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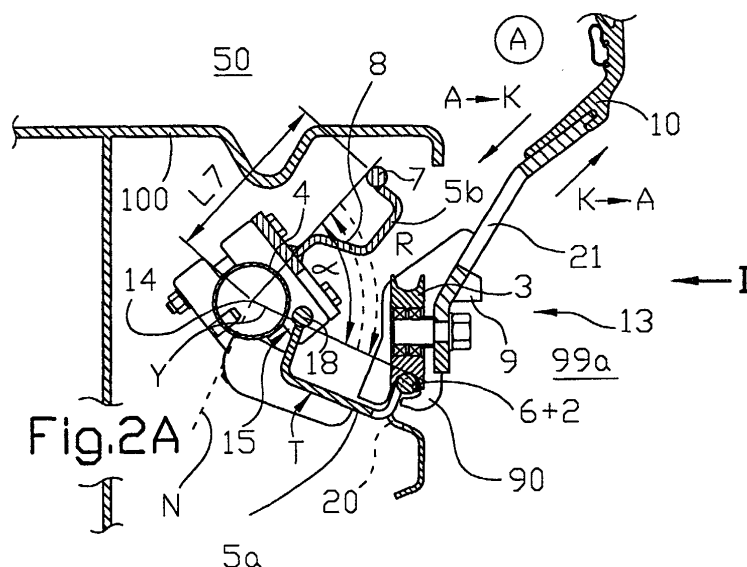
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(54) Lower shift mechanism in railway freight wagons

(57) The invention relates to a lower shift mechanism for the rigid covers (10) of a railway freight wagon, the covers in their closed positions (K) closing the wagon space (50) and in the open positions (A) being movable over the covers in the closed position in the longitudinal direction of the wagon. The lower shift mechanism comprises transport rollers (3) in the covers, stationary run rails (2) in the wagon frame (100), and pivot axles (4) that can be moved around the centre lines (14), which are in the longitudinal direction of the wagon, the axles having, next to the openings (20) of the run rails, lifting rail sections (6) fixed by means of first arms (5a), and an auxiliary rail section (7) fixed by second arms

(5b). The covers are positioned by lifting and lowering them by the transport rollers in the transverse direction of the wagon into their closed positions (K) and their open positions (A), whereby the transport rollers roll on the run rails and on the auxiliary rail sections that are in the said openings. The pivot axles pivot (R) so that the lifting rail sections in the opening movement (K→A) of the cover first move mainly outwards from the wagon space and then also upwards from below into the openings (20) of the run rails and in the closing movement (A→K), in opposite directions, while in the opening movement of the cover, the auxiliary rail sections move away from the openings of the run rails and, in the closing movement, down back into the openings (20).



Description

[0001] The invention relates to a lower shift mechanism for the rigid covers of a railway freight wagon, which in their closed position close the wagon space and in their open position, which is moved outwards from the wagon space, are movable over the covers, which are in their closed positions, in the longitudinal direction of the wagon, the lower shift mechanism comprising: transport rollers rotating in the area of the lower edges of the covers; stationary run rails in the lower parts of the wagon's longitudinal sides in the wagon frame, the rails having openings next to the transport rollers of the covers that are in their closed positions; pivot axles, which are movable around the longitudinal centre lines of the wagon, the axles having rail sections next to the said openings, fixed by means of first and second arms for positioning the covers by lifting and lowering them by the transport rollers in the cross direction of the wagon into two different locations, which correspond to the closed and the open positions of the cover, during which in the open position the transport rollers roll on the run rails and the rail sections in the said openings.

[0002] The movable covers in railway freight wagons refer to covers, which at least to some extent form 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, which is in its 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 a structure, wherein the lower edges of the sliding cover - not a sliding wall - are provided with stationary projecting auxiliary rails, and the sliding cover is opened and closed by means of lifting bars that are of the same length as the sliding cover section, which lifting bars, for the open position of the sliding cover, are turned by a movement that is first directed outwards and then upwards, whereby the lifting bars are aligned with the auxiliary rails of the second sliding cover in its closed position. In this solution, the auxiliary rails that project to the sides of the sliding cover are easily damaged and, as they limit the range of travel of the wagon, the useful space of the wagon is essentially smaller than desired. Furthermore, the shift mechanism based on the gear unit of the lifting bars is heavy, expensive, and requires a lot of maintenance during use. The publications FI-81310 and EP-0 521 695 describe arrangements, whereby the wagon frame is provided with stationary run rails, which comprise openings that accommodate the short pieces of the lifting bars, which lift the cover and are driven by means of a pivot axle that is in the longitudinal direction of the wagon and, generally, any short pieces of lifting bars operated by various mechanisms. In both publications, the cover is transferred into its open position by an opening move-

