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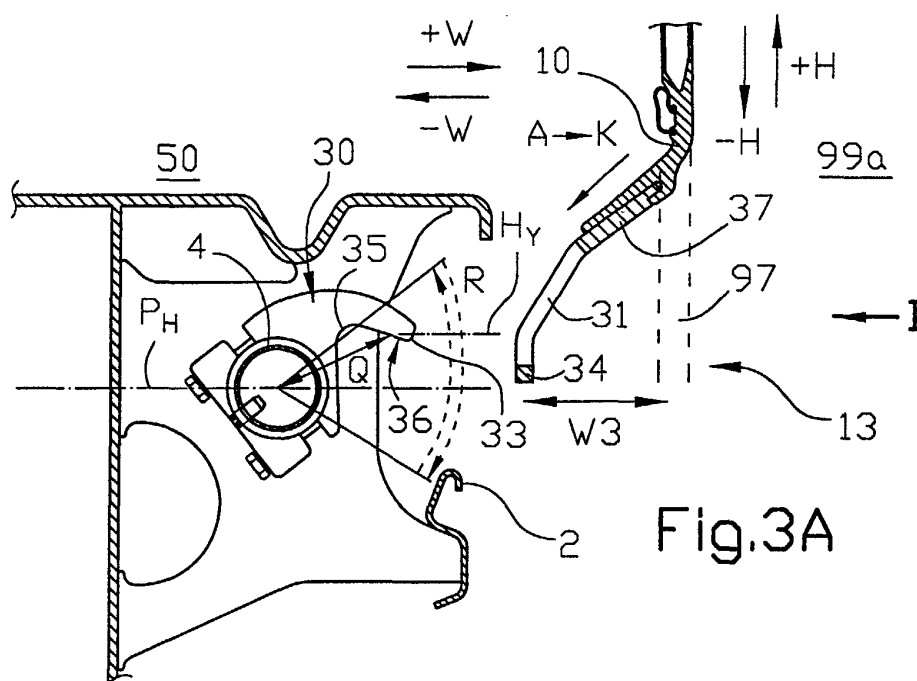
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(54) **Lower locking mechanism for sliding covers of railway freight wagons**

(57) The invention relates to a lower locking mechanism for keeping the rigid covers (10) of a railway freight wagon in their closed positions (K), whereby they close the wagon space (50). In their open position (A), when moved outwards from the wagon space, the covers (10) are movable over the covers in the closed position in the longitudinal direction of the wagon by means of a lower shift mechanism, which comprises transport rollers (3) in the covers, stationary run rails (2) in the wagon frame for the transport rollers, and pivot axes

that are movable around the centre lines (14) that run in the longitudinal direction of the wagon, lifting and auxiliary rail sections (7) fixed to said axles and adapted to fit into the openings (20) of the run rails (2). The locking mechanism further comprises locking hooks (30), rigidly fixed to these pivot axes (4) and moving through holes (31), located in the area of the lower edges (13) of the covers (10), the cam (32) of the locking hook being located behind lower spans (34) in the closed position of the cover.



Description

[0001] The invention relates to a lower locking mechanism for keeping the rigid covers of a railway freight wagon in their closed positions, whereby they close the wagon space, the covers being movable, in an open position that is moved outward from the wagon space, over the covers in their closed positions in the longitudinal direction of the wagon by means of a shift mechanism comprising at least in the area of the lower parts of the longitudinal sides of the wagon: transport rollers in the covers, stationary run rails in the wagon frame for the transport rollers, and pivot axles that are movable around the centre lines that are in the longitudinal direction of the wagon, rail sections fixed to said axles and adapted to fit into the openings in the run rails.

[0002] The movable covers in railway freight wagons refer to covers, which at least to some extent form part of the roof portion of the wagon and which are lifted at least by their lower edges, both outwards from the centre line of the wagon and, at the same time, upwards, whereby the cover is in its open position and movable in the longitudinal direction of the wagon over the second cover that is in the closed position. Numerous different shift mechanisms or lower shift mechanisms of such covers or sliding walls or sliding covers are known. The publication FR-1 451 558 describes sliding covers, which are opened and closed by means of long lifting rails, which for the open position of the cover are turned by a movement that is directed first outwards and then upwards, whereby the lifting rails are aligned with the auxiliary rails of the second sliding cover, which is in its closed position. This solution neither deals with nor describes any arrangement for locking the sliding cover in its closed position. The complicated gear unit that is used to turn the lifting rails could have resistance of a considerable size to keep the sliding cover in place. The patent publication EP-0 121 086 B1 describes an arrangement, wherein the sliding covers in their closed positions are locked to the wagon frame first by means of claws, which form the fixed part of the sliding cover and which are engaged with the lift prevention cams that form the fixed part of the frame and, second, by means of the wedge-shaped bearer feet that form the fixed part of the lower edge of the sliding cover, which feet, when the cover is moved from the open position into the closed position, fall into the groove of the support rail that forms the fixed part of the frame. Indeed, this arrangement is simple and possibly capable of transferring the deformation forces between the wagon frame and the sliding covers, but the open projections are easy to damage and the grooves of the support rail almost invariably get filled with garbage, decelerating and complicating the closing of the covers. The patent publication DE-22 13 824 describes an arrangement for locking the end edges of sliding walls, the ends of the closing movements of which are directed obliquely to each other, to the ends and the intermediate buttments of the

wagon. On the corners of the ends and on the intermediate buttments, there are profile mouldings that turn around a vertical axis, each having a trough of a U shape, the convex side of the shape being stationary on the corresponding vertical axis. When the sliding wall is closed, the vertical edge of the wall projects inside the U trough and, at the same time, the profile mounting turns to its first side past the dead point provided by a spring. When the sliding wall is opened, the vertical edge of the wall exits the U trough and, at the same time, the profile moulding turns to its second side past the said dead point in the opposite direction. The described structure cannot convey any deformation forces between the wagon frame and the sliding walls, because the sliding walls themselves use locking members. Neither does the described structure work in connection with such sliding walls or sliding covers, which close in some other direction than the clearly oblique direction described above.

[0003] The object of the invention is to provide a lower locking mechanism for keeping the rigid covers of a railway freight wagon in their closed positions so that, during the travel of the wagon, the impacts of air pressure exerted on the cover, for example, when driving into a tunnel and from the tunnel will not open them. A second object of the invention is to provide such a lower locking mechanism, which is capable of keeping the cover closed, even if the load inside the wagon shifts or falls and, as a result, leans against the cover on the inside. A third object of the invention is to provide such a lower locking mechanism, which is easy to open without any risks, i.e., the locking can be released even if the load inside the wagon leans against the cover, when the cover opens. A fourth object of the invention is to provide such a lower locking mechanism, which is quick and easy to use. A further object of the invention is to provide such a lower locking mechanism, which is also reliable and cost-effective.

[0004] The problems described above can be solved and the objects defined above implemented by means of the lower locking mechanism according to the invention, which is characterized in that, which is defined in the characterizing part of Claim 1.

[0005] One of the advantages of the lower locking mechanism according to the invention is that the covers and the wagon frame can be reliably locked to each other in the structure, whereby the transverse forces possibly caused by the movement of the freight are effectively received. A second advantage is that the possible movement of the freight does not impede the release of the cover's locking and, thus, the opening of the covers. The lower locking mechanism according to the invention also has an advantageous effect from the point of view of impact reception. A third advantage of the lower locking mechanism according to the invention is that the cover locks to the wagon frame at the same time as the cover is closed, and no separate locking procedures need to be carried out. This is made possible by arrang-

ing the lower locking mechanism according to the invention as part of the lower shift mechanisms of the covers. A fourth advantage of the lower locking mechanism according to the invention is that the other components that are part of the lower shift mechanism contribute to the actual locking. A fifth advantage of the lower locking mechanism according to the invention is that it is suitable to be used as the lower shift mechanism of both sliding walls and sliding covers. A further advantage of the lower locking mechanism of the invention is its simple structure.

[0006] In the following, the invention is described in detail with reference to the appended drawings.

