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(54) **A door safety device for a means of public transport.**

(57) This safety device is effective to inhibit opening of a door in case of failure of the pneumatic system; it is primarily useful with so-called inward rototranslation doors wherein each door wing has a top-mounted peg (4,5,103,202,302) guided slindingly in a track (6,104,203,303) overlying the door. The device comprises a checking member (7,8,105,209-210,315) in said track which is movable between a home position whereat it does not interfere with the peg (4,5,103,202,302) and an operative position whereat it holds the peg back; this member (7,8,105,209-210,315) is held at its home position by the pneumatic system against the bias of springs (16,23,120,215,320) in such a manner as to be automatically brought to its operative position on the occurrence of a failure.

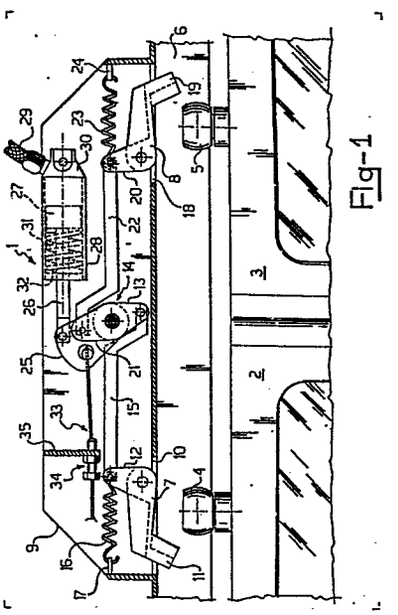

Fig-1

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Description

This invention relates to a safety device for application to a door of a municipal means of public transport, in particular a door of the so-called inward rototranslation type operated by a pneumatic system, wherein a door wing is provided with a top-mounted peg guided for sliding movement in a track overlying the door, said device being effective to inhibit opening of the door in case of failure of the pneumatic system.

Inward rototranslation doors, as recently introduced and valued for their simplicity and tight-fitting ability, usually comprise two door wings which, instead of being pivoted to the vehicle structure, are connected to an upright drive rod, lying adjacent to the door, by upper and lower arms rotatively rigid with the rod and being pivoted to the door wing at a middle region thereof; a peg attached to each door wing close to its edge confronting the other door wing is guided slidingly in a straight track overlying the door.

By means of that peg, the edge of each door wing confronting the other door wing is bound to span the door gap during the door opening and closing movements.

Safety regulations provide for a number of directions and accessory devices to cope with any emergency situations in the most appropriate of ways. In particular, some countries, among which Italy, prescribe that in the event of a malfunction (with attendant pressure drop) in the pneumatic system the doors should remain locked in their closed positions.

The advisability of this prescription has been, and still is, the matter for much arguing because in some (possibly rare but nevertheless not unlikely) cases the vehicle could turn into a deadly trap.

Anyhow, currently in use are safety devices which usually provide direct mechanical locking of the drive rod pneumatic actuation; the locking device is activated each time that the door is closed, and bypassed by the pneumatic system each time that the door is opened. Lacking air pressure, the device is arranged to retain its locked condition and trips to prevent the door from opening under a thrust force applied from the inside.

As may be appreciated, such a locking device is apt to be rather complicated and, above all, liable to breakage failures on account of its being operated each time that the door is opened and closed.

It has been also observed that, due to the peculiar kinematics of an inward rototranslation door, any load applied to a closed door wing is apt to be transferred to the drive rod actuation system, and hence to the locking device, multiplied by several ten times; consequently, it has been found that a relatively moderate force exerted on the door is enough to cause breakage of the locking device.

The complications of prior locking devices, and their being readily liable to fail, constitute a serious obstacle to widespread acceptance of rototranslation doors, in spite of the advantages afforded by the latter being well recognized.

It is an object of this invention to provide a simple and reliable safety device, particularly for an inward rototranslation door, which can ensure locking of the door in the event of a malfunction of the pneumatic system.

This object is achieved, according to the invention, by a safety device as indicated being characterized in that it comprises a checking member in said track adapted to be movable between a home position whereat it does not interfere with the peg and an operative position whereat it holds the peg back, said member being held at its home position by pneumatic means connected in the pneumatic system against the bias of spring means.