ment, whereby the swinging movement of the pieces of lifting bar is directed from a movement inside the wagon first upwards and then outwards, and further slightly past the upper dead point. The patent FI-81310 also describes an embodiment, wherein two rail sections are placed on the pivot axle on its opposite sides in a mirror-symmetrical fashion. In this case, when the cover section is to be transferred from the closing position into the shift position, the first rail section lifts each roller, bearing on them from below, and thus the cover section into the shift position by means of a movement in the direction described above. In the shift position, the first rail section forms an extension of the run rail, as described above. The second rail section on the opposite side to the pivot axle is now below the pivot axle. The cover section with its rollers is lowered into the closing position by pivoting the pivot axle in the opposite direction, after which this pivoting of the pivot axle is further continued in the same direction, whereby the cover section remains supported on the frame, closing it, and the second rail section that was in the shift position below now turns upwards on the outside of the wagon and forms the extension of the run rail in its gap. In that case, the first rail section is located approximately downwards from the pivot axle. In principle, the solution described is simple, not requiring parts that project from the wagon in the lateral direction in the closing position of the wagon cover, but it indeed requires space in the vertical direction also in the closing position of the cover, and a great deal of free space for the swinging movement also on the outside the wagon.

[0003] The object of the invention is to provide such a lower shift mechanism for the rigid covers of a railway freight wagon, which in the closed position of the cover takes so little space both in the horizontal and the vertical directions, that the useful space of the wagon does not become unnecessary small because of the range of travel, and which needs a sufficiently small space when transferring the covers from their closed position into the open position and vice versa. A second object of the invention is such a lower shift mechanism, which does not have projecting parts that damage easily. A third object of the invention is such a lower shift mechanism, which can reliably be made to remain and/or be locked both in its open position and its closed position. A fourth object of the invention is such a lower shift mechanism, which allows as straight run rails as possible for the rollers of the cover. A fifth object of the invention is such a lower shift mechanism, which is light in use and which could easily be remote-controlled and/or automated. A further object of the invention is such a lower shift mechanism, the manufacturing costs of which are competitive.

[0004] The problems described above can be solved and the objects defined above implemented by means of the lower shift 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 shift mech-

anism according to the invention is that, during the travel of the railway wagon, there are no parts of the mechanism in the structure that would project outside the cover, but all essential components are within the area defined by the outer surfaces or the covering of the wagon frame, effectively preventing breaking, distortion or other damage thereof. Such breaking, distortion or other damage could prevent the cover from opening properly; therefore, the good protection of the mechanism provided by the structure of the invention guarantees reliable operation. A second advantage of the lower shift mechanism according to the invention is an easy transfer from the closed position into the open position and vice versa, which is made possible by the parts that are connected to it in a natural way, and a third advantage is the locking of the cover in its closed position, which is made possible by the parts that are connected to it in a natural way. A further advantage of the lower shift 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.

[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 length of the wagon 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 related to the lower shift mechanism according to the invention, 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, viewed at point 1b of Fig. 1 and from the direction VI of Figs. 7A and 7B, and in the wagon frame with the stationary 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 full lines show the levers in the position corresponding to the closed position of the cover, and the dashed lines show 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 $A \rightarrow K$ 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 on 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 turns 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 position 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 $K \rightarrow A$, 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 $A \rightarrow K$, 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 $A \rightarrow K$ 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 counter 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, trying 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 S1 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 shift mechanism for the rigid covers (10) of a railway freight wagon, which covers in their closed positions (K) close the wagon space (50) and, 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) of the wagon, the lower shift mechanism comprising:

- transport rollers (3) that roll in the area of the lower edges (13) of the covers;
- stationary run rails (2) in the lower parts of the longitudinal sides (99a, 99b) of the wagon in the wagon frame (100), the run rails comprising openings (20) next to the transport rollers of the covers in the closed positions;
- pivot axles (4), which are movable around centre lines (14) being in the longitudinal direction (L_L) of the wagon, and which have rail sections fixed by first and second arms (5a, 5b) next to the said openings to position the covers by lifting and lowering them by the transport rollers into two different points in the transverse direction of the wagon, the points corresponding to the closed position (K) and the open position (A) of the cover, the transport rollers (3) rolling, during the open position, on the run rails and on the rail sections that are in the said openings,

characterized in that the first one of the said rail sections is a lifting rail section (6) and the second one is an auxiliary rail section (7); and that in the lower shift mechanism, the pivot axles (4) further pivot (R) so that:

