(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 242 339**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87830144.9**

(22) Date of filing: **13.04.87**

(51) Int. Cl.⁴: **E 05 F 15/00**

(30) Priority: **15.04.86 IT 2008986**

(43) Date of publication of application: **21.10.87 Bulletin 87/43**

(84) Designated Contracting States: **AT BE CH DE ES FR GB GR LI LU NL SE**

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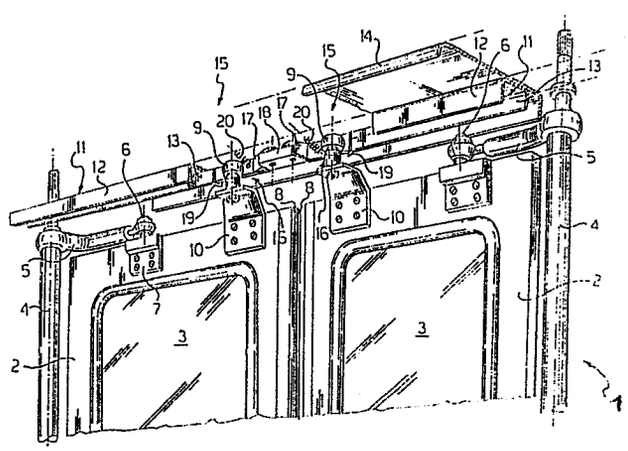
(54) A door safety device for a means of public transport.

(57) This safety device is intended to inhibit a door of a means of public transport from being opened while it is subjected to a thrust force directed from the inside out. The device is particularly useful with so-called inward rototranslation doors wherein each door wing (2) has a top-mounted peg (9) guided slidingly in a track (11) overlying the door, and comprises a section (16) of said track adapted to yield in an outward direction, located at the peg (9) with the door wing (2) in the closed condition. Thus, if the door wing (2) is thrusted upon, the peg (9) can be taken out of its track (11) and prevented from sliding, thereby the door cannot be opened.



EP 0 242 339 A2

DESCRIPTION

This invention relates to a safety device effective to inhibit opening of a door on a municipal means of transport under thrust forces acting in an inside-out direction and being specifically intended for application to a door of the so-called inward rototranslation type wherein a door wing has a top-mounted peg guided for sliding movement in a track overlying the door.

The doors of buses and the like means of public transport are operated in any of several different ways conforming with applicable transport requirements and regulatory bodies.

In particular with urban and suburban transport means, two door types are currently in use, namely the so-called folding door (for outward and inward opening) and inward rototranslation door.

Folding doors, which have long been known and utilized, usually comprise four door wings each. The two side wings are pivoted to the structure of the vehicle at their outer edges and driven rotatively by an air-operable actuator. The two middle wings are instead individually pivoted to an adjoining one of the door side wings and dragged operatively thereby; a peg provided mounted on the middle wing, close to its free edge (i.e.

the edge confronting the other middle wing), is guided slidingly in a straight track overlying the door. By virtue of this peg, the free edge of each middle wing is bound to span the door gap during its opening and closing movements.

Inward rototranslation doors, as more recently introduced and generally preferred on account of their being simpler and tighter fitting, usually comprise two wings which are unconnected pivotally to the vehicle structure and connected instead to an upright drive rod lying adjacently the door through the intermediary of upper and lower arms which are rotatively rigid with the rod and connected pivotally 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.

It is by virtue of this peg that the edge of each door wing confronting the other door wing is bound to span the door gap during its opening and closing movements.

Safety regulations provide, inter alia, for the door to be restrained against opening when subjected to a thrust by the passengers from the inside out; this to avoid that passengers on an overcrowded bus may fall outwards.

As may be appreciated, outward opening folding doors have a kinematics whereby an outwardly directed thrust force will result in the door being opened; due to difficulties in providing such doors with opening-opposing features, the latter door type has been virtually abandoned.

By contrast, the kinematics of inward opening folding doors is such that a thrust force acting from the inside out is apt to hinder opening of the door, thereby no special provisions become

necessary in order to meet the aforementioned safety regulations.

Inward rototranslation doors have kinematics whereby a thrust force applied in the outward direction-may cause the door to open; accordingly, such doors can only be used on condition that they are provided with a suitable safety device of some sort.