Further features and the advantages of a safety device according to the invention will become apparent from the following description of some preferred embodiments thereof, given with reference to the accompanying drawings. In the drawings:

Figure 1 shows a vertical cross-section view through a device according to the invention, incorporating two checking members for the pegs of two door wings, at its home position;

Figure 2 shows a vertical cross-section view of the device of Figure 1, at its operative position;

Figure 3 is a vertical cross-section view of a variation of the inventive device, incorporating a single checking member for one door wing peg, at its operative position;

Figure 4 is a detail view of another variation of the inventive device; and

Figure 5 is a detail view of a further variation of the device according to the invention.

Making now specific reference to Figures 1 and 2, there is depicted a safety device 1 for a two-wing inward rototranslation door, the door wings being only partly visible and designated 2 and 3. Each of the door wings 2 and 3 has a respective top-mounted peg 4 and 5 which is guided slidingly in a single straight track 6 overlying the door wings 2 and 3.

The safety device 1 comprises two checking levers 7 and 8, one for each peg 4 and 5 for which the levers are designed to form checking members. The lever 7 is journalled to a plate 9 (fast with the track 6) at the location of the peg 4 with the wing 2 closed, and is movable through an opening 10 in the track 6 between a home position (see Figure 1) whereat it does not interfere with the peg 4, an,d an operative position (see Figure 2) whereat it holds back the peg 4 by means of a concave arm 11.

An arm 12 of the lever 7 opposed from the arm 11 is connected to an arm 13 of a lay lever 14 (journalled to the plate 9) by a rod 15 which is journalled to both the arm 12 and the arm 13. A spring 16 is stretched between the arm 12 and a ring 17 attached to the plate 9 on the opposed side from the rod 15.

In quite a similar manner, the lever 8 is journalled

to the plate 9 at the location of the peg 5 with the door wing 3 closed, and is movable through an opening 18 in the track 6 between a home position (see Figure 1) and an operative position (see Figure 2) whereat it holds back the peg 5 by means of an arm 19.

An arm 20 of the lever 8, lying opposedly from the arm 19, is connected to an arm 21 of the lay lever 14, lying opposedly from the arm 13, through a rod 22 journalled to both the arm 20 and the arm 21. A spring 23 is stretched between the arm 20 and a ring 24 attached to the plate 9, on the opposed side from the rod 22.

Thus, the levers 7 and 8 are interconnected to be both at all times at either their home or operative positions.

The lay lever 14 is made rotatively rigid with a third arm 25 to which there is connected a rod 26 of a piston 27 arranged to slide sealingly within a cylinder 28 which is permanently supplied with pressurized air through a pipe 29, only partly shown and being connected to a head 30 of the cylinder 28; a spring 31 fits in the cylinder 28 around the rod 26 and is compressed between the piston 27 and a bottom 32 of the cylinder 28.

The arm 25 is also connected, at the remote side from the piston rod 26, to a cable 33 of the so-called Bowden type having an adjustment assembly 34 mounted on a plate 35 fast with the plate 9 and an operating handle (not shown) mounted at an accessible location from the vehicle inside.

The safety device 1 operates as follows.

In normal conditions, that is with the pneumatic system supplying compressed air at the set pressure level, the device 1 is at its home position, shown in Figure 1. In this situation, the compressed air will exert in the cylinder 28 a thrust force effective to overcome the elastic bias of the spring 31 and the springs 16 and 23 (by compressing the former and tensioning the latter). The various arms, levers, and rods take the positions of Figure 1; more specifically, the arms 11 and 19 of the checking levers 7 and 8 are raised and do not interfere with the pegs 4 and 5 in the track 6.

This condition is maintained as long as the proper pressure is maintained within the pneumatic system, irrespective of the door wings 2 and 3 being opened and closed.

Should a malfunction result in an air pressure drop, then the springs 31,16 and 23 will act jointly to bring the device 1 to its operative position, shown in Figure 2. At this position, in particular, the arms 11 and 19 of the checking levers 7 and 8 will hold back the pegs 4 and 5, thus preventing uncontrolled actions by the people in the vehicle (specifically, a pressure on the door wings 2 and 3) from causing the door wings 2 and 3 to open.