- in the opening movement ($K \rightarrow A$) 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 into the openings (20) of the run rails, and in the closing movement ($A \rightarrow K$), in opposite directions ($-W_{AK}$, $-H_{AK}$),
 - in the opening movement ($K \rightarrow A$) of the cover, the auxiliary rail sections (7) move upward and away from the openings (20) of the run rails and, in the closing movement ($A \rightarrow K$), down back into the said openings.
2. A lower shift mechanism according to Claim 1, **characterized in that** the angle (α) between the effective lengths (L_6 and L_7) of the first arms (5a) of the lifting rail sections and the second arms (5b) of the auxiliary rail sections is 120° at a maximum; and that the effective lengths of the first arm (5a) and the second arm (5b) are equal.
 3. A lower shift mechanism according to Claim 1 or 2, **characterized in that** the auxiliary rail sections (7) are rigidly fixed to the pivot axle by means of their second arms (5b).
 4. A lower shift mechanism according to any of the preceding Claims, **characterized in that** the first arm (5a) of the lifting rail section (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), the hinge line being at a hinge distance (L_S), which is smaller than the effective length (L_6) of the first arm, from the centre line (14) of the pivot axle (4).
 5. A lower shift mechanism according to Claim 4, **characterized in that** 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 connecting plane (Y) of the said centre line (14) and the hinge line (25) and from the transport roller (3) supported by the lifting rail section (6), and which limiting block extends from the first arm at least to the normal (N) of the connecting plane (Y) that passes through the said centre line.
 6. A lower shift mechanism according to Claim 5, **characterized in that** in the closed position (K) of the cover, whereupon 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); and that at the beginning of the opening movement ($K \rightarrow A$), said support surface comes in contact with the pivot axle or another member that moves with it, preventing a further pivoting of the first arm (5a) around the hinge line (25), after which the pivoting (R) of the pivot axle causes a movement of the lifting rail sections (6) in transverse directions ($+H_{AK}$, $+W_{AK}$).
 7. A lower shift mechanism according to any of the previous Claims, **characterized in that**, in the closed position (K) of the cover, the lifting rail section (6) with its first arm (5a) 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 hinge axle (18) that attaches the first arm and the pivot axle to each other.
 8. A lower shift mechanism according to any of the previous Claims, **characterized in that** in the closed position (K) of the cover, the transport rollers (3) rest on top of and supported by the lifting rail section (6), whereupon the transport rollers are located between the lifting rail sections (6) and the hinge axle (18) that connects the first arm and the pivot axle to each other.
 9. A lower shift mechanism according to any of the previous Claims, **characterized in that** 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 the second arms (5b); and that the lifting rail sections (6) and the auxiliary rail sections (7) are shorter to the extent of longitudinal plays (E) than the said opening (20) of the run rails.
 10. A lower mechanism according to any of the preceding Claims, **characterized in that** it further comprises locking hooks (30), which are rigidly fixed to the pivot axle (4) and move with its pivoting (R); and that in the area of the lower edge (13) of the covers, there are second through holes (31), the cam (32) of the locking hook being located behind the lower span (34) of the through holes in the closed position (K) of the cover, as viewed from the inside of the wagon.
 11. A lower shift mechanism according to any of the previous Claims, **characterized in that** it further comprises a counter mechanism (60), which is based on a biased spring (64) or some other power element (80) and such a moment rod (65), which is connected to the pivot axle by means of a first bearing (61), the effective arm length affecting the pivot axle being variable during the opening movement ($K \rightarrow A$) and the closing movement ($A \rightarrow K$) 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) without passing by any dead points or without locating in any of the dead points.

12. A lower shift mechanism according to Claim 11, **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. 5
13. A lower shift mechanism according to Claim 11 or 12, **characterized in that** it further comprises 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), and wherein said spring (64) or the other power element is connected, tending to turn the transmission block around the third bearing in a first direction (D1). 10 15
14. A lower shift mechanism according to Claim 12 or 13, **characterized in 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, whereby the effective arm length acting on the pivot axle is essentially zero. 20 25
15. A lower shift mechanism according to Claim 12 or 13 or 14, **characterized in that** in the open position (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 pivot axle and the first bearing (61), whereupon the portion of a force (F_j) conveyed by the third and second arm distances (L3, L2) is at its maximum. 30 35
16. A lower shift mechanism according to any of Claims 11 to 15, **characterized in that** the said spring (64) is a torsion bar spring (64a) in the longitudinal direction (L_L) of the wagon or a helical spring (64b) in the transverse direction ($\pm W, \pm H$) of the wagon; that said other power element is a hydraulic or pneumatic or electric motor or a worm drive; and that said biasing force of the spring or the corresponding exerted force from the motor is in a direction (D2) tending to lift the cover from the closed position into the open position. 40 45
17. A lower shift mechanism according to any of the preceding Claims, **characterized in that** it further comprises on the lower edges (13) of the covers, fixed derailment prevention plates (90) in the transverse direction of the wagon, which extend to the lifting rail sections (6) substantially without touching them and around them so that in the portion of the derailment prevention plate surrounding the lifting rail sections, there is a gap (91) that corresponds to the thickness (S1) of the supporter (76) of the stationary run rail (2). 50 55

