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(54) A detachable rigid joint.

(57) The invention relates to an arrangement in a transport carrier for locking to each other for the duration of transport a fixed, loadbearing structural element (5) and a structural element (4), also loadbearing, which can be moved to the side for the duration of loading and unloading, in such a manner that a clearance-free rigid joint is formed between these elements. An end of the movable element (4) is connected to the fixed element (5) by using a wedged joint combination (6) in which the wedge surfaces of a protrusion (11) and a groove (12) form in the direction of the closing movement (A) inclined planes approximately parallel to each other, in which case the elements tightened to each other are locked in place by using a single-arm lever (20), the fulcrum (26) of which is in one element and the bearing point (27) or its tightening force (B") is against the other element.

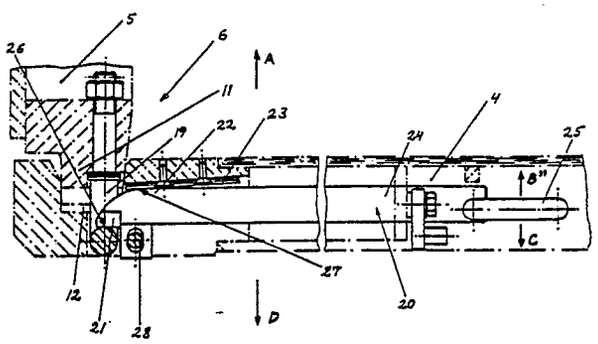

FIG 6

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A detachable rigid joint

The present invention relates to an arrangement and device in transport carriers for locking to each other for the duration of transport a fixed loadbearing structural element and a structural element, also loadbearing, which can be moved to the side for the duration of loading and unloading, in such a manner that a rigid joint without a clearance is created between these elements.

Especially in railway transport, efforts have been made to develop transportation methods and ways such as to make the loading and unloading procedures rapid to carry out without massive crane equipment. In these efforts, special attention has been focussed on the loading of trailers, semi-trailers, and containers and the like. For the loading of these, a number of different techniques as such have been developed, and of them only those are discussed in connection with this application in which the load is introduced onto a railway wagon from the side. In this case, various problems have originated in the fact that, since the outer dimensions of the cross section of a freight wagon are all over the world precisely defined, while the outer dimensions of the load, in this case those of a trailer, semi-trailer or a container, are close to the allowed outer dimensions of the freight wagon, it is not possible to construct the loadbearing structures of the freight wagon to be such that they could be in fixed connection during loading and unloading. For example, the dimensions of trailers allow only a very thin floor and narrow sides for the freight wagon, in which case the sides must be relatively high in order to achieve sufficient strength. In this case, the trailer can be brought between the sides only by turning the side or sides out of the way. In such structures the loading and the unloading take place, for example, by driving the trailer or the like along a ramp into the railway wagon, as in publication GB-2 179 311, or by pushing it from the side of the wagon.

In the structures described above, a special problem area is the attachment of the ends of those loadbearing side walls which are to be turned to the side for the duration of loading and unloading to the rest of the frame structure of the freight wagon, in such a manner that a clearance-free and rigid joint is obtained which is capable of transmitting all tensile and compressive forces, as well as bending forces in the direction of all axles and also torsional forces. In addition, there is the problem of obtaining a joint which is rapid and problem-free to connect and to disconnect.

Thus it is an object of the invention to provide a joint in a transport carrier, for example in a freight wagon, a rigid and clearance-free joint between its fixed structure and its movable structure, such as a side wall, which carries all tensile and compressive forces, bending forces and torques in different directions. In other words, the object is a joint which, when closed, functions quite as if the connected structural elements were of one piece. An additional object is to provide a joint which retains the characteristics described above also when subject to pulsating or fluctuating loads. This means that, during use, a clearance must not form in the joint under the effect of vibration, and of course the joint must not open. An additional object is to provide a joint which can be locked and unlocked rapidly and simply, as well as reliably, and fits in the available space, which is small. It is a further object to provide a locking which can be accomplished without auxiliary tools.

The above problems are solved and the objectives are achieved by means of the arrangement and device according to the invention, which is characterized in what is stated in the characterizing clauses of Claims 1 and 10. It can be deemed to be the most important advantage of the invention that all the structural elements which increase the strength and rigidity of the transport carrier can be used to the full for this purpose, whereupon there are left in the structure of the transport carrier no weak points which might lead to fractures and accidents. The most important advantage is thus the structural reliability achieved by using the invention, and also low costs, since the frequency of repairs and inspections can be reduced from that which would be needed otherwise. It is an additional advantage that the structural elements can be locked to each other without using auxiliary tools, rapidly and with little labour, and so it is economical. The reliability of the joint during travel is also a considerable advantage, since, as a result, traffic safety remains at a high level. The fitting of the joint inside a thin wall is also an advantage.

The invention is described below in greater detail with reference to the accompanying drawings.

Figure 1 depicts as a side elevation a railway wagon in which the pivotable side wall is in place,

Figure 2 depicts a plan view of the railway wagon in Figure 1,

Figure 3 depicts the fixed frame of the railway wagon of Figures 1 and 2,

Figure 4 is an overall representation of the locking system according to the invention, seen from the exterior, from the side,

Figure 5 depicts the structure of Figure 4, in a section through A-A,

Figure 6 depicts the structure of Figure 4, in a section through B-B,

Figure 7 depicts the lever mechanism of Figure 6 when the lever is in the open position,

Figure 8 depicts the structure of Figure 6, in a section through C-C.

Figure 1 depicts generally a railway freight wagon 1, onto which a semi-trailer 2 has been loaded. Figure 2 depicts the same structure, in which the box 3 and the loadbearing side wall 4 fixedly attached to it are indicated with dot-and-dash lines in their aside position, at which time the trailer can be driven onto the box 3 along a driving bridge 35. In Figure 2 the box 3 and the side wall 4 have been drawn with solid lines in their closed position, which thus corresponds to Figure 1. The rest of the freight wagon frame, to which both the wheel and axle sets of the wagon and the box with its side wall are fastened, is indicated generally by numeral 5. In these Figures 1 and 2, the joint according to the present invention is indicated generally by reference numeral 6; in this embodiment there is a joint such as this only at one end of the box and of the side wall, the other end being hinged to the frame 5 by using hinge means 7. It is also possible to form an embodiment in which both ends of the side wall 4 of the box 3 are secured to the frame 5 by using a joint 6 according to the invention.