Fig. 1 shows a railway freight wagon comprising the lower shift mechanism according to the invention along part of the wagon's length and viewed from the side from the direction I of Figs. 2A, 3A.

Figs. 2A-2C show a cross section of the lower shift mechanism according to the invention at points 1a of Fig. 1 and as a section along the plane II-II of Figs. 1 and 4.

Figs. 3A-3C show a cross section of the lower locking mechanism according to the invention, which is related to the lower shift mechanism, at points 1c of Fig. 1 and as a section along the plane III-III of Figs. 1 and 5.

Fig. 4 shows the lower shift mechanism according to Figs. 2A-2C from the side and in the situation of Fig. 2C, viewed from the direction IV of the figure.

Fig. 5 shows the lower locking mechanism according to Figs. 3A-3C from the side and in the situation of Fig. 3C, viewed from the direction V of the figure.

Fig. 6 shows a longitudinal view of the counter mechanism related to the lower shift mechanism according to the invention at point 1b of Fig. 1, viewed from the direction VI of Figs. 7A and 7B, and in the wagon frame with the fixed run rail removed.

Fig. 7A shows a cross section of the controlling end of the counter mechanism according to Fig. 6 as a section along the plane VII-VII of Fig. 6.

Fig. 7B shows a cross section of the lever end of the counter mechanism according to Fig. 6 as a section along the plane VIII-VIII of Figs. 1 and 6, whereby the unbroken lines illustrate the levers in the position that corresponds to the closed position of the cover and the dashed lines illustrate the levers in the position corresponding to the open position of the cover.

[0007] The figures show the lower shift mechanism

with its structural parts for transferring the longitudinal lower edges of the rigid covers 10 of the railway freight wagon, such as sliding covers, which there are normally two in railway freight wagons, or sliding walls, which there are normally four in railway freight wagons, i.e., two pairs, to the side and upwards from the wagon space. Both opposite sliding walls of the pair of sliding walls, which are located on different sides of the wagon and extend to the roof portion of the wagon, are transferred to the side and upwards, and simultaneously in the longitudinal direction of the wagon, in other words, in a mirror-symmetrical fashion; therefore, their handling is fully analogous to the handling of the sliding covers. The covers 10 in their closed position K close the wagon space 50, whereupon they are transferred or lowered downwards and towards the interior of the wagon, and are tightly in contact with the wagon frame 100 by all their edges. In the open position A, which is transferred or lifted outwards from the wagon space 50, i.e., to the side and upwards, the covers 10 are movable over the covers in their closed position in the longitudinal direction L_L of the wagon. In the area of the lower edges 13 of the covers 10, the lower shift mechanism comprises transport rollers 3, which are mounted on bearings in the cover and are thus rolling. In the lower parts of the longitudinal sides 99a, 99b of the wagon in the wagon frame 100, there are stationary run rails 2, which have openings 20 next to the transport rollers of the covers in the closed position K. The lower shift mechanism also comprises pivot axles 4, which are movable around the centre lines 14 that are in the longitudinal direction L_L of the wagon, on which axles there are fixed by means of first and second arms 5a, 5b, next to the openings, at least those rail sections, which can bear on the transport rollers from below and which can be used to position the covers, by lifting and lowering by the transport rollers, into two different points at least in the lateral direction of the wagon, the points corresponding to the closed position K and the open position A of the cover. The transport rollers 3 of the cover 10 in its open position roll on the run rails and the rail sections in the said openings. In the following, the markings -W, -H generally refer to the transverse directions of the wagon towards the inside in a horizontal direction and downwards in the vertical direction, the markings +W, +H generally refer to the transverse directions of the wagon outwards in the horizontal direction and upwards in the vertical direction. [0008] According to the invention, the pivot axles 4 have, next to the said openings, two rail sections, which are fixed by the first and second arms 5a, 5b, the first rail section being a lifting rail section 6 and the second one an auxiliary rail section 7. These two rail sections, i.e., the lifting rail section and the auxiliary rail section thus have different functions. The lifting rail sections 6 are used to lift and lower the cover by supporting it below the transport rollers; in other words, the lifting rail pieces cause a transfer of the cover from the open position into the closed position, i.e., a closing movement A→K and

vice versa, i.e., an opening movement $K \rightarrow A$. On the length of the cover in the open position A, the lifting rail sections 6 also close the openings 20 of the run rails 2, providing directly extending run rails for this portion, whereas the auxiliary rail sections 7 provide directly extending run rails on the length of the cover in the closed position K, when the auxiliary rail sections 7 are brought into the openings 20 of the run rails 2 along the length of the cover in the closed position in a manner described hereinafter. The pivot axles 4 of the lower shift mechanism, on which the lifting rail sections and the auxiliary rail sections are fixed by means of the first and second arms 5a, 5b, pivot R so that the lifting rail sections 6 move in the opening movement $K \rightarrow A$ of the cover first mainly in a transverse direction $+W_{AK}$ outwards of the wagon space, and then also in a direction $+H_{AK}$ upwards from below into the openings 20 of the run rails. In the closing movement $A \rightarrow K$, the pivot axles 4 pivot R in opposite directions compared with that mentioned above so that the lifting rail sections 6 first move mainly in a direction $-H_{AK}$ downwards from above and then also in a transverse direction $-W_{AK}$ towards the wagon space. In the same connection, the auxiliary rail sections 7 also rise in the opening movement $K \rightarrow A$ of the cover away from the openings 20 of the run rails and in the closing movement $A \rightarrow K$ descend back to the said openings. The lifting rail sections 6 and the auxiliary rail sections 7 are aligned with the run rails 2, when they are in the openings 20 of the run rails in the open position A and the closed position K of the covers, as shown in Figs. 2A and 2C.

[0009] The auxiliary rail sections 7 are rigidly, i.e. non-pivotably attached to the pivot axles 4 by their second arms 5b, the axles being formed from bars, profiles or the like, which are of the length L_H of the covers and mounted on bearings in the wagon frame 100 in a suitable manner known as such or in some new manner. The first arms 5a that are intended for the lifting rail sections 6 are attached to the pivot axle by means of a hinge axle 18, which is described in detail hereinafter. The angle α between the effective lengths L_6 and L_7 of the first arm 5a of the lifting rail sections 6 and the second arm 5b of the auxiliary rail sections 7, which lengths are formed between the centre line 14 of the pivot axle and the point of contact of the transport rollers 3 of the rail sections 6 and 7, is 120° at the most, and typically 30° at the most or 45° at the most, but preferably within 60° - 100° . These angle values apply to a situation, wherein a play Z, which is dealt with hereinafter, is eliminated, i. e., is zero. The pivot axle 4 pivots an angle, which is as great as the angle α mentioned above and the angle of the loose movement caused by the play Z put together. The effective lengths L_6 and L_7 of the first arm 5a and the second arm 5b are equal in size at a suitable accuracy. In the closed position K of the cover, the lifting rail sections 6 with their first arms 5a are in their lower dead point, as shown in Fig. 2C, and the transport rollers 3 rest on top of and is supported by the lifting rail section

6. At the same time, the lifting rail section 6 with its first arm 5a hangs loose from but supported by the hinge axle 18, which attaches the first arm and the pivot axle to each other. Furthermore, in this closed position K of the cover, the transport rollers are located between the lifting rail sections 6 and the hinge axle 18, which attaches the first arm and the pivot axle together in the manner shown in Fig. 2C. The lifting rail sections 6 and the auxiliary rail sections 7 are shorter than the said opening 20 of the run rails to the extent of side clearances E. The length L_K of the lifting rail sections and the auxiliary rail sections 6, 7 again is at least as great as the diameter Φ of the transport rollers 3, but preferably this length L_K of the rail sections is smaller than twice the diameter Φ of the transport rollers; in other words, $\Phi < L_K < 2 \times \Phi$. In the area of the lower edge 13 of the covers, there are first through holes 21, the length L_A of which is greater than the length L_K of the auxiliary rail sections 7, and preferably also greater than the length $L_K + 2 \times E$ of the openings 20 of the run rails, for the passing through of the auxiliary rail sections 7 and the second arms 5b. This is understandable, when from the situation of Fig. 2A, the auxiliary rail section above the transport roller 3 and the second arm must, during the closing movement $A \rightarrow K$ of the cover, descend to the situation indicated by Fig. 2B, wherein the auxiliary rail section and the second arm are outside the transport roller, viewed from the inner parts 50 of the wagon, and further downwards to the situation in Fig. 2C and in an opposite direction during the opening movement $K \rightarrow A$ of the cover.

