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(54) SLIDING DOOR ACTUATION MECHANISM

(57) Applicable to public vehicles for passenger transport, fitted with sliding doors (1) displaceable parallel to the bodywork (2) of the vehicle, on the outside of this latter, and insertable into the door hollow (3) in the closed position; doors associated with supports (5) moveable on a main guide (6) and activated by a belt (7) activated by driving element (9); on each one of the two sections of the belt (7) respective runners (12) are fixed to which twin angular "L"-shaped connecting-rods (10) are articulately attached, at their apex, each one of which is articulately joined at the free end of its longest branch to the corresponding support (5); whereas at its other end it incorporates a large teat or roller (14), moveable on an auxiliary guide (16) with a bend in his internal end, so that these connecting-rods (10) maintain their longest branch perpendicular to the doors (1) during the main part of the run of these latter parallel to the bodywork (2) of the vehicle; and they swivel inwards bringing-about the emplacement of said doors (1), when they reach the oblique section of the auxiliary guides.

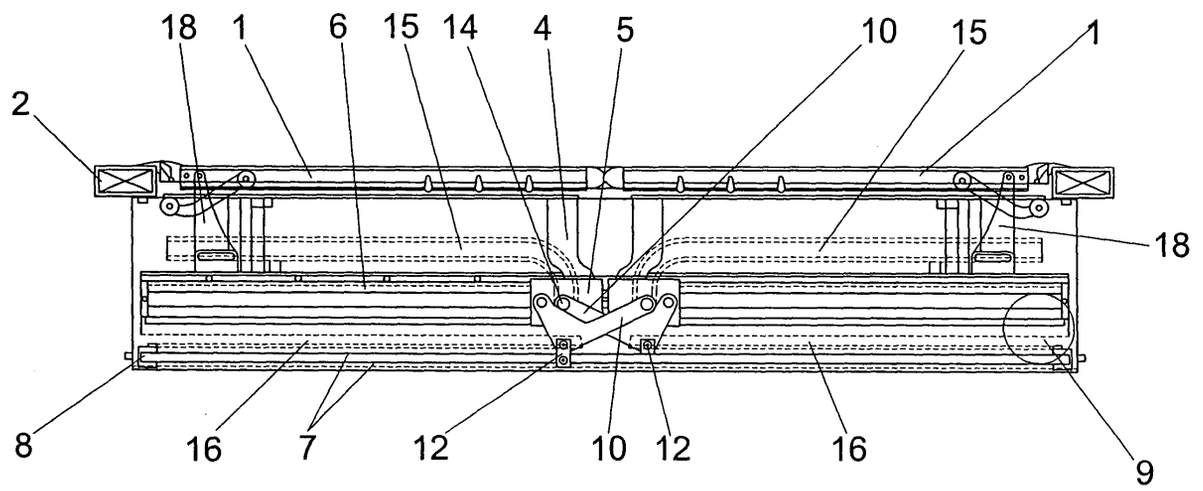

FIG. 3

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Description

OBJECT OF THE INVENTION

[0001] The present invention refers to a mechanism that has been designed especially to carry out frontal coupling and uncoupling movements of the doors of a vehicle to and from the corresponding door opening, specifically of the type in which said doors are moveable along runners, in their own plane, parallel to the bodywork of the vehicle, and capable of moving transversely, to fit into and to withdraw from the door opening.

[0002] The object of the invention is centred specifically on the mechanism with which the transverse movement of the doors is carried out, for their insertion into and withdrawal from the door opening.

[0003] The invention is applicable in the field of public transport vehicles, specifically for vehicles dedicated to passenger transport, such as trains, buses and similar, although it can be applied to any other door found in any other type of terrestrial, marine or air vehicle.

