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(54) **AN EMERGENCY RELEASE DEVICE FOR A DOOR ACTUATION SYSTEM WITH TWO DECOUPLERS**

(57) An emergency release device (1) for a door actuation system (2) with two decouplers (3, 3') comprises a sliding body (10), movable between a locking position and a release position, a first Bowden connection interface (12), arranged on the sliding body (10), for activating and deactivating a first decoupler (3), a second Bowden connection interface (12'), arranged on the sliding body (10), for activating and deactivating a second decoupler (3'), a spring device (14), which strains the sliding body (10) permanently towards the release position, a locking mechanism (15), movable in a locking configuration, wherein it locks the sliding body (10) in the locking position, and a release configuration, wherein it releases the sliding body (10) towards the release position, a third Bowden connection interface (16), arranged on the locking mechanism (15), for displacing the locking mechanism (15) from the release configuration to the locking configuration, optionally, a release detector (18) for detecting the attainment of the release configuration and for generating a corresponding electric release signal, as well as an electric restore actuator (20), operable for displacing the sliding body (10), against the force of the spring device (14), from the release position to the locking position and for displacing the locking mechanism (15) from the release configuration to the locking configuration.

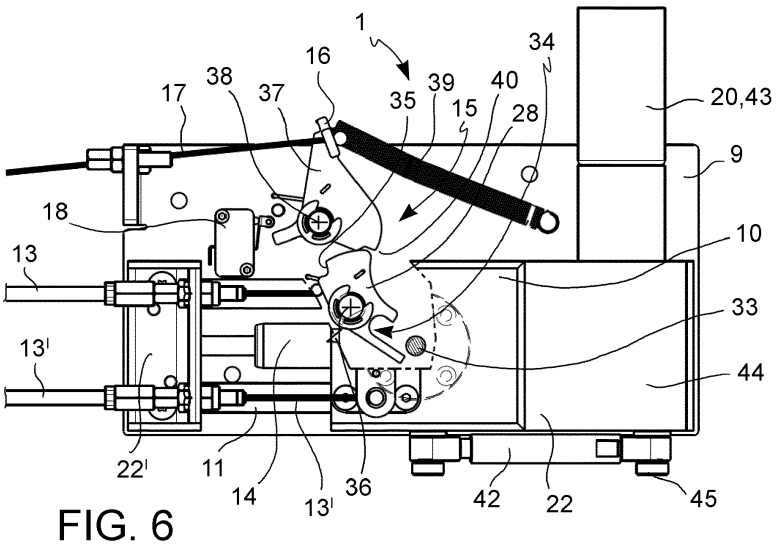

FIG. 6

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Description

[0001] The present invention relates to an emergency release device for a door actuation system with two decouplers, for example, for a double-leaf door, for example, which is orientable or roto-translatable, in particular for means of public transport, such as buses or trains.

[0002] The single orientable or roto-translatable leaf of the double-leaf door of a vehicle, for example of a bus, is connected by means of interposing arms, which are orientable, or directly to a rotating column and it is movable, by means of a rotary movement of the rotating column, from an open position to a closed position and vice versa.

[0003] In a first known configuration, the movement of the rotating column occurs by means of a rotary drive having an external housing constrained to the structure of the vehicle and an outlet shaft supported in the external housing and connected integrally to the rotating column on rotation. Thus, the movement of the leaf occurs in response to a rotation of the outlet shaft, while the external housing of the drive is stationary. The use of a rotary drive is known in this first configuration with a pneumatic linear actuator and a screw-type drive, which converts the linear movement of the linear actuator into a rotary movement of the outlet shaft.

[0004] In a second known configuration, the movement of the rotating column occurs by means of a rotary drive having an external housing, which forms the rotating column, or which is integrally constrained on rotation to the rotating column, as well as a stationary shaft supported in the external housing and stationarily constrained to the structure of the vehicle. Unlike the first configuration, here, the movement of the leaf occurs in response to a rotation of the external housing, while the shaft is stationary.

[0005] The use of a compact electric rotary drive is favored in this second configuration as the diameters of known fluid dynamic drives are too elevated to be able to act as a rotating column.

[0006] Known electric rotary drives are usually provided with an automatic locking brake, which is permanently elastically pushed into a locking position to keep the door closed with electric drive off, and electrically releasable during operation of the rotary drive.

[0007] In addition to the automatic locking brake, the rotary electric drives must also be provided with a mechanical emergency opening (or release) device, allowing the opening of the door despite being unable to release the locking brake in the event of an electricity failure.

[0008] As an emergency opening (or release) device, the inclusion is known of a manually operable mechanical decoupler between two reduction stages of the rotary drive, for example, by means of a Bowden cable. When actuating the decoupler, the latter detaches the two reduction stages of the rotary drive from each other and consequently decouples the rotating column (and thus the leaf of the door) from the side of the rotary drive, which is engaged/engageable by the automatic locking brake. In this way, the leaf of the door can be pushed manually into an open position despite being unable to release the locking brake.

[0009] Publication EP2803801 A1 by the applicant describes a rotary drive for a door or a ramp, which is orientable and/or translatable on public transport vehicles, comprising an electric motor, a reduction gear arranged on a front side of the motor and connected to a front portion of a motor shaft, an outlet shaft connected to the reduction gear, an automatic locking brake arranged on a rear side of the motor opposed to the front side, which acts on a rear portion of the motor shaft, as well as a decoupler additionally comprised with the automatic locking brake and operable to decouple the rear portion of the motor shaft (preferably on the rear side of the motor) from the automatic locking brake, also in the event of being unable to release the locking brake.

[0010] In the case of double-leaf doors, each leaf is operated by means of a rotary drive thereof, comprising an automatic locking brake thereof.

[0011] In the event of an emergency, it is thus necessary to comprise two mechanical emergency opening (or release) devices to allow the manual opening of each of the two leaves of the door in the event of an electricity failure, despite being unable to release the two locking brakes.

[0012] In an emergency, the inclusion of two different mechanical release devices with two manually operable levers or handles can confuse the user and the actuation of only one of the two release devices might not be sufficient to allow a manual thrust opening of the door because the movement of the single released leaf could be prevented by the second leaf, which is still locked.

[0013] On the other hand, the manual actuation of both mechanical release devices may require elevated force by the user and result in unsuccessful release attempts, further increasing panic and delaying the release of passengers from dangerous situations.

[0014] Thus, it is the object of the present invention to provide an emergency release device for a door actuation system with two decouplers, described in the introduction, having such features as to ensure a reliable and repeatable operation thereof, with a rapid release effect on both leaves, which is easily operable, without excessive effort by the user.

[0015] These and other objects are achieved by means of an emergency release device for a door actuation system with two decouplers, for example, for a double-leaf door, according to claim 1. The dependent claims relate to advantageous and preferred embodiments.

[0016] According to one aspect of the invention, an emergency release device for a door actuation system with two decouplers, for example, for a double-leaf door, comprises:

- a support structure,

- a sliding body connected to the support structure by means of a guide device, movable between a locking position and a release position,
- a first Bowden connection interface arranged on the sliding body for the connection of a first Bowden cable to the sliding body, for activating and deactivating a first decoupler of the door actuation system,
- a second Bowden connection interface arranged on the sliding body for the connection of a second Bowden cable to the sliding body, to activate and deactivate a second decoupler of the door actuation system,
- a spring device connected between the support structure and the sliding body, which strains the sliding body permanently towards the release position,
- a locking mechanism connected between the support structure and the sliding body and movable in:
    - a locking configuration, wherein the locking mechanism engages and locks the sliding body in the locking position, and
    - a release configuration, wherein the locking mechanism disengages the sliding body so that the spring device moves the sliding body from the locking position to the release position,
- a third Bowden connection interface arranged on the locking mechanism for the connection of a third Bowden cable to the locking mechanism, for the displacement of the locking mechanism from the release configuration to the locking configuration,
- optionally, a release detector associated with the locking mechanism, configured to detect the attainment of the release configuration and generate a corresponding electric release signal intended for an electric control system of the door actuation system,
- an electric restore actuator connected to the support structure and operable to displace the sliding body, against the force of the spring device, from the release position to the locking position and to displace the locking mechanism from the release configuration to the locking configuration.