Where, by contrast, people in the vehicle wish to deliberately open the door wings 2 and 3 (e.g. in order to leave the vehicle following some accident), they shall merely have to force the door wings 2 and 3 in their normal opening direction, thereby the pegs 4 and 5 exert on the arms 11 and 19 of the levers 7 and 8 a sufficient force to shift said arms against the bias of the springs 31, 16 and 23. Alternatively, it will be always possible to disengage the levers 7 and 8 from the pegs 4 and 5 through the cable 33 by pulling its handle in quite a conventional manner.

Shown in Figure 3 is a simplified variation of the invention which is only suitable for use with a single door wing instead of two. According to this variation, a safety device 101 is shown for a wing 102 of an inward rototranslation door having a peg 103 guided slidingly in a straight track 104.

The device 101 comprises a checking lever 105 journalled to a plate 106 (fast with the track 104) at the location of the peg 103 with the wing 102 closed; the lever 105 is movable, through an opening 107 in the track 104, between a home position whereat it does not interfere with the peg 103, and an operative position (see Figure 3) whereat it holds back the peg 103 by a concave arm 108.

An arm 109 of the lever 105, lying opposedly from the arm 108, is connected to a rod 110 of a piston 111 sealingly slidable within a cylinder 112 which is permanently supplied with pressurized air through a pipe 113 connected to a head 114 of the cylinder 112; a spring 115 fits in the cylinder 112 around the piston rod 110 and is compressed between the piston 111 and a bottom 116 of the cylinder 112.

The arm 109 is also connected, on the opposed side from the rod 110, to a Bowden cable 117 having an adjustment assembly 118 mounted on a small plate 119 fast with the plate 106 and an operating handle (not shown) mounted at an accessible location from the vehicle inside.

A further spring 120 is compressed between the arm 109 and the small plate 119, being coiled around the cable 117.

The operation of the safety device 101 is quite similar to that of the device 1, and accordingly, will not be discussed in detail.

In accordance with another variation of the invention, there is shown in Figure 4 a safety device 201 for a wing (not shown) of an inward rototranslation door having a peg 202 which is guided slidingly in a track 203.

The device 201 comprises a washer 204 which is attached to the peg 202 and formed with an elevation 205.

The device 201 further comprises a cylinder 206 mounted on a plate 207 (fast with the track 203) at the location of the peg 202 with the door wing closed. The cylinder 206 is mounted in a substantially orthogonal position to the track 203, and accommodates a piston 208 slidably in sealed relationship therein which has a piston rod 209 carrying at its free end a small wheel 210 projecting into the track 203 through an opening 211.

The cylinder 206 is of a type having a closed head 212 and a sealed bottom 213 through which there opens a compressed air supply pipe 214; a spring 215 is compressed between the piston 208 and the head 212.

The piston rod 209 with the wheel 210 forms a checking member for the peg 202 and is movable between a home position whereat it does not interfere with the peg 202 and an operating position (see Figure 4) whereat it holds back the peg 202 by

virtue of the wheel 210 becoming engaged with the elevation 205 on the washer 204.

The operation of the device 201 is similar to that of the devices 1 and 101. The peg 202 holding action is provided by the piston rod 209, small wheel 210, and elevation 205 on the washer 204. Also in this variation, in an emergency situation, the locked door may be opened by forcing it in its normal opening direction, that is by having the wheel 210 move over and past the elevation 205 and compressing the spring 215.

In a further variation of this invention, as shown in Figure 5, a safety device 301 for a door wing (not shown) of an inward rototranslation door having a peg 302 guided slidingly in a track 303 is provided.

The device 301 comprises a washer 304 which is attached to the peg 302 and has a top surface including a flat sunk portion 305 and a flat raised portion 306 which are interconnected by an obliquely lying portion 307.

The device 301 also comprises a cylinder 308 mounted on a bracket 309 which is associated adjustably with a plate 310 made fast with the track 303; the bracket 309 is attached to the plate 310 by means of a pin 311 and a bolt 312 passed through a slot in the bracket 309. The cylinder 308 accommodates, in sealed sliding relationship therein, a piston 314 having a piston rod 315 jutting into the track 303 through an opening 316 located at the same location as the peg 302 with the door wing closed.

The cylinder 308 is of a type which has a closed head 317 and a sealed bottom 318 through which there opens a compressed air supply pipe 319; a spring 320 is compressed between the piston 314 and the head 317.

