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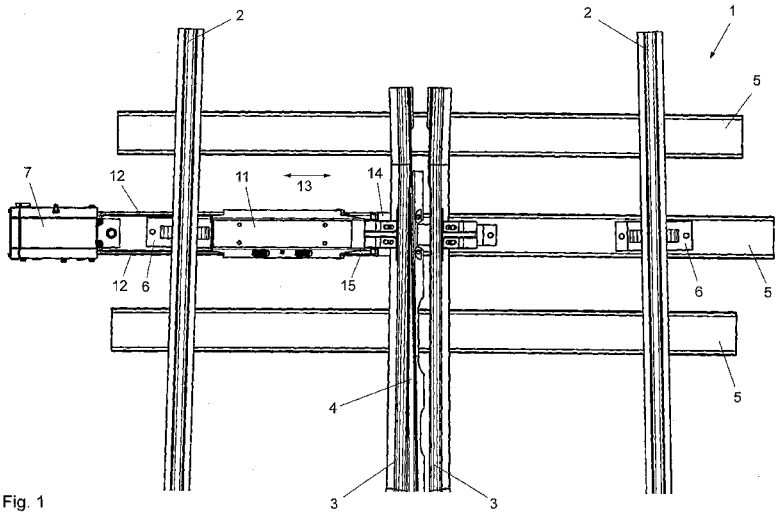


Fig. 1

(57) Abstract: In a set of rail points, running rails (2) and wing rails (3) are fastened to a concrete sleeper (5) on which a switching device (11) is arranged for switching a movable switch diamond (4). The concrete sleeper (5) has a cuboid geometry with an upper side (17), chamfered longitudinal edges bounding the upper side and side faces (18) extending from the longitudinal edges. The switching device (11) is fastened on the upper side (17) of the concrete sleeper (5) between a running rail (2) and a wing rail (3), wherein the drive equipment (7) is arranged outside the running rails (2), preferably connected to the concrete sleeper (5). The drive equipment (7) is connected to the switching device (11) by at least one line (12) running along the chamfered longitudinal edges, wherein the switching device (11), the at least one line (12) and, where appropriate, the drive equipment (7) run within the sleeper width.

(57) Zusammenfassung:

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Bei einer Weiche sind Fahrschienen (2) und Flügelschienen (3) auf einer Betonschwelle (5) befestigt, auf der eine Stelleinrichtung (11) zum Verstellen einer beweglichen Herzstückspitze (4) angeordnet ist. Die Betonschwelle (5) weist eine quaderför- mige Geometrie mit einer Oberseite (17), die Oberseite begrenzenden, abgeschrägten Längsrändern und von den Längsrändern ausgehenden Seitenflächen (18) auf. Die Stelleinrichtung (11) ist an der Oberseite (17) der Betonschwelle (5) zwischen einer Fahrschiene (2) und einer Flügelschiene (3) befestigt, wobei die Antriebseinrichtung (7) außerhalb der Fahrschienen (2) angeordnet, vorzugsweise mit der Betonschwelle (5) verbunden ist. Die Antriebseinrichtung (7) ist über wenigstens eine entlang der abgeschrägten Längsränder verlaufende Leitung (12) mit der Stelleinrichtung (11) verbunden, wobei die Stelleinrichtung (11), die wenigstens eine Leitung (12) und ggf. die Antriebseinrichtung (7) innerhalb der Schwellenbreite verlaufen.

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# Switch for railway tracks

The disclosure relates to a switch including running rails, wing rails and a frog having a frog point capable of reciprocating between the wing rails, wherein the running rails and the wing rails are fastened to a sleeper on which a setting device is arranged for switching the frog point, said setting device being connected to a driving device via at least one line.

For switching tongue rails relative to running rails between an abutting position and a spaced-apart position, setting devices are required, which are connected to the tongue rails via a connecting rod assembly. Setting devices are also required for switches having a frog with a movable frog point for shifting the frog point between the two wing rails. In either case, the setting device and the connecting rod assembly are usually arranged between two sleepers, i.e. in what is called the sleeper bay, or in a hollow sleeper, in which a driving device, e.g. a hydraulic drive, may also be disposed. The arrangement of a setting device for a movable frog point along with the connecting rod assembly in the sleeper bay, or in a hollow sleeper, is, for instance, described in EP 343150 A2.

Hollow sleepers involve the drawback of requiring special measures in the region where they are laid in ballast, since hollow sleepers in general have to be set more deeply than standard sleepers. Consequently, separate excavation of the ballast bed is required on the mounting sites.

The switch that has become known from DE 202010008526 U1 allows the setting device and the rod assembly for switching the tongue rails to be fastened to a standard concrete sleeper without protruding beyond the sleeper in terms of width. The installation of hollow sleepers is thus avoided.

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It is against this background and the problems and difficulties associated therewith that the present invention has been developed.

In one aspect, there is provided a switch comprising running rails, wing rails and a frog having a frog point capable of reciprocating between the wing rails, wherein the running rails and the wing rails are fastened to a sleeper on which a setting device is arranged for switching the frog point, said setting device being connected to a driving device via at least one line, wherein the sleeper is a concrete sleeper having a cuboid geometry with an upper side, chamfered longitudinal edges bounding the upper side, and side faces extending from the longitudinal edges, that the setting device is fastened to the upper side of the concrete sleeper between a running rail and a wing rail, that the driving device is arranged outside the running rails and preferably connected to the concrete sleeper, that the at least one line connecting the driving device to the setting device extends along the chamfered longitudinal edges, wherein the setting device, the at least one line and optionally the driving device extend within the width of the sleeper, wherein at least one switch rod and optionally a checker rod extend from the setting device, being led through below the rail foot of a wing rail, wherein the switch rod and, where appropriate, the checker rod extend within the width of the concrete sleeper and are each hinged to the rail foot of the movable frog point so as to be pivotable about a vertical pivot axis.

In one form, the setting device, the at least one line, and optionally the driving device, extend within an envelope that is laterally bounded by extensions of the side faces of the concrete sleeper.

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In one form, the driving device is designed as a hydraulic unit and hydraulically connected to the setting device via the at least one line, which is designed as a hydraulic line.

In one form, the wing rail is formed with a height that is reduced relative to that of the frog point, and that the switch rod and, where appropriate, the checker rod are led through a free space between the rail foot of the wing rail and the upper side of the sleeper.

In one form, the wing rails are formed with an asymmetric tongue rail profile.

In one form, the switch rod and, where appropriate, the checker rod are each hinged to the setting device via a pivot mechanism allowing for an at least biaxial pivotal movement, in particular a spheroidal joint.

In one form, the switch rod and, where appropriate, the checker rod engage the movable frog point via a fork head encompassing the rail foot.

In one form, the movable frog point is slidingly mounted on a base plate disposed on the concrete sleeper.

In one form, a rail chair is fastened, in particular welded, to the base plate for supporting the wing rails.

In one form, the width of the rail chair at most corresponds to half the width of the concrete sleeper, wherein the switch rod and, where appropriate, the checker rod are laterally guided past the rail chair.

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In one form, the base plate is connected to the concrete sleeper via at least one fastening element that can be screwed into a recess of the concrete sleeper, the setting device being connected to the concrete sleeper via the at least one fastening element.

In one form the sleeper is a concrete sleeper having a cuboid geometry with an upper side, chamfered longitudinal edges bounding the upper side, and side faces extending from the longitudinal edges, that the setting device is fastened to the upper side of the sleeper between a running rail and a wing rail, that the driving device is arranged outside the running rails and preferably connected to the sleeper, that the at least one line connecting the driving device to the setting device extends along the chamfered longitudinal edges, wherein the setting device, the at least one line and optionally the driving device extend within the width of the sleeper.