Most of the safety devices currently employed are embodied by a mechanical lock which acts directly on the pneumatic actuation system for the drive rod; the lock is operated electromagnetically, but more frequently pneumatically, each time that the door is closed, and is arranged to trip on in the event of an outward thrust force acting on the door to inhibit operation of the drive rod. The lock is also arranged to be in a locked condition while at rest, and require application of (either electric or pneumatic) power to bring it to a released condition; this in order to ensure that the door locking device will retain its effectiveness even in the event of the vehicle ancillary systems going out of order.

It may be appreciated that such locking devices are fairly complex and liable to failures as a result of their being operated each time that the door is opened and closed.

The complexity is such as to constitute a serious obstacle to widespread application of rototranslation doors, in spite of the advantages afforded by the latter over folding doors being universally recognized.

It is an object of this invention to provide a safety device for an inward rototranslation door, which is simple and can ensure locking of the door when thrusted upon from the inside out.

This object is achieved, in accordance with the invention, by a safety device as indicated being characterized in that it comprises an outwardly yielding track section, located at the peg with the door in the closed condition.

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

Figure 1 is a partly cutaway perspective interior view of the top portion of an inward rototranslation type door incorporating a safety device according to this invention;

Figure 2 is a plant view diagram of the movement of a wing of the door shown in Figure 1;

Figures 3 and 4 are sectional plan views of the safety device of Figure 1, respectively shown in its normal operating and wing outward thrust conditions;

Figures 5 and 6 are a plan view and cross-sectional view, respectively, of a further modified embodiment of the safety device shown in Figure 3, in the normal operating condition thereof; and

Figure 7 is a plan view of a further modified embodiment of the safety device shown in Figure 3.

In the drawing figures, the reference numeral 1 denotes generally a door of the so-called inward rototranslation type particularly intended for use on an urban or suburban means of public transport, such as a bus, tramcar or trolley bus.

The door 1 comprises two side-by-side door wings 2. The two door wings 2 are symmetrical about their mating line and provided with ancillary members which are also symmetrical and symmetrically

positioned; accordingly, reference will be made in the ensuing description to just one of the door wings 2, it being understood that like considerations would apply symmetrically to the other of the door wings. In the drawings, corresponding items of the two door wings carry the same reference numerals.

The door wing 2, which is glazed as at 3, is linked to a drive rod 4 by means of an upper arm 5 and a lower arm (not shown in the drawings).

The arm 5 is connected, at one end, rigidly to the rod 4 for rotation therewith, and at the other end is mounted pivotally on a pin 6 carried by a bracket 7 attached to the door wing 2. The lower arm, not shown, is attached in quite a similar manner to the rod 4 and the wing 2.

The door wing 2 is also provided, at a location close to its edge 8 confronting the other door wing 2, with a peg 9 mounted on a bracket 10 affixed to the wing 2 and jutting out upwardly therefrom. The peg 9 is guided slidingly along a straight track 11 overlying the door 1.

The track 11 has a substantially inverted U-like cross-sectional shape including two vertical walls 12 and 13 which lie parallel to each other and are oppositely located to face the interior and exterior, respectively, and is secured below an eave 14 mùade fast with the structure (not shown) of the vehicle.

The door 1 incorporates two safetry devices, both comprehensively designated 15, one for each door wing 2.

The safety device 15 comprises a section 16 of the track 11 which is designed to yield in an outward direction. Along said section 16, the wall 13 of the track 11 is discontinued and

replaced with a lever 17 journalled to the track 11 with the intermediary of a bracket 18 (common to both door wings 2) which is fast with the track 11.

The lever 17 is movable between a first position whereat it is substantially aligned to the wall 13 (normal operating position), and a second position whereat it is shifted outwards (on a thrust force being applied to the wing 2 from the inside out). Such positions would be defined by conventional travel limit detents, not shown in the drawings.

The wall 13 carries, at the location of the lever 17, an abutment surface or shoulder 19 facing outwards.

Making now specific reference to Figures 3 and 4, the safety device 15 comprises a spring 20 stretched between the wall 12 and the lever 17, within the track 11 itself but at such a location as not to interfere with the peg 9. The spring 20 is selected to have appropriate elastic characteristics to allow the lever 17 to be shifted outwardly as the thrust force exerted on the wing 2 reaching a set danger value. Thus, the peg 9 would be taken out of the track 11 against the shoulder 19, and any action tending to open the door 1 can effectively result in no movement of the wing 2 being thrusted upon.