[0010] The first arm 5a of the lifting rail sections 6 is fixed to the pivot axle 4 by means of a hinge mechanism 15, which allows a limited pivoting of the first arm around the hinge line 25 of its hinge axle 18, the line being parallel with the centre line 14 of the pivot axle. The hinge line 25 is at a hinge distance L_S , which is shorter than the effective length L_6 of the first arm, from the centre line 14 of the pivot axle 4, as shown in Figs. 2A-2C. The hinge mechanism 15 further comprises a limiting block 11, which is rigidly fixed to the first arm 5a on its back side T, which is located away from the connective plane Y of the said centre line 14 and the hinge line 25 and from the transport roller 3 carried by the lifting rail section 6. The limiting block 11 is rigidly fixed to the first arm 5a, or the limiting block and the first arm are made of the same piece, and preferably extends from any point on the length of the first arm 5a at least to the normal N of the connective plane Y, which passes through the centre line 14 of the pivot axle. It is possible, that the edge of the limiting block 11, which points away from the lifting rail sections, does not extend all the way to the said normal but fairly close, however. The edge of the limiting block on the side of the lifting rail sections can extend all the way to the lifting rail sections or end at some other point along the length of the first arm between the lifting rail and the hinge line, but preferably not closer to the hinge mechanism than approximately in the middle of this length of the arm. In the closed po-

sition K of the cover, wherein the auxiliary rail sections 7 are aligned with the run rails 2, there is a play Z between the support surface 22 of the limiting block 11 and the pivot axle 4, which is shown in Fig. 2C. At the beginning of the opening movement K→A, when the pivot axle in the figures pivots R counter-clockwise - of course, the direction on the opposite side of the wagon is opposite, i.e., clockwise - the said support surface 22 comes into contact with the pivot axle 4 or its projection or some other member moving with it, preventing the further pivoting of the first arm 5a around the hinge line 25, as can be seen in figure 2B. After this, the pivoting R of the pivot axle also causes a movement of the cover 10 by means of the lifting rail sections 6 and thus the transport rollers 3 bearing on them, in the transverse directions $+H_{AK}$, $+W_{AK}$, i.e., outwards from the wagon space 50 into the open position according to Fig. 2A. During the opposite closing movement A→K, the pivoting of the pivot axle also causes the movement of the cover 10 by means of the lifting rail sections 6 and thus the transport rollers 3 bearing on them, in the transverse directions $-H_{AK}$, $-W_{AK}$, i.e., towards the wagon space, until at the end of the closing movement, the contact of the said support surface 22 with the pivot axle 4 or its projection or the like is released and, finally, in the closed position K of the cover, there is the play Z between the support surface 22 of the limiting block and the pivot axle. In this position, thus, the lifting rail section 6 is in its lower dead point and hangs with its first arm 5a from the pivot axle 4 by means of the hinge axle 18. The centre line 14 of the pivot axle, the length of the rail sections 6, 7, and the hinge line 25 are parallel.

[0011] The cover 10 is locked in its closed position K by means of a locking device according to the invention, comprising locking hooks 30, which are rigidly fixed to the pivot axles 4 described above, and which move with their pivoting R, project from the pivot axles, and comprise a mainly downward-pointing cam 32. In the area of the lower edges 13 of the covers, the locking mechanism further comprises second through holes 31, behind the lower span 34 of which, viewed from the interior of the wagon, the cam 32 of the locking hook is located in the closed position K of the cover. These second through holes 31 are located at a different point on the length L_H of the covers than the first through holes 21 described previously, as can be perceived on the basis of Figs. 1, 4, and 5. As the locking hooks 30 are rigidly or fixedly attached to the pivot axles, they pivot the same angle as the second arm 5b; in other words, an angle, which is as large as the above-mentioned angle α and the angle of the loose movement caused by the play Z put together. The locking hooks 30 in particular project from the pivot axle outside the vertical plane passing through the centre line 14 of the axle, when examined from the side of the wagon space 50. Accordingly, the locking hooks in the open position A of the cover are up, i.e., at an upper point H_Y , and in the closed position K of the cover down, i.e., at a lower point H_A .

[0012] To be more precise, the cam 32 of the locking hook has a contact surface 36 on the side of the pivot axle, which surface, when being pressed into a closed position, tightens the cover 10 behind the lower span 34 of the second through hole. This is provided by means of decreasing the distance Q between the contact surface and the centre line 14 of the pivot axle from the tip 33 of the cam towards the bottom 35 of the locking hook. During pivoting R of the pivot axle 4, the contact surface 36 of the cam 32 of the locking hook on the side of the pivot axle moves between the upper point H_Y , which corresponds to the open position A of the cover, and the lower point H_A , which corresponds to the closed position K of the cover. The upper point H_Y is above the horizontal plane P_H that passes through the centre line 14 of the pivot axle and the lower point H_A below the same. By means of such an arrangement, the movement $H_Y \rightarrow H_A$ of the locking hook 30 and its contact surface 34 in particular, and the closing movement A→K of the cover, which thus is inwards in the transverse directions $-H_{AK}$, $-W_{AK}$, take place approximately in the same direction, whereby the locking hook, when closing behind the lower cord 34, as viewed from the wagon space, tightens the cover in the transverse directions $-H_{AK}$, $-W_{AK}$. In the closed position K of the cover, the said contact surface forms an angle $\chi \pm 30^\circ$, at the most, with respect to a vertical plane P_V , although in the preferred embodiment illustrated by the figures, this angle χ is substantially zero. The lower spans 34 of the second through holes 31 are horizontal and connect the opposite sides of the through holes, as shown in Fig. 5. The thickness S of the locking hooks 30 in the direction of the pivot axle is smaller than the distance L4 of the tip 33 of its cam from the centre line 14 of the pivot axle.

[0013] There are at least two combinations of the locking hook 30 and the through hole 31 on the length L_H of one longitudinal side 99a, 99b of each cover, but there can also be more, such as three, in the manner shown in Fig. 1. Furthermore, the through hole 31 is preferably located at a horizontal distance W3, which is in the transverse direction of the wagon, as measured from the hypothetical extension 97 pointing downwards from the vertical portion 98 of the longitudinal side of the cover, towards the inside of the wagon, as shown in Fig. 3A. The said through hole is either formed in the cover 10 or in a counter piece 37 fixed to the cover.

[0014] Furthermore, the lower shift mechanism comprises a counter mechanism 60 shown in Figs. 6 and 7A-7B, which is used to lighten the opening movement of the covers 10 and to keep the cover in its open position A without passing any dead points or without locating in any of the dead points. This is necessary because the lifting rail sections 6 in the closed position K of the cover are in their lower dead points and lift the cover upwards and outwards to the extent of an angle, the size of which, i.e., the angle α between the arms 5a and 5b and the angle caused by the loose movement of the play Z together is considerably smaller than 180° . The coun-