Figure 3 depicts the railway wagon frame 5 alone, on the basis of which it is evident that the frame 5 alone is not capable of bearing the load, unless it is made very massive; high strength and rigidity also require the securing of the wall, i.e. wall 4, opposite to the side wall 8, tightly at its ends at points 9 and 10 of the frame 5. In Figure 4 the locking mechanism 6 is seen from the same direction as in Figure 1.

Figure 8 shows, in accordance with this embodiment, a wedge-like protrusion 11 in the frame 5 and a wedge-like groove 12, into which the protrusion 11 is slotted tightly, in the side wall 4. When the box 3 with its side wall 4 is being closed, this closing takes place by using, for example, a hydraulic cylinder 13, shown in Figure 2, which pulls the box and the side wall inside the frame 5 of the freight wagon. In Figures 6-8, in this case the side wall 4 moves in the direction of the arrow A, whereupon the wedge-like protrusion 11 pushes into the wedge-like groove 12 and slots in tightly. The other side surface 14 of the wedge-like protrusion is straight and approximately parallel to the closing movement A of the side wall 4 at this point of the closing movement. The corresponding side surface 15 of the side wall groove 12, coming against this surface 14, is parallel to the plane 14, and so the surfaces 14 and 15 slide along each other during closing. The side surface 16, opposite to the surface 14 of the protrusion 11, constitutes a wedge surface, as does the surface 17 opposite to the side 15 of the groove 12, coming against this surface 16. The protrusion 11 thus forms a truncated wedge, the extrapolated wedge apex of which points from the side of the railway wagon outwards, the straight surface 14 being approximately perpendicular to rhe longitudinal axis of the wagon. The groove 12 is also a groove having the shape of a truncated wedge in the same position, the extrapolated apex of which also points to outside the wagon, in the same direction as the extrapolated apex of the protrusion 11. The length of the wedge-like protrusion 11 and groove 12 is preferably vertical, and in this case parallel to the pivot axis of the hinge 7. In this case the wedge surface 16 of the wedge-like protrusion and the wedge surface 17 of the groove constitute, in the direction of the closing movement A, inclined planes approximately parallel to each other, whereas the straight surfaces 14 and 15 are parallel to each other and to the closing movement A. In this case, when the protrusion is pressed into the groove, they press tightly against each other without this tightening causing any deformative forces acting on the side wall 4 or the frame 5. It is also advantageous that the end surfaces 33a and b, 34a and b of the said wedge-like protrusions and grooves are also wedge-like and form inclined planes in relation to each other; in each case the apexes, or extra-polated apexes, of the wedges are perpendicular to the direction A of the closing movement.

Since the wedge surfaces 16 and 17 form a relatively small wedge angle in relation to a plane perpendicular to the longitudinal axis of the wagon, typically approximately 4-10° and preferably approximately 7°, a joint such as this bears effectively any tensile and compressive stresses in the direction of the longitudinal axis of the wagon, as well as any bending stresses appearing on the plane of the side wall, without the joint notably tending to open as the load fluctuates. The wedge surfaces may be flat or, for example, cylindrical surfaces, the rotation axes of which are perpendicular to the closing direction A.

In this embodiment, in order to prevent the slackening of the wedge protrusion and the groove and to bear torsional stresses, there are two U-shaped bows 19 installed in the frame 5 so as to protrude at its protrusion and from the frontal surface 18 of the protrusion. The U-shaped portion thus extends outwards from the wedge protrusion 11, and the branches of the U-shape point towards the centre line of the wagon, and they are fixedly locked to the wagon frame 5 by using nuts 32, for example. The aim is to place the bows 19 so that

the plane defined by the branches 19b, 19c of a bow is parallel to the longitudinal direction of the protrusion 11 and the groove 12. In addition, the plane defined by the branches of the U-shape should be located as close to the wedge surface 17 of the side wall 4 as possi ble. The purpose of this is that the working arm of the single-arm lever 20, which is used for locking the joint, should become as short as possible in order that the moment in it would be maximal.

The two single-arm levers 20 shown in Figure 4 are preferably placed in a position approximately parallel to the longitudinal axis of the wagon, and they consist of a tip 21, which bears on the inner arch of the bow 19 during operation, a support surface 22, which presses against a slide surface 23 in the side wall 4 and slides along it during operation, and an arm 24 and, when necessary, a handle 25.

At the beginning of the closing of the joint 6, the parts are in the position shown in Figure 7, in which the wedge protrusion 11 is pressed into the wedge groove 12 and the bow 19 comes outside the frontal surface 18 of the wedge protrusion 11. When the joint is being locked, the tip 21 of the lever is pushed behind the U-shape of the bow 19, whereupon the slide surface 22 which is on the opposite side of the bow in relation to the tip 21 comes against the slide surface 23. When the lever 20 is turned using the handle 25, first in direction B′, which at the final stage, i.e. in direction B″, is approximately the same as the tightening direction A, the lever 20 pivots about the mutual contact point 26 between the bow 19 and the tip 21 and pushes the side wall 4 from the contact point 27 between the slide surface 23 and the support surface 22 further in the tightening direction A. By this structure the difference between the working lever arm and the actuating lever arm of the lever 20 is maximized, the working lever arm being the distance between points 26 and 27 and the actuating lever arm being the distance between point 26 and the handle 25.

During transport, any tensile, compressive and bending forces which tend to open the joint will have to work with lever arms reverse to the closing, whereupon the opening of the lever is highly improbable. This embodiment presented has additionally the specific advantage that the force which tends to open the joint has to be able, with a small lever arm from point 26 to point 27, additionally to work against the friction force between the surfaces 22 and 23, and to exceed it. This friction force is effective for a considerably long time, since, when the handle turns for this reason in direction C, the side wall 4 also turns in direction D, whereupon the slide surfaces 22 and 23 continue to remain in tight compression, tending to brake any increase in turning. It is also possible to arrange the angle between the surfaces 22 and 23 to be smaller than the friction angle, whereupon the contact point will be self-retaining.