On removal of the thrust force acting on the wing 2, the lever 17 will return to its normal operating position, thus restoring the track 11 to its continuous character and enabling opening of the door wing 2.

Figures 5 and 6 show, as a variation of the safety device 15, a safety device 15a; all the detail items of the device 15a which correspond to items already described in connection with the device 15 are designated by the same reference numerals and

no further described herein.

The safety device 15a comprises a spring 21 overlying the eave 14, being stretched between a peg 22 fast with the eave 14 and a peg 23 fast with the lever 17 and led through an opening 24 in the eave 14. A microswitch 25, mounted on the eave 14, is operated by a small arm 26 attached to the peg 23. The spring 21 has quite similar elastic characteristics to those of the spring 20 in the device 15.

With the lever 17 shifted outwards by the thrust force acting on the wing 2, the microswitch 25 will complete an electric circuit (not shown), which results in the vehicle driver being warned of a locked door situation, e.g. by a light indicator on the dashboard panel being turned on. This will enable the driver to immediately detect a situation of piotential danger or at least irregular.

Shown in Figure 7 as a further variation of the safety device 15 is a safety device 15b. Here too, corresponding items to the items already discussed in connection with the safety device 15 are denoted with like reference numerals and no further described herein.

The safety device 15b comprises a cylinder-piston unit 27 having a body 28 attached rigidly to the eave 14 and a piston rod 29 connected, via a small connecting rod 30, to a peg 31 which is made fast with the lever 17 and passed through an opening 32 in the eave 14.

A fitting 33 formed on the body 28 of the cylinder-piston unit 27 is connected to the pressurized air system of the vehicle, such that the air pressure will hold the piston rod 29 in a retracted attitude; consequently, the lever 17 will be in

its normal operating position and is shifted on the thrust force against the door wing 2 overcoming the pressure from the air in the cylinder-piston unit 27. A spring 34 mounted within the cylinder-piston unit 27 is effective to shift the lever 17 (irrespective of whether a thrust force is being applied to the door wing 2) in case failure of the pressurized air system results in the pressure within the cylinder-piston unit 27 being released.

As may be appreciated from the foregoing description, a device according to this invention can fully achieve the object set forth. In fact, this device affords both nearly absolute reliability in operation, and simple construction and straightforward operation ensuring long life and reliability. In this respect, it should be noted that, unlike any of comparable prior devices, the safety device of this invention remains deactivated during normal operation of the door, and only becomes operative where required.

Of course, a skilled person in the art may introduce many modifications to the device described hereinabove without departing, however, from the protection scope as defined in the appended claims.

CLAIMS

1. A safety device effective to inhibit opening of a door on a municipal means of transport under thrust forces acting in an inside-out direction, and specifically intended for application to a door of the so-called inward rototranslation type wherein a door wing (2) has a top-mounted peg (9) guided for sliding movement in a track (11) overlying the door, characterized in that it comprises an outwardly yielding track (11) section (16) located at said peg (9) with the door wing in the closed condition.

2. A safety device according to Claim 1, characterized in that said track (11) has a substantially U-like cross-section shape with two parallel walls (12,13) facing the one outwards and the other inwards, said outwardly facing wall (13) being discontinued at said yielding section (16) and replaced with a lever (17) journalled to said track and being movable between a first position whereat it is substantially aligned to said wall (13) of said track facing outwards and a second position whereat it is shifted outwards.

3. A safety device according to Claim 2, characterized in that said outwardly facing wall (13) of said track (11) has an abutment surface (19) facing outwards.

4. A safety device according to Claim 3, characterized in that it comprises a spring (20,21) arranged to act on said lever (17) such as to hold it elastically at said first position.

5. A safety device according to Claim 3, characterized in that it comprises a cylinder-piston unit (27) supplied with pressurized air and arranged to act on said lever (17) to hold it yieldingly at said first position.

6. A safety device according to Claim 5, characterized in that within said cylinder-piston unit there is mounted a spring (34) effective to shift said lever to said second position on a pressurized air outage.

7. A safety device according to Claims 4, 5 or 6, characterized in that it comprises a microswitch (25) linked operatively to said lever (17) so as to sense the position of said lever (17).

