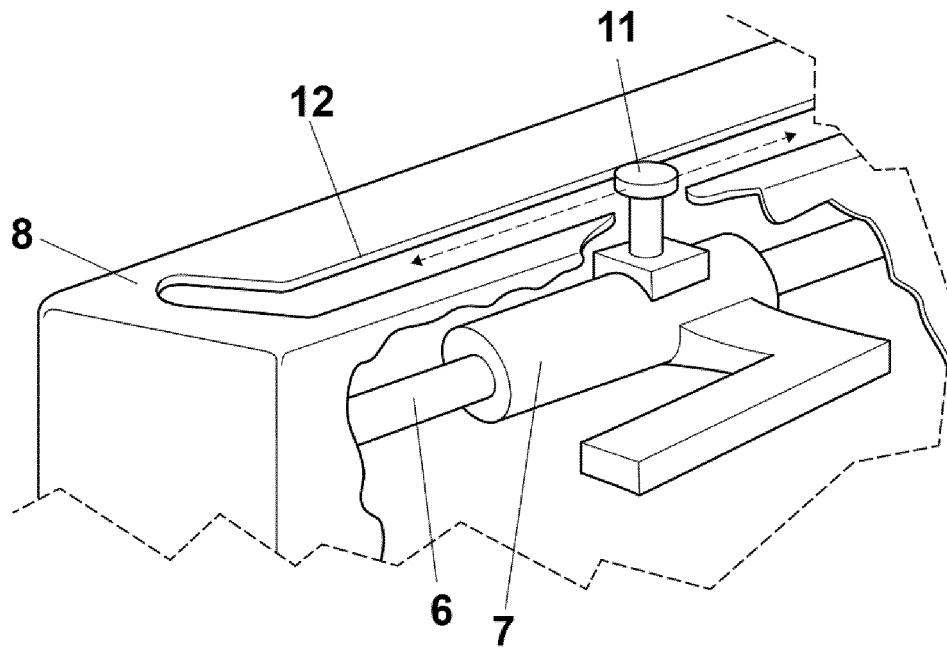
**FIG. 3a**



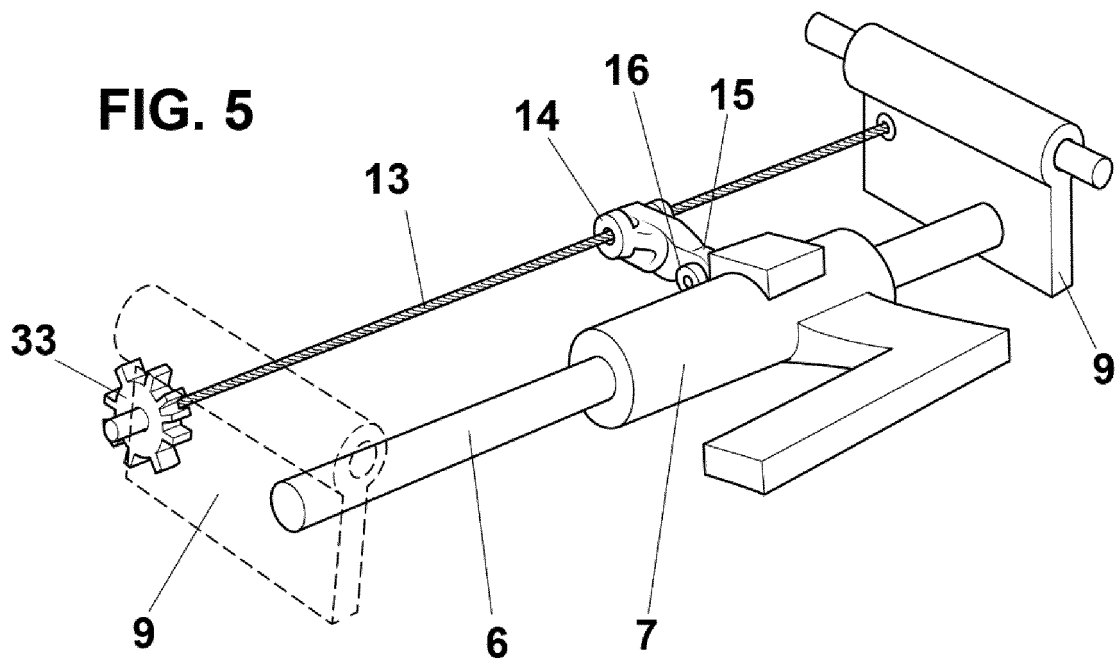
**FIG. 3b**



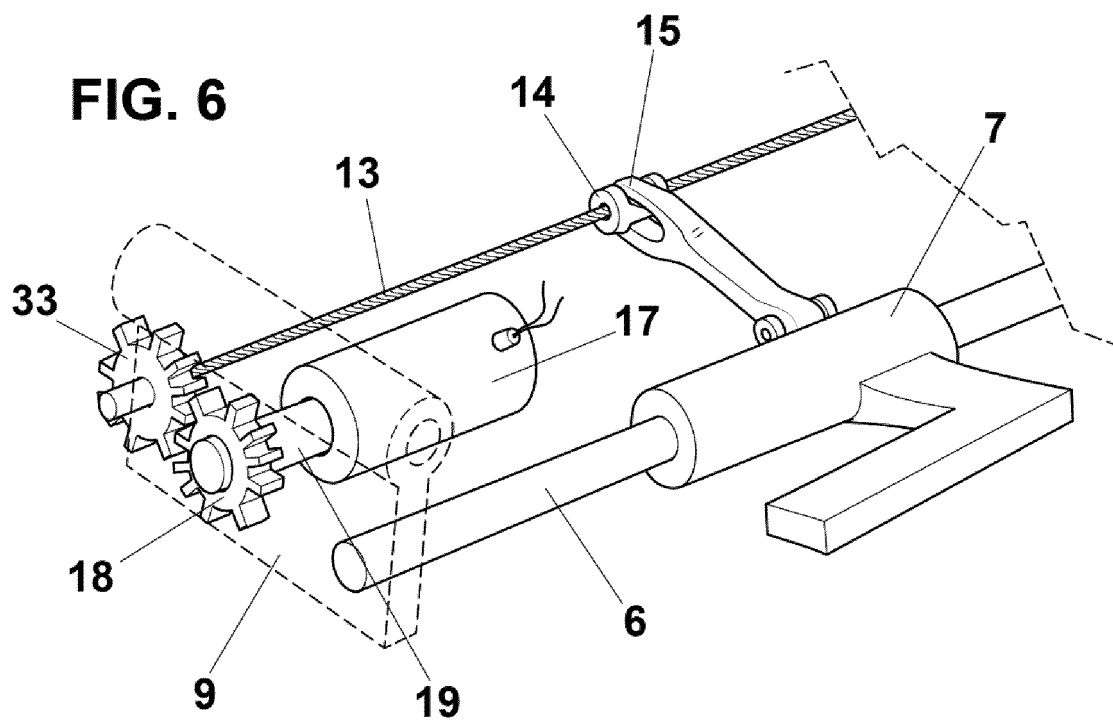
**FIG. 4**



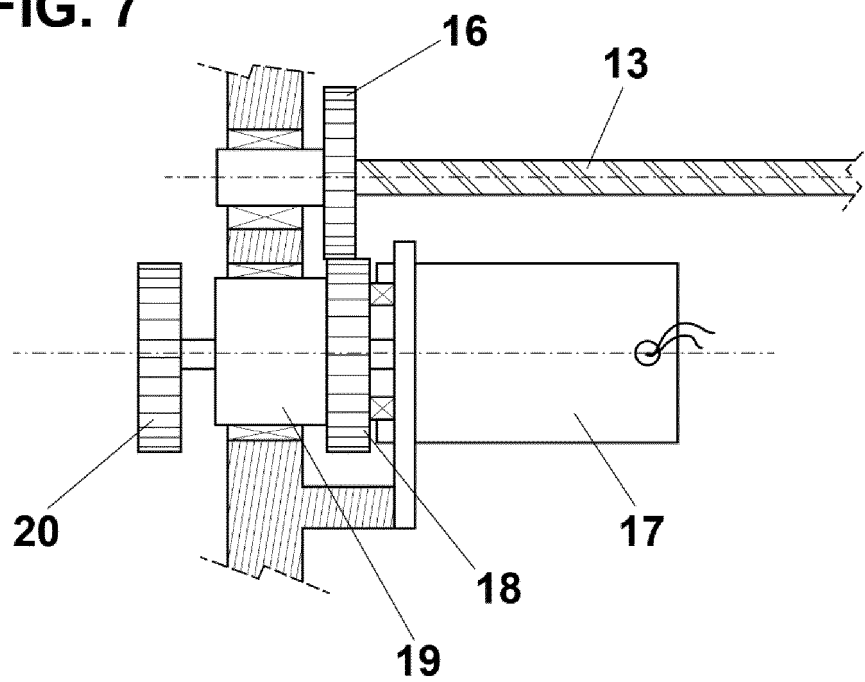