[0017] Due to the displacement of the sliding block by means of a preloaded spring device, and not (or not only) by means of the force exerted by the user by the third Bowden cable, the door can easily be released in an emergency without excessive effort.

[0018] Due to the displacement of a single sliding body, the release of both decouplers, or door leaves, is carried out in a synchronized manner, or in a predetermined sequence, in response to a single manual door release operation.

[0019] Due to the interposition of a locking mechanism between the third Bowden cable, operated manually by the user, and the sliding block, the locking force, the release force and the locking and release positions of the sliding body, as well as the thrust force needed to push the sliding block into the release position, can be selected and set according to design parameters of the door with a double decoupler, independently of parameters of force and geometry of the emergency handle or lever by means of which the third Bowden cable will be operated.

[0020] The release detector allows the recognition and signaling of a door release state by means of an electric control system of the emergency release device, or of the door, or of the whole vehicle and the electric restore operation allows a restore, for example, automatic, of the emergency release device by means of the electric control system, without the need for further manual intervention.

[0021] The set of these partial technical effects synergically result in a reliable and repeatable operation of the emergency release device, with a consequent rapid and synchronized release on both decouplers or leaves, with easy operation and without excessive effort by the user.

[0022] The door actuation system with two decouplers can be associated, for example, with a double-leaf door of the type comprising:

- a first leaf, movable between an open position and a closed position by means of a first rotary drive thereof,
- a second leaf, movable between an open position and a closed position by means of a second rotary drive thereof,

wherein the first rotary drive and the second rotary drive each comprise:

- an outlet portion for transmitting the movement of the rotary drive to the leaf and a brakeable portion coupled to the outlet portion,
- an automatic locking brake, which acts on the brakeable portion, to lock the leaf in the closed position,
- a decoupler, operable to decouple the brakeable portion from the outlet portion in order to allow a manual displacement of the leaf towards the opening position, also in the event of being unable to release the automatic locking brake.

[0023] In order to better understand the invention and appreciate the advantages thereof, embodiments will be described below by way of non-limiting examples, with reference to the drawings, wherein:

- figure 1 is a schematic illustration of functional groups of an inlet and outlet system for a vehicle with a double-leaf door, as well as of an actuation subsystem with an emergency release device for the double-leaf door, according to embodiments,
- figure 2 is a schematic illustration of functional groups of an inlet and outlet system for a vehicle with a single- or double-leaf door, as well as of an actuation sub-system with an emergency release device for a leaf of the door, according to embodiments,

- figure 3 is a perspective view of the emergency release device in a locking configuration, according to one embodiment,
- figure 4 is a perspective view of the emergency release device in figure 1 in a release configuration,
- figure 5 is a view from above of the emergency release device in figure 3, in the locking configuration, with parts removed so that some of the otherwise covered details are visible,
- figure 6 is a view from above of the emergency release device in figure 4, in the release configuration, with parts removed so that some of the otherwise covered details are visible,
- figure 7 is a further view of the emergency release device in the locking configuration, with parts removed so that some of the otherwise covered details are visible,
- figure 8 is a schematized view of a rotary drive for a door leaf according to one embodiment,
- figure 9 is a schematized view of a rotary drive for a door leaf according to a further embodiment,
- figures 10, 11, 12 illustrate a non-desired interaction sequence of a locking-mechanism configuration.

Detailed description of the invention

[0024] Figures from 4 to 7 illustrate an emergency release device 1 for a door actuation system 2 with two decouplers 3, 3', for example, for a double-leaf door 4, 4' or with a single leaf 4, in particular, for a vehicle for transporting people, for example, a bus or a railway carriage.

[0025] The double-leaf door 4, 4' can be, for example, of the type comprising a first leaf 4, movable between an open position and a closed position by means of a first rotary drive thereof 5, a second leaf 4', movable between an open position and a closed position by means of a second rotary drive thereof 5', wherein the first rotary drive 5 and the second rotary drive 5' each comprise an outlet portion 6 for transmitting the movement of the rotary drive to the leaf 4, 4', and a brakeable portion 7 coupled to the outlet portion 6, an automatic locking brake 8, which acts on the brakeable portion 7 to lock the leaf 4, 4' in the closed position, as well as a decoupler 3, 3' operable to decouple the brakeable portion 7 from the outlet portion 6 to allow a manual displacement of the leaf 4, 4' towards the open position, also in the event of being unable to release the automatic locking brake 8 (figures 1, 8, 9).

[0026] Alternatively, the double- 4, 4' or single-leaf door 4 can be of the type comprising at least one leaf 4, movable between an open position and a closed position by means of a rotary drive 5 thereof, wherein the rotary drive 5 comprises an outlet portion 6 for transmitting the movement of the rotary drive 5 to the leaf 4, and a brakeable portion 7 coupled to the outlet portion 6, an automatic locking brake 8, which acts on the brakeable portion 7 to lock the leaf 4 in the closed position, as well as a first and a second decoupler 3, 3', operable (for example, in sequence) to decouple the brakeable portion 7 from the outlet portion 6 to allow a manual displacement of the leaf 4 towards the open position, also in the event of being unable to release the automatic locking brake 8 (figures 2, 8, 9).

[0027] According to one aspect of the invention, the emergency release device 1 comprises:

a support structure 9, for example, a metal plate, for example, made of aluminum or steel,

a sliding body 10, for example, a metal block, for example, made of aluminum or steel, connected to the support structure 9 by means of a guide device 11, movable between a locking position (figures 3, 5) and a release position (figures 4, 6),

a first Bowden connection interface 12 arranged on the sliding body 10 for the connection of a first Bowden cable 13 to the sliding body 10, to activate and deactivate a first decoupler 3 of the door actuation system 2,

a second Bowden connection interface 12' arranged on the sliding body 10 for the connection of a second Bowden cable 13' to the sliding body 10, to activate and deactivate a second decoupler 3' of the door actuation system 2,

a spring device 14 connected between the support structure 9 and the sliding body 10, which strains the sliding body 10 permanently towards the release position,

a locking mechanism 15 connected between the support structure 9 and the sliding body 10 and movable in:

- a locking configuration (figure 5), wherein the locking mechanism 15 engages and locks the sliding body 10 in the locking position, and
- a release configuration (figure 6), wherein the locking mechanism 15 releases the sliding body 10 so that the spring device 14 moves the sliding body 10 from the locking position to the release position,

a third Bowden connection interface 16 arranged on the locking mechanism 15 for the connection of a third Bowden cable 17 to the locking mechanism 15, for the displacement of the locking mechanism 15 from the release configuration to the locking configuration (sequence of figures 5, 6),

optionally, a release detector 18 associated, for example, with the locking mechanism 15, with the sliding body 10, or with the spring device 14, and configured to detect the attainment of the release configuration and generate a corresponding electric release signal intended for an electric control system 19 of the door actuation system 2,

an electric restore actuator 20 connected to the support structure 9 and operable to displace the sliding

body 10, against the force of the spring device 14, from the release position to the locking position, and to displace the locking mechanism 15 from the release configuration to the locking configuration.

[0028] According to one embodiment, the guide device 11 comprises two parallel guide bars 21 extending through two guide holes 23 of the sliding block 10, whose opposite ends can be connected to two opposite support walls 22, which can be screwed, in turn, to the metal plate of the support structure 9. In this way, the guide device 11 determines a translation travel direction of the sliding body 10, which corresponds to an actuation (traction) and return translational travel direction of the first Bowden cable 13 and the second Bowden cable 13'.