To hold the lever 20 in place when it is not tightened, the lever 20 is secured to the side wall 4 of the wagon by using, for example an axle 28, in which case the hole 29 in the lever 20 is oval so that the lever should function as a single-arm lever and not as a double-arm lever. The axle 28 has no functional significance other than support. The lever may, of course, be suspended from the side wall 4 in many other manners, for example by using hooks or bows. When the joint has been tightened and the lever 20 has been turned to its final position, approximately parallel to the longitudinal axis of the wagon, the lever 20 is further locked, at the end on the side of the bow 25, to the side wall 4 by means of a cotter, a locking nut, a lock or in some other manner deemed suitable in the given case.

In the structure, the tip 21 of the lever 20 and the slide surface 23 have been arranged to be simple to replace whenever they are deemed to be too worn. The operating position of the lever 20 can be adjusted to be suitable by means of the protrusion of the bow 19, i.e. the distance between the contact point 26 and the frontal surface 18 of the protrusion 11. This adjustment can be carried out, for example, by means of washers 31 placed between the flange parts 30 in the bow branches and the frame 5, the washers being tightened together by using nuts 32. The adjusting can, of course, be carried out also in other ways, for example by means of the positions of a nut placed in the place of the flanges 30 and the washers 31 and the nut 32, in relation to the rest of the bow 19.

Especially the stop-face pairs of the wedge-like protrusion and the wedge-like groove which come against each other, i.e. surface 14 and 15 and respectively surface 16 and 17, are hardened, but to different degrees of hardness. This is in order that the surfaces should not adhere to each other under the great forces present. Surfaces of different degrees of hardness move with a lower force against each other, and their wear is less than that of surfaces which are alike.

Depending on the use, the straight surfaces 14 and 15 and the wedge surfaces 16 and 17 of the wedge-like protrusion 11 and the wedge-like groove 12 may be located in the opposite manner as compared with this embodiment, i.e. with the wedge surfaces towards the ends of the railway wagon and the straight surfaces towards the middle of the wagon. It can also be thought that both sides of the wedge protrusion and the wedge groove are wedge-like. Depending on the use, the structure may also be the opposite in the sense that the

wedge-like groove is located in the frame 5 and the wedge-like protrusion in the side wall 4. In this alternative, also, the directions and locations of the wedge surfaces may be various, as above. The bow may also be placed in either part, regardless of which part has a protrusion and which part has a groove. However, it is in general the most appropriate to ensure that the lever 20 tightens in the same direction A as is the direction of the tightening of the wedge protrusion into the wedge groove and that it is located on the outer side of the wagon, where it is easily accessible. In each wedge joint 6 the lever arms 20 may number one, two, or more, according to the need in the given case. Likewise, it is possible to secure and lock some wall part by using one, two, or more locking systems 6 according to this invention, with their wedge protrusions and grooves.

Claims

1. An arrangement in transport carriers (1) for locking to each other for the duration of transport a fixed, loadbearing structural element (5) and a structural element (4), also loadbearing, which can be moved to the side for the duration of loading and unloading, in such a manner that a clearance-free rigid joint (4) is created between these elements, **characterized** in that at least one end of the movable element (4) is connected to the fixed element (5) by using a wedged joint combination (6) in which a wedge-like protrusion (11) in one element (4 or 5) is slotted tightly into a corresponding wedge-like groove (12) in the other element, when the movable element is brought into its place by a turning or pushing closing movement (A), whereupon the wedge surfaces (16, 17) of the wedge-like protrusion (11) and groove (12) form, in the direction of the closing movement, inclined planes approximately parallel to each other, and that the elements tightened to each other are locked in place by using at least one single-arm lever (20) the fulcrum (26) of which is located in one of the element and the bearing point (27) of its tightening force is against the other element.

2. A locking arrangement according to Claim 1, **characterized** in that the single-arm lever (20) constitutes that component of the structural element (4 and 5) against which the bearing point (27) of the tightening force is formed, and that the fulcrum (26) of the lever is formed when the tightening of the lever is being started under the effect of its pivoting movement (B), when the tip (21) of the lever bears on the corresponding component (19) in the other structural element.

3. A locking arrangement according to any of the above claims, **characterized** in that the apexes, or extrapolated apexes, of the wedge surfaces of the wedge-like protrusion (11) and the wedge-like groove (12) are substantially perpendicular to the direction (A) of the closing movement.

4. A locking arrangement according to any of the above claims, **characterized** in that at least two stop faces (14, 15) of the wedge-like groove (12) and the wedge-like protrusion (11) form planes approximately parallel to the closing movement (A), and the other stop faces (16, 17; 33a, b; 34a, b) are inclined surfaces approximately parallel to each other, and that the said surfaces (14, 15), parallel to the closing movement, point in the joints (6) towards the ends of the transport carrier (1).

5. A locking arrangement according to any of the above claims, **characterized** in that the wedge surfaces (16, 17; 331, b; 34a, b) of both the wedge-like protrusion (11) and the wedge-like groove (12) form in relation to the plane running through the closing direction A an angle of 4-10° and preferably approximately 7°.

6. A locking arrangement according to any of the above claims, **characterized** in that the fulcrum (26) of the single-arm lever (20) in one of the structural elements consists of an approximately U-shaped bow (19) or the like attached to this element, the tip of the single-arm lever (20) pushing behind its U-bend when the pivoting movement of the lever is being made.

7. A locking arrangement according to any of the above claims, **characterized** in that the inclined surfaces of the wedge-like protrusion and/or the wedge-like groove are straight surfaces.

8. A locking arrangement according to any of Claims 1-6, **characterized** in that the inclined surfaces of the wedge-like protrusion and/or the wedge-like groove are cylindri cal surfaces the axes of which are perpendicular to the closing direction (A).