**FIG. 5**



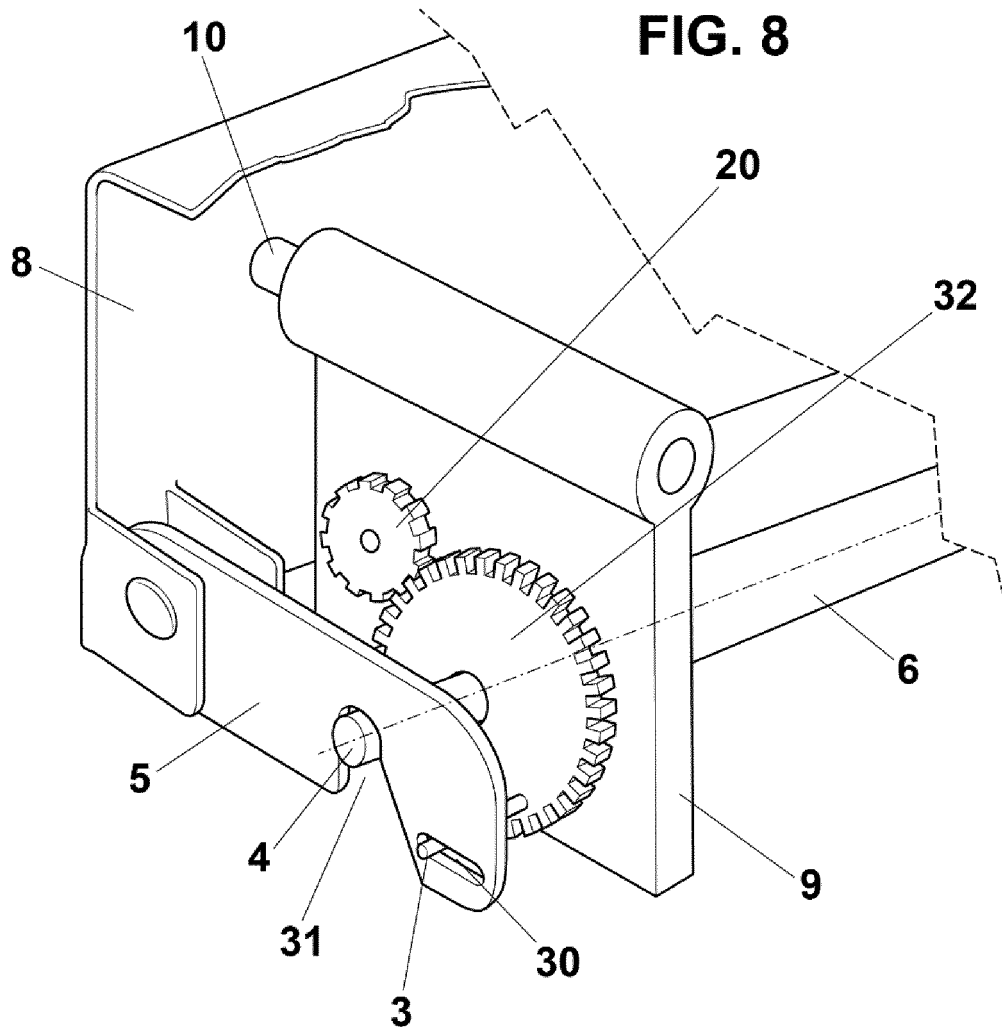
**FIG. 6**



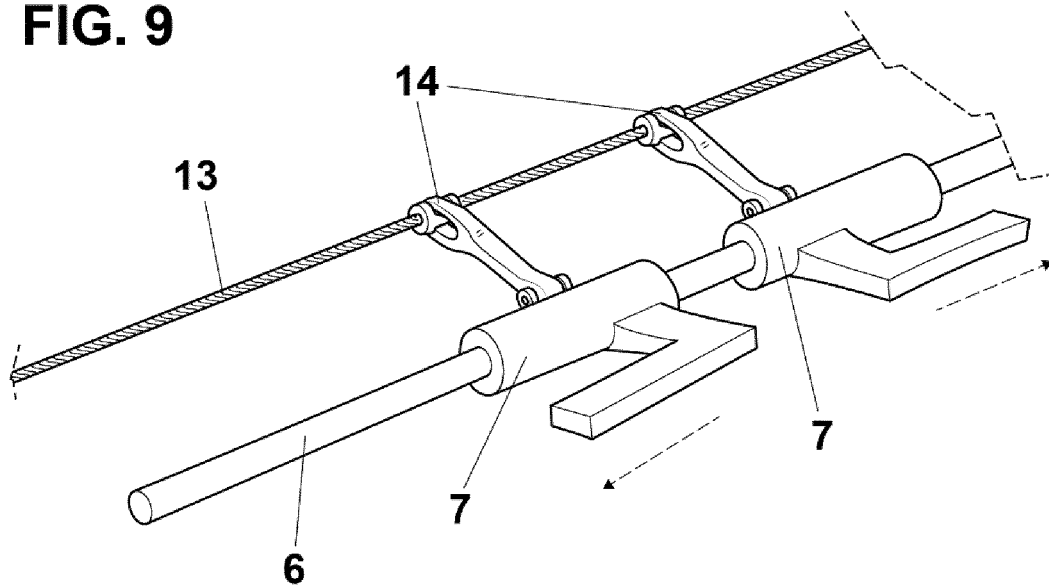
**FIG. 7**



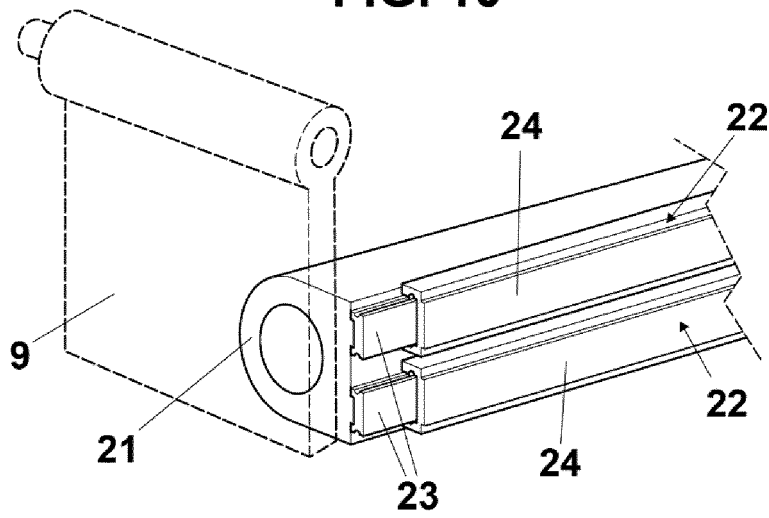