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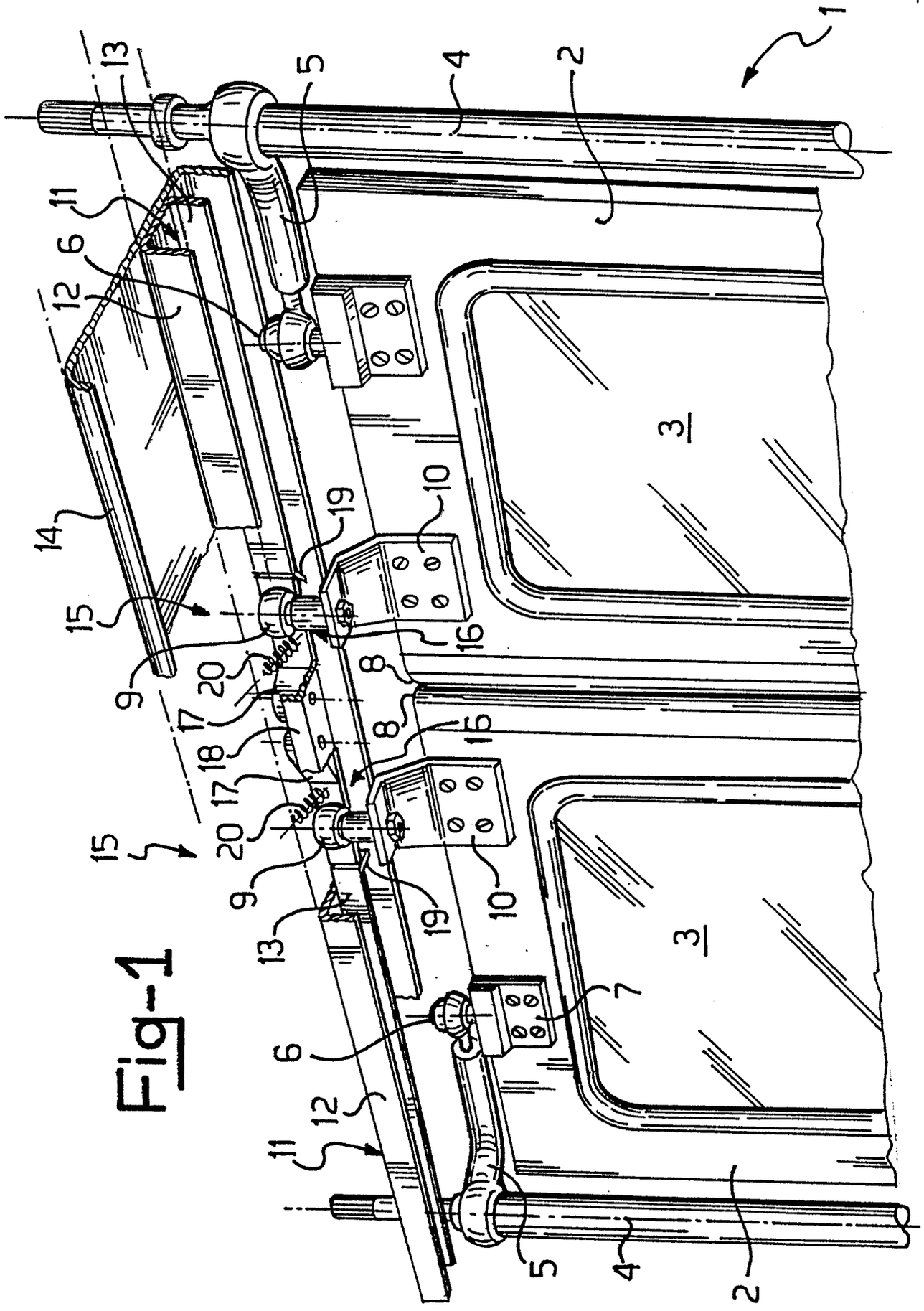