9. A locking arrangement according to any of the above claims, **characterized** in that the outer surface (22) which produces the bearing point (27) of the tightening force of the single-arm lever (20) is convex and preferably cylindrical, the axis of the cylinder being at least approximately parallel to the apexes, or extrapolated apexes, of the wedge surfaces, and that the convex support surface (22) slides along the slide surface (23) of the structural element in question during the locking pivoting of the lever, and that the final direction (B″) of the locking pivoting movement of the lever (20) is approximately the same as the closing direction (A).

10. A device in transport carriers for locking to each other for the duration of transport a fixed, loadbearing structural element (5) and a structural element (4), also loadbearing, which can be moved to the side for the duration of loading and unloading, in such a manner that a clearance-free rigid joint is formed between these elements, **characterized** in that at least one end of the movable element (4) has a wedge-like groove or protrusion (11, 12) and the area of the fixed structural element coming against it has respectively a wedge-like protrusion or groove (12, 11), in which case the wedge-like protrusion (11) in one element is slotted tightly into the wedge-like groove (12) in the other element when the movable element (4) is brought into its place by a turning or pushing closing movement, that at least two of the wedge surfaces (16, 17) of the wedge-like protrusion and groove form, in the direction of the closing movement, inclined planes approximately parallel to each other and that, in order to lock in place the elements (4, 5) tightened to each other, one of the structural elements has at least one single-arm lever (20) the fulcrum (26) of which is in one element and the bearing point (27) of its tightening force is against the other element.

11. A device according to Claim 10, **characterized** in that the stop-face pairs of the wedge-like protrusion and the wedge-like groove, coming against each other, have been hardened, but to different degrees of hardness.

12. A device according to Claim 9 or 10, **characterized** in that the U-shaped bow (19) which forms the fulcrum (26) of the lever (20) is adjustable in the direction of the branches (19b, 19c) of the bow, in order to set the lever (20) into the correct position, and that the tip piece (21) of the lever (20), coming against the inner bend of the bow 19), as well as the slide surface (23) which forms the bearing point (27) of the tightening force in the other element, are replaceable.