[0029] According to one embodiment, the Bowden coupling interfaces 12, 12' are formed by a rocker arm 26 oscillatingly connected to the sliding body 10 about a rocker arm axis 27 transverse (preferably orthogonal) to the translational travel direction of the sliding body 10, and positioned on two opposite sides with respect to the rocker arm axis 27. In this way, a difference in resistance between the first 13 and the second Bowden cable 13' increases the actuation travel of the Bowden cable, offering less resistance to the Bowden cable, which offers more resistance and/or allows an actuation of the two decouplers 3, 3' in a predetermined sequence by means of the difference in the mechanical actuation resistance of the two decouplers 3, 3'.

[0030] Besides the first and the second Bowden coupling interfaces 12, 12' arranged on the sliding body 10 and configured for the connection of the Bowden cables 13, 13', a first Bowden abutment seat 24 and a second Bowden abutment seat 24' are comprised for positioning and stopping external casings 25, 25' of the first Bowden cable 13 and the second Bowden cable 13'.

[0031] The first 24 and the second 24' Bowden abutment seats can be formed in one same wall, for example, a metal angular profile, formed or screwed to a first wall 22 of the opposite walls 22, 22'.

[0032] According to one embodiment, the spring device 14 can comprise a gas spring or a helical spring preferably arranged in an intermediate region between the two guide bars 21, and possibly with an orientation and thrust effect parallel to the direction of extension of the guide bars 21. The spring device can be connected or positioned between the aforesaid first wall 22' of the opposite walls 22 and the sliding body 19.

[0033] Advantageously, the spring device 14 comprises two springs (e.g. gas or helical) placed parallel (figure 4) to ensure a thrust operation of the sliding body 10 with safety redundancy.

[0034] The elastic force of the gas or helical spring is adjustable, for example, by means of selecting the preloaded compression length, or by means of adjusting the pressure of the gas in the gas spring, and it is consequently adaptable to the decoupling resistance of the decouplers 3, 3'.

[0035] According to one embodiment, the locking mechanism 15 comprises:

- a hooking lever 28 connected rotatably to the support structure 9 about a hooking axis 36 between a hooking position (figure 5) and a release position (figure 6) and forming a hooking seat 34 and a stop seat 35 arranged on two opposite sides to the hooking axis 36,
- a projection 33, for example, a pin, integral with the sliding body 10, and
- a trigger 37 connected rotatably to the support structure 9 about a trigger axis 38 between a stop position (figure 5) and a trigging position (figure 6), forming the third Bowden coupling interface 16 and a stop portion 40, and
- a stop spring 39, which strains the trigger 37 permanently towards the stop position (figure 5).

[0036] The hooking lever 28, the projection 33 and the trigger 37 are configured and shaped so that:

- when the trigger 37 is in the stop position, the stop portion 40 engages the stop seat 35 and stops the hooking lever 28 in the hooking position,
- when the trigger 37 is rotated (by means of the third Bowden cable 17 and against the force of the stop spring 39) from the stop position to the trigging position, the stop portion 40 disengages the stop seat 35 and allows the hooking lever 28 to rotate from the hooking position to the release position,
- when the hooking lever 28 rotates from the hooking position to the release position, the hooking seat 34 releases the projection 33 and allows the sliding body 10 to slide (pushed by the spring device 14) from the locking position to the release position, thus actuating the first and the second Bowden cable 13, 13',
- when the sliding body 10 slides (pushed by the electric restore actuator 20) from the release position to the locking position, the projection 33 engages the hooking seat 34 and rotates the hooking lever 28 from the release position to the hooking position,
- when the hooking lever 28 rotates from the release position to the hooking position (and in the absence of actuation of the third Bowden cable 17), the stop spring 39 triggers the stop portion 40 of the trigger 37 into the stop seat 35 of the hooking lever 28 and stops the hooking lever 28 again in the hooking position, thus completing the device 1 restore.

[0037] According to one embodiment, the hooking seat 34 of the hooking lever 28 comprises a first projection (or surface) 30 and an opposite, second projection (or surface) 31, longer than the first projection (or surface) 30, which mutually delimit a groove 32 so that the first projection (or surface) 30 locks and releases the projection 33 of the sliding body 10, while the second projection (or

surface) 31, of a greater length, intercepts the projection 33 when the sliding body 10 returns from the release position to the locking position.

[0038] According to one embodiment, the hooking lever 28 is permanently elastically (spring 29) strained towards the release position, in order to ensure the necessary position synchrony for the restore. In the absence of positioning of the hooking lever 28 in the release position, by means of the spring 29, the situation shown in the sequence in figures 10, 11, 12 could occur, wherein the pin 33 might not enter the hooking seat 34 in the restore step.

[0039] According to a further embodiment, the device comprises a further stop spring 41, which strains the trigger 37 permanently towards the stop position (figure 7), ensuring an operation redundancy of the device 1 restore.

[0040] According to a further embodiment, the trigger 37 forms a sensing projection or portion 42, which interacts with the release detector 18, for example, switching an electric microswitch between two different switching states, to detect a device state 1 set and not actuated (figure 5) and a device state 1 actuated and not yet restore (figure 6).

[0041] Advantageously, the stop seat 35 of the hooking lever 28 and the stop portion 40 of the trigger 37 are positioned and shaped so that, when the trigger 37 stops in the stop position and the hooking lever 28 stops in the hooking position (figure 5), a resulting support force 46 between the stop seat 35 and the stop portion 40 (generated by the spring device 14) intersects the trigger axis 38 of the trigger 37.

[0042] This creates a stable locking position of the sliding body 10, independent of the relation of elastic forces between the stop spring 39, 41 and the spring device 14, and allows, for example, the spring device 14 to exert a highly elevated thrust force on the sliding body 10, and the stop spring 39, 41 to exert an elastic resistance to the manual actuation of the third Bowden cable 17, which is less elevated and can easily be overcome by the user by operating the release handle, or lever 47, in an emergency.

[0043] Advantageously, the device 1 is configured so that the first, second and third Bowden cable 13, 13', 17 can all three be coupled to only one same side of the device 1. This favors the installation of the device 1 and the Bowden cables 13, 13', 17.

[0044] According to one embodiment, a telescopic transmission rod 42 is arranged between the sliding body 10 and the electric restore actuator 20, slidingly compactable in a shortened configuration (figure 4), wherein the transmission rod 42 can transmit an axial compression force from the restore actuator 20 to the sliding body 10 to reposition the sliding body 10 from the release position to the locking position, and slidingly extendable in an elongated configuration (figures 3, 7) starting from which the transmission rod 42 can house the movement of the sliding body 10 from the locking position to the release position, shortening slidingly, without transmitting movements to the restore actuator 20.

[0045] This ensures a reliable operation of the device 1 and eliminates the risk of jamming and resistance due to the internal mechanical resistance of the restore actuator 20.

[0046] According to one embodiment, the electric restore actuator 20 can be controlled, for example, by means of the control system 19 and it can comprise an electric motor 43, with or without a reducer 44, coupled to the telescopic transmission rod 42, for example, by means of an eccentric 45 (making a modified crankshaft and rod mechanism, of thrust only and without traction phase) or by means of a screw-type drive (not shown, also thrust only and without traction phase).

[0047] In the embodiment shown in the figures, in the restore step of the emergency release device 1, the eccentric 45 performs:

- a first rotation of 180° in a direction towards the sliding body 10, by means of which it positions the sliding body 10 from the release position to the locking position by means of the compacted telescopic transmission rod 42,
- a further rotation of 180° in a direction a way from the sliding body 10 and by means of which it re-extends the telescopic transmission rod 42.