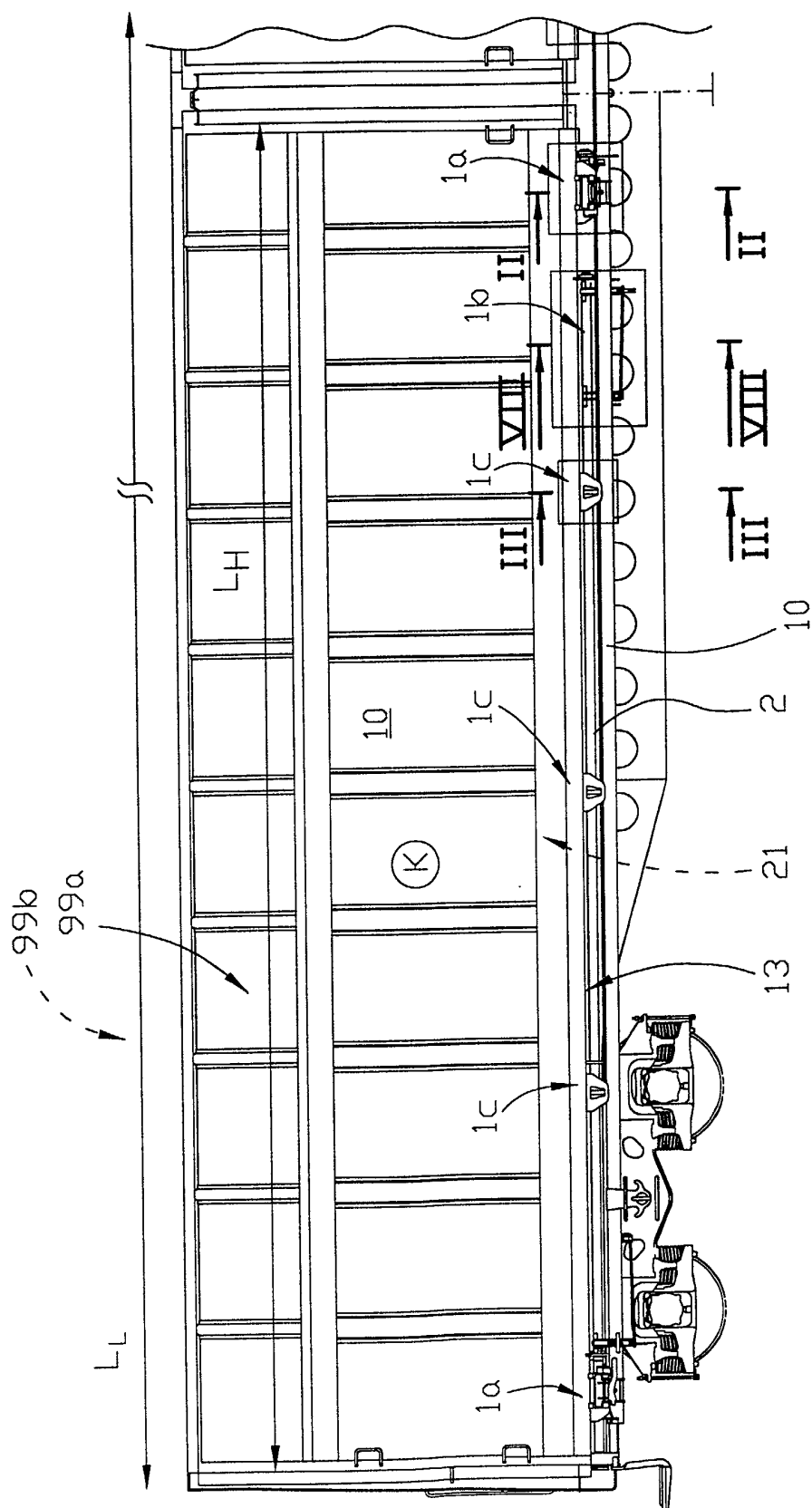


Fig.1

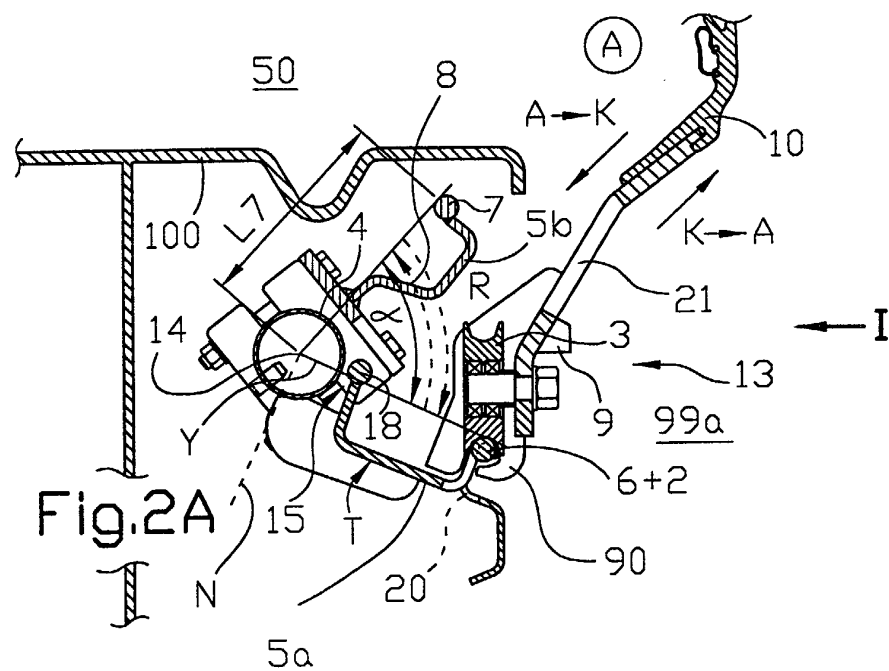