The piston rod 315 forms a checking member for the peg 302 and is movable between a home position whereat it does not interfere with the peg 302 and an operating position (see Figure 5) whereat it will hold the peg 302 back by engaging with the oblique portion 307 of the washer 304.

The safety device 301 operates in quite a similar manner to that of the device 201, with the difference that, in the absence of a wheel on the piston rod, provision is made for adjusting the inclined setting of the cylinder 308 during the assembling step of the device 301 in order to ensure best engagement of the piston rod 315 with the washer 304.

As may be appreciated from the foregoing description, a safety device according to this invention can fully achieve its set objective: in fact, the reliability of such a device would be ensured by both its simple mechanics and the fact that it is only activated where required and not each time that the door is closed.

Moreover, this safety device goes a step further than lawful provisions by enabling (in a simple way) a door locked because of a compressed air outage to be opened in emergency situations.

Claims

A door safety device for a municipal means of public transport, in particular for use with doors of the so-called inward rototranslation type operated by a pneumatic system, wherein a door wing (2,3,102) is provided with a top-mounted peg (4,5,103,202,302) guided for sliding movement in a track (6,104,203,303) overlying the door, said device being effective to inhibit opening of the door in case of failure of the pneumatic system, charactyerized in that it comprises a checking member (7,8,105,209-210,315) in said track (6,104,203,303) adapted to be movable between a home position whereat it does not interfere with said peg (4,5,103,202,302) and an operative position whereat it holds back said peg (4,5,103,202,302), said member (7,8,105,209-210,315) being held at its home position by pneumatic means (27,28,111,112,206,308) connected in the pneumatic system against the bias of spring means (16,23,120, 215,320).

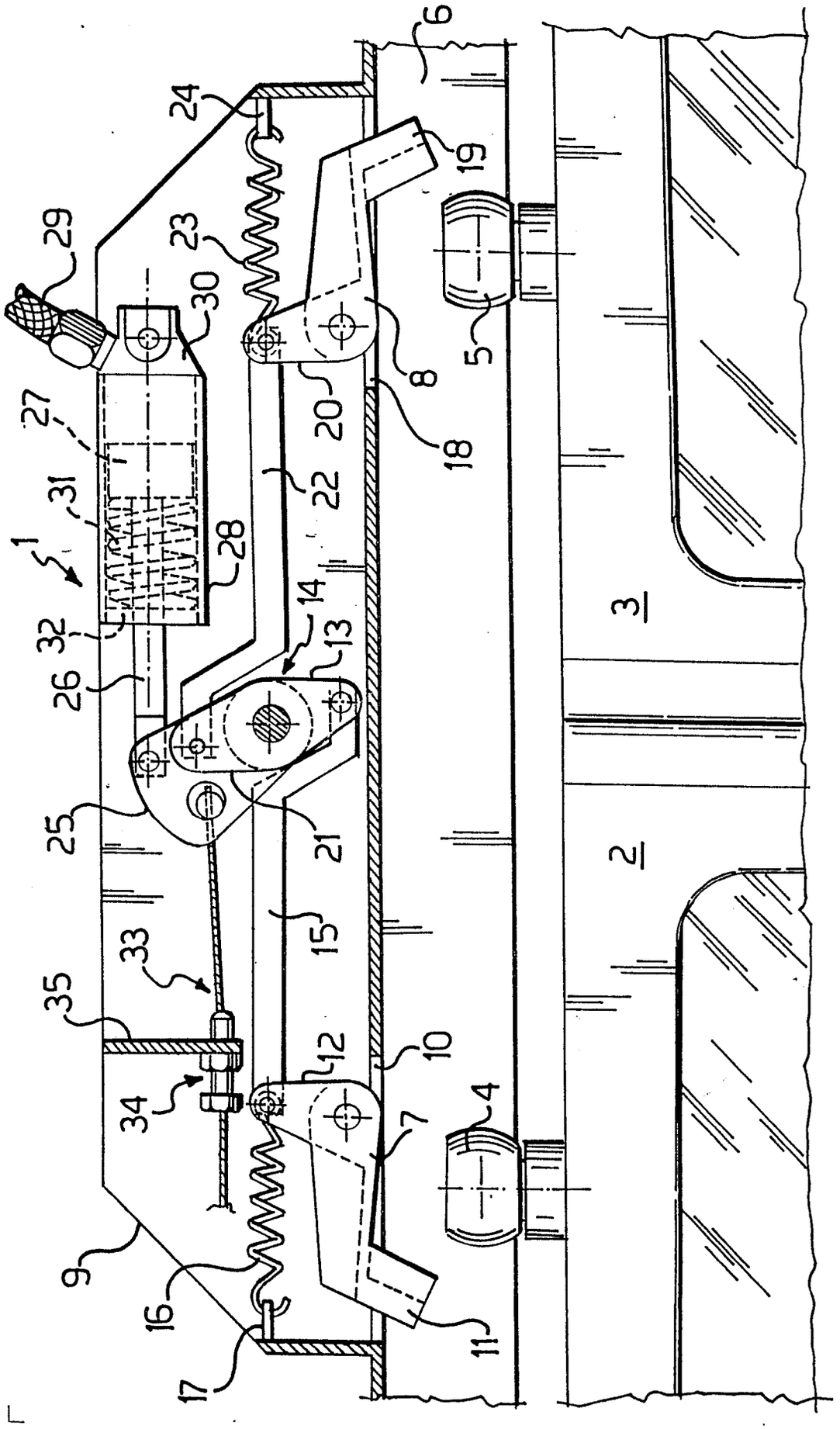
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Fig-1