In one form, a common concrete sleeper, in particular a standard concrete sleeper, is thus used to fasten the driving and setting devices, wherein the components required for actuating the movable frog point extend within the width of the sleeper, i.e. in particular within an envelope that is laterally bounded by the side faces of the concrete sleeper, or their extensions. As a result, no elements project laterally beyond the sleeper so as to enable tamping in the region of the sleeper in the same manner as in the track itself. Furthermore, there is the advantage of the structure being homogenous, i.e. the sleepers remain structurally identical throughout the switch region irrespective of whether a drive for a movable frog is provided or not. The arrangement of the setting device, the at least one line and optionally the driving device within the width of the sleeper in this respect preferably implies that the mentioned

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structural units do not project beyond the widest measure of the sleeper in the normal projection.

The invention enables the simple installation of a switch, since no special measures need to be taken in the region of the ballast formation, as it would be required with hollow steel sleepers, which basically have to be set more deeply than standard sleepers. This will additionally result in identical track mountings and track fixations as for sleepers having no switch drives.

The driving device, which is in particular designed as a hydraulic unit, is connected to the concrete sleeper preferably in an end region of the sleeper outside the running rails, wherein a holding means may optionally depart from the sleeper to extend beyond the end side of the concrete sleeper so as to enable sufficient space to be provided for fastening the driving device. Independently, the width extension of the holding means and the driving device are, however, selected such that these will basically be located within the width of the concrete sleeper. In this respect, the structural heights of both the setting device and the driving device are preferably selected so as to exclude a collision with the clearance gauge.

If, as in correspondence with a preferred configuration, the driving device is designed as a hydraulic unit, the latter is hydraulically connected to the setting device via the at least one line, which is designed as a hydraulic line.

In an advantageous manner, not only the hydraulic lines but also the connecting rod assembly connecting the setting device and the movable frog point are disposed within the width of the concrete sleeper. The connecting rod assembly, which extends from the setting device, in addition to a switch rod responsible

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for switching the movable frog point optionally also comprises a checker rod for an end position checking device. In order to accomplish the arrangement of the connecting rod assembly within the width of the sleeper in a simple manner, a preferred further development of the invention provides that the switch rod and, where appropriate, the checker rod are led through below the rail foot of a wing rail. In this context, it may, in particular, be provided that the wing rail is formed with a height that is reduced relative to that of the frog point, and that the switch rod and, where appropriate, the checker rod are led through a free space between the rail foot of the wing rail and the upper side of the sleeper. The switch rod and, where appropriate, the checker rod can in this case be formed straight, i.e. without bends, so as to provide an optimum flow of force. In a preferred manner, the switch rod and, where appropriate, the checker rod engage the rail foot of the frog point.

In order to prevent relative displacements of the movable frog point relative to the sleeper carrying the setting device from causing the introduction of undesired forces into the switch rod and the setting device, a preferred configuration provides that the switch rod and, where appropriate, the checker rod are each hinged to the setting device via a pivot mechanism allowing for an at least biaxial pivotal movement, in particular a spheroidal joint. It may, further, be provided that the switch rod and, where appropriate, the checker rod are each hinged to the rail foot of the movable frog point so as to be pivotable about a vertical pivot axis.

The connection of the rod assembly to the frog point constructively is realized in a simple manner in that the switch rod and, where appropriate, the checker rod engage the movable frog point via a fork head encompassing the rail foot.

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An enhanced stability of the frog point is preferably ensured in that the wing rails are formed with asymmetric tongue rail profiles.

In one form, the setting device, the wing rails and the frog point rest not directly on the concrete sleeper but on a base plate disposed on the concrete sleeper, optionally via an interposed elastic support plate. In particular the movable frog point is slidingly mounted on the base plate disposed on the sleeper such that said base plate functions as a slide chair for the frog point.

In one form, the base plate is connected to the concrete sleeper via at least one fastening element that can be screwed into a recess of the concrete sleeper, the setting device being connected to the concrete sleeper via the at least one fastening element. However, this does not rule out that further fastening elements are provided, which can optionally be screwed into bores to be separately introduced and extending from the upper side of the concrete sleeper. As a result, it is possible to not only connect the setting device to the concrete sleeper without modifying the latter, but to additionally use bores already provided in the concrete sleeper to fix the setting device.

The free space provided between the concrete sleeper and the lower surface of the rail foot of the wing rails in a constructively advantageous and space-saving manner is achieved in that a rail chair is fastened, in particular welded, to the base plate for supporting the wing rails. In a preferred manner, the width of the rail chair at most corresponds to half the width of the sleeper so as to enable the switch rod and, where appropriate, the checker rod to be laterally guided past the rail chair.

Means for bracing down and laterally supporting the wing rails preferably engage the rail chair.

In the following, the invention will be explained in more detail by way of exemplary embodiments schematically illustrated in the drawing. Therein,

Fig. 1 is a ground plan of the switch according to the invention;

Fig. 2 is a sectional view of a sleeper;

Fig. 3 is a side view of the switch according to Fig. 1;

Fig. 4 is a detailed view of the switch according to Fig. 1 in the region of the switching device;

Fig. 5 is a detailed view of the switch according to Fig. 3 in the region of the frog point, and

Fig. 6 is a sectional view along line VI-VI of Fig. 5;

Fig. 7 is a ground plan of a modified configuration of the switch according to the invention in a partial illustration;

Fig. 8 is a sectional view along line VIII-VIII of Fig. 7;

Fig. 9 is a sectional view along line IX-IX of Fig. 7;

Fig. 10 is an illustration according to Fig. 8, depicting a modified configuration of the attachment of the rod assembly to the frog point; and

Fig. 11 is an illustration according to Fig. 8, depicting a further modified configuration of the attachment of the rod assembly to the frog point.

Fig. 1 illustrates a section of a switch 1 comprising running rails 2 and a frog including a movable frog point 4 capable of being reciprocated between the two wing rails 3. The running rails 2 and the wing rails 3 are fastened to several concrete sleepers 5. The fastening of the running rails 2 is each realized via fastening plates 6 attached to concrete sleepers 5

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and conventional rail fastening means bracing down the rail foot of the running rail 2.

A drive unit 7, which is designed as a hydraulic unit and fastened to the sleeper 5 outside the running rails 2, is provided for switching the movable frog point 4. The fastening is more clearly depicted in Fig. 3, from which it is apparent that the support or frame from which the drive unit 7 extends comprises a plate-shaped base portion 8 extending along the upper side of the sleeper 5 to beyond the end face 9 of the concrete sleeper 5, wherein legs 10 angled from the area of the base portion 8 extend outside the concrete sleeper 5, being supported on the end face 9 of the concrete sleeper 5 by their transverse edges so as to provide sufficient stability. Instead of the support of the drive unit 7 extending beyond the end face 9 of the sleeper 5, there is the option to lengthen a standard sleeper such that a plate is fastened to the same in an end region, from which plate the drive unit 7 extends. In the latter case, it is not necessarily required that the plate 8 surmounts the end face 9 of the sleeper 5. The drive unit can also be fastened to a separate base plate outside the sleeper.

Between a wing rail 3 and a running rail 2, a setting device 11 is fastened to the upper side of the sleeper 5 and hydraulically connected to the drive unit 7 via lines 12. In the switching device 11, the hydraulic pressure provided by the drive unit 7 is transformed into a switching movement in the sense of double arrow 13, for instance by the aid of a hydraulic cylinder piston unit. A switch rod 15 extends from the setting device 11 and contacts the rail foot of the movable frog 4 in order to enable the reciprocation of the movable frog 4 in the sense of double arrow 13. In addition to the switch drive, the setting device 11 may comprise an integrated switch locking device and a separate end-position checking device. The switch lock serves to fix the

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movable frog point 4 in its respective end position. The end-position checking device serves to mechanically scan the current state of the movable frog point 4 and generate a check signal to enable the reliable determination of whether the movable frog point 4 has been switched correctly and whether the movable frog point 4 is in its respective, correct end position. To this effect, the end-position checking device comprises a checker rod 14 extending substantially transversely to the longitudinal direction of the rails, which is displaced in the longitudinal direction of the rod during the switching of the movable frog point 4. The position of the checker rod 14 is detected in the setting device 11 by the aid of electromechanical transducers, e.g. in the form of end switches or tongue detector contacts.