Fig.2C

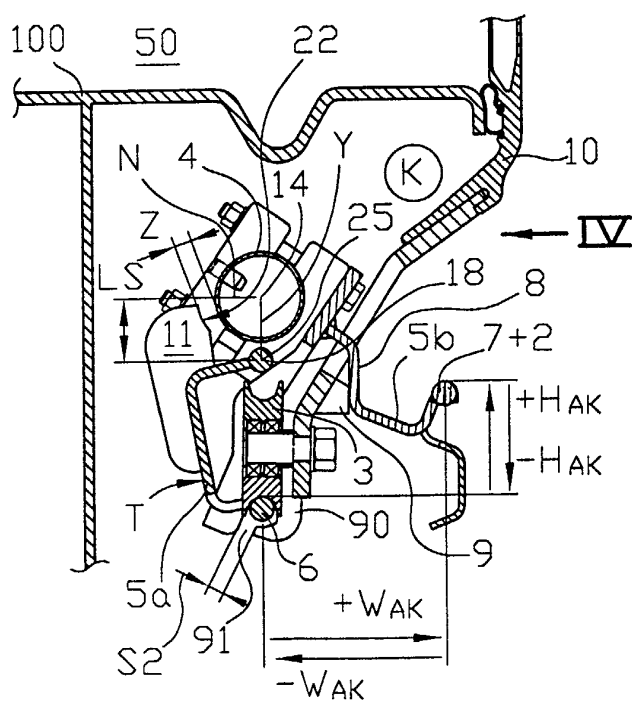
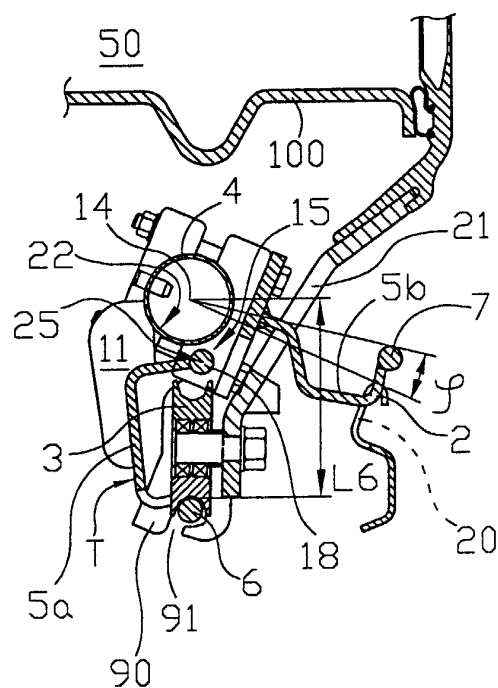