BACKGROUND TO THE INVENTION

[0004] In the type of vehicles previously mentioned the use of sliding doors is common, for example a pair of doors that act against each other to close a single door opening of a width equivalent to the combined width of such doors, in such a way that, in the closing movement, these latter, for example, trace a trajectory parallel to the vehicle bodywork, or in other words, a prior movement in their own plane, to finally undergo a transverse movement with which they are fitted into the door opening. During the opening movement the doors are first withdrawn from the door opening, in a complementing manner, and afterwards they move in their own plane, by sliding on suitable guides, in the sense of moving apart, up to the fully open limit position.

[0005] Sliding doors of this type are described in the Spanish invention patent ES 2 073 669, in the European patent EP 0957019, in the PCT WO 01/85518 and in the European patent EP 0820889, among other documents.

[0006] All of them present as common denominator a notable structural complexity, especially as regards the mechanism with which the transverse movement of the doors is achieved, for their insertion into or withdrawal from the door opening, which has negative repercussions both at cost level and later at maintenance level.

DESCRIPTION OF THE INVENTION

[0007] The activating mechanism that the invention proposes forms a structurally very simple solution and with full functional guarantees, resolving in a fully satisfactory way the problems previously set out.

[0008] The proposed invention refers to a door opening mechanism of the type in which the path of displacement of the doors forms an "L" path, or a 90° change of trajectory, consisting of an initial withdrawal perpendicular to the plane of the door and afterwards a second movement of separation of the doors, parallel to the same plane of the doors.

[0009] For this and more specifically the mechanism of the invention, starting with the use of the classic longitudinal guide for displacement, also longitudinal, or by sliding of the doors, and with the use of a belt or similar as a means for drawing them longitudinally, centres its characteristics on the fact that the supports by means of which the doors slide on the guide are connected to the activating belt in these doors by means of two pivoting angular "L"-shaped connecting-rods, that define the three points for fixation to the doors, and the displacement mechanisms of these latter; articulately joined at their apex to runners respectively integral with the two parallel branches defined by the belt; each of these angular connecting-rods being in turn articulately joined at the free end of one of its branches, which could be the main branch, to the support of the corresponding door; whereas at the free end of its branch, for example the smaller, a pivot or roller is established, moveably guided on an auxiliary and corresponding guide, with an end section that has a sharp bend, suitable for bringing-about in the angular connecting-rod, in the end phase of closing of the doors, a swivelling in the angular connecting-rods that results in a pulling towards the interior of the door supports, together with the actual main guide, and parallel to the movement in the same direction of said doors, in order that these are inserted into the door opening, or withdrawn in the first case when a movement in the opposite sense is carried out, that is, the opening movement.

[0010] The most characteristic point of this mechanism is based on the crossing of the fixation points of said swivelling angular connecting-rods to the securing points on the activating belt, an action that brings-about the swivelling and rotation about the retaining axis of the anchoring points of said connecting-rods and with this the opening or extraction of said doors in the direction perpendicular to the plane defined by the doors.

DESCRIPTION OF THE DRAWINGS

[0011] To supplement the description that is being carried out, and with the aim of leading to a better understanding of the characteristics of the invention, in agreement with a preferred example of its practical embodiment, as an integral part of said description it is accompanied by a set of drawings where in an illustrative and non limiting way, the following have been represented:

Figure 1.- Shows a plan schematic representation of a system of sliding doors for vehicles, fitted with the activating mechanism that forms the subject of the present invention, in the opening limit position for said doors.

Figure 2.- Shows a representation similar to Figure 1 in a closing intermediate phase of said doors.

Figure 3.- Shows another representation similar to that of the previous figures, now with the doors in the closed limit position.

Figure 4.-Shows an enlarged detail of figure 2 at the level of the mechanism of the invention.

Figure 5.- Shows a detail similar to that of the previous figure but corresponding to the position of the mechanism of figure 3.

PREFERABLE EMBODIMENT OF THE INVENTION

[0012] In the figures depicted the sliding doors have been referenced by (1), displaceable parallel to the bodywork (2) of the vehicle and finally insertable into the door opening (3), doors that through ties (4) are connected to respective supports (5) moveable on a principal guide (6), that, as in the example of practical embodiment shown in the figures, can be double; a guide (6) through which the supports (5) are moveable with the assistance of a continuous belt (7), mounted on end pulleys (8) and activated by a driving element (9).