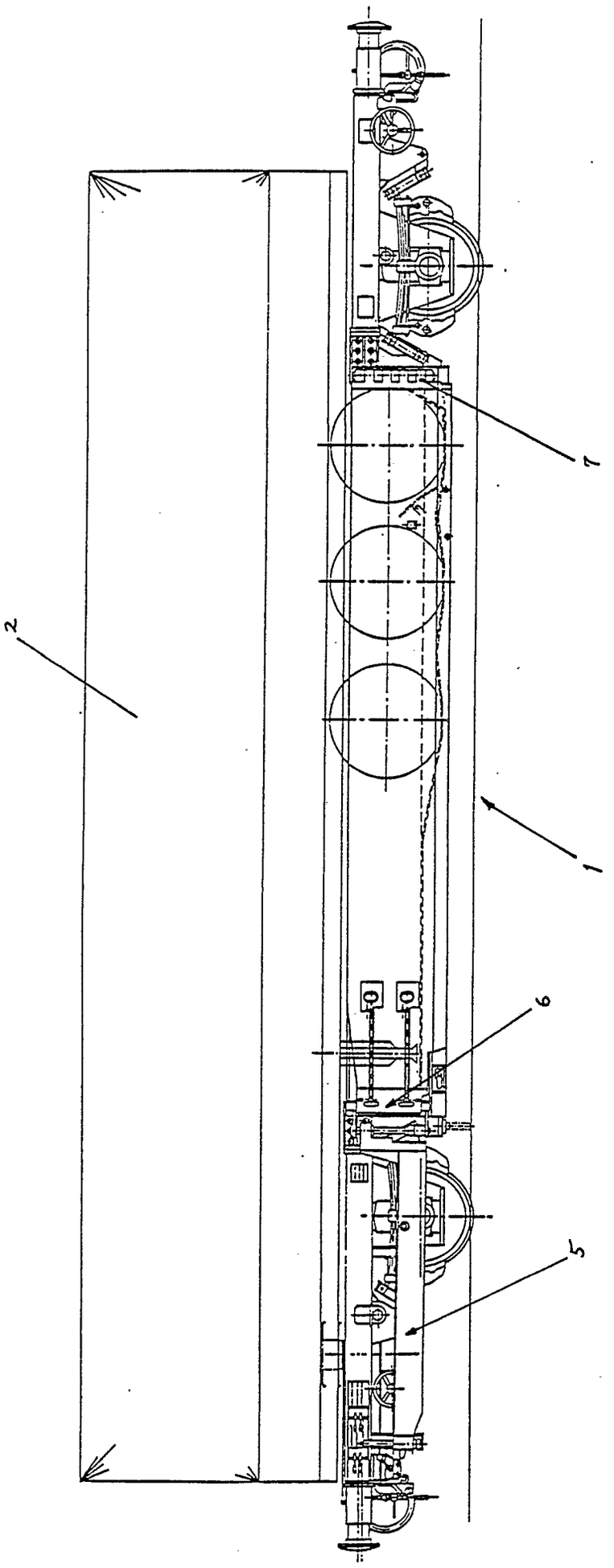


FIG 1

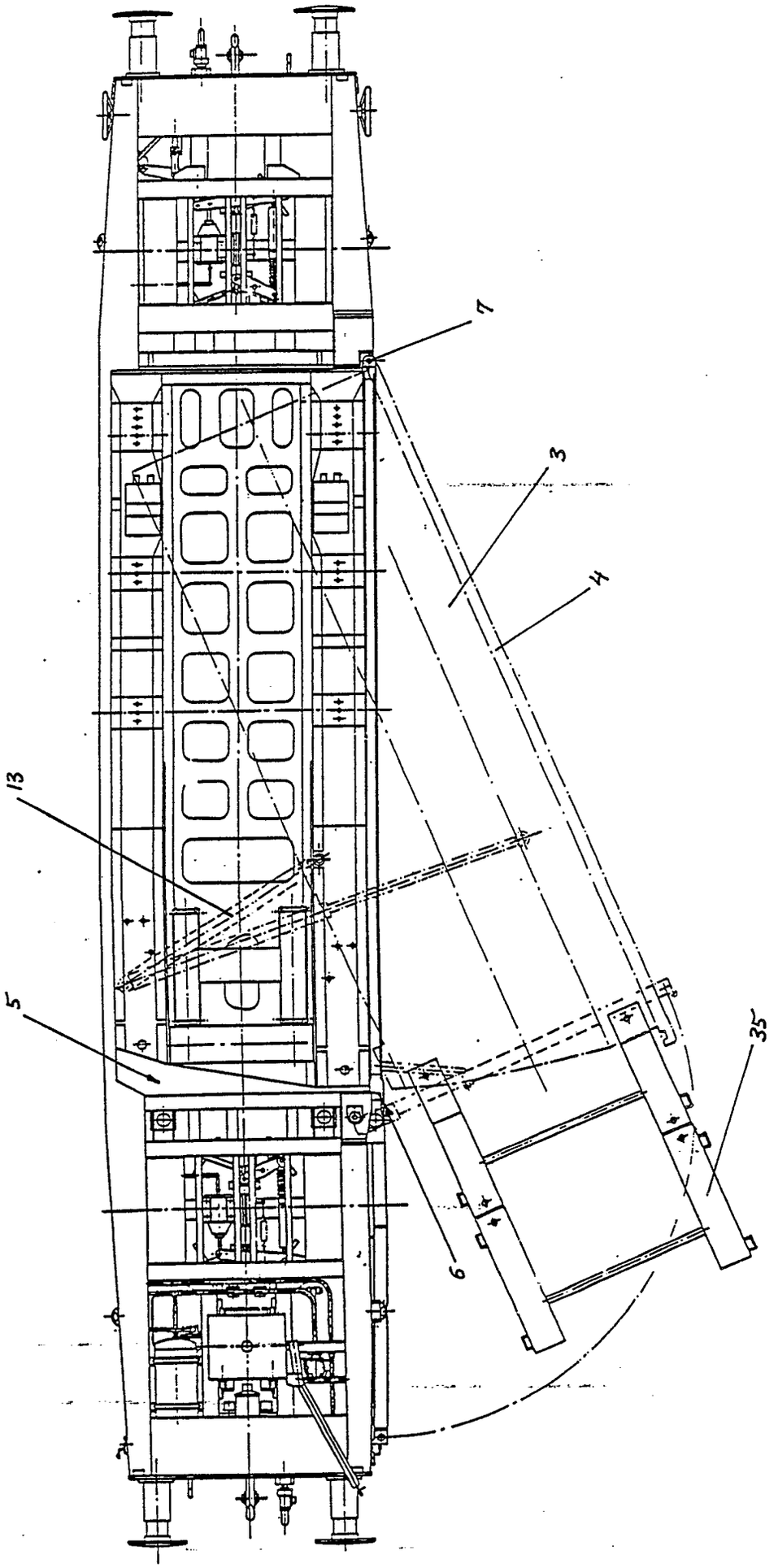


FIG 2