ter mechanism 60 is based on a biased spring 64 or another power element 80, the force of which affects in the transverse direction of the wagon, and on a moment rod 65, which is connected to the pivot axle by means of a first bearing 61, the functional length of the arm affecting the moment rod being variable during the opening movement $K \rightarrow A$ and the closing movement $A \rightarrow K$. For this purpose, a pivoted part 67 is rigidly fixed to the pivot axle 4, pivoting with the axle. The moment rod 65 is connected to the pivot axle by means of the first bearing 61 in a pivotable manner; to be more precise, to the pivoted part 67 that is fixed to the pivot axle, at a first arm distance $L1$ from the centre line 14 of the pivot axle. Furthermore, the counter mechanism comprises a transmission block 70, which is connected to the moment rod 65 in a pivotable manner by means of a second bearing 62 at a second arm distance $L2$ from the first bearing 61, and to the wagon frame 100 or a corresponding point in a pivotable manner by means of a third bearing 63, in accordance with Fig. 7B. In the transmission block, between the third bearing 63 and the second bearing 62, there is a third arm distance $L3$. Accordingly, the counter mechanism works by the combination of three lever arms, which consists of the first arm distance $L1$, which pivots with the pivot axle for the opening movement $K \rightarrow A$ and the closing movement $A \rightarrow K$ of the cover, of the third arm distance $L3$, which turns around the third bearing 63 with respect to the wagon frame 100, and of the second arm distance $L2$, which connects the first and second arm distances. All three arm distances $L1$, $L2$, $L3$ are located below the horizontal plane P_H that passes through the centre line 14 of the pivot axle. The said spring 64 or the other power element 80 is connected to the transmission block 70 so as to turn the transmission block by means of a force F_J around its third bearing 63 in a first direction of rotation $D1$, which tends to push the moment rod 65, depending on the relative positions of the arm distances, either towards the pivot axle or to pivot the pivot axle 4 in another direction of rotation $D2$, which causes the opening movement $K \rightarrow A$ of the cover. The directions of rotation $D1$ and $D2$ are such that, next to the centre line 14 of the pivot axle and the connecting line segment of the third bearing 63, they are oriented in the same direction and contain an essential component that points outwards in the horizontal transverse direction $+W$ of the wagon.

[0015] The pivoted part 67, the moment rod 65, and the transmission block 70 are located at such points with respect to one another, that in the closed position K of the covers, the first bearing 61, the second bearing 62, and the centre line 14 of the pivot axle are aligned with each other, as shown by unbroken lines in Fig. 7B. In this situation, the functional arm length that affects the pivot axle 4 is essentially zero. This is understandable, when the first arm distance $L1$ and the second arm distance $L2$ are aligned with each other and the centre line 14 of the pivot axle, whereby there is no moment arm that would pivot the pivot axle. Furthermore, in the

closed position K of the covers, the third arm distance $L3$ between the third bearing 3 and the second bearing 62 is essentially perpendicular to the second arm distance $L2$ between the second bearing 62 and the first bearing 61. In that case, the third arm distance $L3$ of the transmission block works as a lever arm with respect to its third bearing 63, with the force F_J trying to turn it in the other direction of rotation $D2$. In the case, where the third and second arm distances are exactly perpendicular to each other, the third arm distance $L3$ is as great as its functional arm length, but when the angle δ between the third and second arm distances, which can be within 60° - 120° , deviates from the right angle, however, the portion of the force F_J conveyed by the functional arm length of the third arm distance $L3$ is at its maximum. However, as the functional arm length affecting the pivot axle 4 is zero, as described above, this is not a disadvantage.

[0016] In the open position A of the covers, the first arm distance $L1$ between the first bearing 61 and the centre line 14 of the pivot axle is essentially perpendicular to the second arm distance $L2$ between the second bearing 62 and the first bearing 61, whereby the functional arm length affecting the pivot axle is at its maximum, when the first arm distance $L1$ works as a lever arm that pivots the pivot axle 4. If the first and second arm distances are then exactly perpendicular to each other, the first arm distance $L1$ is as great as its functional arm length, but when the angle β between the first and the second arm distances, which angle can be within 60° - 120° , deviates from the right angle, the moment, which is exerted on the pivoted part 67 by the force F_J through the third arm distance of the transmission block 70 and particularly the second arm distance $L2$ of the moment rod 65 with the intermediation of the functional arm length of the first arm distance $L1$ of the pivoted part, is at its maximum, as illustrated by the parts drawn with dashed lines in Fig. 7B. Furthermore, in the open position A of the covers, the third bearing 63, the second bearing 62, and the first bearing 61 are essentially aligned with each other, whereby the portion of the force F_J conveyed by the third arm distance $L3$ between the third and the second bearings to the moment rod 65 is at its minimum, but this is not a disadvantage, because the moment rod formed by the first arm distance $L1$ of the pivoted part 67, i.e., to its functional arm length, is at its maximum. The greater the bias of the spring 64, the smaller the decrease in the force F_J , when the transmission block 70 turns in the direction of rotation $D1$. If hydraulics, pneumatics, an electric motor or a screw transmission or another corresponding device is used as the power element 80, no such decrease in power takes place. For the open position A , any surface 71 of the transmission block 70 can be given such a shape that it bears on the wagon frame 100, for example, in the manner shown in Fig. 7B, whereby the opening movement $K \rightarrow A$ stops at the right place.

[0017] The said spring 64 is preferably a torsion bar

spring 64a in the longitudinal direction L_L of the wagon, which is shown in Fig. 6 in particular or, alternatively, a helical spring 64b in the transverse direction $\pm W$, $\pm H$ of the wagon, as indicated by the dashed line in Fig. 6. The other power element 80 can be a hydraulic or pneumatic or electric motor or a screw transmission, which is schematically illustrated in Fig. 6 by the line of dots and dashes. The said bias of the spring or the corresponding effective power of the motor is in a direction, which tends to lift the cover from the closed position into the open position. One end of the torsion bar spring 64a or, generally, of the spring 64 is supported by a bracket 72. Furthermore, Fig. 7A shows an adjusting screw 69, which is coupled between the wagon frame 100 or the support 73 fixed to it and the bracket 72. The bracket 72 is connected to the wagon frame in a pivotable fashion by means of a fourth bearing 74. When the adjusting screw is used to turn the other end of the torsion bar spring 64a, the bracket can be turned around the bearing 74 and, thus, the spring is provided with the desired bias.

[0018] On the lower edges 13 of the covers 10, the lower shift mechanism also comprises fixed derailment prevention plates 90 in the transverse direction $\pm W$, $\pm H$ of the wagon, extending to the lifting rail sections 6; to be more precise, mainly around the lifting rail sections, but without touching them so that in the portion of the derailment prevention plate surrounding the lifting rail sections, there is a gap 91, which corresponds to the thickness S1 of the supporter 76 of the stationary run rail 2. To be more precise, the width S2 of the gap 91 in a direction perpendicular to the direction of the supporter 76 is greater than the thickness S 1 of the supporter, but smaller than the thickness S3 of the run rail 2, and also smaller than the thickness of the lifting rail sections 6 and the auxiliary rail sections 7. The thickness of the lifting rail sections and the auxiliary rail sections at least in the horizontal direction $\pm W$ is essentially the same as the thickness S3 of the stationary run rails. In this way, the derailment prevention plate prevents the transport rollers of the cover from falling off the run rails 2, the lifting rail sections 6, and the auxiliary rail sections 7 under the effect of forces acting from outside.

[0019] The second arms 5b that are intended for the auxiliary rail sections have a downward-pointing bend 8, which in the closed position K of the cover is supported in the area of the lower edges 13 of the cover and preferably against the lower edge of the first through holes 21 or a support 9 on the lower edges, from outside the wagon towards the inside at least in the transverse direction $-W$, preventing the cover from opening accidentally under the effect of wind, for example. As a result, the coupling between the transport roller 3 and the lifting rail section 6 does not impede the above-mentioned prevention of opening the cover. The said bend and the fact that it presses the cover 10 towards the inside are also significant for the locking of the cover described earlier. The locking hooks 30 of the lower locking mechanism and the lower spans 34, which act as their

counter parts, prevent the cover from shifting outwards in the transverse directions $+W$, $+H$. When the bend 8 bears against the support 9 in the cover, the second arms 5b of the lower shift mechanism also prevent the cover from shifting outwards. In this way, the working parts of the lower locking mechanism can be placed next to the lifting rail section and the auxiliary rail section of the lower shift mechanism without using special supplementary parts, reducing the total number of parts needed in the lower locking mechanism.