In the sectional view according to Fig. 2, the cross section of the concrete sleeper 5 is schematically illustrated, and it is apparent how the hydraulic lines 12 are arranged and how they can be led through below the running rail 2. The concrete sleeper 5 has cuboid or block geometry with chamfered, i.e. beveled, upper longitudinal edges 16 bordering, on the one hand, the upper side 17 of the concrete sleeper 5 laterally and, on the other hand, its side faces 18. To the upper side 17 of the concrete sleeper is fastened the running rail, which is not illustrated in Fig. 2 for the sake of clarity. The hydraulic lines 12 extend along the chamfered longitudinal edges 16 of the concrete sleeper 5 such that they can, on the one hand, be led through below the rail foot of the running rail 2, but, on the other hand, will not laterally protrude beyond the width B of the concrete sleeper 5.

From Fig. 1, it is apparent that also the drive unit 7 and the setting device 11 have such widths that the width B of the concrete sleeper 5 will not be exceeded.

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From the side view according to Fig. 3, it is apparent that wing rails 3 and the movable frog 4 are fastened to a base plate 19, wherein the wing rails 3 are each designed to have a height that is reduced relative to that of the movable frog point 4 and are each supported on a rail chair 20. Lateral supports 21 supporting the wing rails 3 against tilting each engage the rail chair 20. The base plate 19 and the fastening plate 6 of the running rail 2, which is illustrated on the left-hand side of the drawing, are each fastened to the sleeper 5 by a fastening screw 22. The fastening screws 22, at the same time, hold the setting device 11, the setting device 11 being screwed with the concrete sleeper 5 by further fastening screws 23. The setting device 11 comprises a casing whose respective end-face region is each connected to the concrete sleeper 5 via a mounting plate 24, which in turn comprises bottom surfaces extending in a mutually offset manner, one of which rests on the upper side of the sleeper 5 while the other rests on the base plate 19 and the fastening plate 6, respectively. Thus, the mounting plate 24 on its bottom comprises a step whose height matches the base plate 19 and the rib plate 6, respectively.

From the detailed illustration according to Fig. 4, the switch rod 15, which extends from the setting device 11, and the checker rod 14 are more readily apparent. The connection of the setting device 11 to the movable frog point 4 is depicted in detail in Fig. 5. In Fig. 5, only the switch rod 15 is illustrated. However, the following explanations analogously also apply to the checker rod 14. The switch rod 15 is connected to the setting device 11 via a spheroidal joint 25 including a switching element driven in the sense of double arrow 13. On the opposite end, the switch rod is hinged to the rail foot 27 of the movable frog 4 via a fork head 26. The fork head 26 encompasses the rail foot 27 of the movable frog 4 by its fork-shaped end. The hinge connection of the fork head 26 is realized

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articulately, the pivot axis being denoted by 28. To allow for the arrangement of the switch rod 15 below the wing rails 3, the wing rails 3 have a rail profile that is lower than that of the movable frog point 4, the wing rails 3 being supported on an elevated rail chair 20. As is apparent from Fig. 6, the rail chair 20 has a relatively small width so as to enable the switch rod 15 and the checker rod 14 to be laterally guided past the rail chair 20 without protruding beyond the width B of the concrete sleeper 5.

The lateral support of the wing rails 3 is effected by the aid of support elements 21 fastened to the rail chair 20. To this end, the rail chair 20 comprises lateral recesses 29 each overlapping a widened head 30 of a screw bolt 31. On the free ends of the screw bolts 31 is each provided a thread, onto which a bolt nut (not illustrated) can be screwed to brace the lateral support element 21 against the rail foot 32 of the wing rails 3. The lateral supports 22, moreover, are each supported on a web 34 of the wing rails 3 via a plate-shaped element 33, the connection of the plate-shaped element 33 to the web 34 being realized by means of a schematically indicated screw connection 35.

From Figs. 5 and 6, it is further apparent that the base plate 19 rests on the concrete sleeper 5 via an interposed, elastic seating means.

Figs. 7 to 11 depict modified embodiments in which the wing rails 3 are each formed with a thick-web rail profile rather than an asymmetric rail profile as in the configuration according to Figs. 1 to 6. The thick-web rail profile provides an improved ability to take up wheel loads of about 40 tons or more, which act directly on the wing rails in the region of the

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frog point. The reference numerals used in Figs. 1 to 6 have been retained for identical parts.

Fig. 7 depicts a detail of the switch in the region of the movable frog 4, wherein it is apparent that the lateral supports 21 of the wing rails 3 are not illustrated. From the setting device 11 extend again a switch rod 15 and a checker rod 14, which are fastened to the rail foot 27 of the movable frog point 4. The switch rod 15 and the checker rod 14 are led through below the wing rail 3 as is more readily apparent from Fig. 8. The wing rails 3 in this case have the same profile height as the movable frog point 4 such that the fastening of the switch rod 15 and the checker rod 14 to the rail foot 27 of the movable frog point 4 has to be done from below. Unlike in the configuration according to Figs. 1 to 6, a simpler rail chair 20 (not illustrated) is provided for supporting the wing rails 3, since the wing rails 3 rest directly on the base plate 19, as does the movable frog point 4. The fastening of the switch rod 15 and the checker rod 14 to the rail foot 27 is effected by means of a dovetail. The lower side of the rail foot 27 of the movable frog point 4 in the region of connection of the rod assembly is provided with a dovetail recess 37, which is form-fittingly enclosed by the two-part connecting piece 38 of the switch rod 15 and the checker rod 14, respectively. The two halves of the connecting piece 38 are braced against the dovetail recess 37 from both sides by the aid of a screw. To further stabilize the position of the movable frog point 4 in the respective abutment on the wing rails 3, a laterally milled channel or chamfer 39 corresponding to the outer contour of the connecting piece 38 is provided on the rail foot of the wing rail 3.

As is apparent from Fig. 9, the switch rod 15 and the checker rod 14 are led through between the upper side of the sleeper 5

and the lower side of the rail foot of the wing rails 3 within the structural height of the base plate 19.

Fig. 10 depicts an alternative configuration of the attachment of the switch rod 15 and the checker rod 14 to the lower side of the frog point 4 by the aid of a bolt connection without causing any relevant weakening of the cross section of the movable frog point 4. A bolt 40 is provided, which passes through a recess of the switch rod 15 and the checker rod 14 in a rotationally movable manner and is inserted in a blind hole introduced into the movable frog point 4 from below, and secured in its position by the aid of screws.

Another design for the connection of the switch rod 15 and the checker rod 14 to the movable frog point 4 without causing any weakening of the moment of inertia of the frog point is illustrated in Fig. 11. There, the switch rod 15 and the checker rod 14 in the region of the neutral axis are led through bores made in the rail web of the wing rails 3 and are screwed with the frog point 4 by the aid of a screwed angle compensating element 41.

Throughout the specification it will be understood that the term "comprise" or "include" and any of its derivatives (eg comprises, comprising, include, including) as used in this specification is to be taken to be inclusive of features to which it refers, and is not meant to exclude the presence of any additional features unless otherwise stated or implied.

The reference to any prior art in this specification is not, and should not be taken as, an acknowledgement of any form of suggestion that such prior art forms part of the common general knowledge.