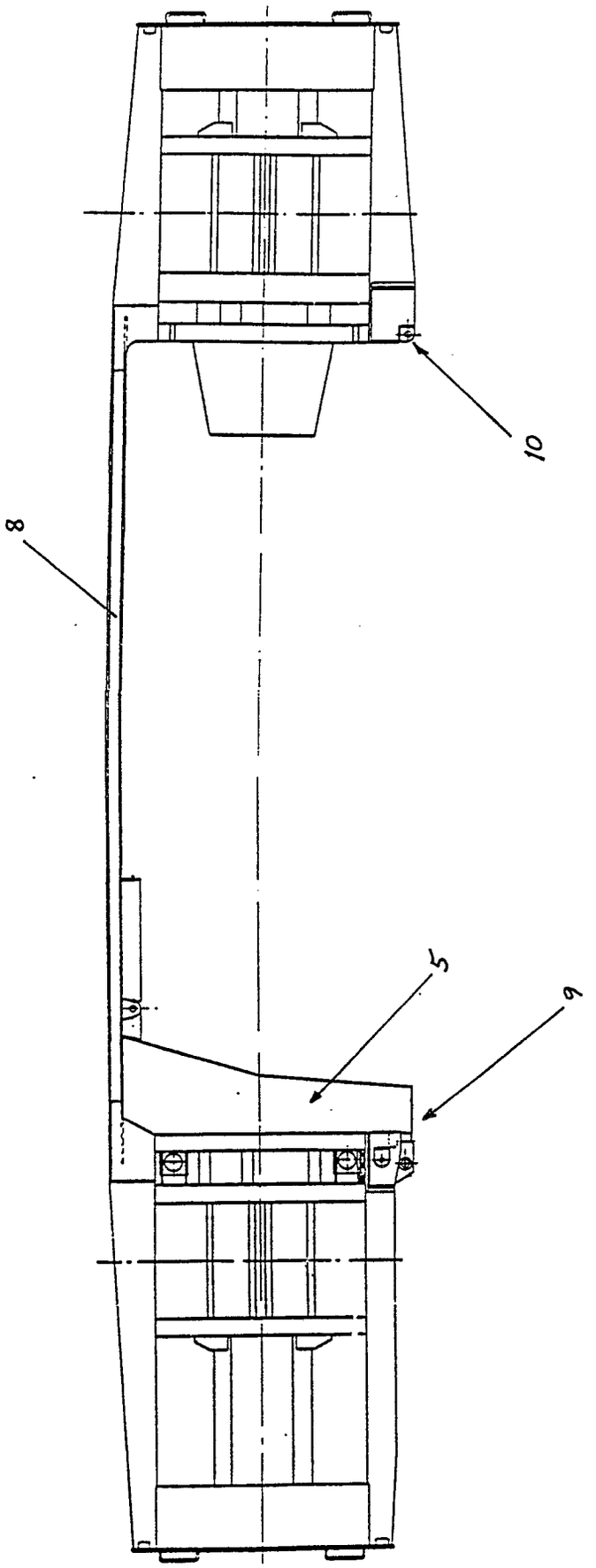


FIG 3

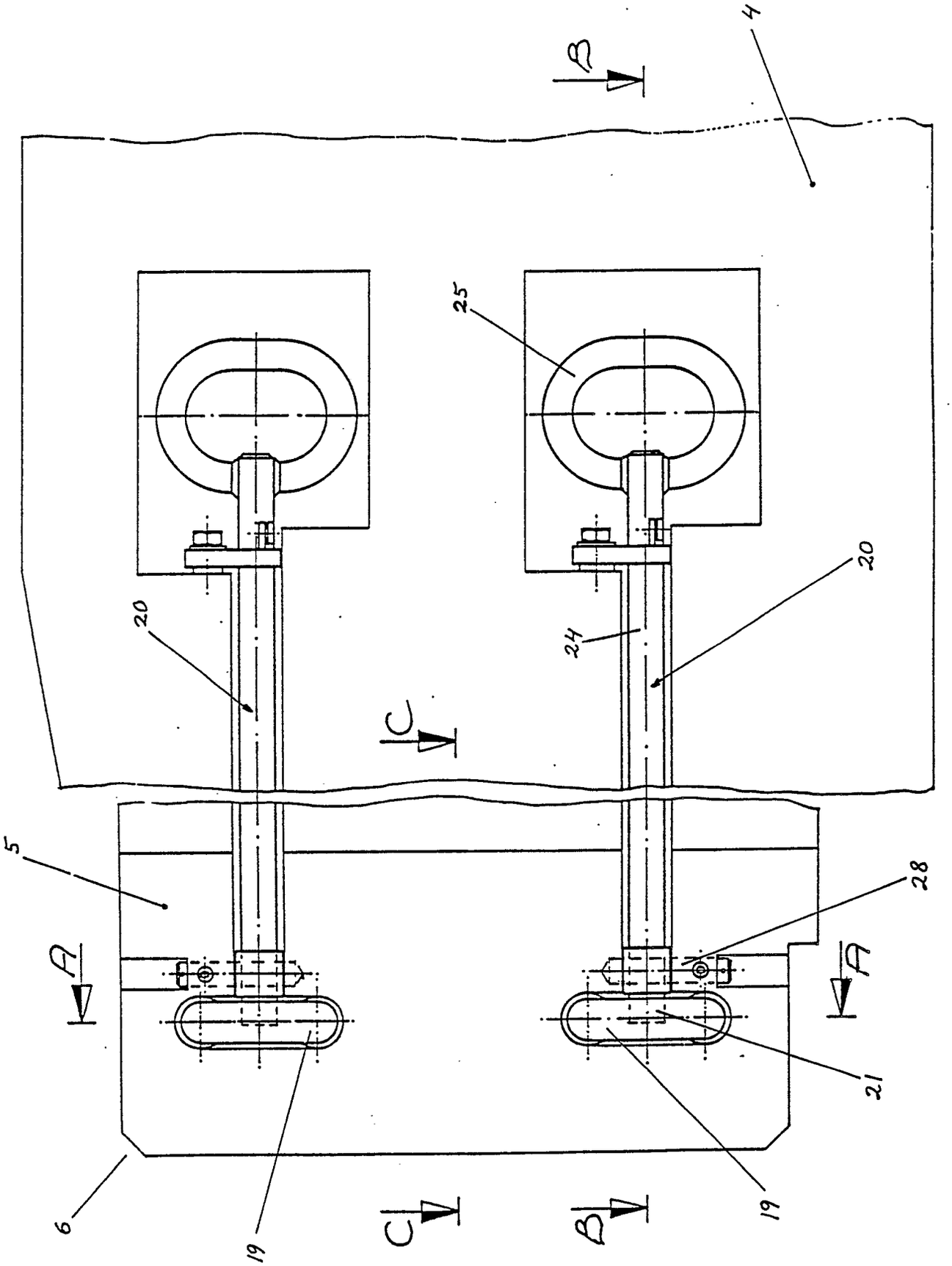
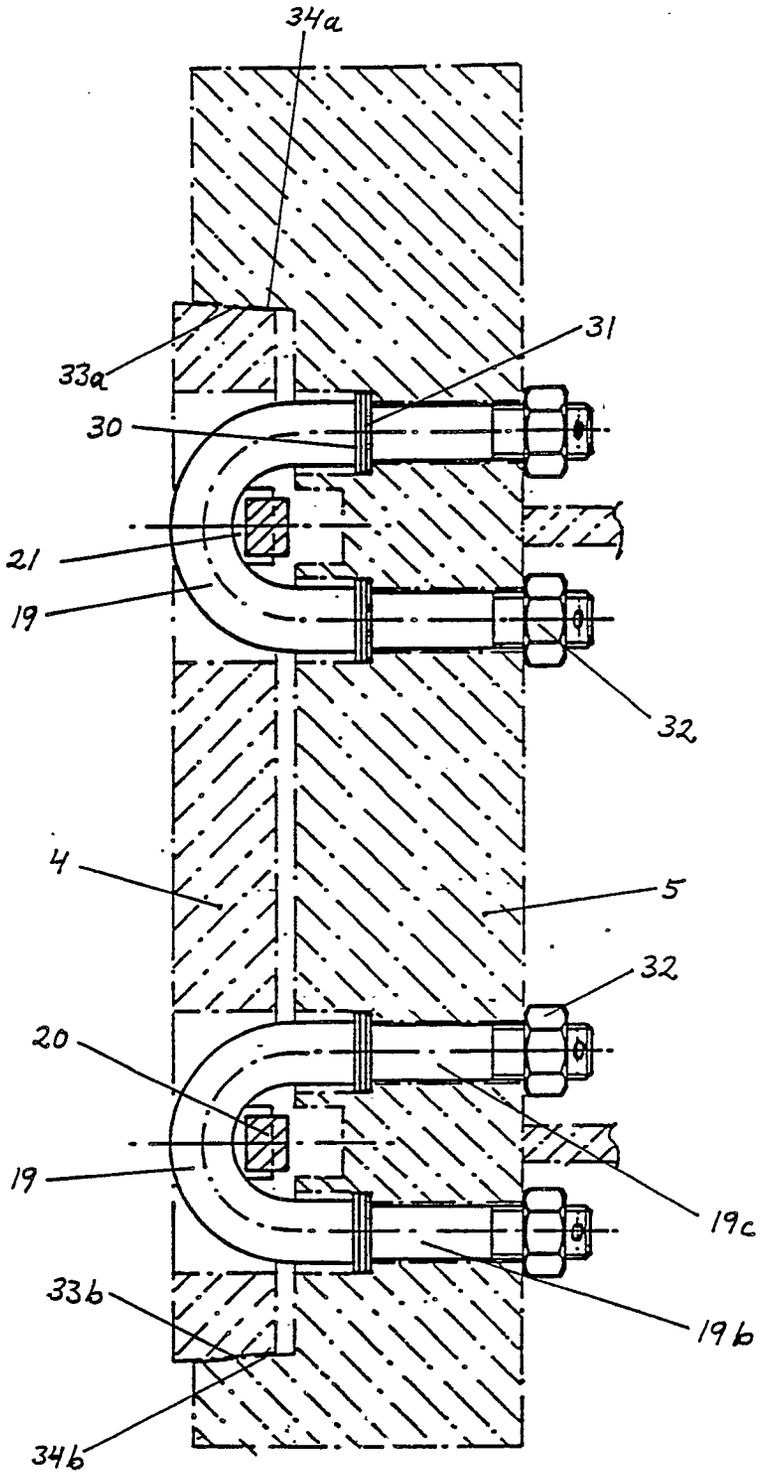