Claims

1. A lower locking mechanism for keeping the rigid covers (10) of a railway freight wagon in their closed positions (K), whereupon they close the wagon space (50), the covers in their open position (A), in which they are moved outwards from the wagon space, being movable over the covers that are in the closed positions in the longitudinal direction (L_L) of the wagon by means of a shift mechanism, which comprises at least in the area of the lower parts of the longitudinal sides (99a, 99b) of the wagon: transport rollers (3) in the covers, and stationary run rails (2) for them in the wagon frame (100), and pivot axles (4), which are movable around the centre lines (14) that are in the longitudinal direction (L_L) of the wagon, rail sections fixed to said axles and adapted to fit into the openings (20) of the run rails, **characterized in that** the locking mechanism further comprises locking hooks (30) that are rigidly fixed to the pivot axles (4) and movable with their pivoting (R); and that in the area of the lower edges (13) of the covers, there are through holes (31) with lower spans (34) behind which the cam (32) of the locking hook is located in the closed position (K) of the cover.
2. A lower locking mechanism according to Claim 1, **characterized in that** the distance (Q) between the contact surface (36) of the cam (32) of the locking hook directed towards the pivot axle and the centre line (14) of the pivot axle decreases from the tip of the cam towards the bottom (35) of the locking hook.
3. A lower locking mechanism according to Claim 1 or 2, **characterized in that** the contact surface (36) of the cam (32) of the locking hook directed towards the pivot axle moves during the pivoting (R) of the pivot axle (4) between an upper point (H_Y), which corresponds to the open position (A) of the cover, and a lower point (H_A), which corresponds to the closed position (K) of the cover; that said upper point is above the horizontal plane (P_H) that runs through the centre line (14) of the pivot axle and the said lower point is below the same.

4. A lower locking mechanism according to Claim 1, 2 or 3, **characterized in that** the said contact surface in the closed position (K) of the cover forms an angle (χ) $\pm 30^\circ$, at the most, with respect to the vertical plane (P_V). 5
5. A lower locking mechanism according to any of the preceding Claims, **characterized in that** the lower spans (34) of the through holes (31) are horizontal. 10
6. A lower locking mechanism according to any of the preceding Claims, **characterized in that** the thickness (S) of the locking hooks (30) in the direction of the pivot axle is smaller than the distance (L4) of the tip (33) of its cam from the centre line (14) of the pivot axle. 15
7. A lower locking mechanism according to any of the preceding Claims, **characterized in that** on the length (L_H) of one longitudinal side (99a, 99b) of each cover, there are at least two combinations of the locking hook (30) and the through hole (31). 20
8. A lower locking mechanism according to any of the preceding Claims, **characterized in that** the said through hole (31) is located at a horizontal distance (W3) in the transverse direction of the wagon from the extension (97), which extends downwards from the vertical portion (98) of the cover, towards the inside of the wagon; and that said through hole is either formed in the cover (10) or the counter piece (37) fixed to the cover. 25 30
9. A lower locking mechanism according to any of the preceding Claims, **characterized in that** it further comprises lifting rail sections (6) and auxiliary rail sections (7) fixed to said pivot axles next to the openings (20) of the run rails by first and second arms (5a, 5b) in such positions that: 35 40
 - in the opening movement (K→A) of the cover, the lifting rail sections (6) first move mainly in a direction ($+W_{AK}$) outwards from the wagon space and then also in a direction ($+H_{AK}$) upwards from below and into the openings (20) of the run rails and, in the closing movement (A→K), in opposite directions ($-H_{AK}$, $-W_{AK}$), 45
 - in the opening movement (K→A) of the cover, the auxiliary rail sections (7) move up and away from the openings (20) of the run rails and in the closing movement (A→K), move down back into the said openings. 50
10. A lower locking mechanism according to Claim 9, **characterized in that** in the second arms (5b), there is a downward-pointing bend (8), which in the closed position (K) of the cover bears against a support (9) in the area of the lower edges (13) of the cover at least inwards in the longitudinal direction (-W) of the wagon. 55
11. A lower locking mechanism according to Claim 9, **characterized in that** the effective lengths (L6, L7) of the first arm (5a) and the second arm (5b) are equal; that the auxiliary rail sections (7) are rigidly fixed to the pivot axle by their second arms (5b); and that the first arm (5a) of the lifting rail sections (6) is fixed to the pivot axle by means of a hinge mechanism (15), which allows a limited pivoting of the first arm around the hinge line (25) of its hinge axle (18).
12. A lower locking mechanism according to Claim 11, **characterized in that** the lifting rail section (6) with its first arm (5a) in the closed position (K) of the cover is in its lower dead point; and that in the closed position (K) of the cover, the lifting rail section (6) with its first arm (5a) hangs loose supported by the said hinge axle.
13. A lower locking mechanism according to any of Claims 9 to 12, **characterized in that** further comprising a counter mechanism (60) based on a biased spring (64) or some other power element and on such a moment rod (65), which is connected to the pivot axle by means of a first bearing (61), the effective arm length (L_A) affecting the pivot axle being variable during the opening movement (K→A) and the closing movement (A→K) of the covers, the counter mechanism being used to lighten the opening movement of the covers and to keep the cover in its open position (A).
14. A lower locking mechanism according to Claim 13, **characterized in that** the moment rod (65) is pivotably connected to the pivot axle by means of the first bearing (61) at a first arm distance (L1) from the centre line (14) of the pivot axle.
15. A lower locking mechanism according to Claim 13 or 14, **characterized in that** further comprising a transmission block (70), which is pivotably connected to the moment rod (65) by means of a second bearing (62) at a second arm distance (L2) from the first bearing (61) and pivotably to the wagon frame (100) or the like by means of a third bearing (63).
16. A lower locking mechanism according to Claim 14 or 15, **characterized in that**
 - in the closed positions (K) of the covers: the first bearing (61), the second bearing (62) and the centre line (14) of the pivot axle are aligned with each other, whereby the effective arm length acting on the pivot axle is substantially zero; and
 - in the open positions (A) of the covers: at least

the second arm distance (L2) between the second bearing (62) and the first bearing (61) is substantially perpendicular to the first arm distance (L1) between the centre line (14) of the pivoted axle and the first bearing (61), whereupon the portion of the force (F_J) conveyed by the third and second arm distances (13, L2) is at its maximum.

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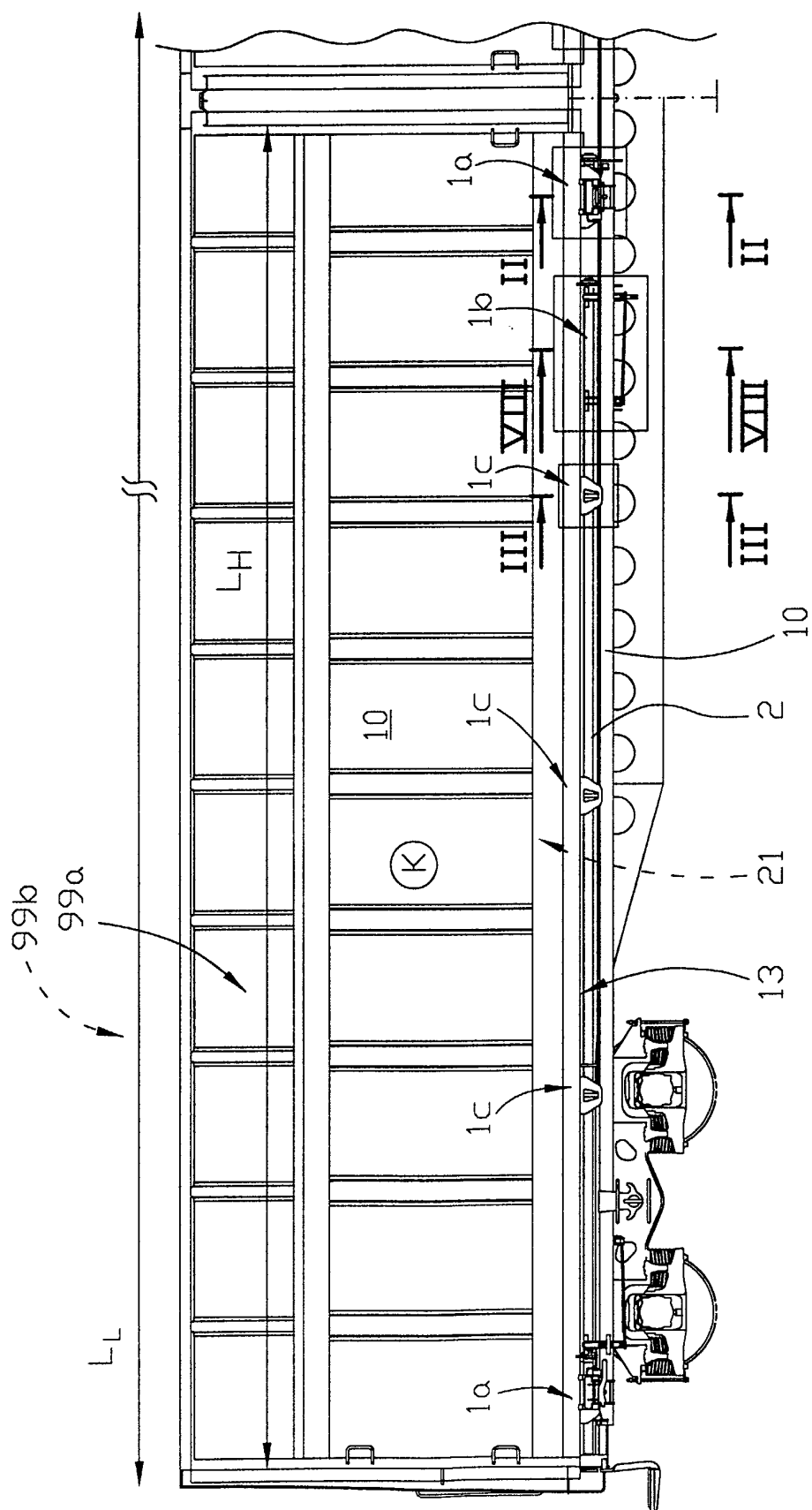