Fig.2B



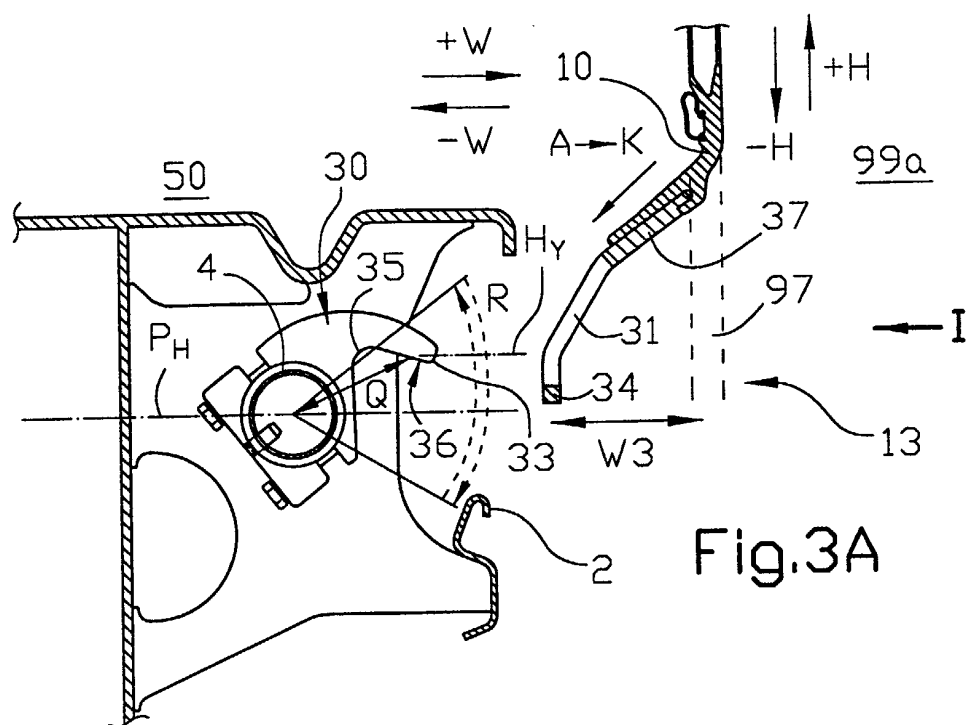
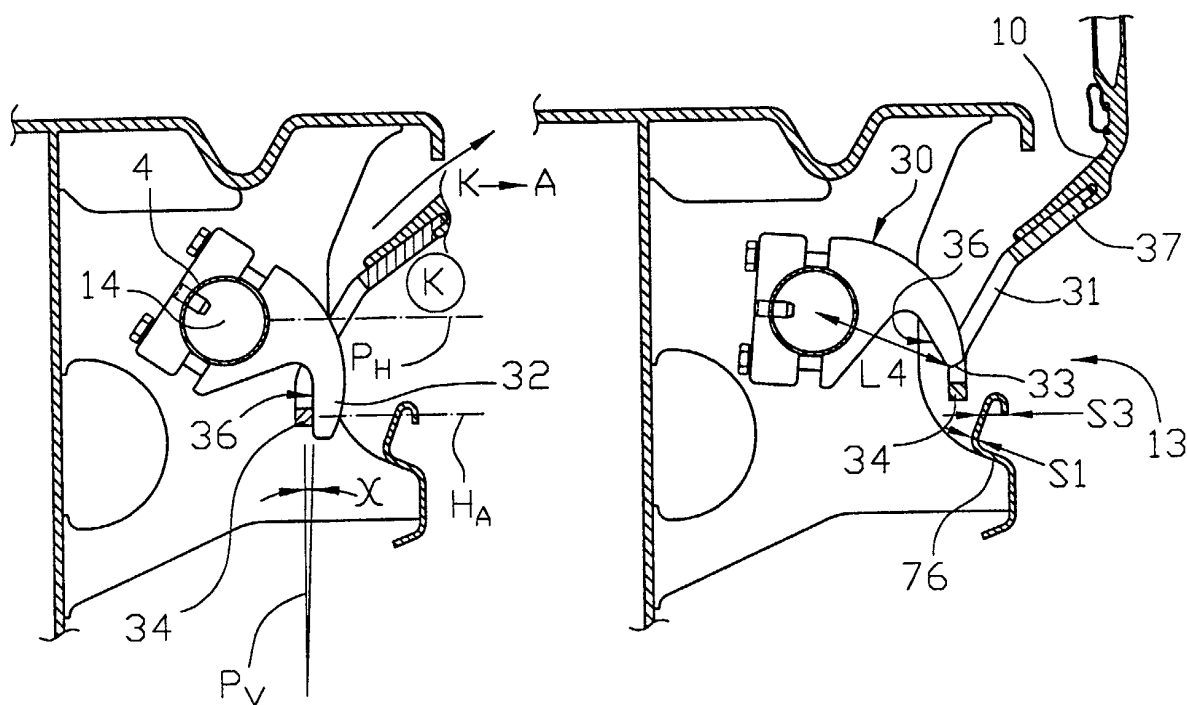