[0013] Each support (5) is connected with one of the sections of the belt (7) by means of an "L"-shaped angular connecting-rod (10), so that each connecting-rod (10) is joined, through an articulated joint (11), to a runner (12) integral with the corresponding section of the belt (7), at the same time that through the free end of its longest branch, for example, and with the assistance of another articulated joint (13), it connects to the corresponding support (5) being guided in its movement by the guides (15). At the free end of, for example, the shorter branch of each connecting-rod (10) a complementing pivot roller (14) or similar is established, that similarly freely moves in an auxiliary guide (16), which is parallel to the main guide (6) and with an internal end section that is bent obtusely outwards. In this way and by the combined action of the articulated joints (13) and guides (15) with the rollers (14) and guides (16) the angular connecting-rods (10) are in this way forced to swivel, as shown in figure 5, which brings with it a combined movement of the doors (1), of mutual approach to each other and of inward movement, that is, towards the position for fitting into the door opening (3).

[0014] The connecting-rods (18) assure the parallel opening and closing of the doors, these not meriting any further detailed technical explanation.

[0015] In accordance with this structure, the operation of the mechanism is as follows:

[0016] Starting from, for example, the opening limit position shown in figure 1, the starting of the motor (9) brings about the movement of said doors (1) in their own plane, up to the position shown in figure 2, in which the rollers (14) reach the bend established between the two sections of the auxiliary guides (16), while the articulated joints (13) pass along the guides (15).

[0017] From this moment the doors (1) continue moving in the direction of mutual approach, since the supports (5) can continue approaching each other; but at the same time the angular connecting-rods (10) swivel, that brings about a withdrawal of the supports (5) and consequent retraction of the doors (1) to the closed limit position shown in figure 3, in which the angular connecting-rods (10) cross each other, each runner (12) passing beyond the opposite runner (12'), in a stable position.

[0018] In the opening movement the belt (7) moves in the opposite direction to the previous one and the angular connecting-rods (10) are forced into a swivelling movement also in the opposite direction, that in the first case brings-about the outwards pushing of the supports (5) and of the guide (6) on which they move, with the consequent outwards pushing also of the doors (1), until reaching the position shown in figure 2, in which the doors (1) have sufficiently separated from the bodywork of the vehicle, and are in condition to complete their run, now in their own plane.

Claims

1. Activating mechanism for sliding doors, preferably for vehicles intended for the public passenger transport, such as trains, buses and similar, of the type in which said doors combine a longitudinal movement in their own plane, with a transverse movement for fitting into and withdrawal from the door opening; for which purpose said doors have supports that slide on a main guide drawn by a suitably motorized belt; **characterised in that** each support (5) associated with the corresponding door (1) and sliding on the main guide (6), is connected to the motorized belt (7) at opposite points of the actual belt through twin angular connecting-rods (10), preferably "L"-shaped, each one joined to its corresponding door; connecting-rods that through their apexes (11) are articulately joined to each of the runners (12) drawn by the belt (7); runners (12) that when the doors meet, the following-on movement in the displacement of the belt does not stop, bringing-about this continuation of movement of the belt (7), the articulation of the angular connecting-rods (10) and with this the crossing between each other of the apexes (11) of each connecting-rod (10) and with this the movement of insertion and withdrawal of the doors.

2. Activating mechanism for sliding doors, according to claim 1, **characterised in that** the guides (6), supports (5) and doors (1), are retractable or extendible in the movement of insertion or withdrawal by means of the action of the connecting-rods (10) activated by the belt (7).