**FIG. 8**



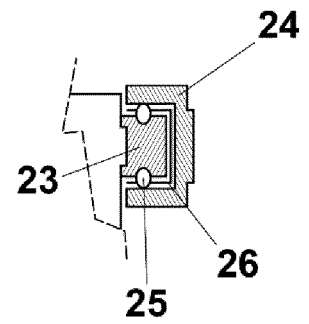
**FIG. 9**



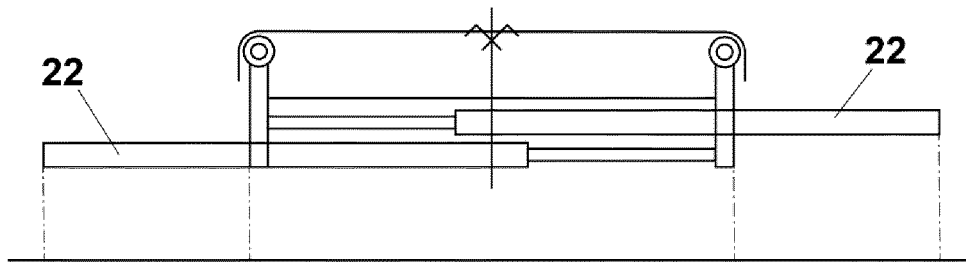
**FIG. 10**



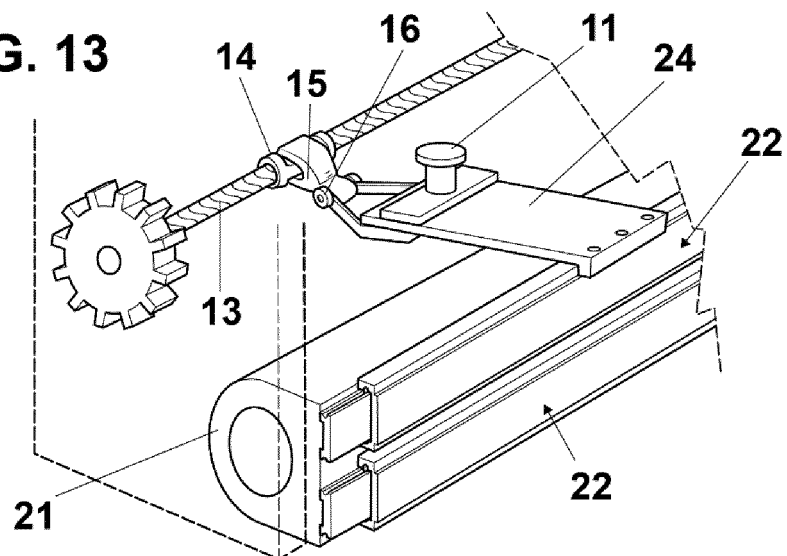
**FIG. 11**



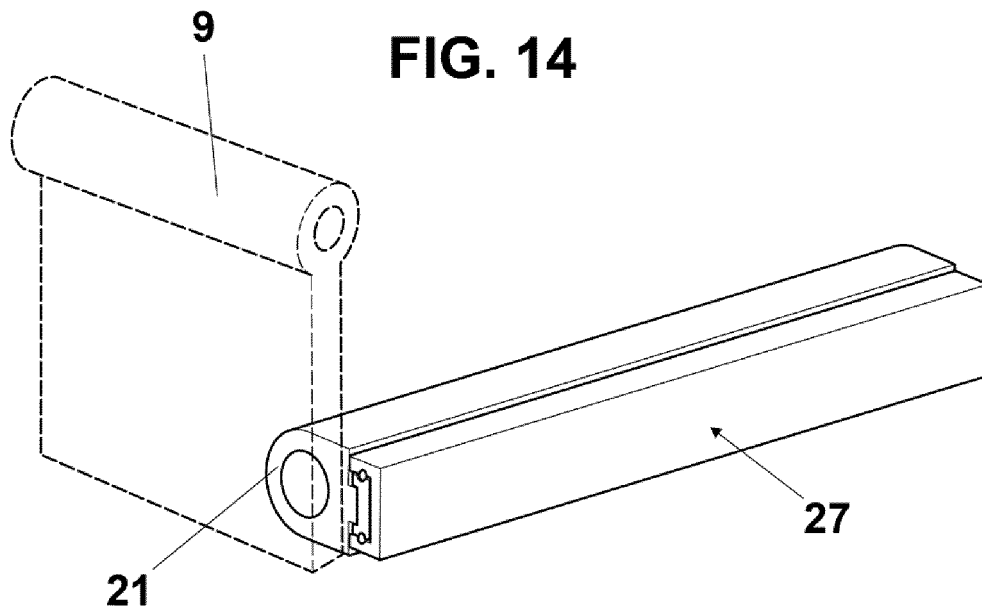