Fig.1

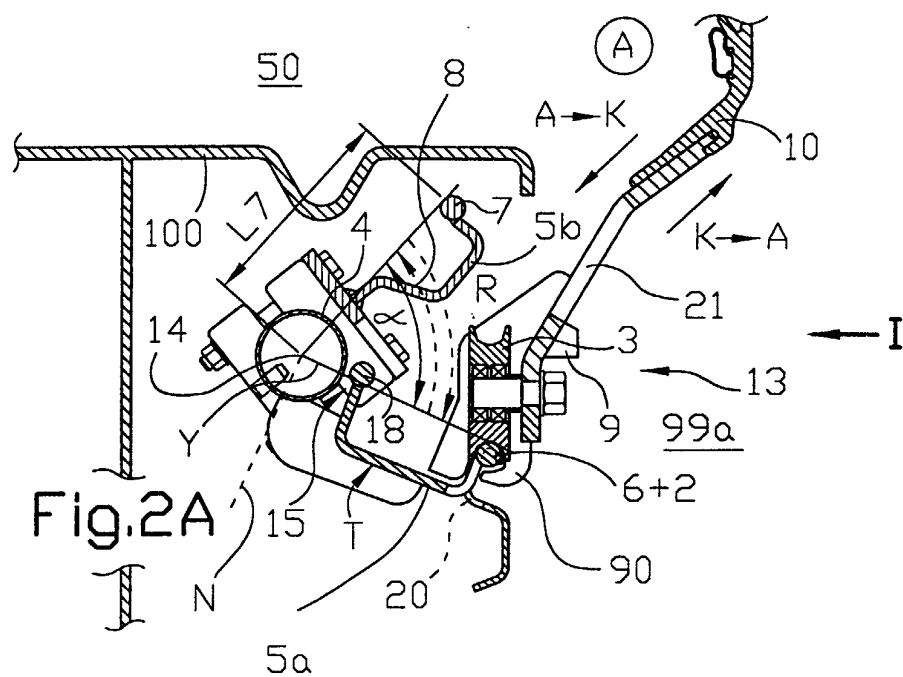


Fig. 2C

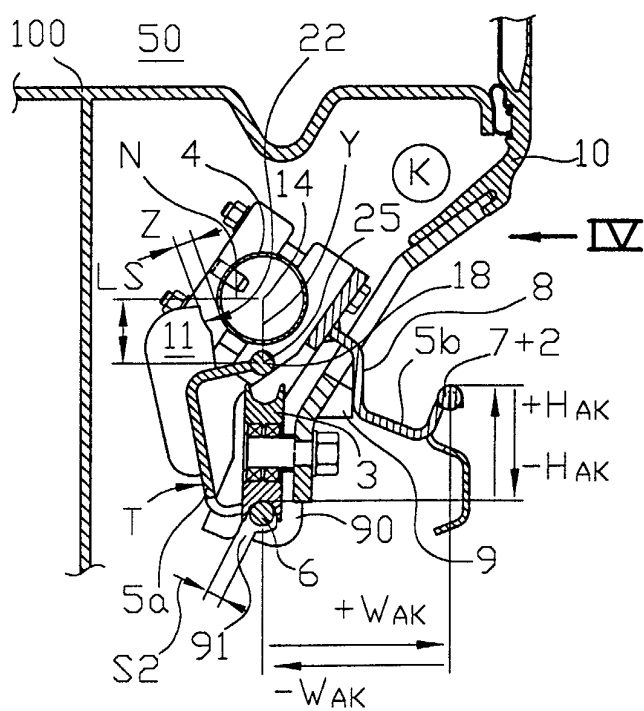
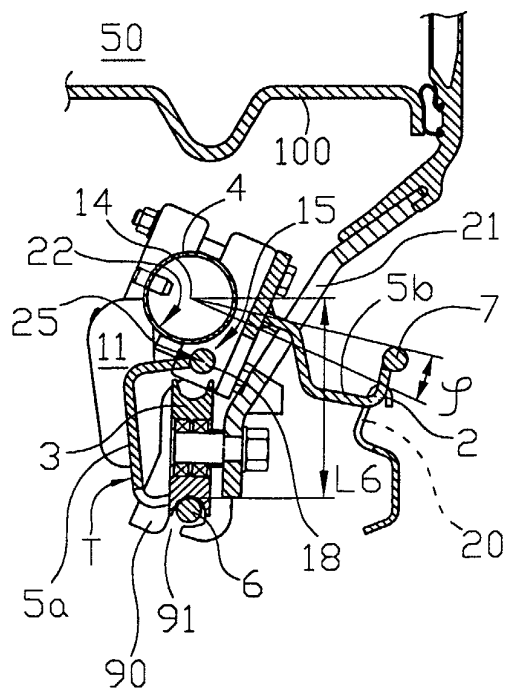