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It will be appreciated by those skilled in the art that the invention is not restricted in its use to the particular application described. Neither is the present invention restricted in its preferred embodiment with regard to the particular elements and/or features described or depicted herein. It will be appreciated that various modifications can be made without departing from the principles of the invention. Therefore, the invention should be understood to include all such modifications in its scope.

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Claims:

1. A switch comprising running rails, wing rails and a frog having a frog point capable of reciprocating between the wing rails, wherein the running rails and the wing rails are fastened to a sleeper on which a setting device is arranged for switching the frog point, said setting device being connected to a driving device via at least one line, wherein the sleeper is a concrete sleeper having a cuboid geometry with an upper side, chamfered longitudinal edges bounding the upper side, and side faces extending from the longitudinal edges, that the setting device is fastened to the upper side of the concrete sleeper between a running rail and a wing rail, that the driving device is arranged outside the running rails and preferably connected to the concrete sleeper, that the at least one line connecting the driving device to the setting device extends along the chamfered longitudinal edges, wherein the setting device, the at least one line and optionally the driving device extend within the width of the sleeper, wherein at least one switch rod and optionally a checker rod extend from the setting device, being led through below the rail foot of a wing rail, wherein the switch rod and, where appropriate, the checker rod extend within the width of the concrete sleeper and are each hinged to the rail foot of the movable frog point so as to be pivotable about a vertical pivot axis.

2. The switch according to claim 1, wherein the setting device, the at least one line, and optionally the driving device, extend within an envelope that is laterally bounded by extensions of the side faces of the concrete sleeper.

3. The switch according to either of claims 1 or 2, wherein the driving device is designed as a hydraulic unit and hydraulically

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connected to the setting device via the at least one line, which is designed as a hydraulic line.

4. The switch according to any one of claims 1, 2 or 3, wherein the wing rail is formed with a height that is reduced relative to that of the frog point, and that the switch rod and, where appropriate, the checker rod are led through a free space between the rail foot of the wing rail and the upper side of the sleeper.

5. The switch according to any one of claims 1 to 4, wherein the wing rails are formed with an asymmetric tongue rail profile.

6. The switch according to any one of claims 1 to 5, wherein the switch rod and, where appropriate, the checker rod are each hinged to the setting device via a pivot mechanism allowing for an at least biaxial pivotal movement, in particular a spheroidal joint.

7. The switch according to any one of claims 1 to 6, wherein the switch rod and, where appropriate, the checker rod engage the movable frog point via a fork head encompassing the rail foot.

8. The switch according to any one of claims 1 to 7, wherein the movable frog point is slidingly mounted on a base plate disposed on the concrete sleeper.

9. The switch according to claim 8, wherein a rail chair is fastened, in particular welded, to the base plate for supporting the wing rails.

10. The switch according to claim 9, wherein the width of the rail chair at most corresponds to half the width of the concrete

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sleeper, wherein the switch rod and, where appropriate, the checker rod are laterally guided past the rail chair.

11. The switch according to any one of claims 8, 9 or 10, wherein the base plate is connected to the concrete sleeper via at least one fastening element that can be screwed into a recess of the concrete sleeper, the setting device being connected to the concrete sleeper via the at least one fastening element.