**FIG. 12**



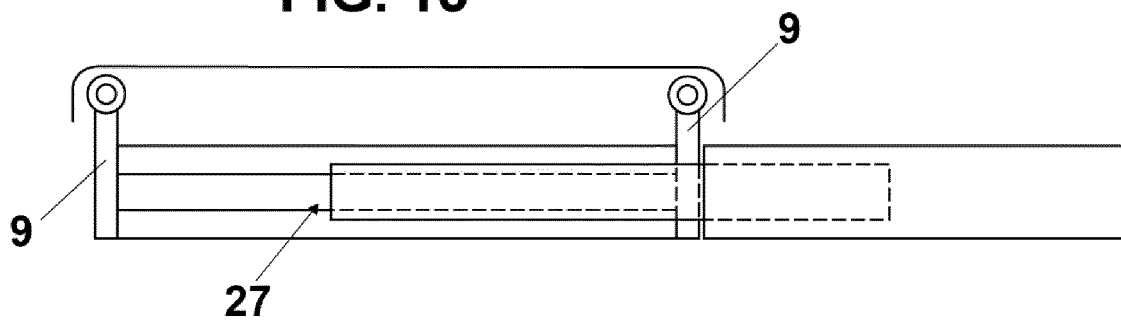
**FIG. 13**



**FIG. 14**



**FIG. 15**



## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/ES2018/070352

## A. CLASSIFICATION OF SUBJECT MATTER

**See extra sheet**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
B61D, E05D, E05F, E05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, INVENES