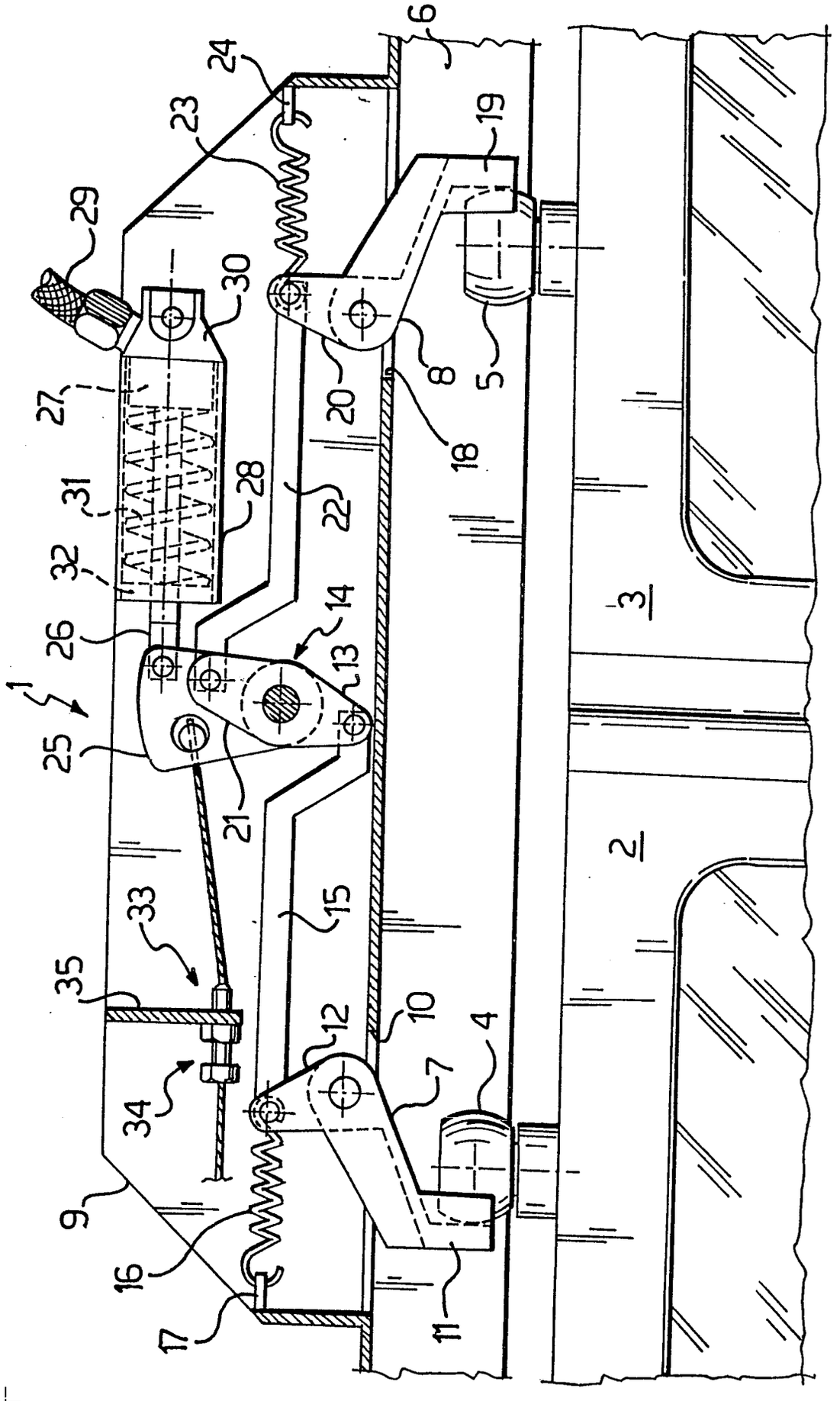
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Fig-2