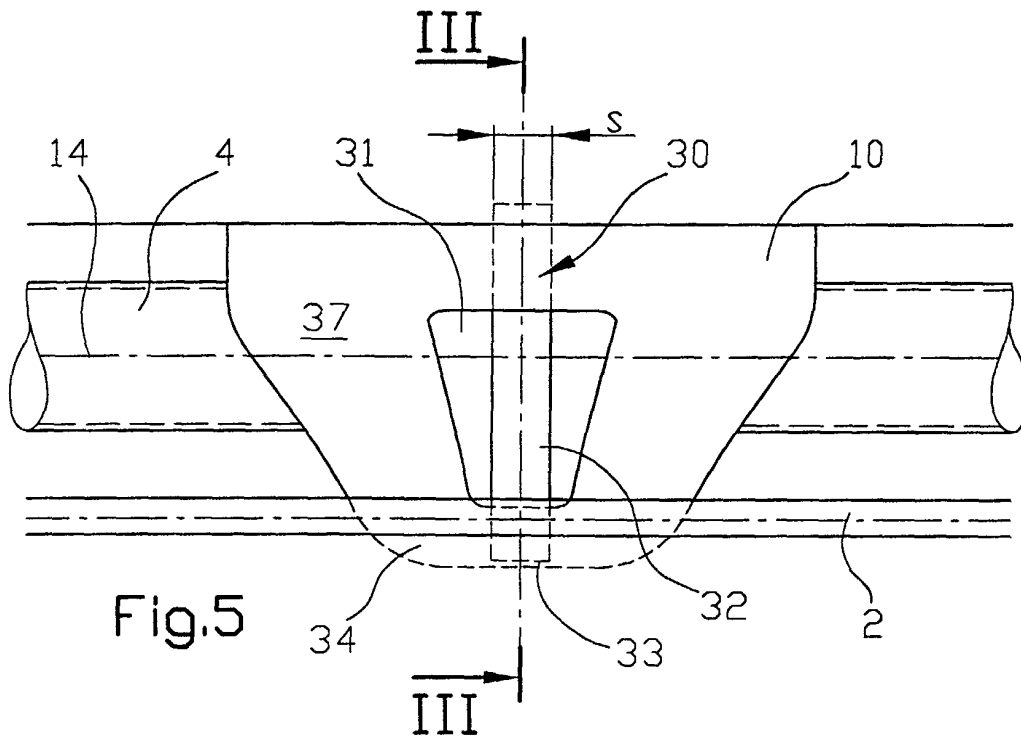
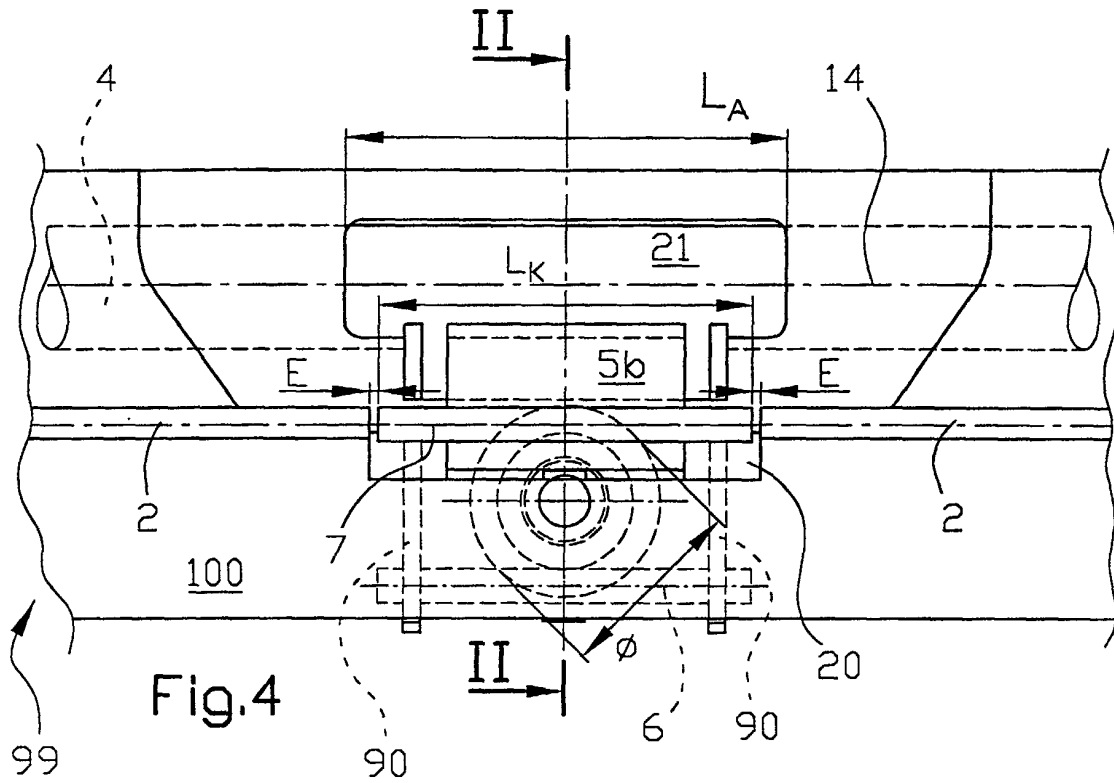