Description of embodiments of the door actuation system 2

[0048] With reference to figures 8 and 9, the door actuation system 2 for an inlet/outlet device, in particular a door or a ramp, which is orientable and/or translatable and similar on public transport vehicles, comprises a rotary drive 5, 5' with an electric motor 48, a first reduction gear 49 arranged on a front side of the motor 48 and connected to a front portion of a motor 48 shaft 50, a second reduction gear 51 connected to the first reduction gear 49, an outlet shaft 52 (forming the aforesaid outlet portion 6) connected to the second reduction gear 51, an automatic locking brake 8 arranged on a rear side of the motor 48 opposed to the front side and which acts on a brakeable portion 7 coupled to a rear portion 53 of the motor shaft 50, as well as a decoupler 3 connected between the brakeable portion 7 and the rear portion 53 of the motor shaft 50 and operable to decouple the brakeable portion 7 from the rear portion 53 of the motor shaft 50 to decouple the motor shaft 50 from the locking brake 8 also in the event of being unable to release the locking brake 8.

[0049] The actuation of the decoupler 3, 3' occurs by a Bowden cable 13, 13' by means of the manually operable emergency release device 1.

[0050] Actuation 1 can comprise a second decoupler 3' connected between the second reduction gear 51 and the outlet shaft 52 (forming the aforesaid outlet portion 6) and operable to decouple the outlet shaft 52 from the

second reduction gear 51.

[0051] Actuation of the second decoupler 3' occurs, for example, by the same Bowden cable 13, or by means of a further Bowden cable 13', using the same manually operable emergency release device 1.

[0052] In this way, in the event of an electricity failure to open the door 4, 4' by means of the door actuation system 2 and to release the automatic locking brake 8 from the brakeable portion 7, the outlet shaft 52 can be manually decoupled from the whole motor unit 48 - first reduction gear 49 - second reduction gear 51, allowing the opening of the door 4, 4' by manual thrust.

[0053] In one embodiment, the manual emergency release device 1 is configured first to operate the first decoupler 3 and then the second decoupler 3'.

[0054] According to one aspect of the invention, a rotating column 54 is rotatably constrained to a frame 55 of the door and one or more orientable arms 56 are integrally connected on rotation to the rotating column 54 to move (open and close) a leaf 4, 4' of the door in response to a rotation of the rotating column 54. The rotary drive 5, 5' is at least partially inserted in the rotating column 54, integrally constrained on rotation to the frame 55, while the outlet shaft 52 is connected to transmit the rotary movement thereof to the rotating column 54, for example, by means of a direct anti-rotation connection 58, or by means of a transmission gear (not shown).

[0055] In the embodiment in figure 9, the locking brake 8 is arranged externally to the rotating column 54 (and preferably above an upper support thereof) and connected to the motor shaft 50 by means of a transmission portion extending from inside the rotating column 54 to the outside thereof. Such transmission portion can be formed, for example, by the aforesaid brakeable portion 11'.

[0056] An upper arm of the orientable arms 56, which commands the movement of the leaf 4, 4' of the door, can be mounted integrally on rotation and on translation to the rotating column 54 or, alternatively, the orientable arm 56 can be engaged with the rotating column 54 integrally on rotation, but translatable or adjustable in height, for example, by means of an axial guide welded to the rotating column 54 (not shown).

Claims

1. An emergency release device (1) for a door actuation system (2) with two decouplers (3, 3'), for example, for a double-leaf door (4, 4'), wherein the emergency release device (1) comprises:

   - a support structure (9),
   - a sliding body (10) connected to the support structure (9) by means of a guide device (11) in a movable manner between a locking position and a release position,
   - a first Bowden connection interface (12) arranged on the sliding body (10) for the connection of a first Bowden cable (13) for activating and deactivating a first decoupler (3) of the door actuation system (2),
   - a second Bowden connection interface (12') arranged on the sliding body (10) for the connection of a second Bowden cable (13') for activating and deactivating a second decoupler (3') of the door actuation system (2),
   - a spring device (14), which strains the sliding body (10) permanently towards the release position,
   - a locking mechanism (15) connected between the support structure (9) and the sliding body (10) and movable in:

     - a locking configuration, wherein the locking mechanism (15) engages and locks the sliding body (10) in the locking position, and
     - a release configuration, wherein the locking mechanism (15) releases the sliding body (10) so that the spring device (14) moves the sliding body (10) from the locking position to the release position,

   - a third Bowden connection interface (16) arranged on the locking mechanism (15) for the connection of a third Bowden cable (17) for the displacement of the locking mechanism (15) from the release configuration to the locking configuration,
   - an electric restore actuator (20) connected to the support structure (9) and operable for displacing the sliding body (10), against the force of the spring device (14), from the release position to the locking position and for displacing the locking mechanism (15) from the release configuration to the locking configuration.

2. An emergency release device (1) according to claim 1, wherein the guide device (11) comprises two parallel guide bars (21) extending through two guide holes (23) of the sliding block (10), and opposite ends of the two guide bars (11) are connected to two support walls (22, 22') connected to the support structure (9).

3. An emergency release device (1) according to any one of the preceding claims, wherein the first and the second Bowden coupling interfaces (12, 12') are formed by a rocker arm (26) oscillatingly connected to the sliding body (10) about a rocker arm axis (27), transverse to a translational travel direction of the sliding body (10), wherein the first and the second Bowden coupling interfaces (12, 12') are positioned on two opposite sides to the rocker arm axis (27).

4. An emergency release device (1) according to any

one of the preceding claims, wherein the spring device (14) comprises two springs or two gas springs placed to exert a thrust on the sliding body (10) with safety redundancy with respect to each other.

5. An emergency release device (1) according to any one of the preceding claims, wherein the locking mechanism (15) comprises:

- a hooking lever (28) connected rotatably to the support structure (9) about a hooking axis (36), between a hooking position and a release position, forming a hooking seat (34) and a stop seat (35) arranged on two opposite sides to the hooking axis (36),
- a projection or a pin (33), integral with the sliding body (10),
- a trigger (37) connected rotatably to the support structure (9) about a trigger axis (38) between a stop position and a trigging position, forming the third Bowden coupling interface (16) and a stop portion (40),
- a stop spring (39), which strains the trigger (37) permanently towards the stop position,

wherein the hooking lever (28), the projection (33) and the trigger (37) are configured and shaped so that:

- when the trigger (37) is in the stop position, the stop portion (40) engages the stop seat (35) and stops the hooking lever (28) in the hooking position,
- when the trigger (37) is rotated against the force of the stop spring (39) from the stop position to the trigging position, the stop portion (40) disengages the stop seat (35) and allows the hooking lever (28) to rotate from the hooking position to the release position ,
- when the hooking lever (28) rotates from the hooking position to the release position, the hooking seat (34) releases the projection (33) and allows the sliding body (10) to slide from the locking position to the release position, actuating the first and the second Bowden cable (13, 13'),
- when the sliding body (10) is displaced by the restore actuator (20) from the release position to the locking position, the projection (33) engages the hooking seat (34) and rotates the hooking lever (28) from the release position to the hooking position,
- when the hooking lever (28) rotates from the release position to the hooking position, the stop spring (39) triggers the stop portion (40) of the trigger (37) in the stop seat (35) of the hooking lever (28) and stops the hooking lever (28) again in the hooking position.

6. An emergency release device (1) according to claim 5, wherein the hooking seat (34) of the hooking lever (28) comprises a first surface (30) and a second opposite surface (31), longer than the first surface (30), which mutually delimit a groove (32), wherein the first surface (30) locks and releases the projection (33) of the sliding body (10), while the second surface (31) intercepts the projection (33) during the return of the sliding body (10) from the release position to the locking position.

7. An emergency release device (1) according to claim 5 or 6, comprising a spring (29), which strains the hooking lever (28) permanently elastically towards the release position.

8. An emergency release device (1) according to claim 5, 6 or 7, comprising a further stop spring (41), which strains the trigger (37), with redundancy with respect to the stop spring (39), permanently towards the stop position.