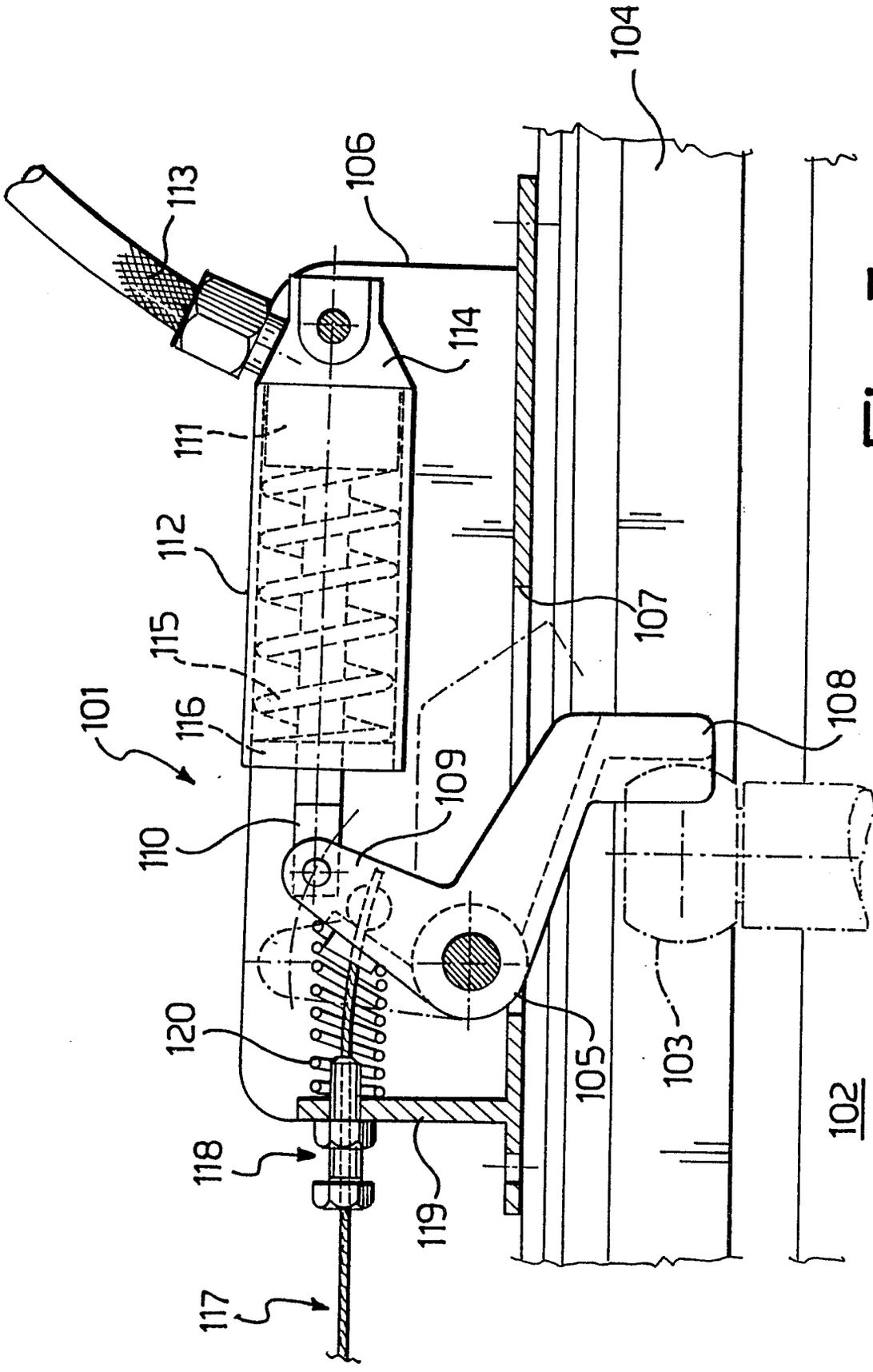
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Fig-3