Fig-1

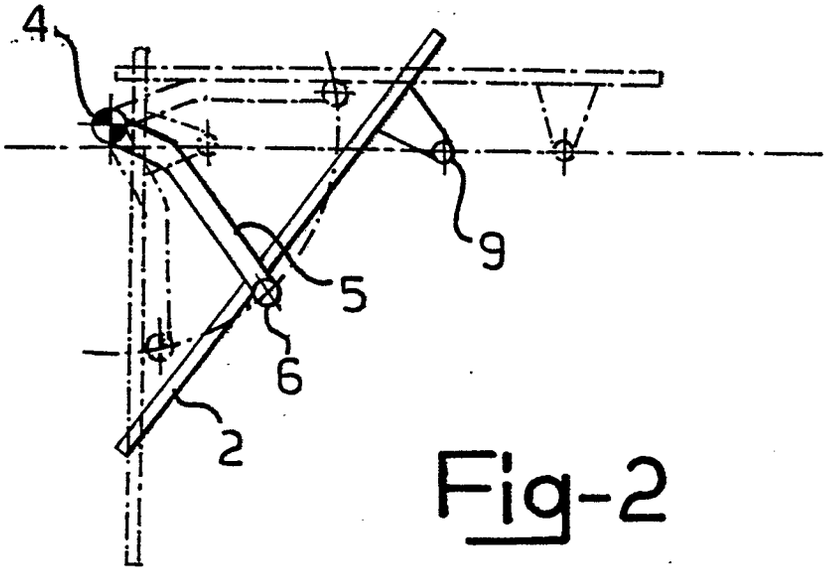

Fig-2

Fig-7

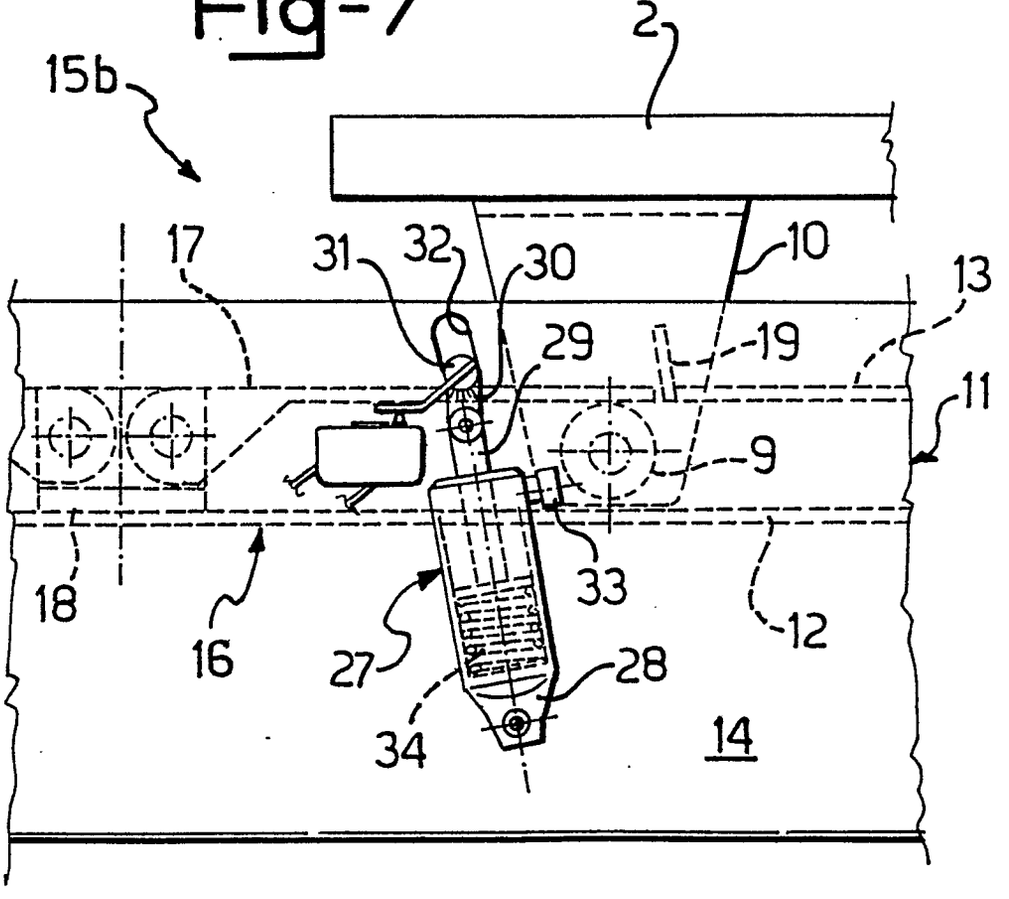