FIG 4



A — A

FIG 5

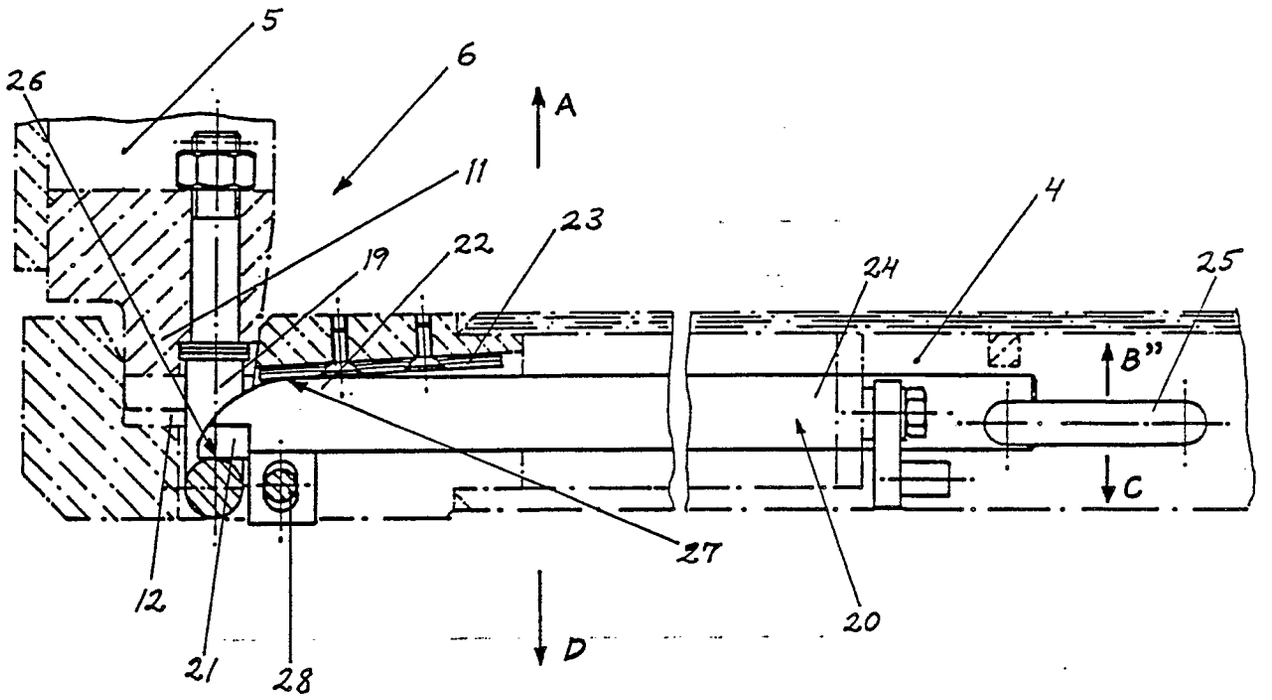
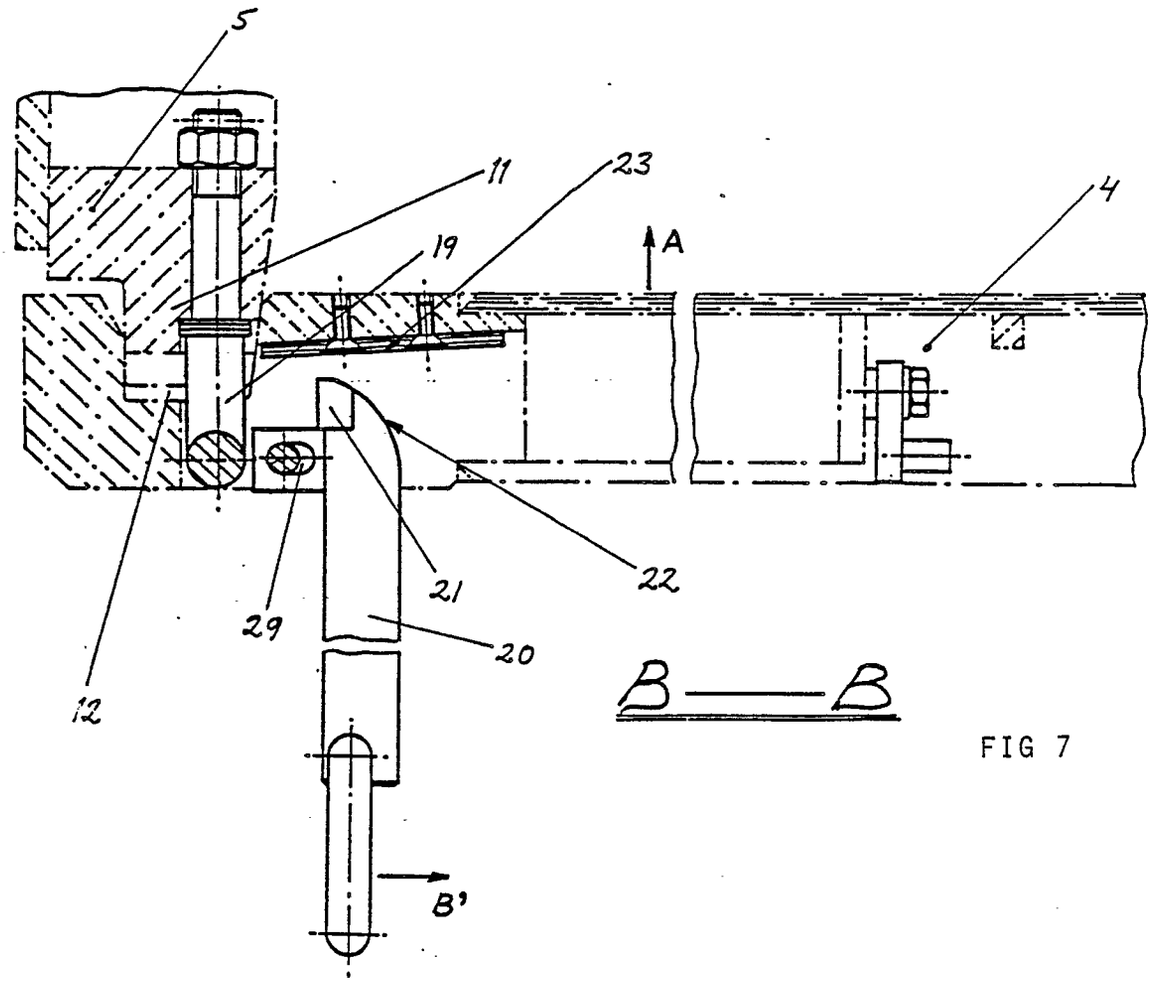