3. Activating mechanism for sliding doors, according to claim 1 and 2, **characterised in that** through the free end of one of its branches, preferably the longest branch, it is articulately attached (13) to the corresponding support (5), it being planned that a pair of auxiliary guides (15) also participate in the mechanism, one for each angular connecting-rod (10), on which the articulated joints (13) are guided that link with the supports (5) and another pair of guides (16) with a section parallel in the main with the principal guide (6); a large teat or roller (14) freely moving in each of these auxiliary guides (16), established in the free end of the shortest branch of the angular connecting-rod (10), so that the auxiliary guides (16) maintain stable the angular position of the connecting-rods (10) during the displacement of the doors (1) in their own plane; and they combine said longitudinal displacement with a transverse swivelling movement in the closing end phase or in the initial opening phase, acting on the supports (5) to insert and to withdraw the doors (1) from the doors opening (3).

4. Activating mechanism for sliding doors, according to claim 1, **characterised in that** in the closing limit position for said doors (1), the runners (12-12') associated with two sections of the belt (7) and corresponding with the respective doors (1), mutually pass beyond each other, the angular connecting-rods (10) remaining crossed over each other.

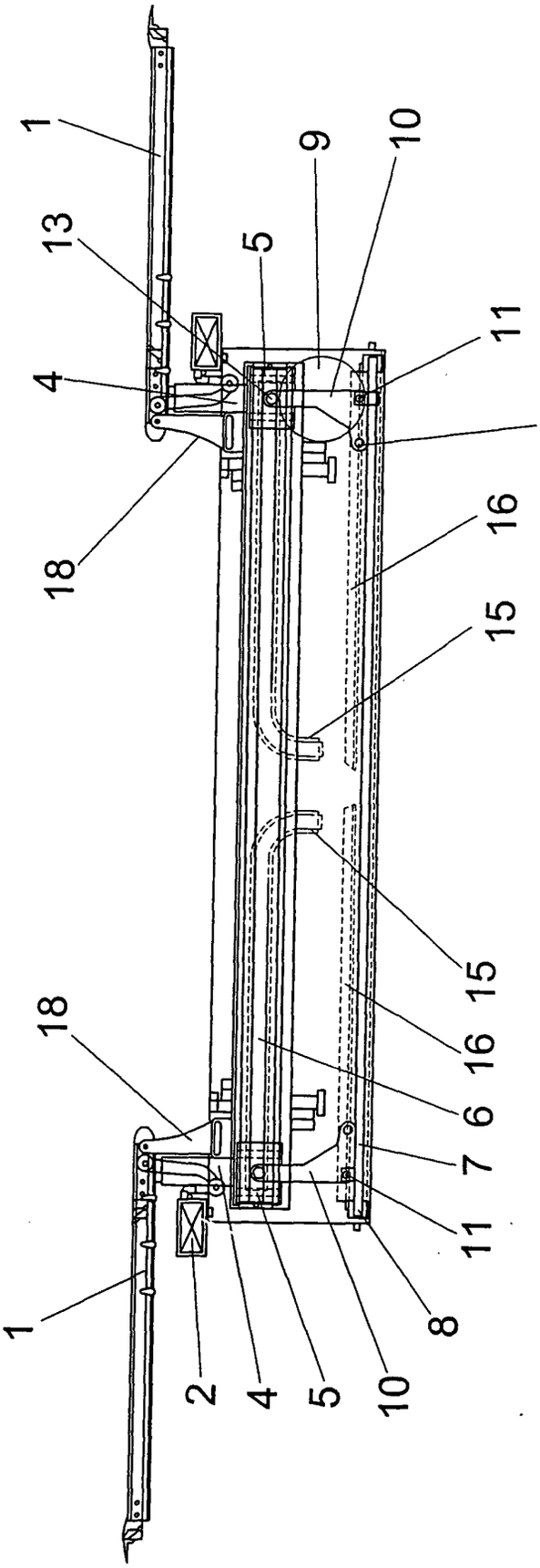

FIG. 1

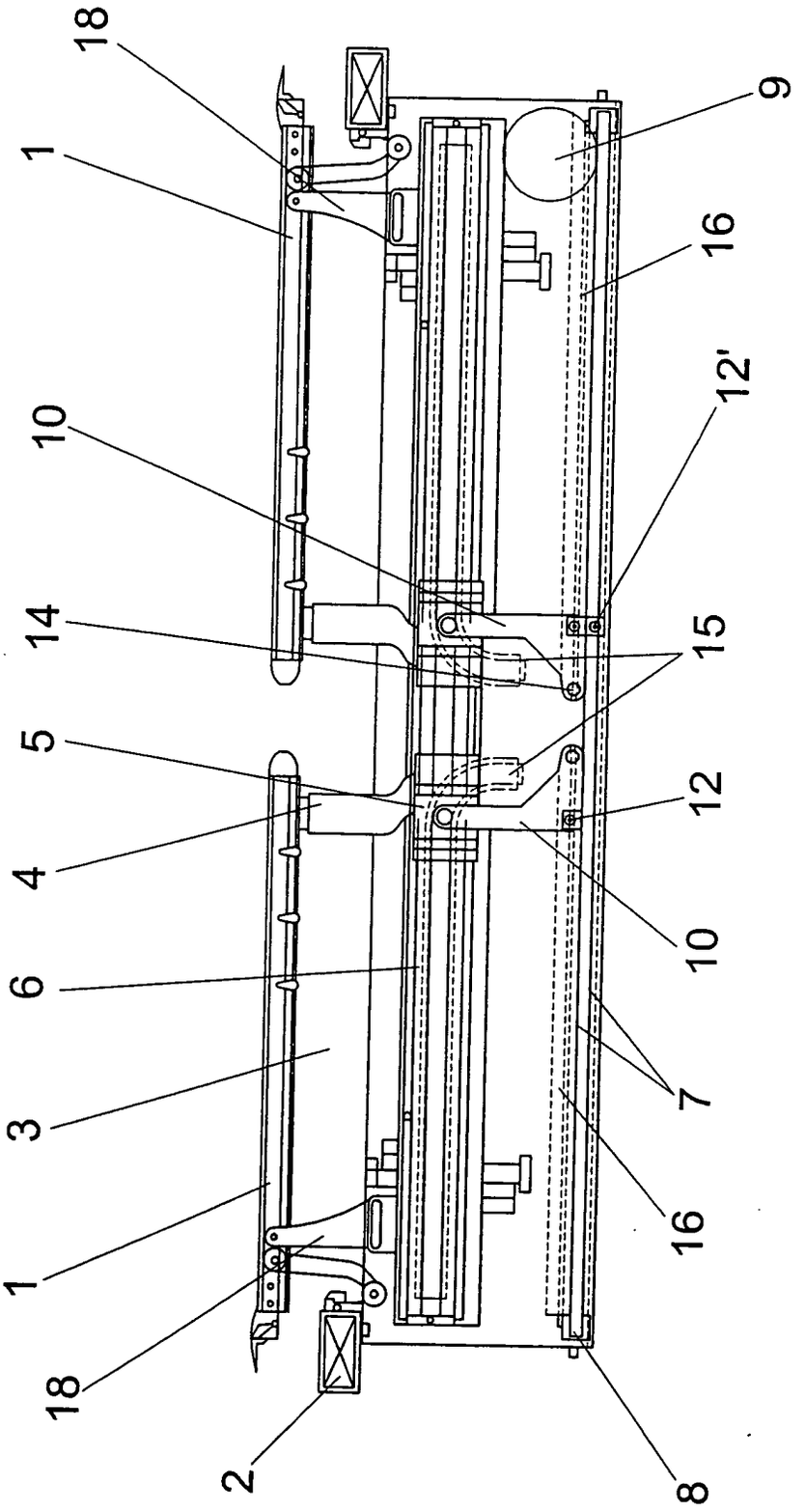

FIG. 2

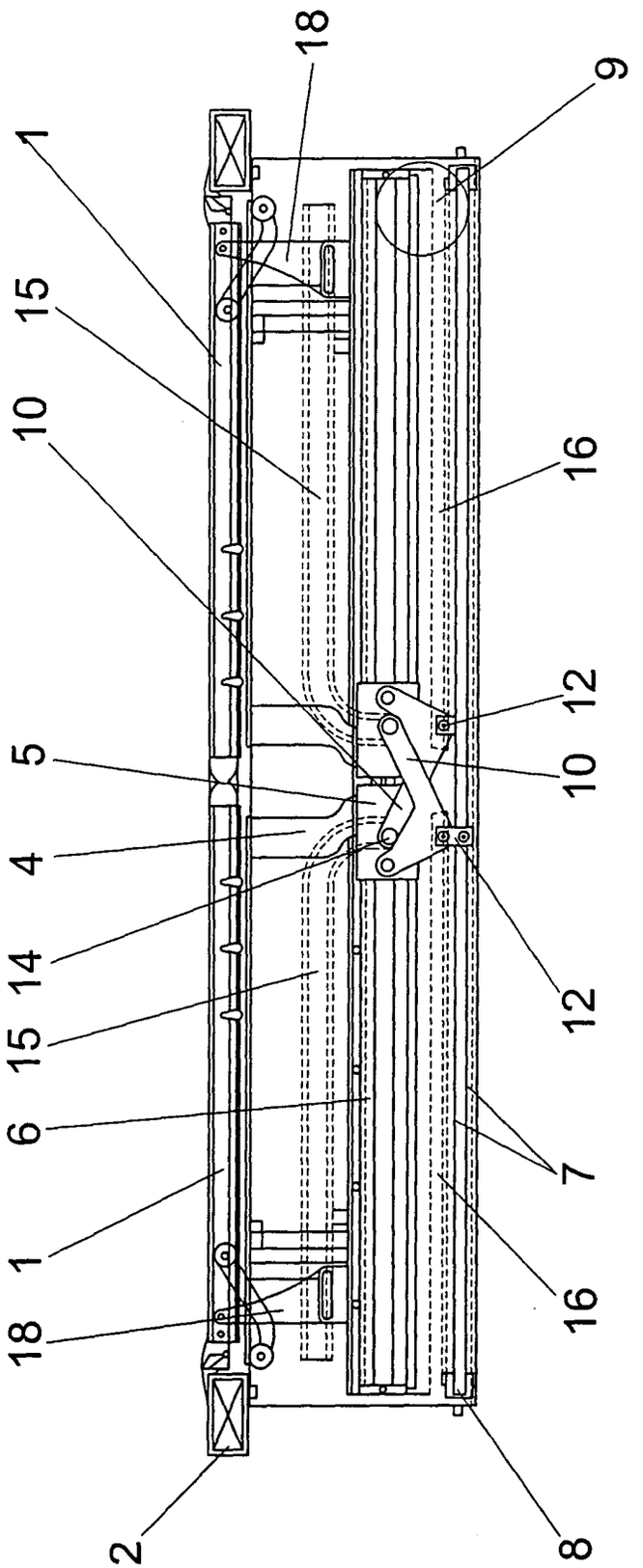

FIG. 3

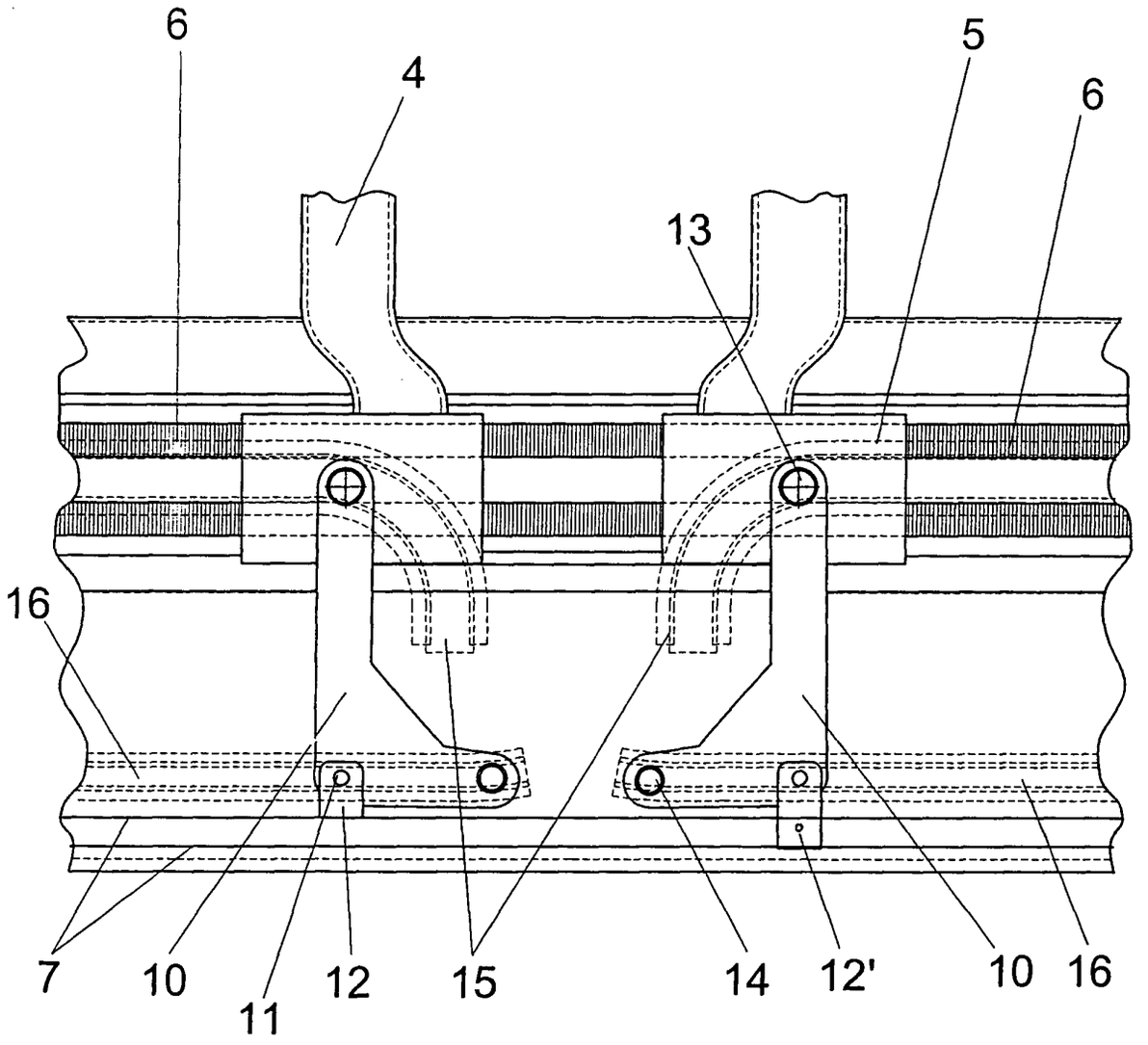

FIG. 4

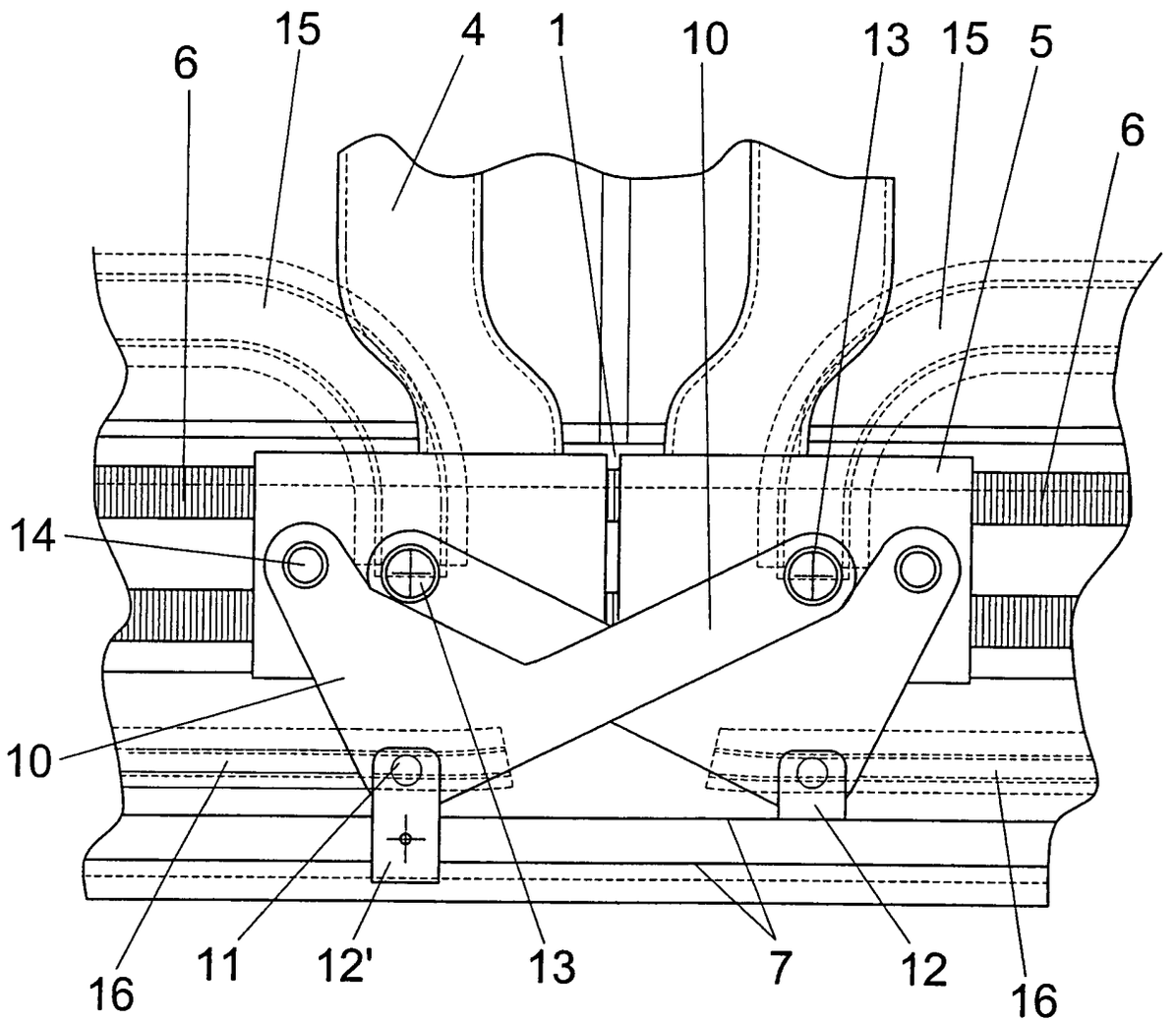

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES 02/ 00601

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E05D 15/10, E05F 15/14

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)

IPC 7 E05D, E05F, B61D, B60J.

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2795446 A1 (FERSYSTEM S.A.)29.12.2000. **The whole document**	1-3
A	DE 4316253 A1 (BODE & CO.) 17.11.1994. **Abstract, figures**	1-3
A	BE 622387 A (VERKEHRSMITTEL ENTWICKLUNG). 31.12.1962.Page 10, line 1-10; figure 6.	2,3
A	WO 0185518 A1 (GEBR. BODE GMBH & CO.)15.11.2001. **Abstract, figures**	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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

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

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Date of the actual completion of the international search	Date of mailing of the international search report
31January 2003 (31.01.03)	**21 March 2003 (21.03.03)**
Name and mailing address of the ISA/ **SPTO** Facsimile No.	Authorized officer F. CALDERÓN Telephone No. + 34 91 3495322

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No
PCT/ES 02/ 00601

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Form PCT/ISA/210 (patent family annex) (July 1992)