Fig-3

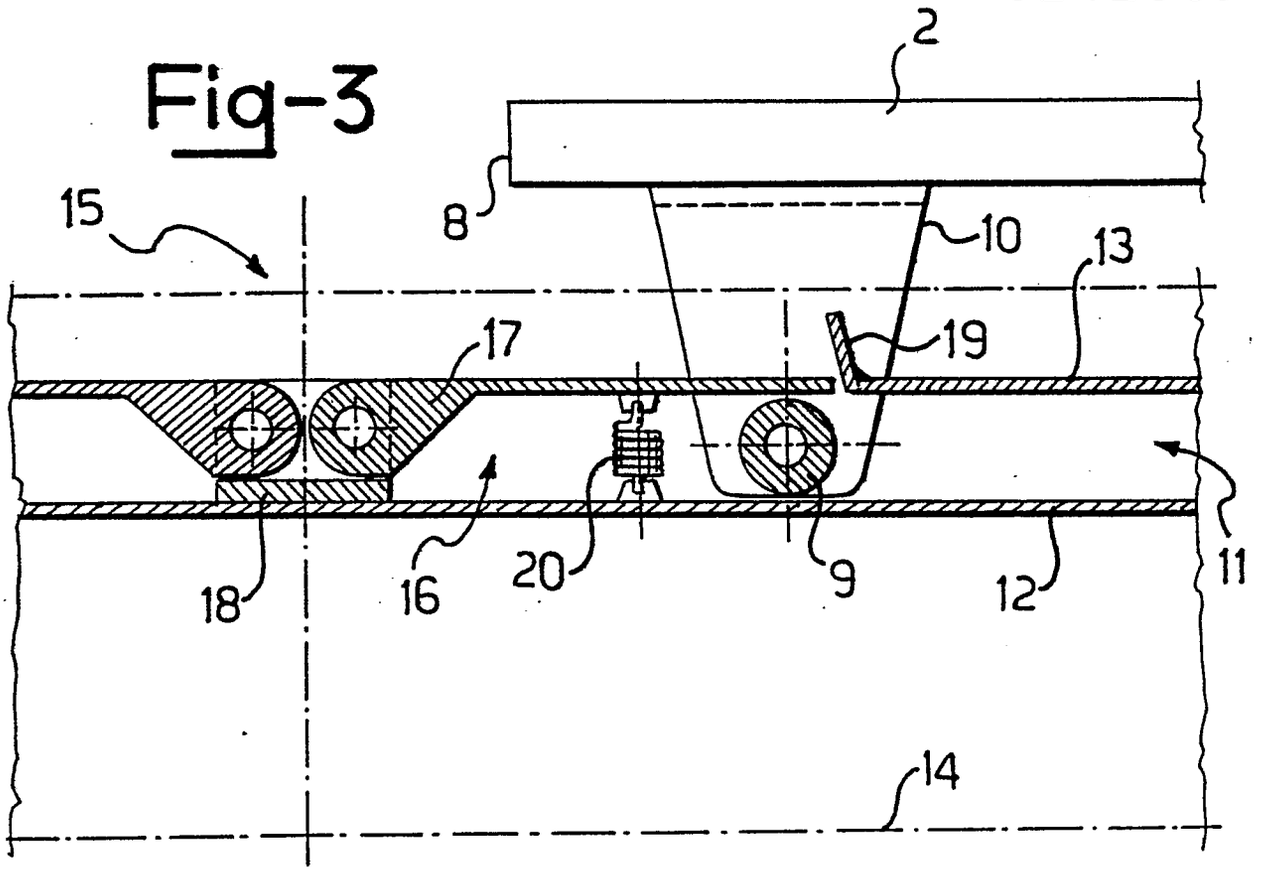
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Fig-4