5
6
26
A
11
19
22
23
4
24
25
B"
C
27
12
21
28
D
20

FIG 6


5
11
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19
A
4
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12
B'
B — B

FIG 7

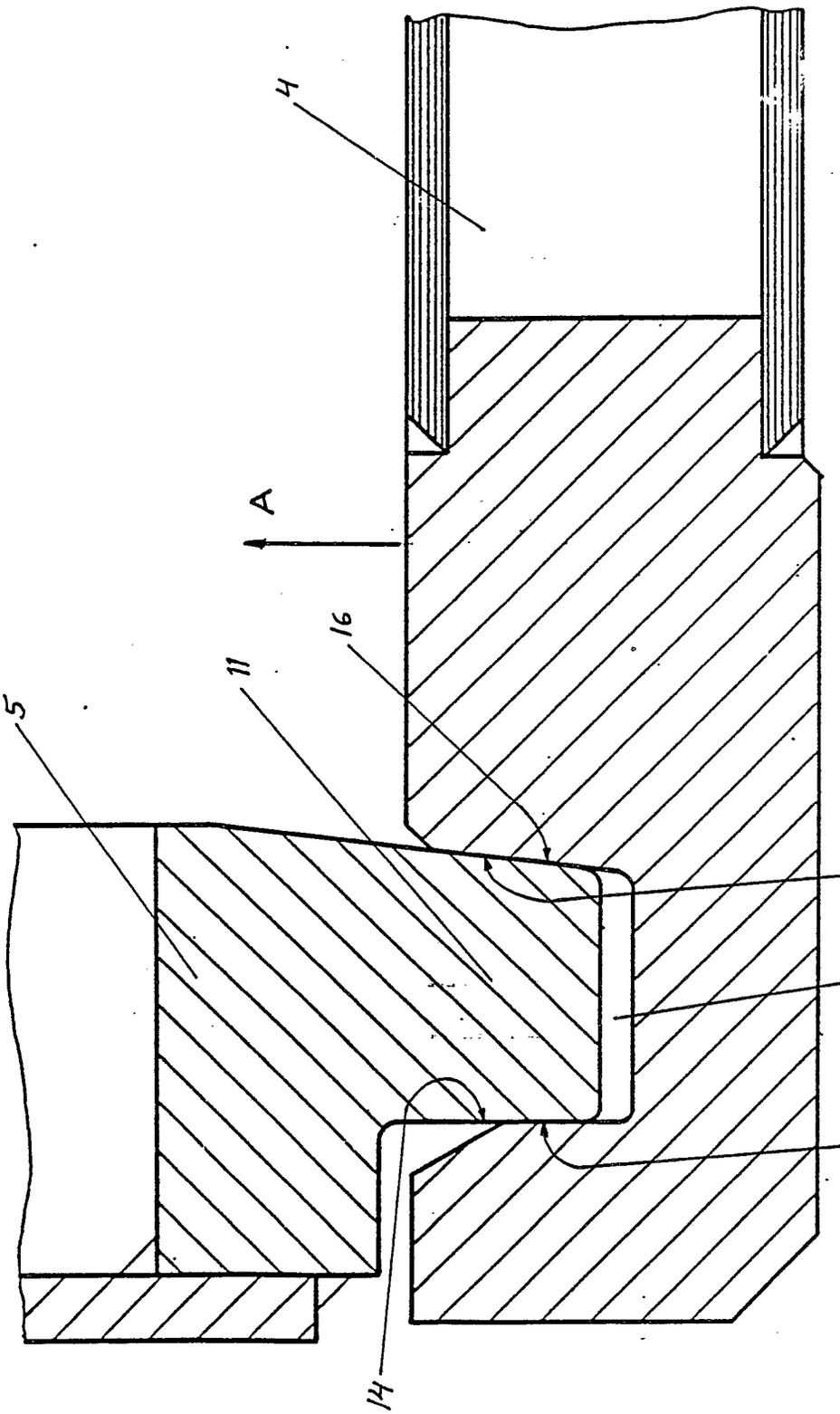

FIG 8