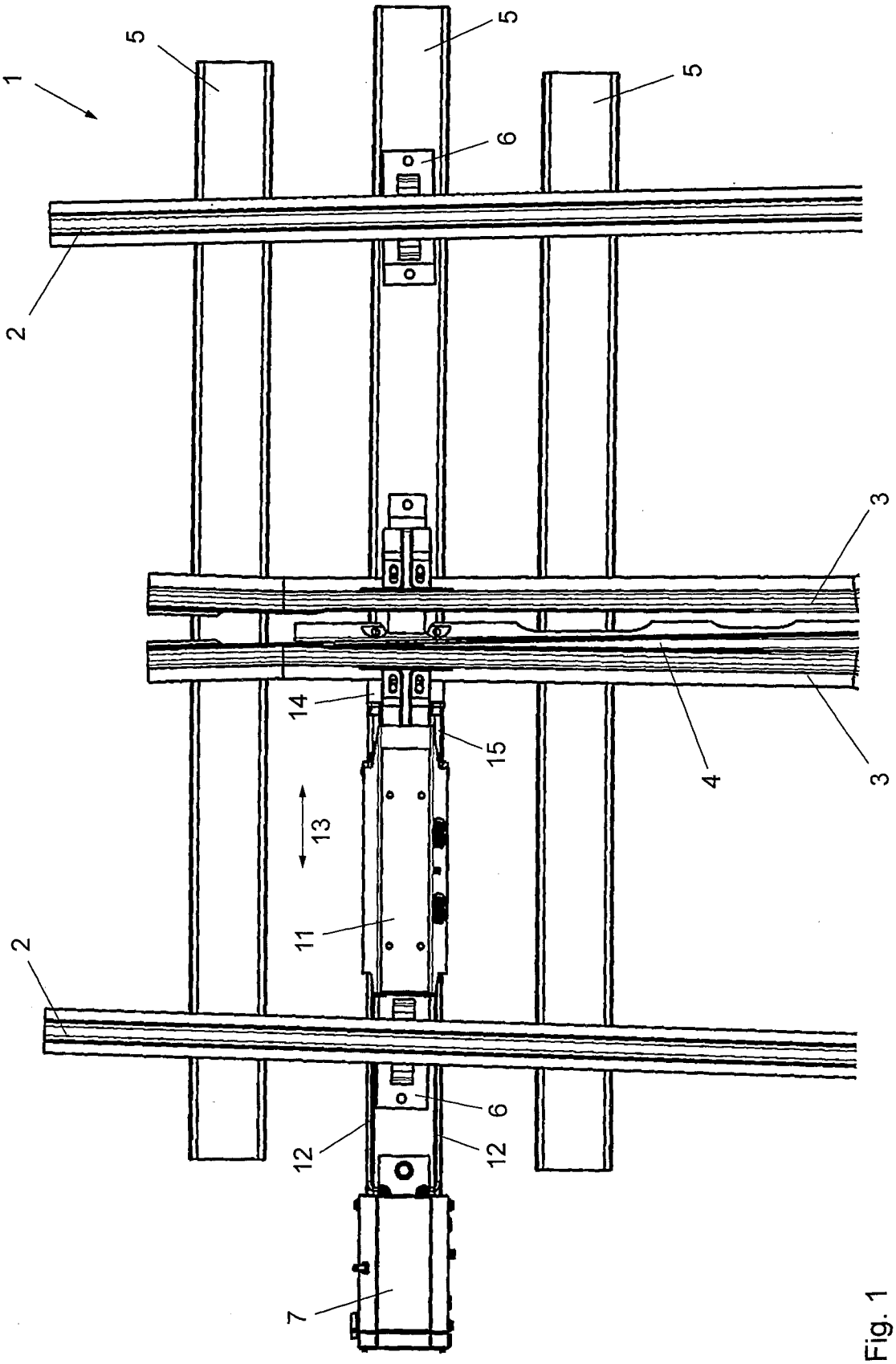


Fig. 1

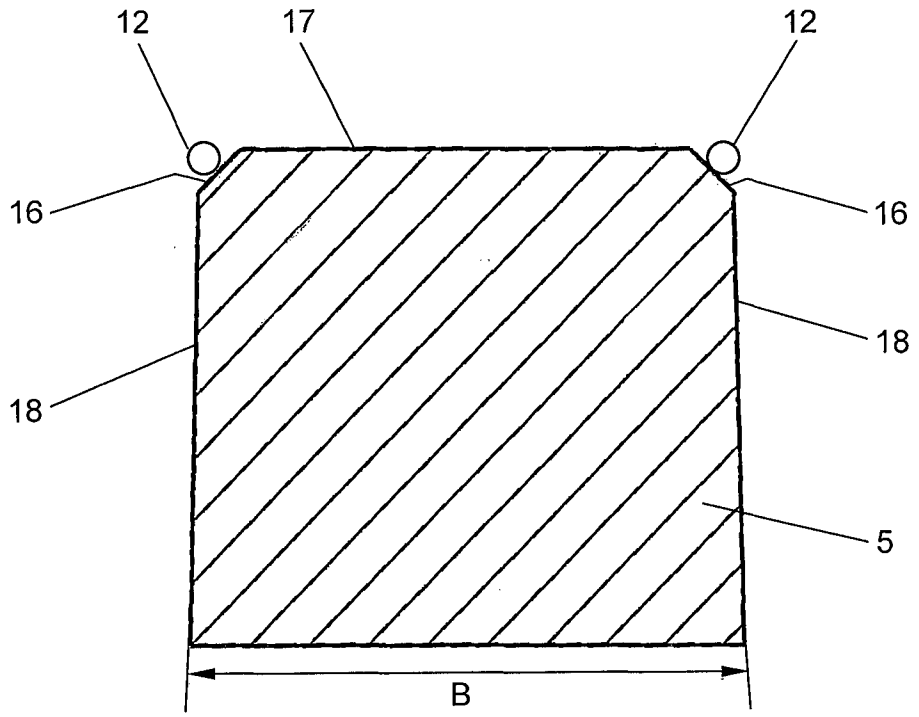


Fig. 2

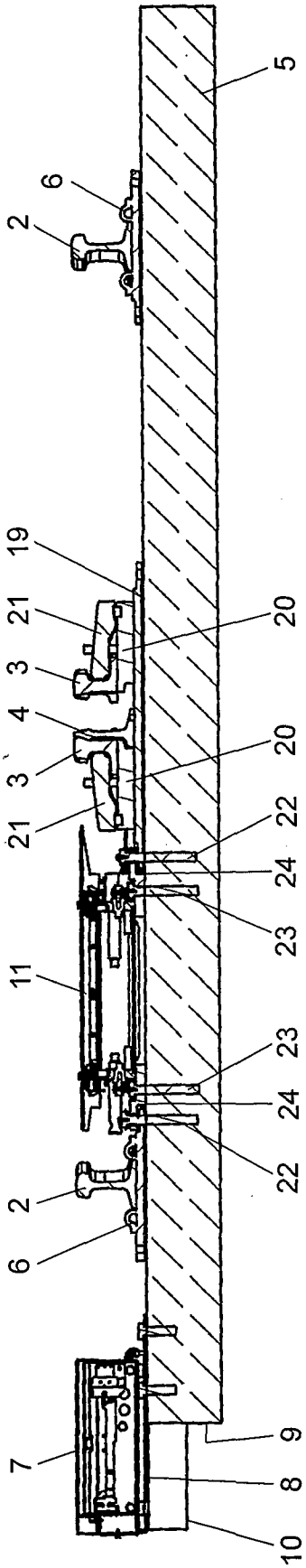


Fig. 3

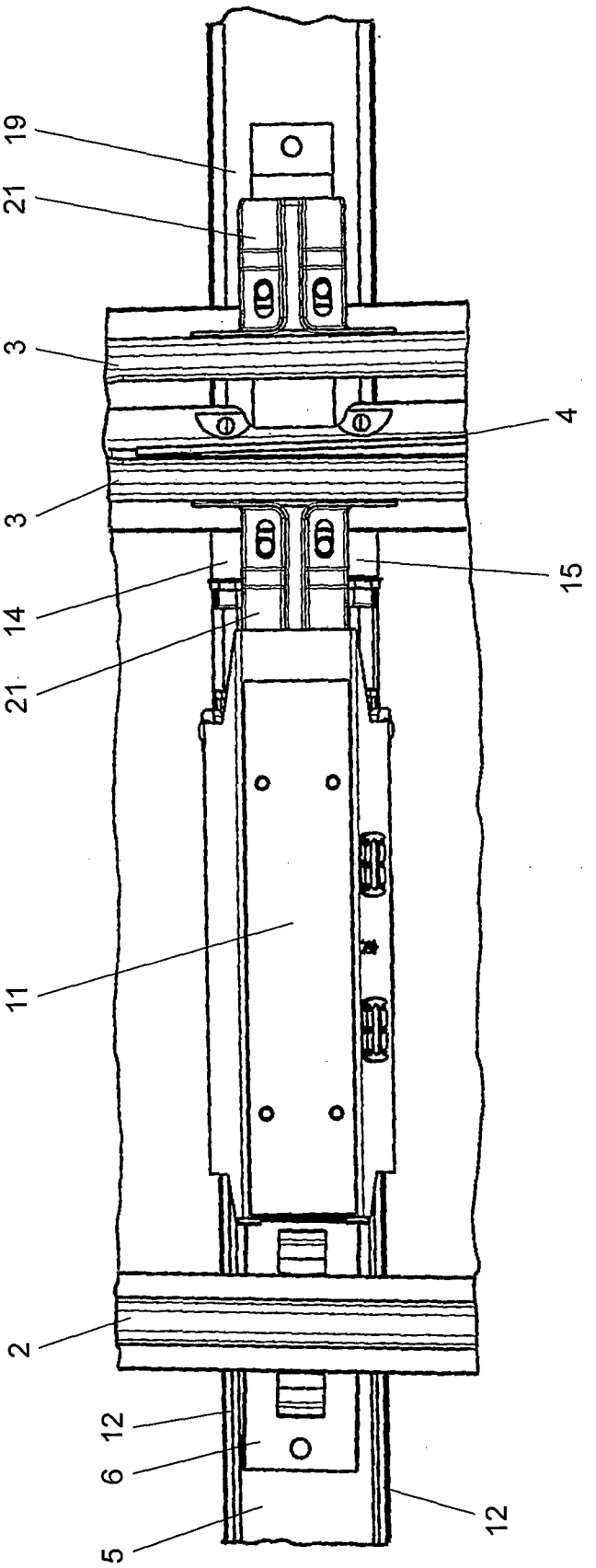