9. An emergency release device (1) according to claim 5, 6, 7 or 8, wherein the trigger (37) forms a sensing projection (42), which switches an electric microswitch of a release detector (18) between two different switching states, depending on the position of the trigger (37).

10. An emergency release device (1) according to claim 5, 6, 7, 8 or 9, wherein the stop seat (35) of the hooking lever (28) and the stop portion (40) of the trigger (37) are positioned and shaped so that, when the trigger (37) stops in the stop position and the hooking lever (28) stops in the hooking position, a resulting support force (46) between the stop seat (35) and the stop portion (40), generated by the spring device (14), intersects the trigger axis (38) of the trigger (37).

11. An emergency release device (1) according to any one of the preceding claims, wherein the first, second and third Bowden cable (13, 13', 17) can all three be coupled to one same side of the device (1).

12. An emergency release device (1) according to any one of the preceding claims, wherein a telescopic transmission rod (42) is arranged between the sliding body (10) and the electric restore actuator (20), slidingly configurable:

- in a shortened configuration, wherein the transmission rod (42) can transmit an axial compression force from the restore actuator (20) to the sliding body (10) for repositioning the sliding body (10) from the release position to the locking position, and
- in an elongated configuration, starting from which the transmission rod (42) can house the

movement of the sliding body (10) from the locking position to the release position, shortening slidingly without transmitting movements to the restore actuator (20).

13. An emergency release device (1) according to claim 12, wherein the electric restore actuator (20) comprises an electric motor (43) coupled to the telescopic transmission rod (42) by means of an eccentric (45) to make a crankshaft and rod mechanism, of thrust only and without traction phase.

14. An emergency release device (1) according to any one of the preceding claims, comprising a release detector (18) configured to detect the attainment of the release configuration and generate a corresponding electric release signal.