Fig. 2B



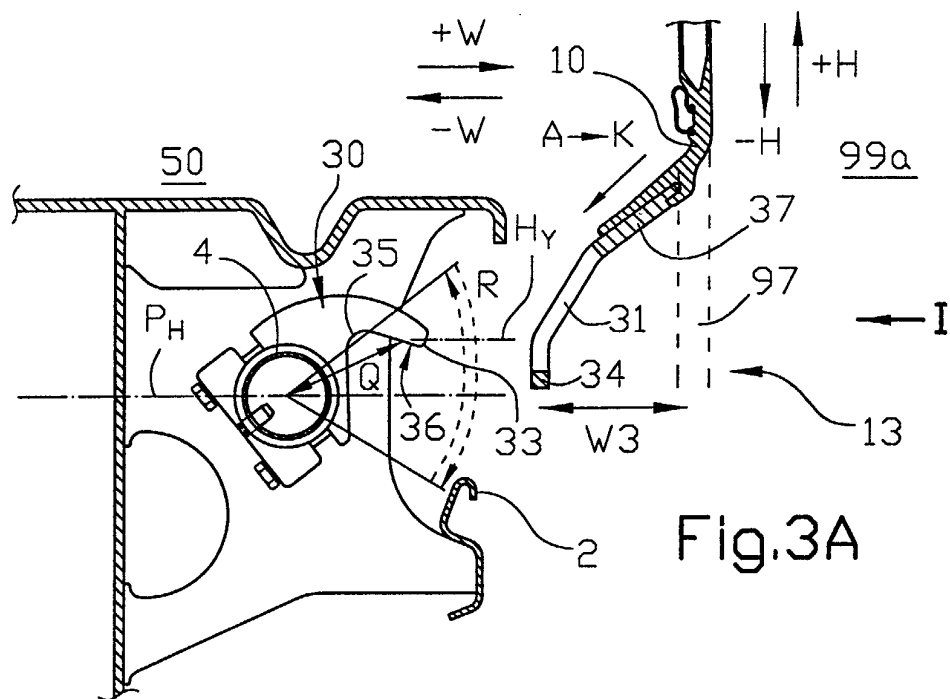
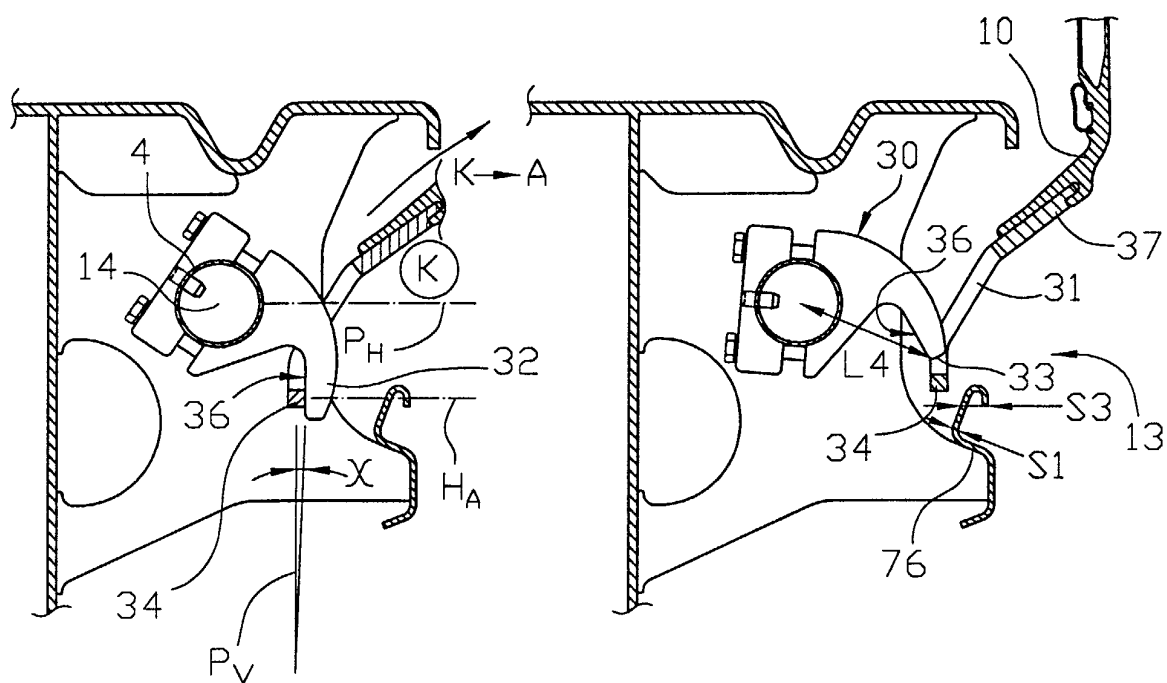
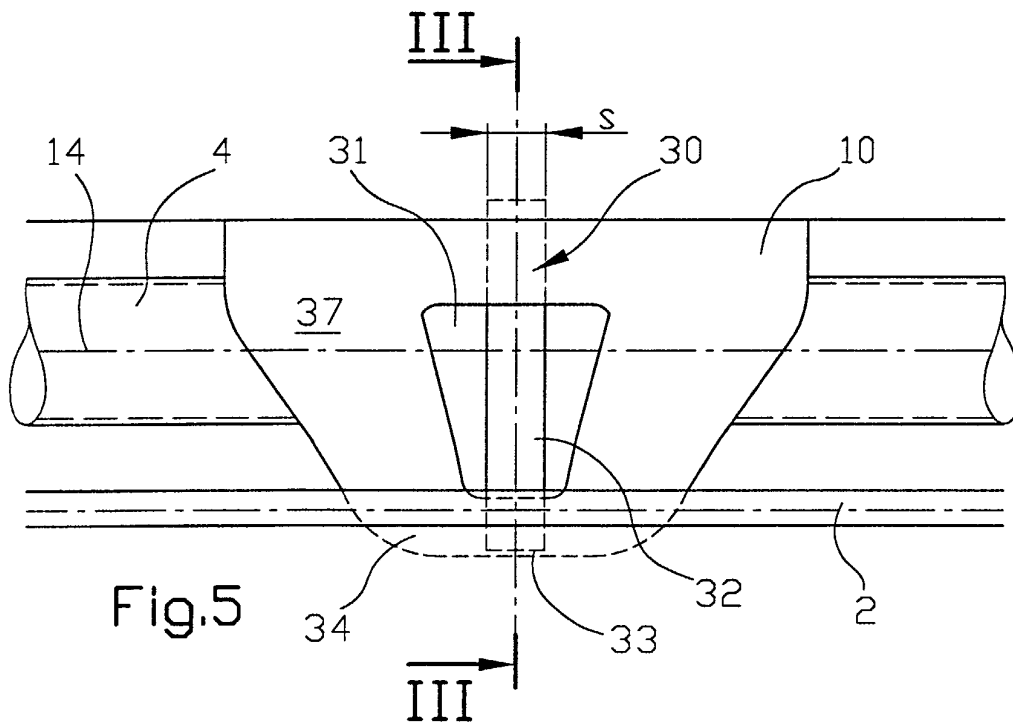
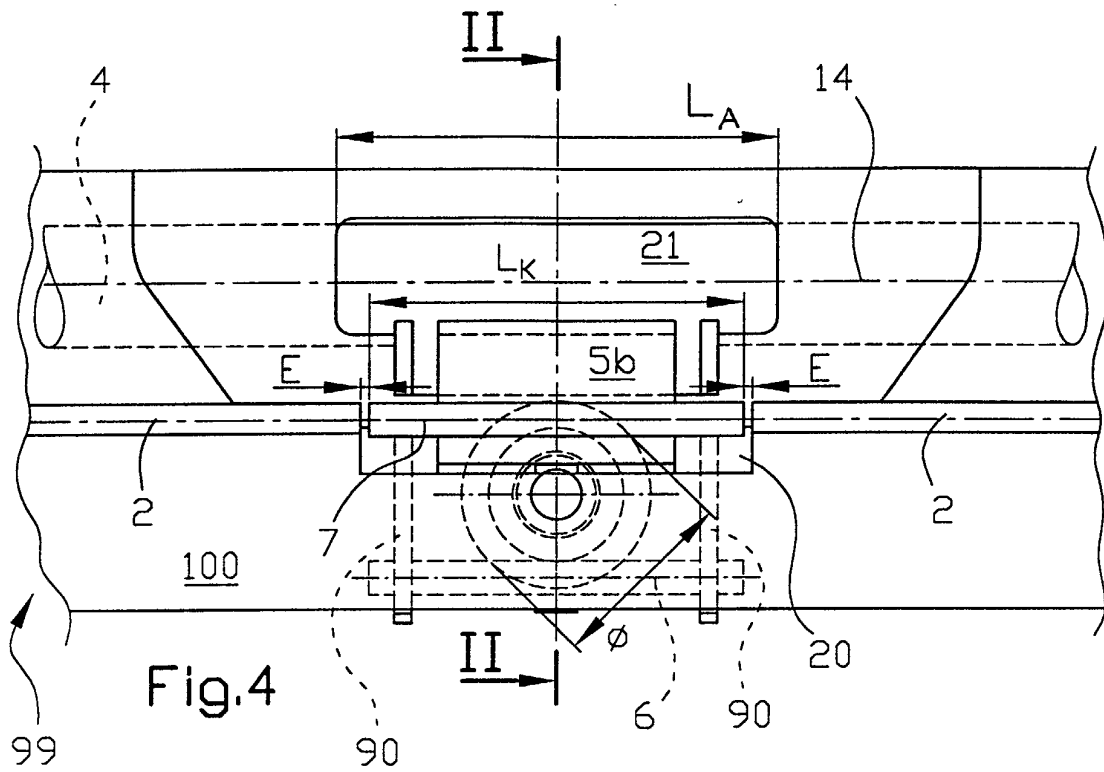