Fig-4

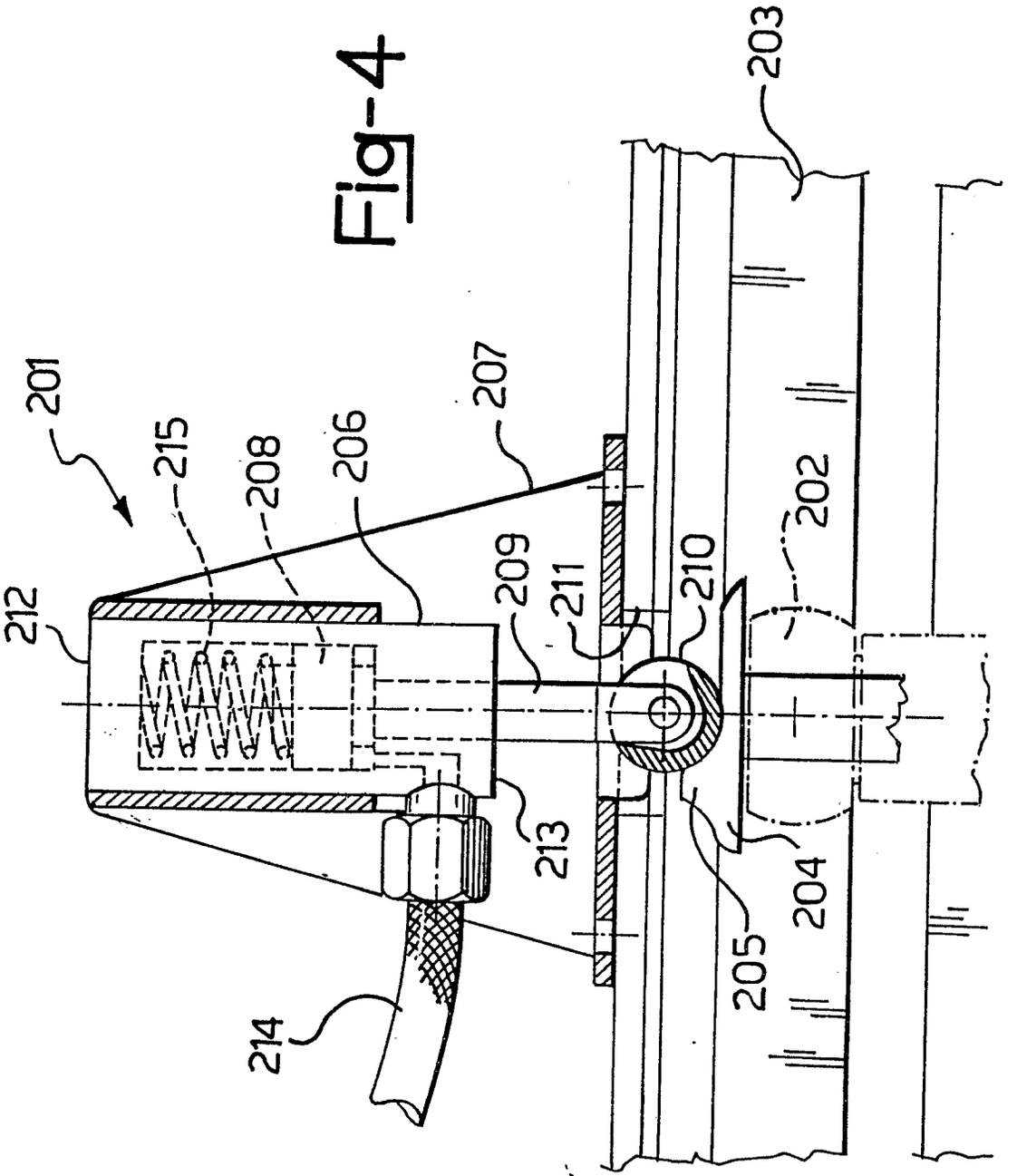
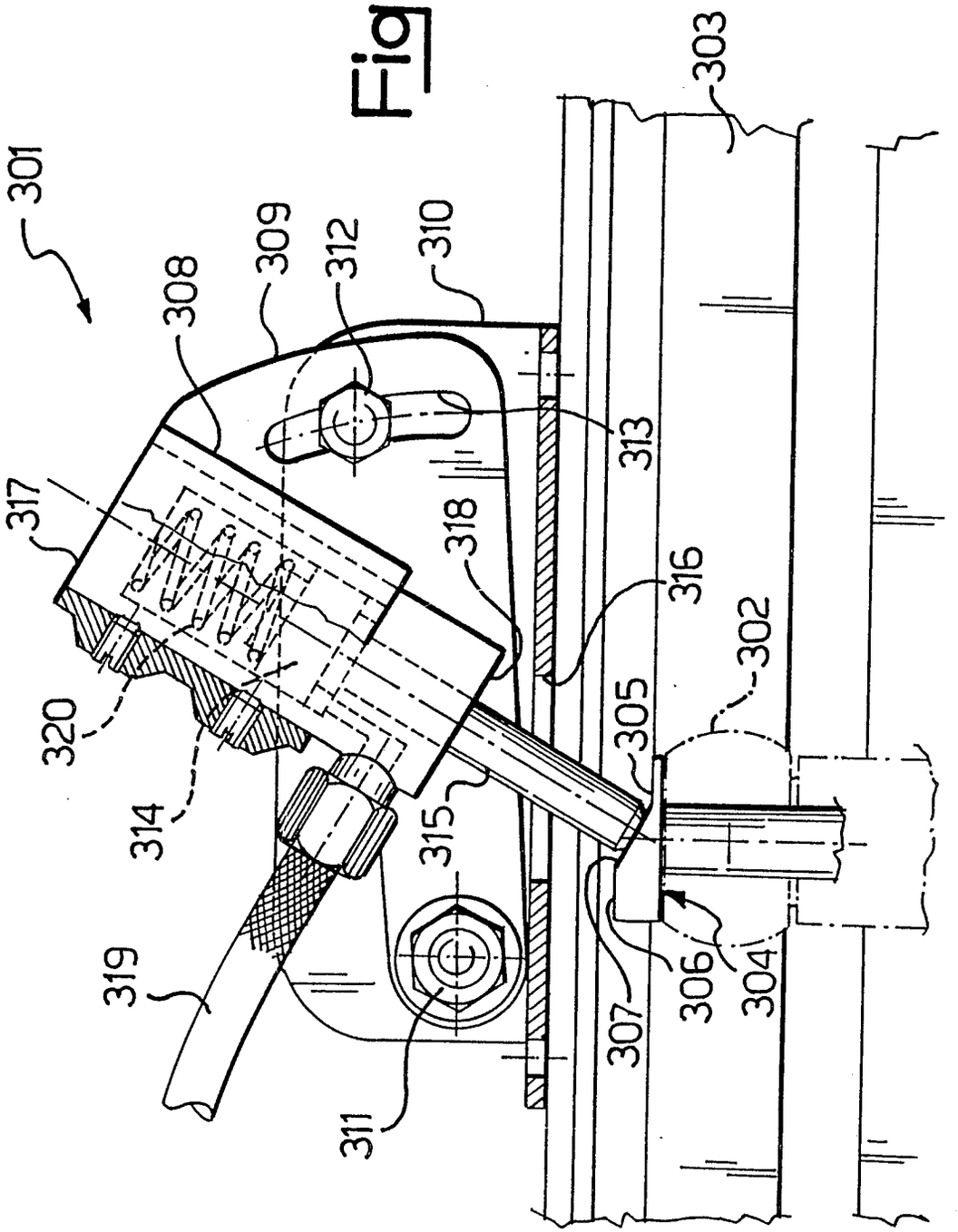


Fig-5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