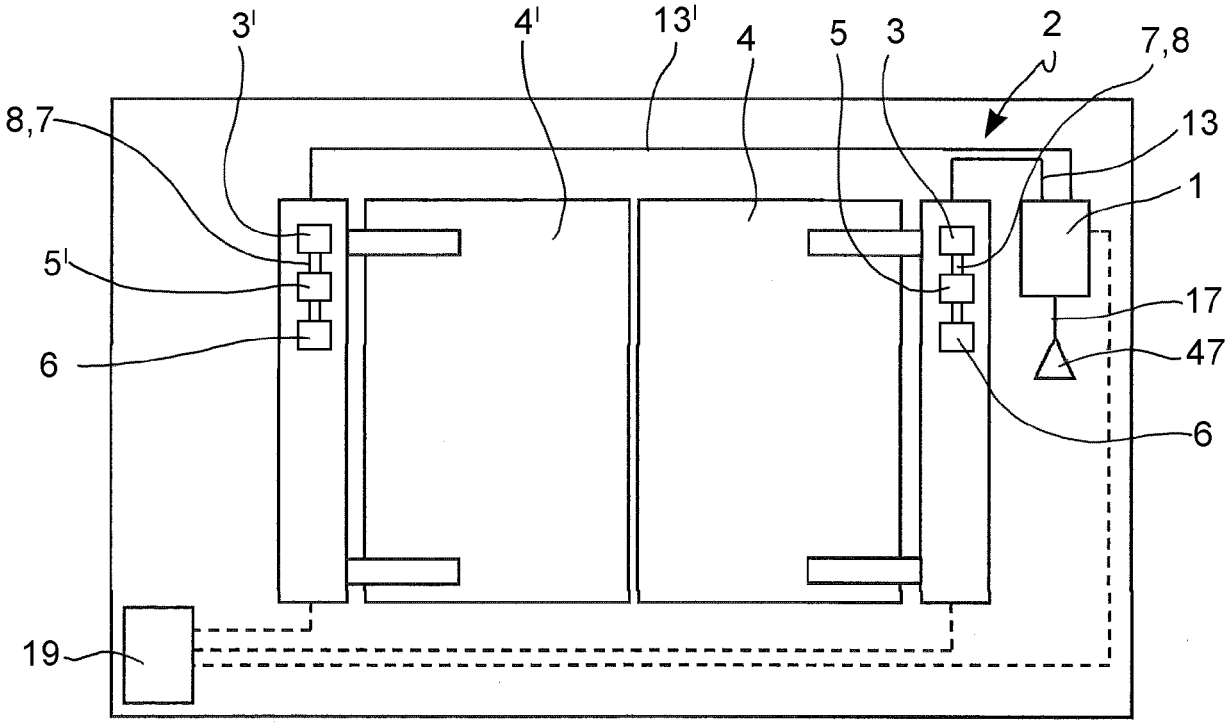

FIG. 1

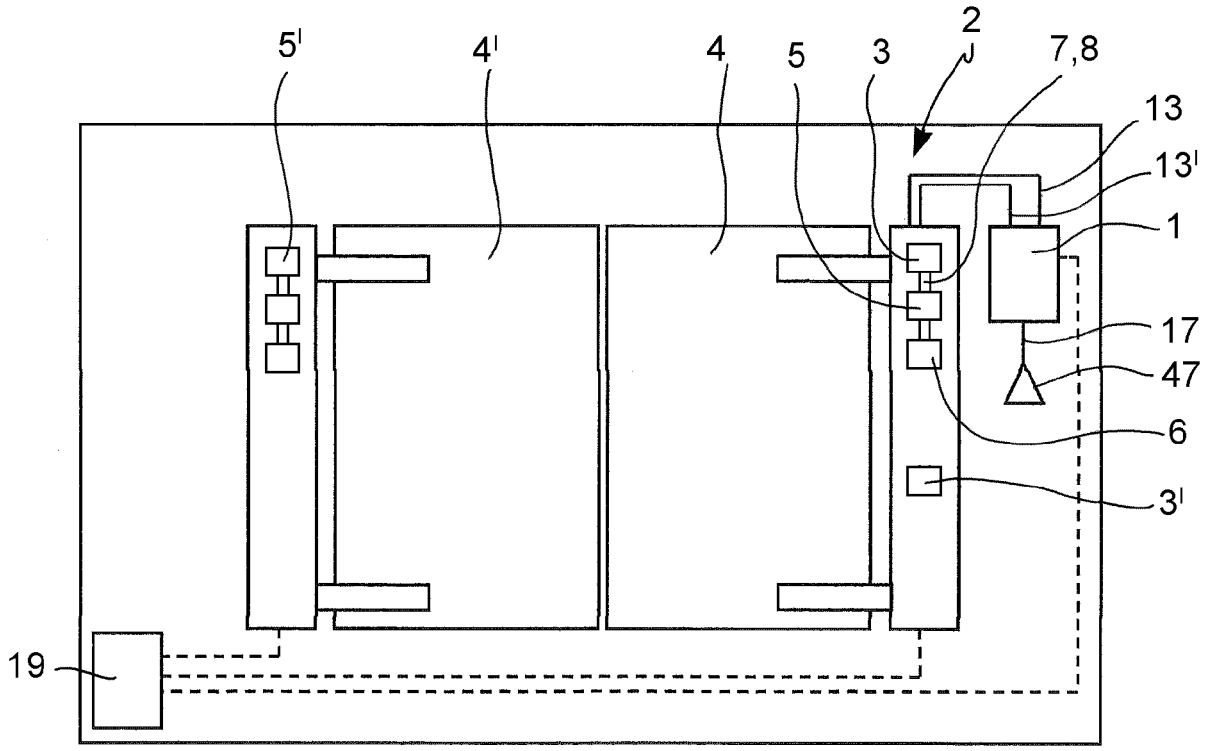

FIG. 2

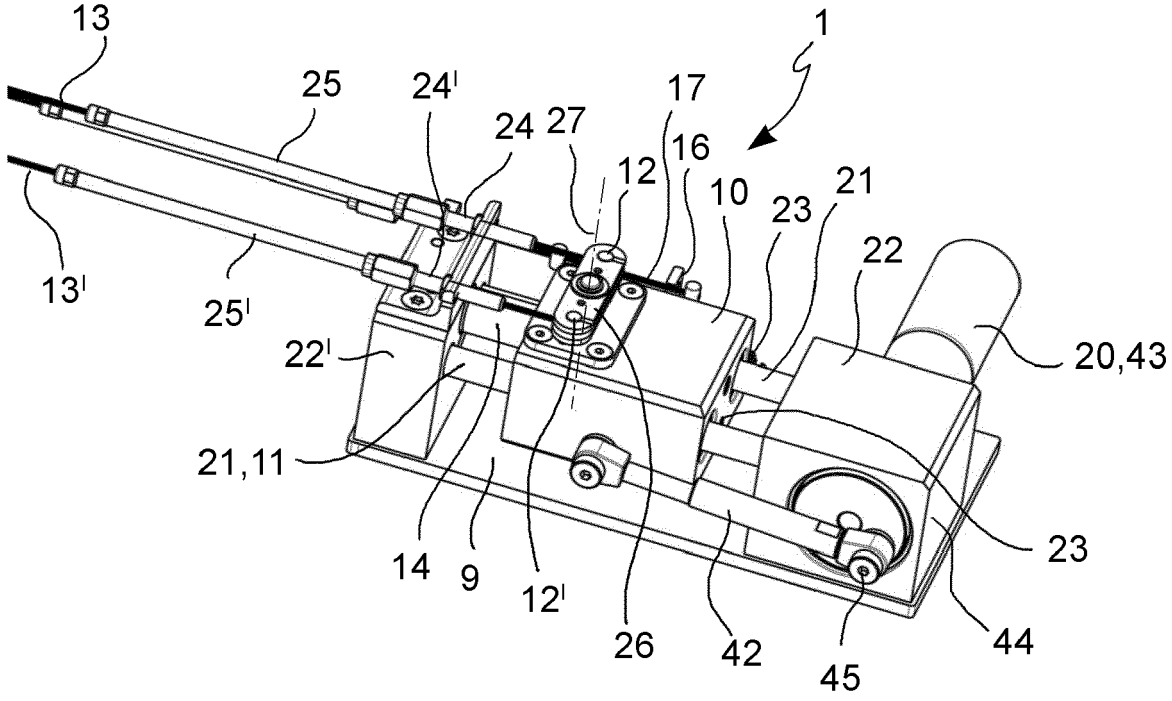
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FIG. 3

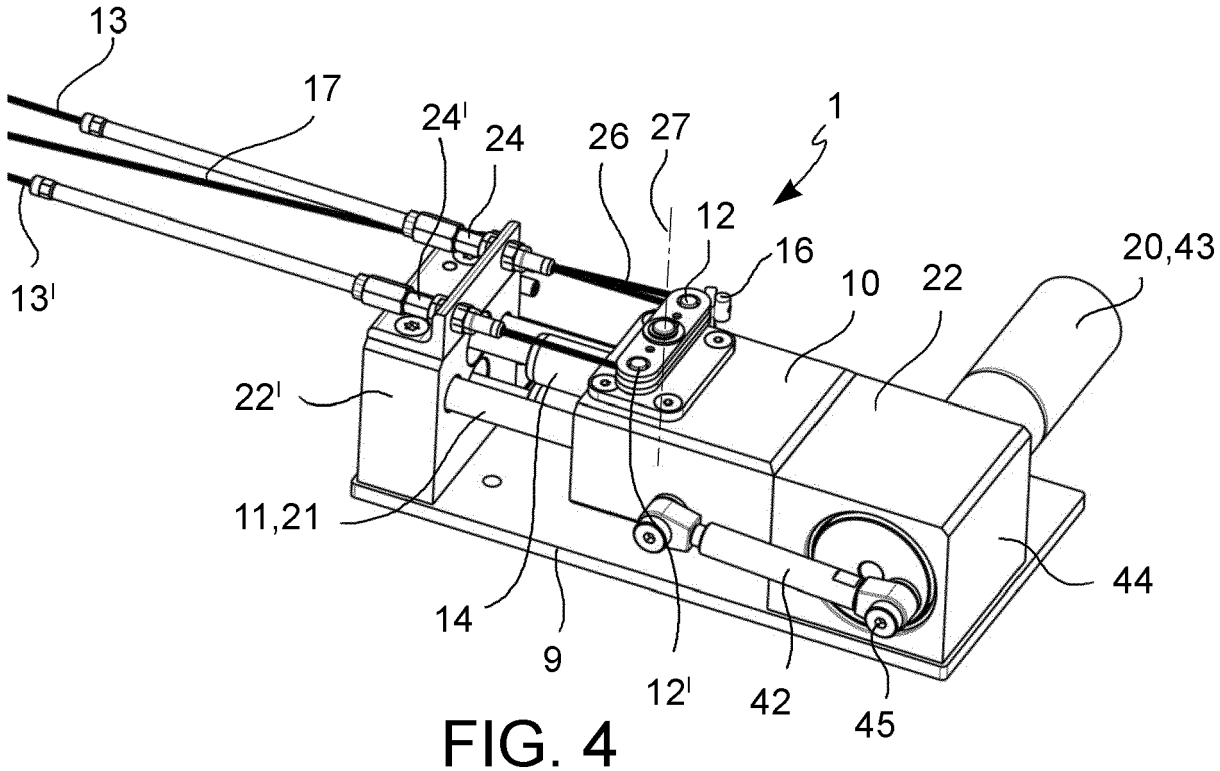
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FIG. 4

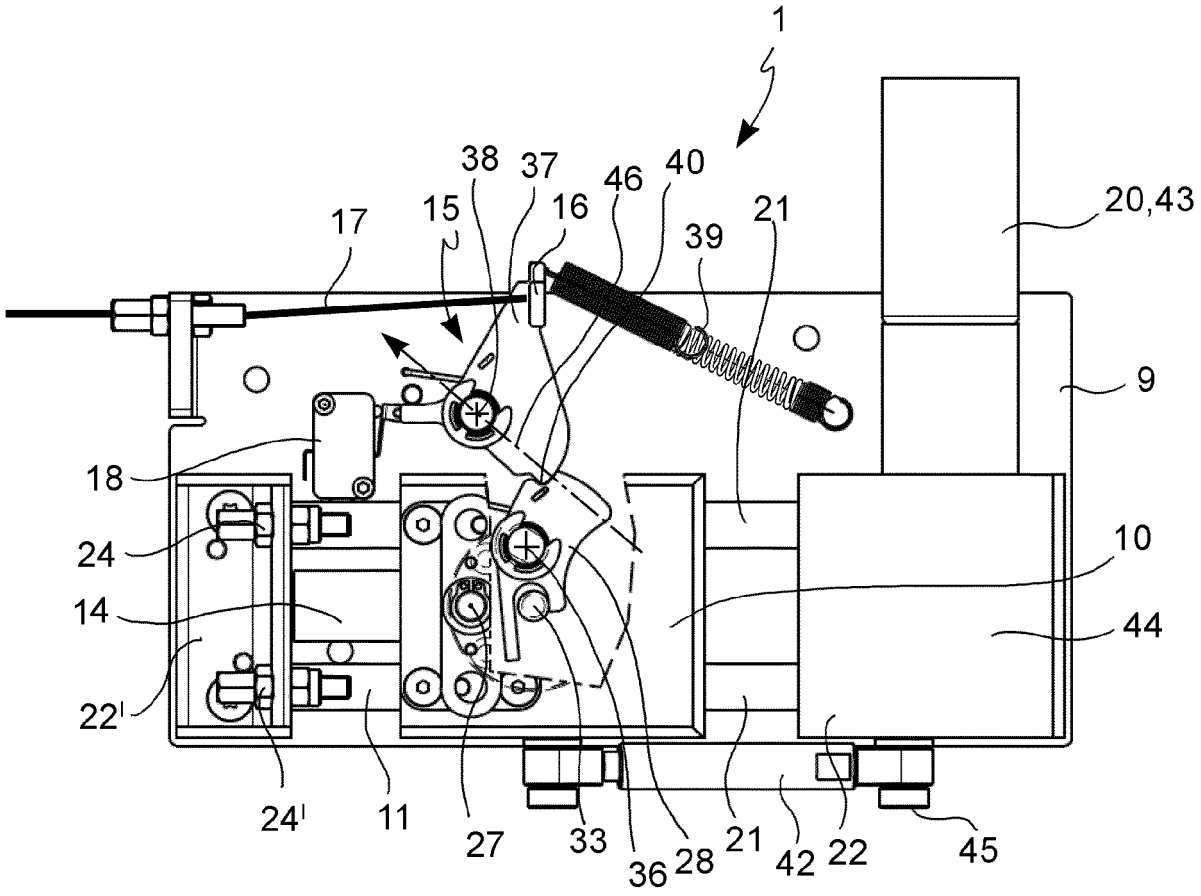
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FIG. 5