Fig.3A

Fig.3C

Fig.3B





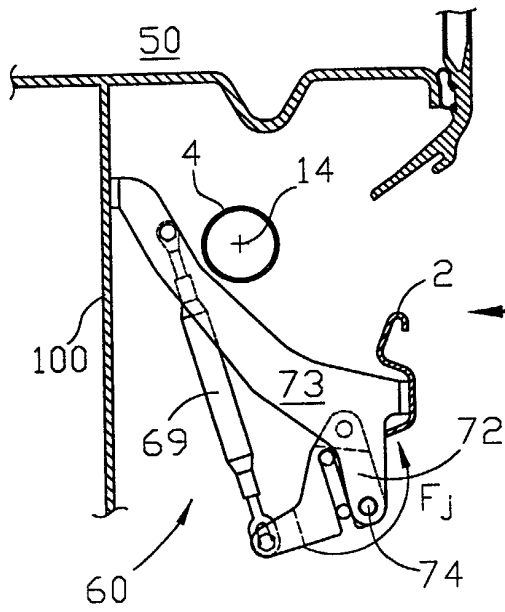


Fig. 7A

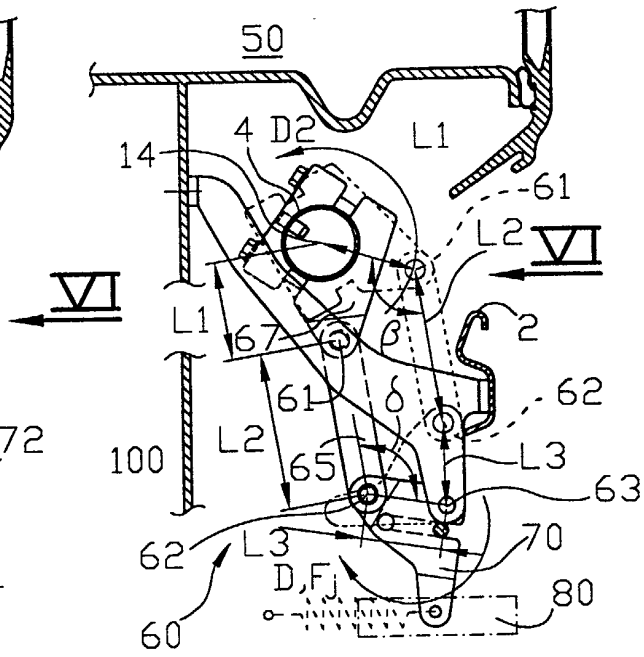


Fig. 7B

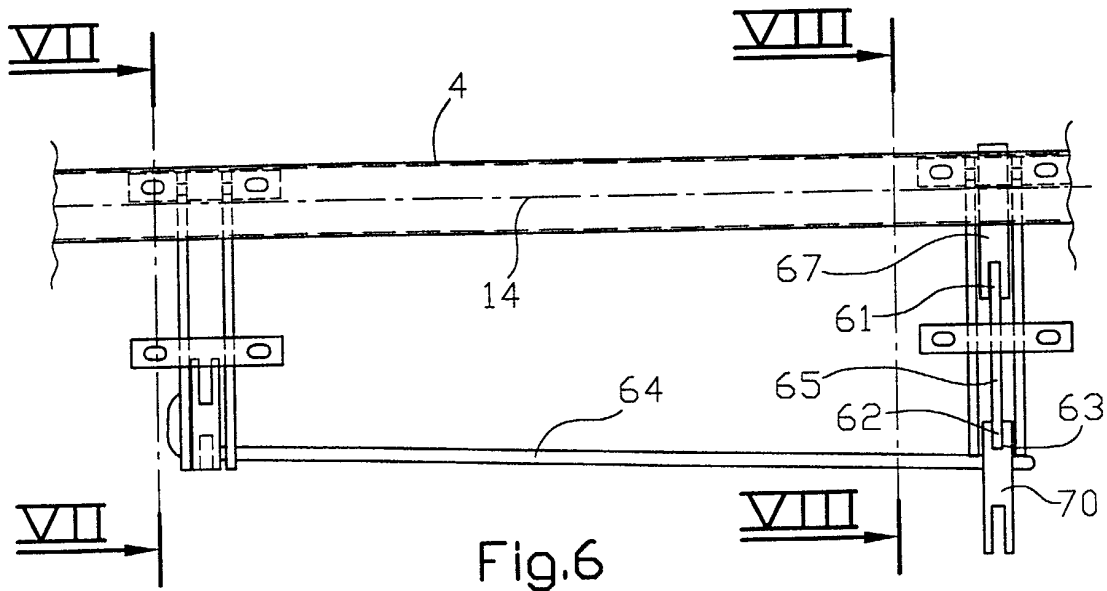


Fig. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 02 39 6084

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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		2 October 2002	Chlosta, P
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