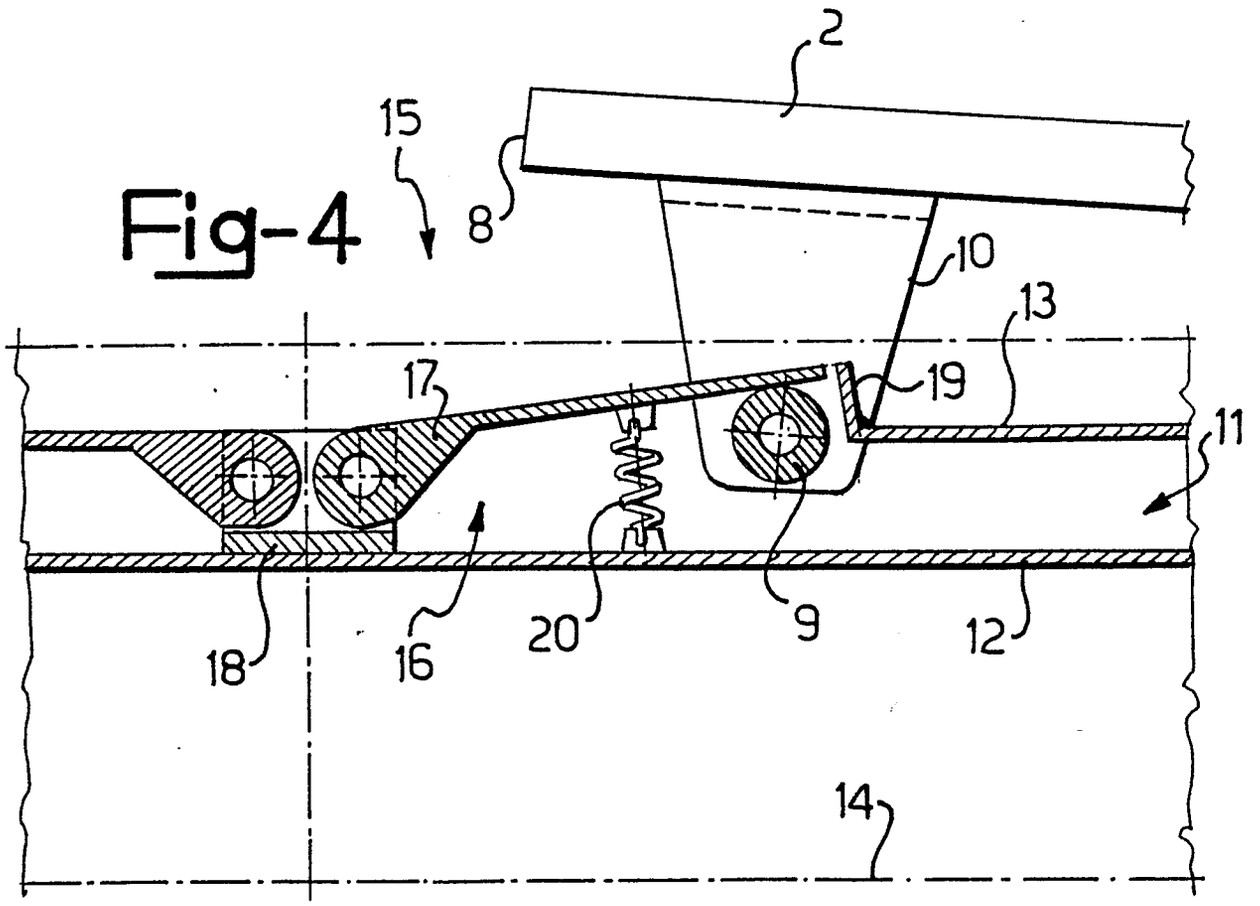
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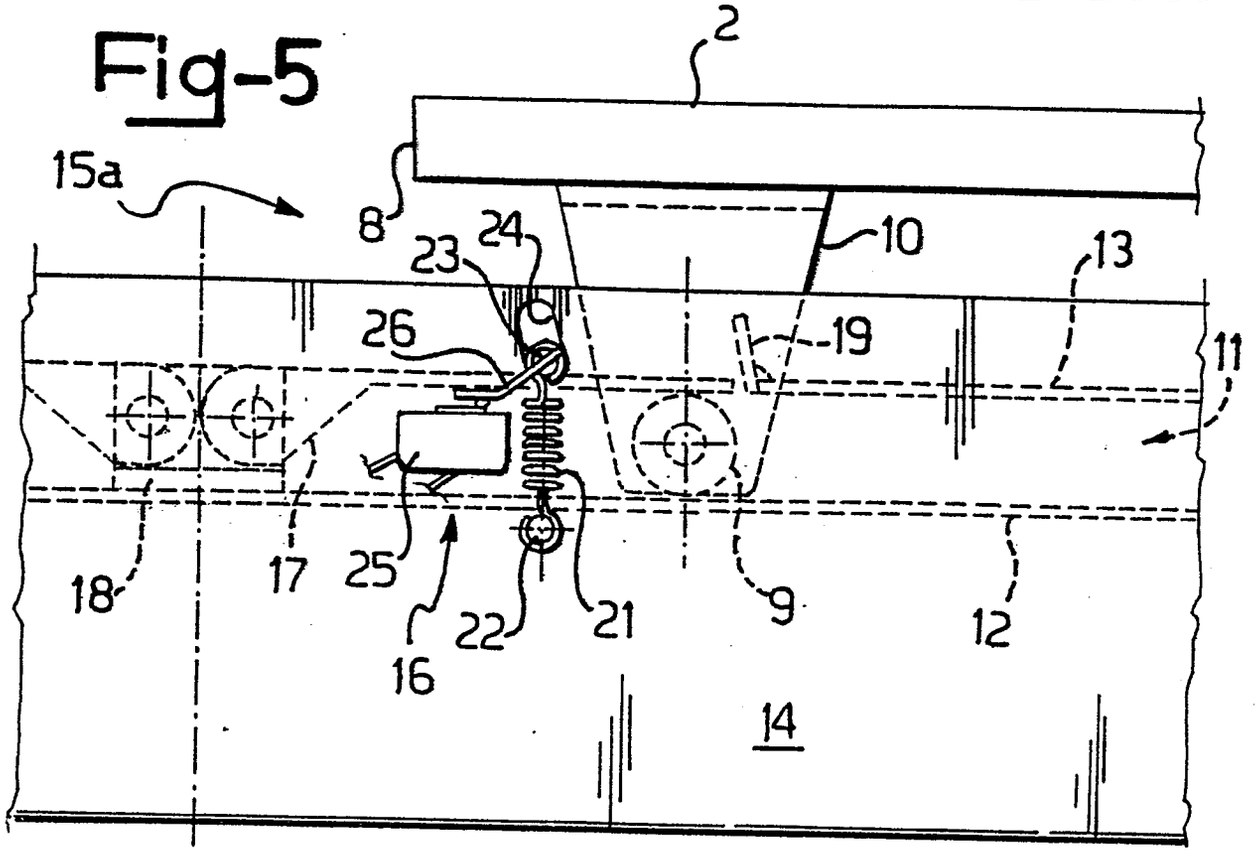
Fig-5