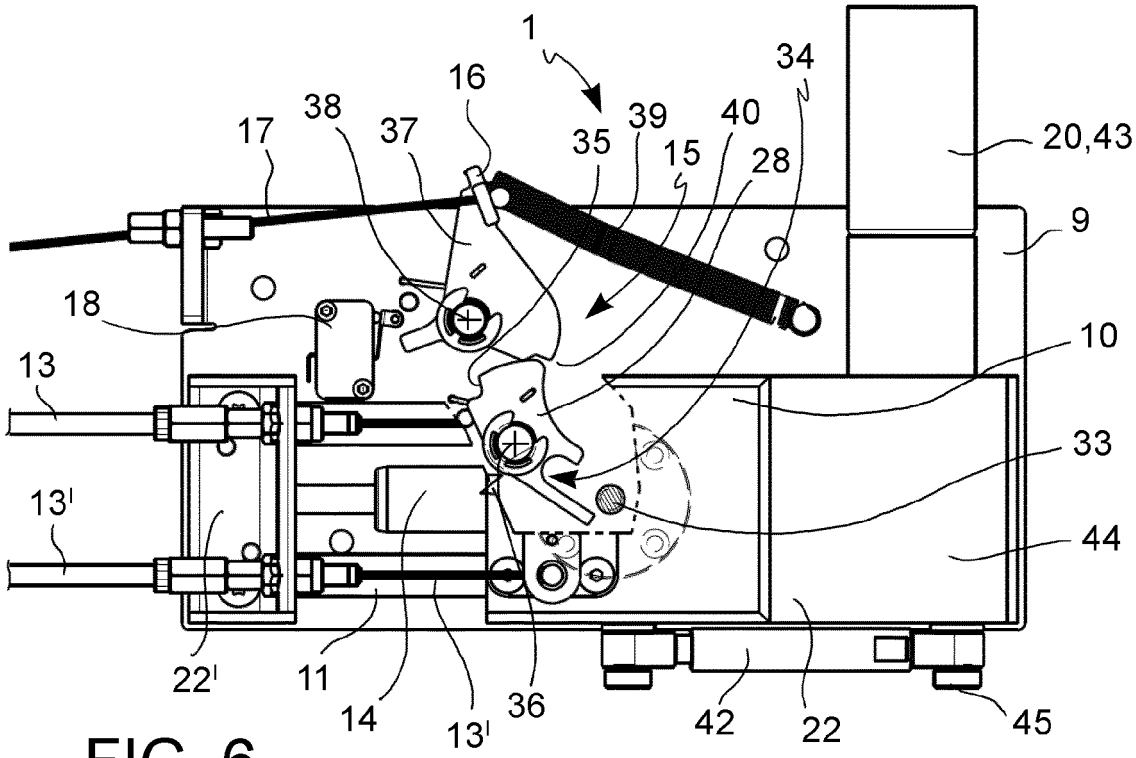
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FIG. 6