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5893236 A (KRBEC MARIANNE L ET AL.) 13/04/1999, column 2, line 66 - column 4, line 30; figures 1-11.	1-12
A	CA 2357292 A1 (WESTINGHOUSE AIR BRAKE TECHNOL) 14/03/2002, the whole document.	1-12
A	US 2006225356 A1 (JAROLIM REINHOLD) 12/10/2006, paragraphs [0015]-[0038]; figures 1-9.	1
A	US 2008190151 A1 (RITT ALOIS ET AL.) 14/08/2008, paragraphs [0014]-[0034]; figures 1-8.	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance.

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure use, exhibition, or other means.

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search  
21/12/2018

Date of mailing of the international search report  
(10/01/2019)

Name and mailing address of the ISA/

OFICINA ESPAÑOLA DE PATENTES Y MARCAS  
Paseo de la Castellana, 75 - 28071 Madrid (España)  
Facsimile No.: 91 349 53 04

Authorized officer  
D. Hermida Cibeira

Telephone No. 91 3493026

Form PCT/ISA/210 (second sheet) (January 2015)

## INTERNATIONAL SEARCH REPORT

International application No.

Information on patent family members

PCT/ES2018/070352

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
US5893236 A	13.04.1999	JPH10317796 A JP3073188B B2 EP0878371 A1 EP0878371 B1 DE69816366T T2 CN1198997 A CN1113764C C CA2217078 A1 CA2217078 C AT245102T T	02.12.1998 07.08.2000 18.11.1998 16.07.2003 15.04.2004 18.11.1998 09.07.2003 13.11.1998 27.02.2001 15.08.2003
CA2357292 A1	14.03.2002	US2002092236 A1 US2004159047 A1 US6539669 B1 MXPA01009329 A JP2002206613 A EP1188636 A2 EP1188636 A3 CN1344633 A BR0107053 A AU7205201 A	18.07.2002 19.08.2004 01.04.2003 20.08.2003 26.07.2002 20.03.2002 02.01.2003 17.04.2002 09.07.2002 21.03.2002
US2008190151 A1	14.08.2008	ES2388671T T3 HK1104594 A1 JP2007533879 A JP4809327B B2 US8113552 B2 RU2006141361 A RU2372462 C2 KR20070004060 A KR101297960B B1 WO2005103429 A2 WO2005103429 A3 CN1950583 A CN1950583B B BRPI0510165 A BRPI0510165 B1 AT500462 A1 AT500462B B1 EP1743080 A2 EP1743080 B1	17.10.2012 09.12.2011 22.11.2007 09.11.2011 14.02.2012 27.05.2008 10.11.2009 05.01.2007 19.08.2013 03.11.2005 05.01.2006 18.04.2007 31.08.2011 02.10.2007 23.02.2016 15.01.2006 15.02.2010 17.01.2007 08.08.2012
US2006225356 A1	12.10.2006	ES2415633T T3 US7549251 B2 RU2005126403 A RU2330766 C2 PL376319 A1 PL207784B B1 KR20050105440 A JP2006513088 A	26.07.2013 23.06.2009 10.01.2006 10.08.2008 27.12.2005 28.02.2011 04.11.2005 20.04.2006

Form PCT/ISA/210 (patent family annex) (January 2015)

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2018/070352

### Information on patent family members

Information on patent family members		Publication date	Patent family member(s)	Publication date
Patent document cited in the search report			JP4625332B B2	02.02.2011
			EP1587701 A1	26.10.2005
			EP1587701 B1	17.04.2013
			WO2004065154 A1	05.08.2004
			CN1738731 A	22.02.2006
			CN100434294C C	19.11.2008
			CA2513805 A1	05.08.2004
			CA2513805 C	08.11.2011
			BR0318013 A	29.11.2005
			BR0318013 B1	04.09.2012
			AU2003303751 A1	13.08.2004
			AU2003303751 A2	13.08.2004
			AT500017 A1	15.10.2005
			AT500017B B1	15.03.2006
	-----			

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2018/070352

5

10

15

20

25

30

35

40

45

50

55

CLASSIFICATION OF SUBJECT MATTER

*B61D19/00* (2006.01)

*E05D15/10* (2006.01)

*E05F15/652* (2015.01)

*E05F15/655* (2015.01)

*E05F15/662* (2015.01)

*E05B83/40* (2014.01)