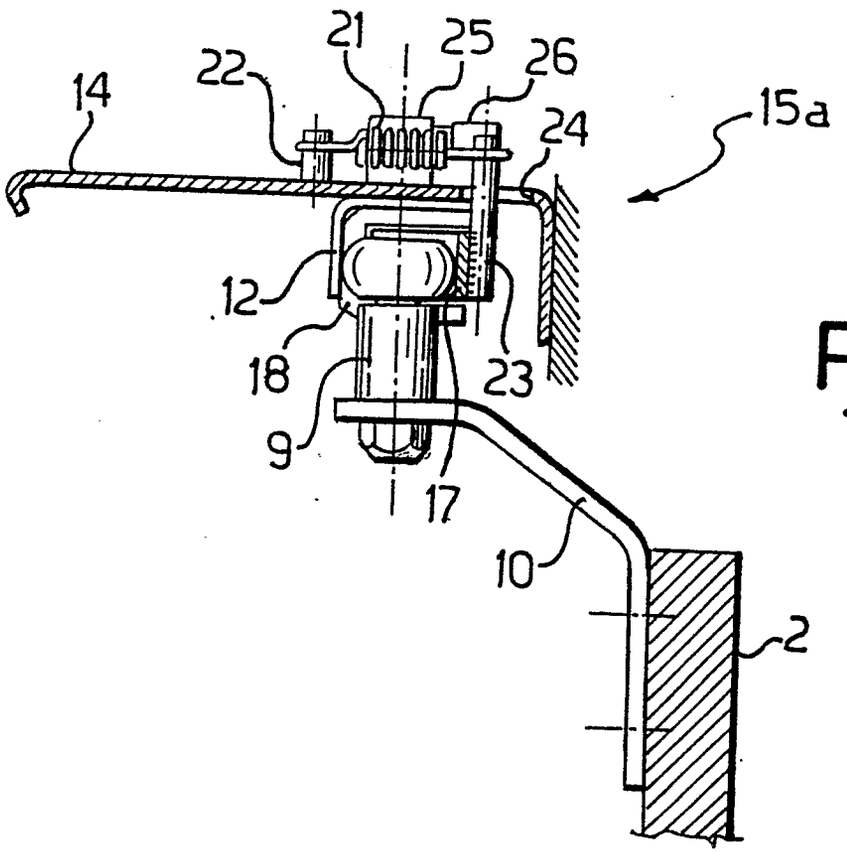


Fig-6