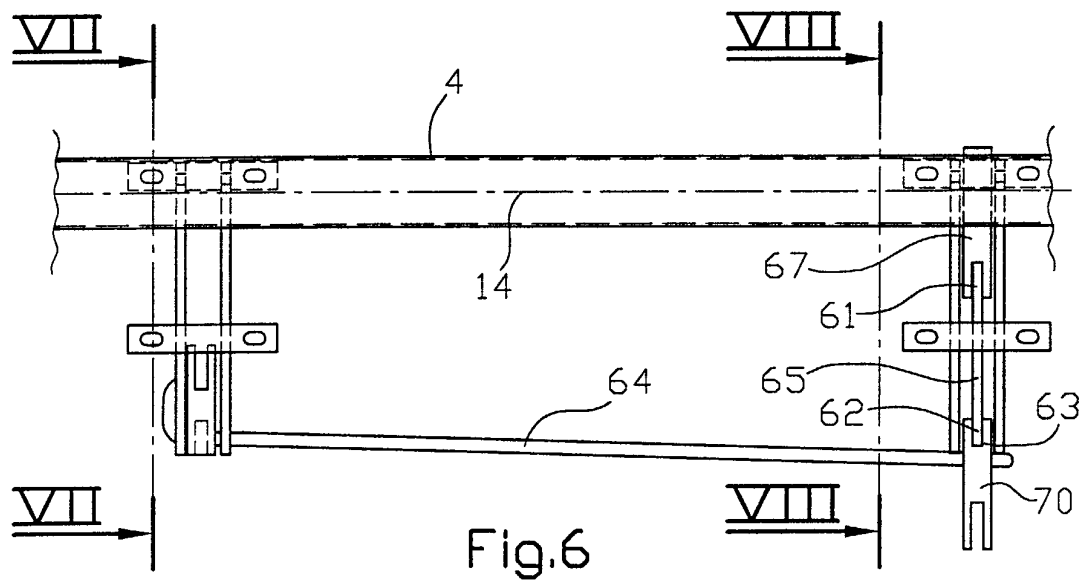
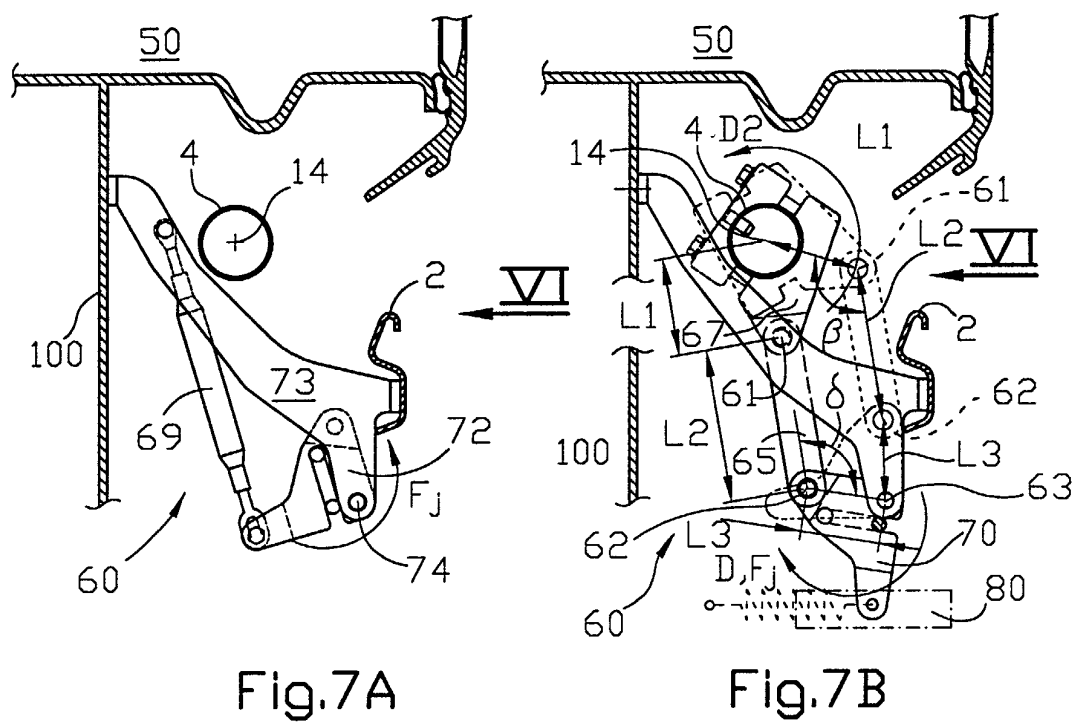
Fig.3A

Fig.3C

Fig.3B









European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 39 6083

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	DE 196 01 066 A (RAUTARUUKKI OY) 8 August 1996 (1996-08-08) * column 7, line 2 - column 8, line 35; figure 3 *	1,2,5-8	B61D19/00 B61D39/00
Y	EP 0 855 325 A (DEUTSCHE WAGGONBAU AG) 29 July 1998 (1998-07-29) * column 2, line 58 - column 3, line 28; figures 1,2 *	1,2,5-8	
D,A	EP 0 121 086 A (WAGGON UNION GMBH) 10 October 1984 (1984-10-10) * figures 1,2,7,8 *	1	
A	GB 2 104 021 A (LINKE HOFMANN BUSCH) 2 March 1983 (1983-03-02) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B61D
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 25 September 2002	Examiner Fuchs, A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 39 6083

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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25-09-2002

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 19601066	A	08-08-1996	FI 97458 B	13-09-1996
			DE 19601066 A1	08-08-1996
			IT T0960066 A1	01-08-1997
			SE 509054 C2	30-11-1998
			SE 9600147 A	03-08-1996
EP 0855325	A	29-07-1998	DE 19701887 A1	23-07-1998
			AT 210039 T	15-12-2001
			CZ 9800165 A3	12-08-1998
			DK 855325 T3	11-02-2002
			EP 0855325 A1	29-07-1998
			ES 2168149 T3	01-06-2002
			HU 9800086 A2	29-01-2001
			PL 324376 A1	03-08-1998
			SI 855325 T1	30-06-2002
			SK 7298 A3	11-01-1999
EP 0121086	A	10-10-1984	DE 3312001 A1	04-10-1984
			AT 46880 T	15-10-1989
			BR 8400953 A	26-02-1985
			CA 1217388 A1	03-02-1987
			CS 8401458 A3	15-04-1992
			DD 222250 A5	15-05-1985
			DE 3479993 D1	09-11-1989
			DK 69984 A ,B,	03-10-1984
			EP 0121086 A2	10-10-1984
			ES 530162 D0	01-11-1984
			ES 8500154 A1	01-01-1985
			HU 191540 B	30-03-1987
			LV 5608 A3	10-05-1994
			NO 840844 A ,B,	03-10-1984
			RO 89031 A1	15-03-1986
			SU 1324581 A3	15-07-1987
			US 4569293 A	11-02-1986
			YU 54984 A1	30-04-1988
GB 2104021	A	02-03-1983	DE 3132002 A1	03-03-1983
			AT 373558 B	10-02-1984
			AT 148482 A	15-06-1983
			BE 893014 A1	16-08-1982
			CH 655469 B	30-04-1986
			DD 207883 A1	21-03-1984
			ES 511752 D0	16-02-1983
			ES 8303992 A1	16-05-1983
			FR 2511327 A1	18-02-1983
			NL 8202036 A ,B,	01-03-1983

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 39 6083

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

25-09-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2104021 A	SE	441432 B	07-10-1985
	SE	8204651 A	11-08-1982

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82