Fig. 4

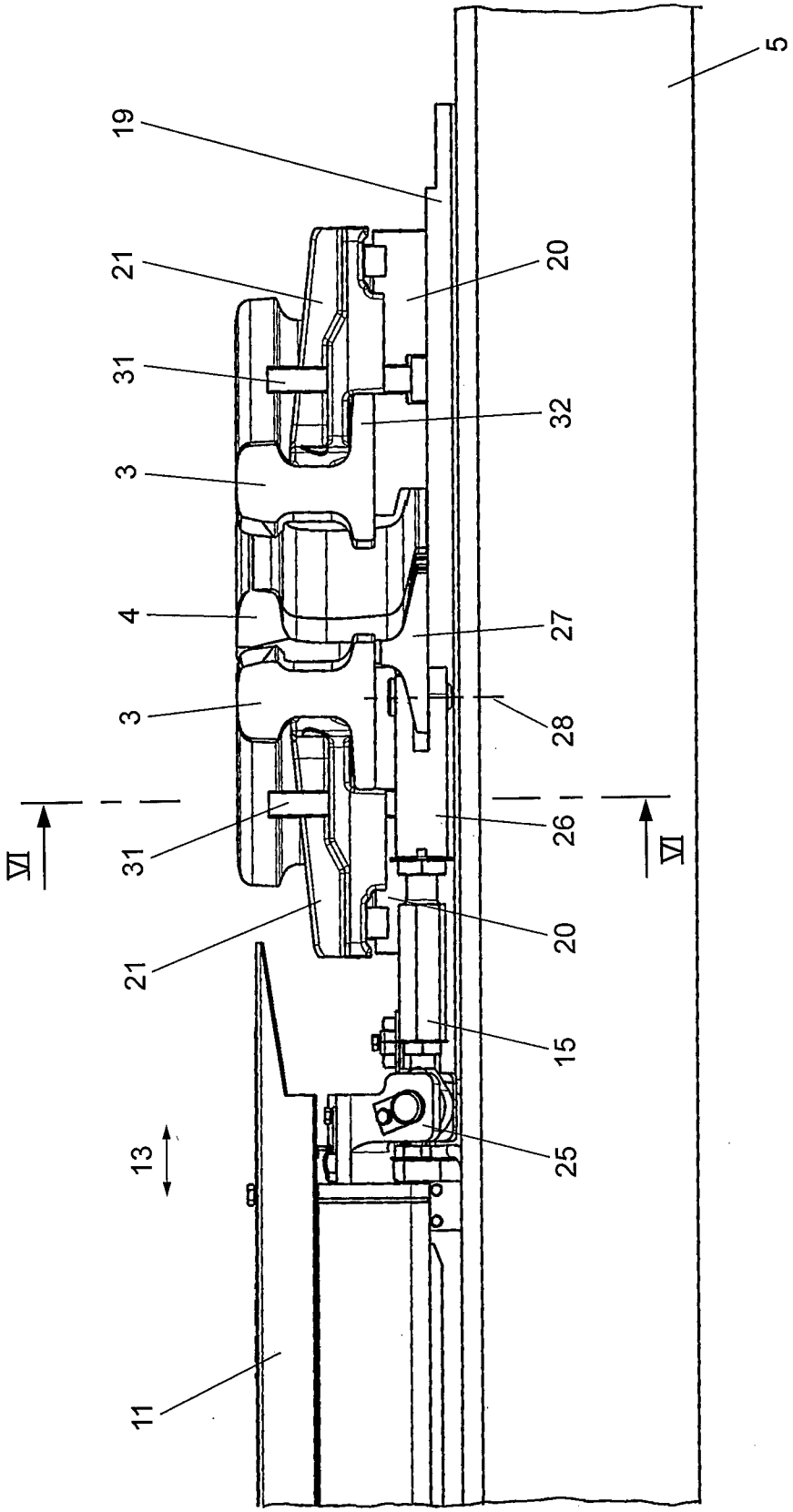


Fig. 5

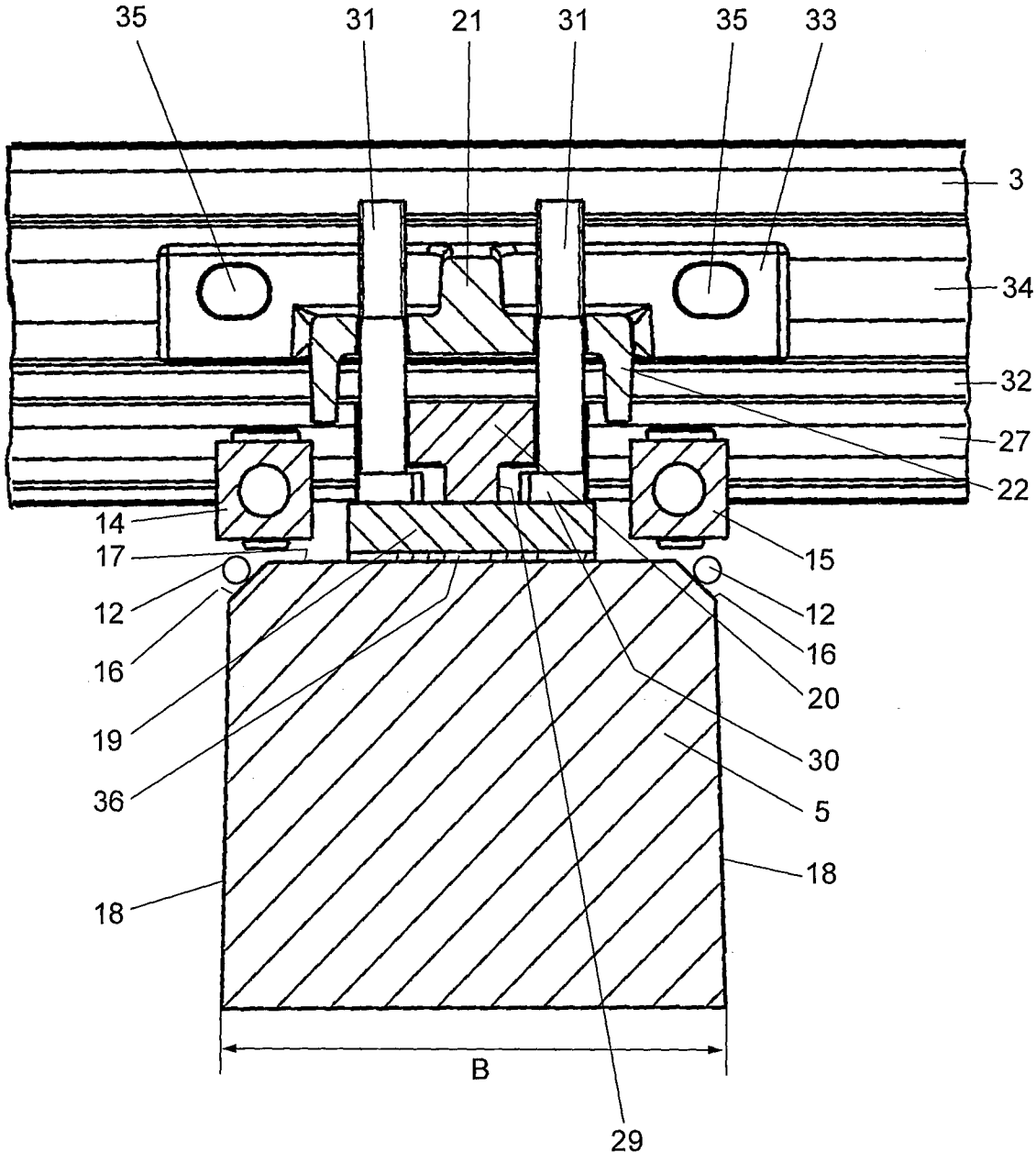
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Fig. 6