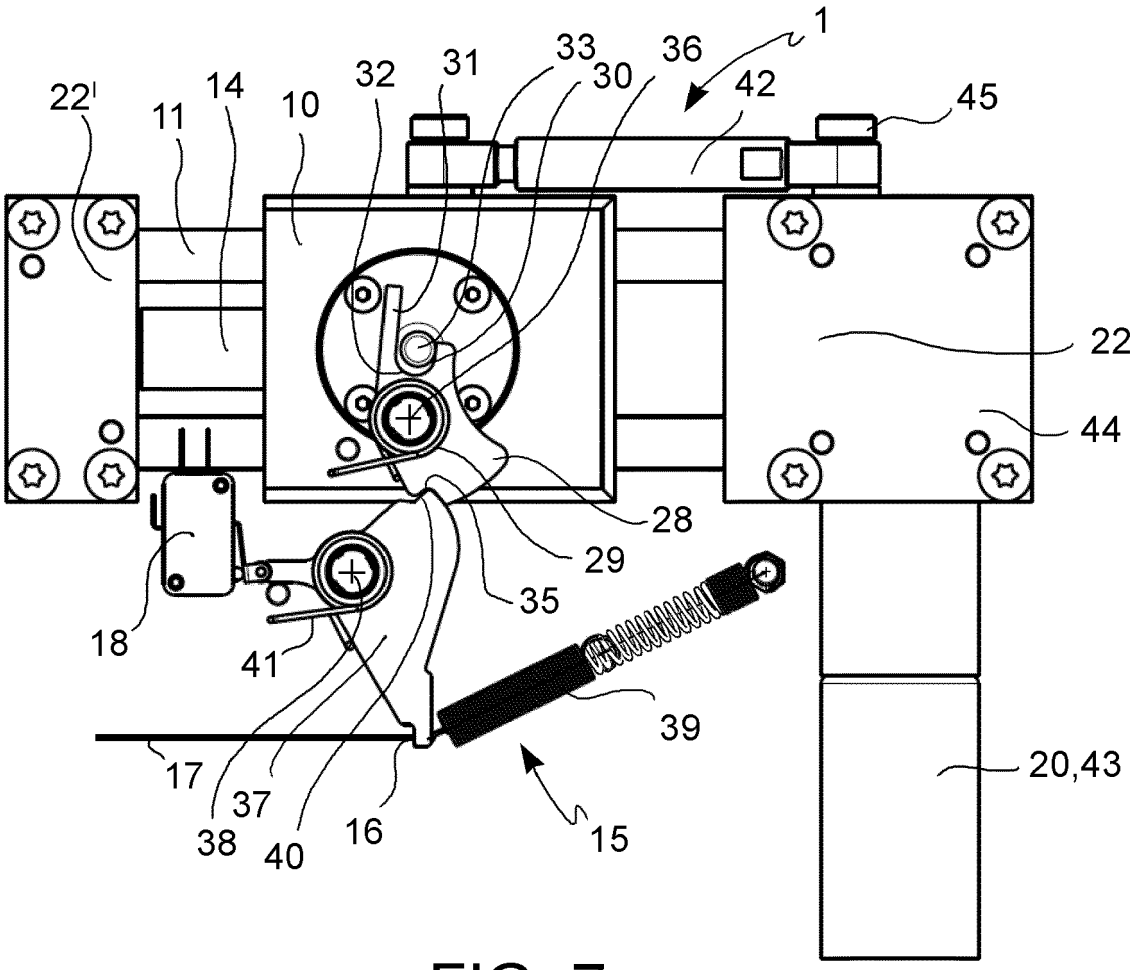

FIG. 7

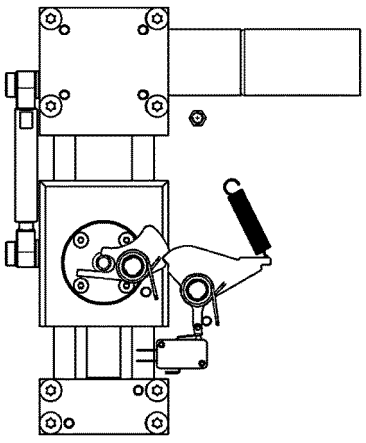

FIG. 10

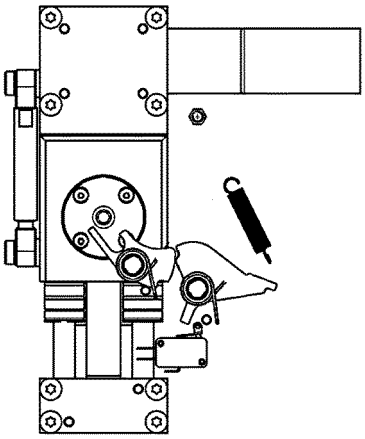

FIG. 11

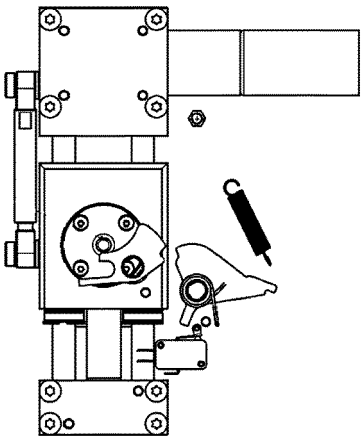

FIG. 12

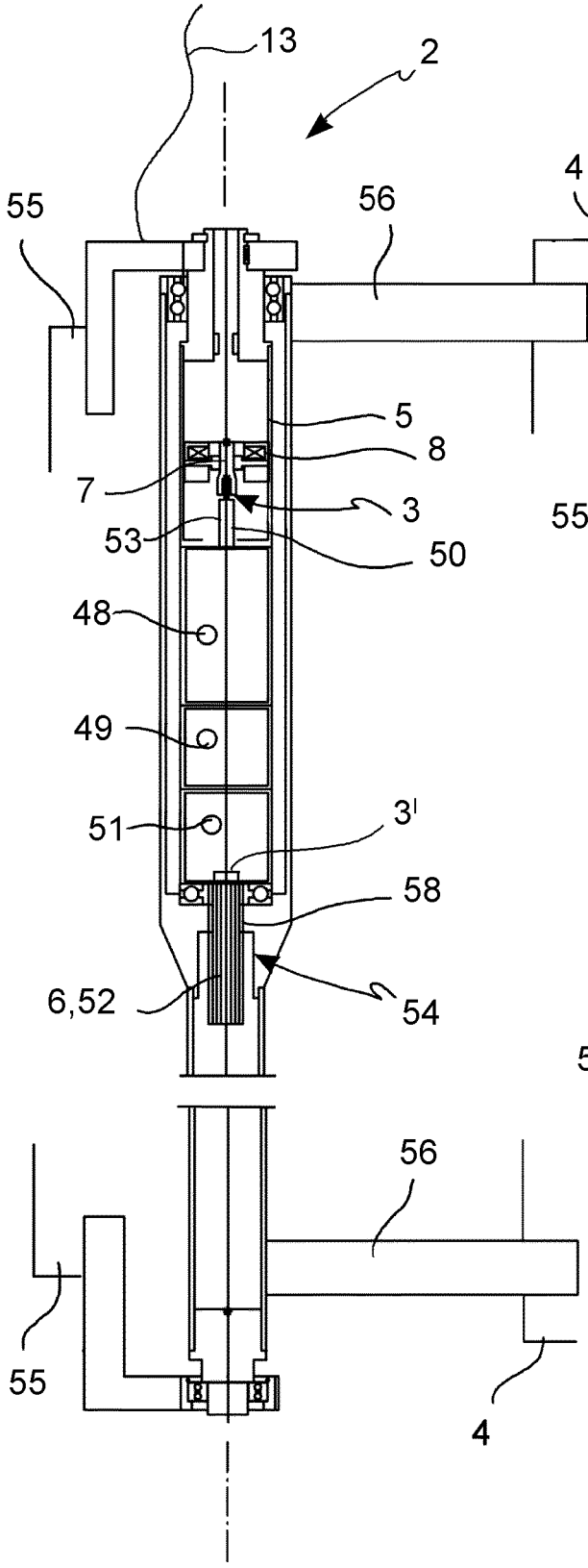
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FIG. 8

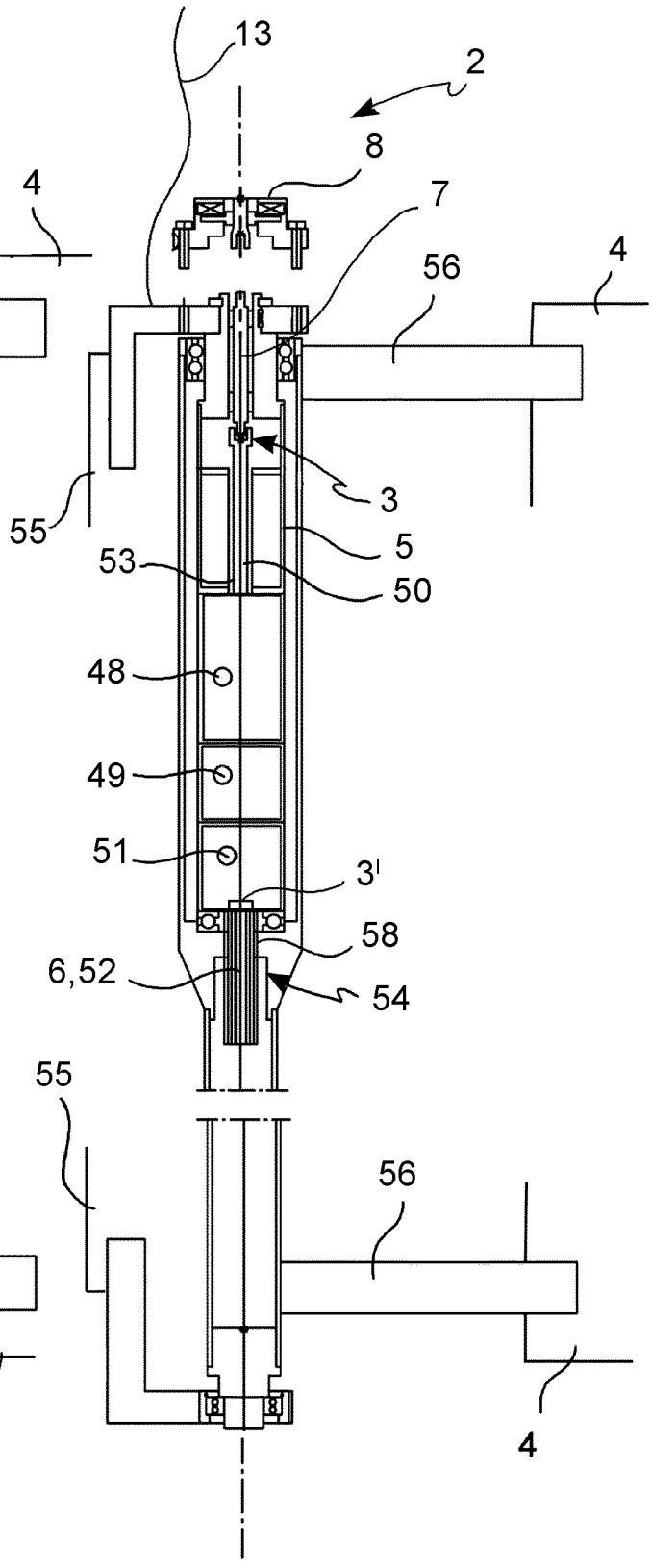
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FIG. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 18 21 5614

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Place of search	Date of completion of the search	Examiner
The Hague	3 June 2019	Witasse-Moreau, C

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