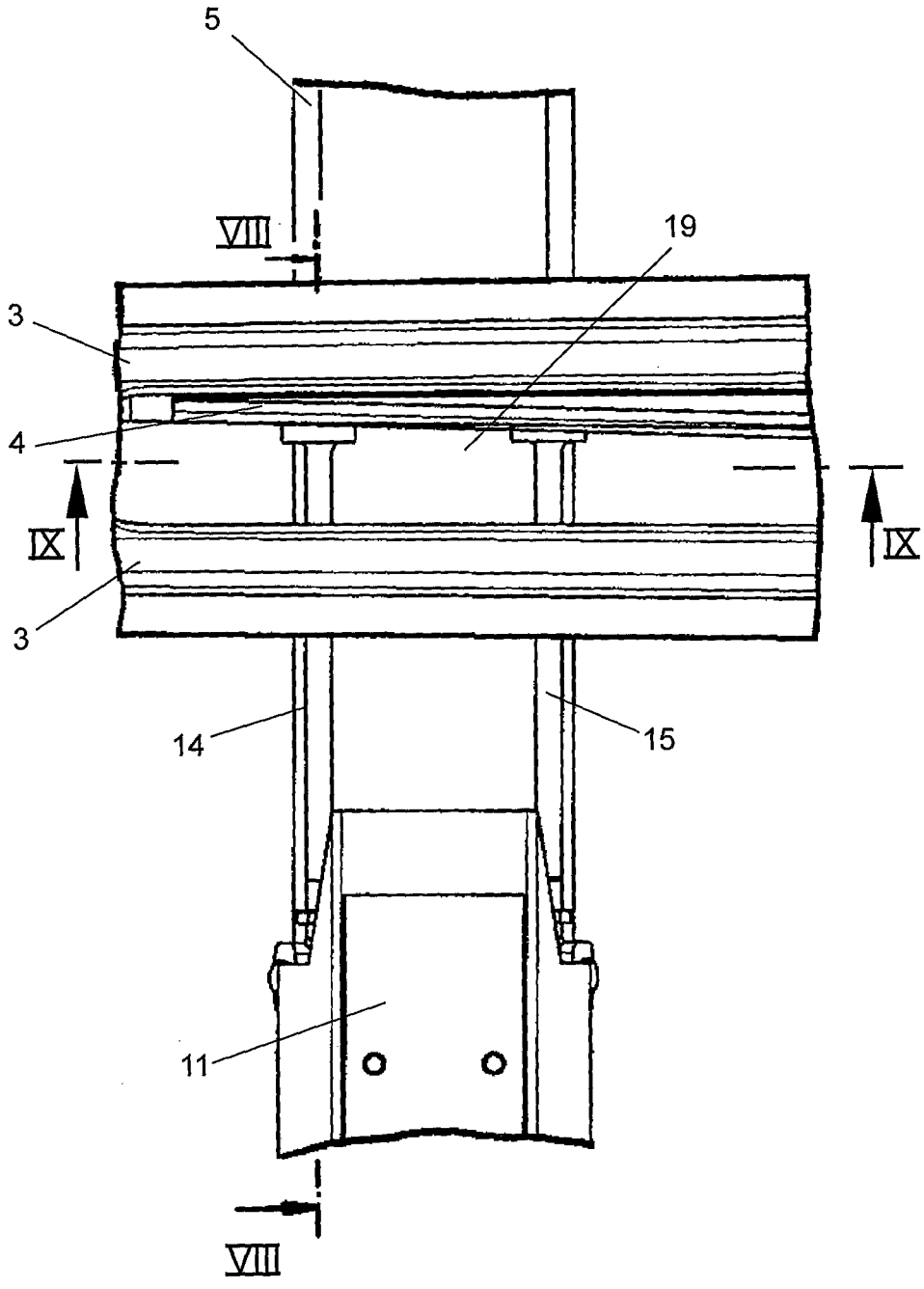


Fig. 7

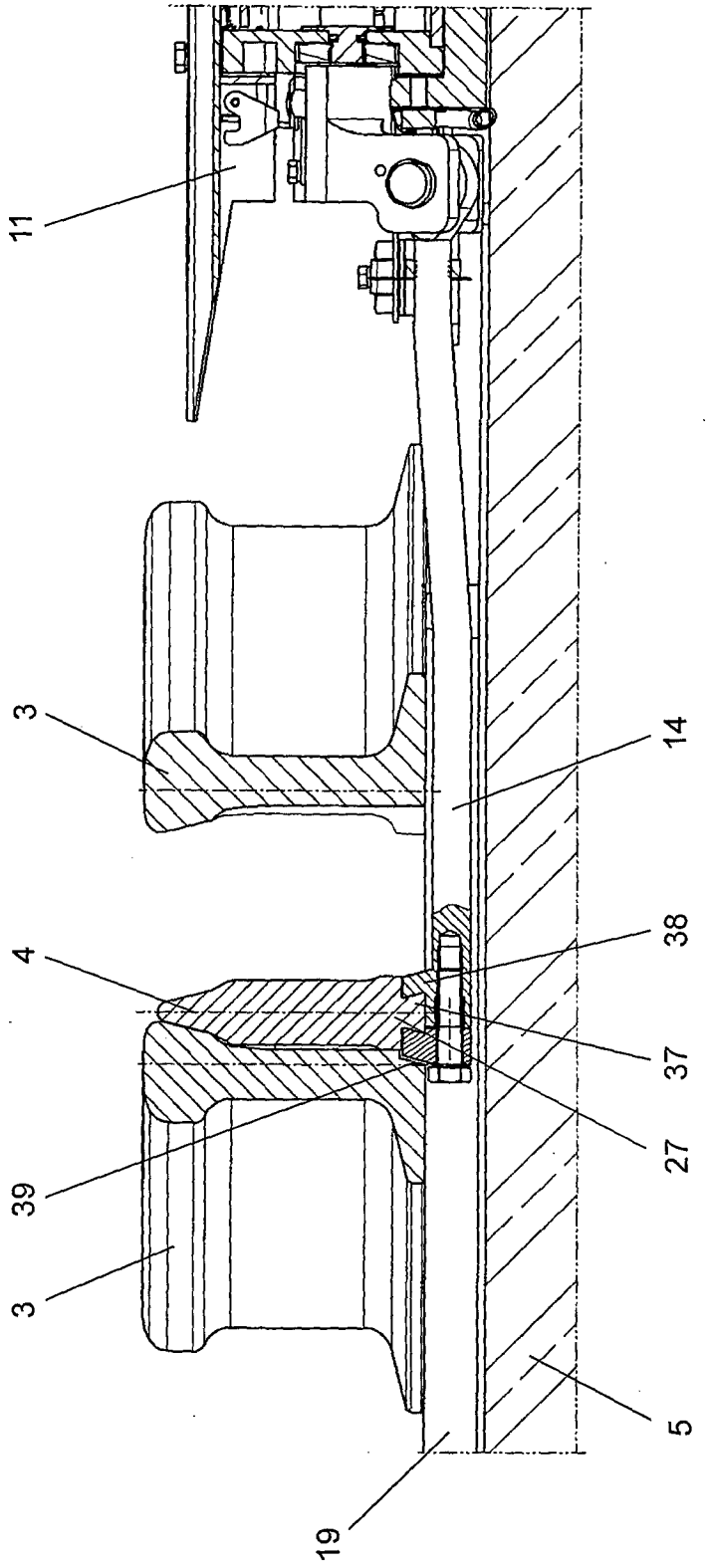


Fig. 8

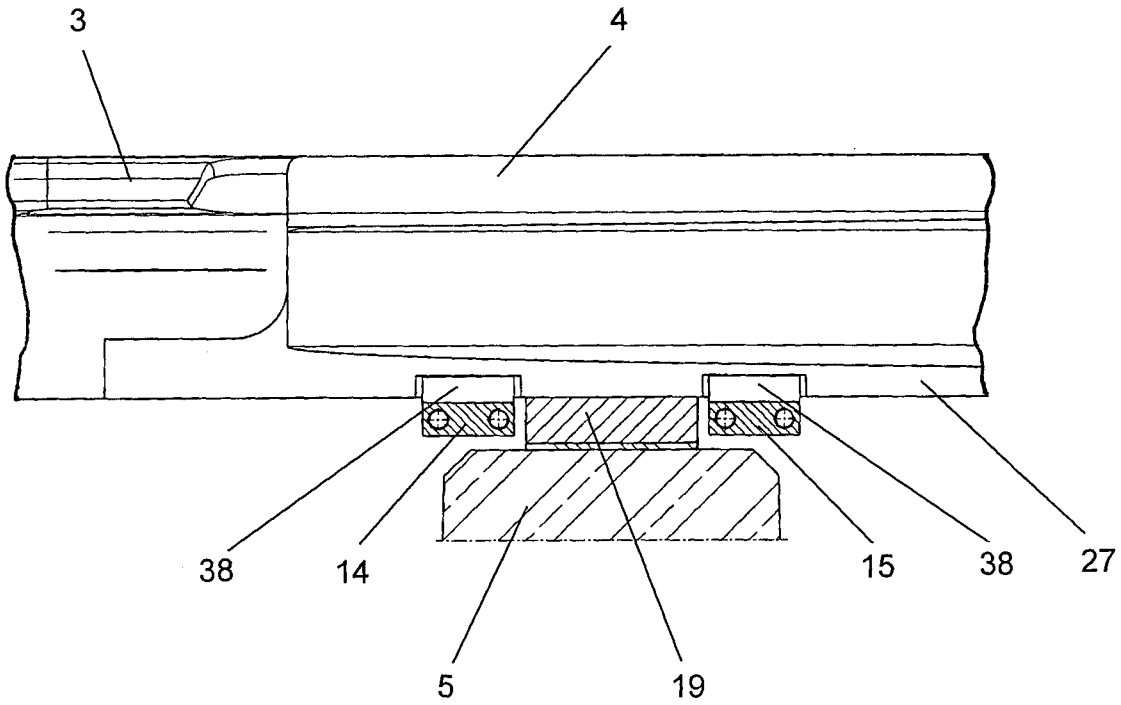


Fig. 9

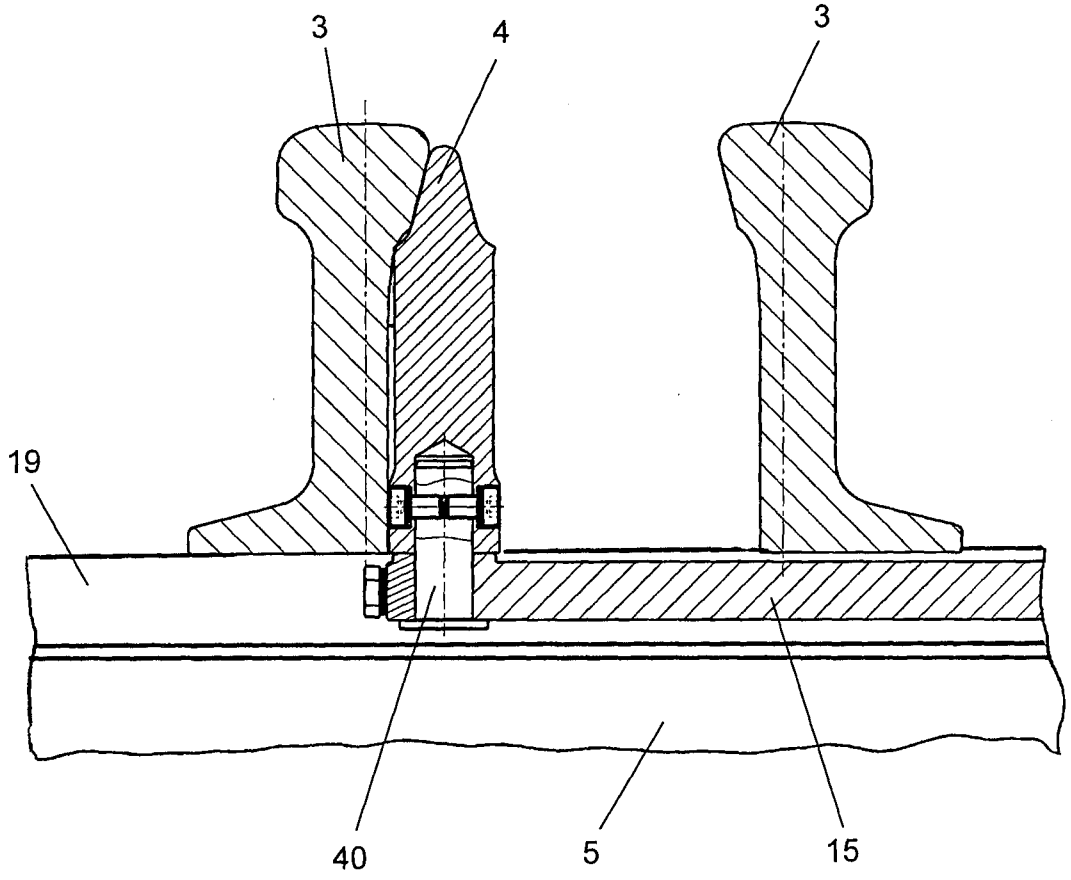


Fig. 10

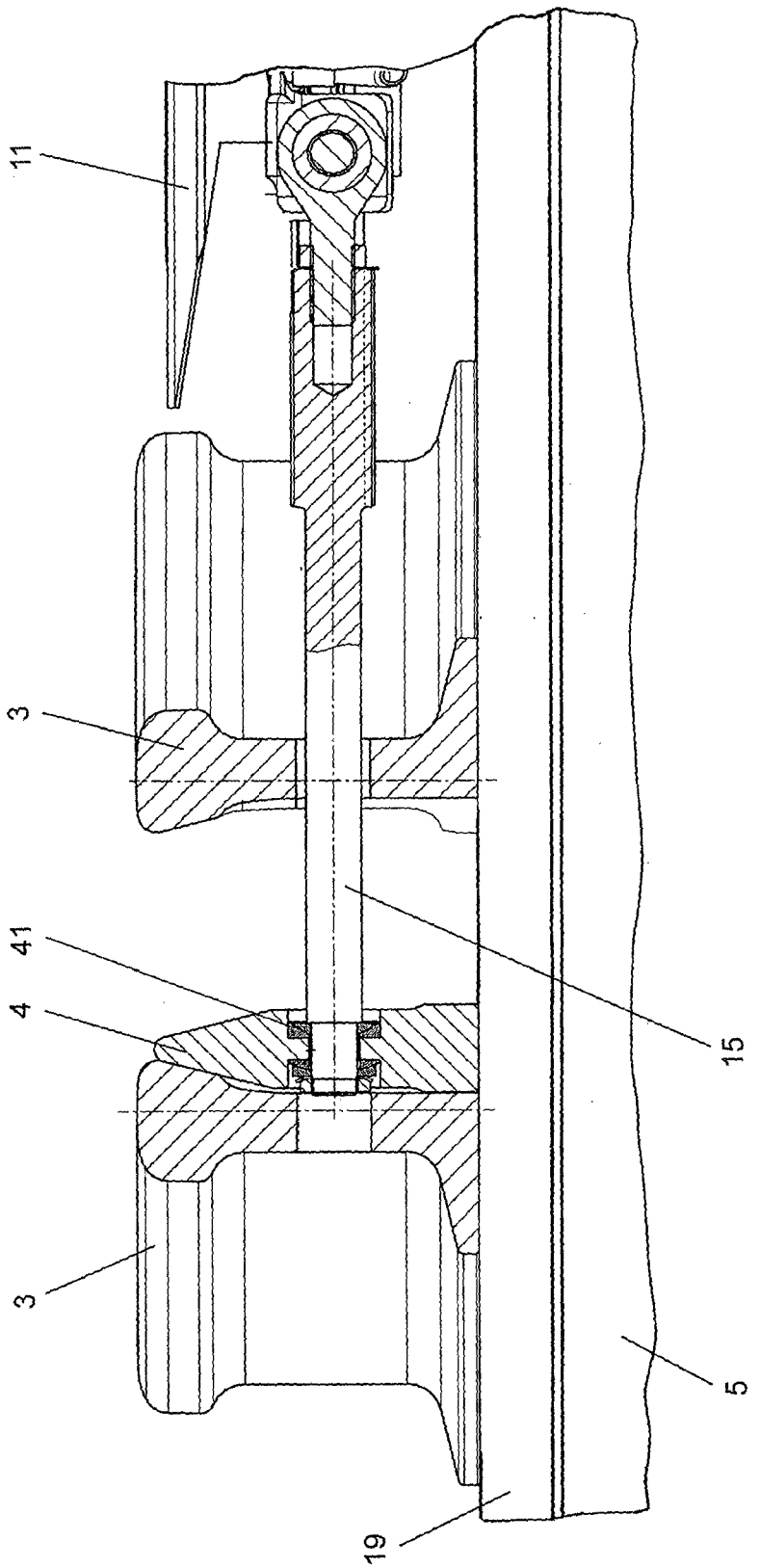


Fig. 11