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(54) Actuating and locking device for a railroad switch device

(57) An actuating and locking device for a railroad switch device, including:
two lock boxes (2);
a stretcher bar (1);
two connecting rods (5), driven by the stretcher bar (1) and attached to respective tongues (9) of the switch device, said connecting rods (5) being arranged such that they can pivot in a vertical plane, wherein each of said connecting rods (5) is configured to be attached to the corresponding tongue (9) through a sliding attachment (7,8) configured to allow the tongue (9) to slide in a longitudinal direction of the tongue, and wherein the device additionally comprises two articulated detecting rods (12,13), each of said detecting rods being coupled to a lug (7) of the sliding attachment (7,8).

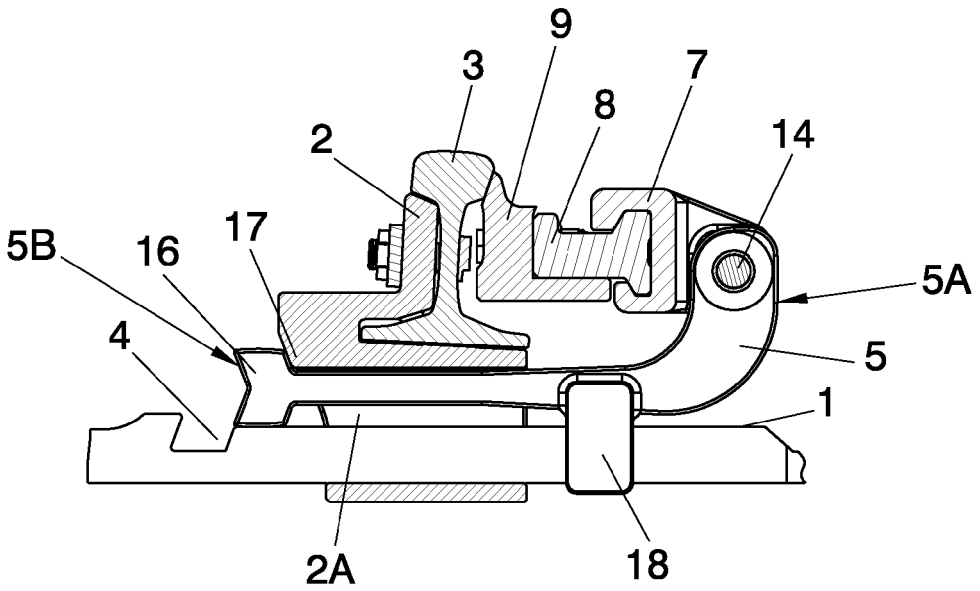

FIG. 9

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Description

Technical Field of the Invention

[0001] The invention is comprised in the technical field of actuating and locking systems and devices for switch devicees of railway turnouts. The invention can be especially advantageous in high performance turnouts, such as high speed turnouts, the great length of tongues of which makes it necessary to be able to absorb the expansions and shrinkages thereof without blocking the switch setting system.

Background of the Invention

[0002] In turnout there are mobile elements, such as switch devicees, which allow giving passage to the rail traffic alternatively on one forked track or another. For the purpose of assuring the final position of the mobile elements and preventing possible accidents due to derailing, there are mechanical systems which allow transmitting the movement from the manual lever box or electric switch motor, and which further allow securely fixing the final position of said mobile elements. In said mobile elements it is necessary to fix the coupling position of one of them (coupled tongue) and the decoupling position of the other one with sufficient space or clearance (decoupled tongue), for the purpose of assuring the safe passage of rail traffic.

[0003] It is therefore necessary at the passage of the mentioned traffic for the coupled element to remain firmly tightened against its stock rail and the decoupled element to remain open enough so that the railway wheel flanges do not hit against it, causing damages or an inopportune movement thereof.

[0004] The device in charge of performing the task of transmitting the movement of the switch setting system to the tongues and assuring their final position once the setting thereof has been performed is called the lock. The lock is typically moved by the switch motor or manual lever box through an operating rod, which transmits a linear force from the motor to a stretcher bar of the lock. On the other hand, between the setting motor and the tongues there are usually two detecting rods which serve to detect if the tongues have correctly and securely reached their final position when the operation has been already performed.

[0005] Different types of locks are known in the field of railroads and they are discussed below (those systems which are integrated in the setting motor, and which are therefore not external thereto are not described herein).

- On one hand, the so-called "clamp Jocks". In these locking devices, the movement of the lever box or setting motor is transmitted through the operating rod to a stretcher bar transverse to the axis of the turnout in its main track (a turnout has two tracks: a main or through track, which is usually straight and on which trains travel at a higher speed, and a secondary or branch track which diverts from the previous one, with a lower traveling speed) which, by means of slots made in said stretcher bar, moves two connecting rods articulated directly or by means of attachment lugs to the tongues of the turnout. Said connecting rods slide inside respective fixed elements usually referred to as lock boxes and which are attached to the stock rails. When the movement of the connecting rod towards the outside of its respective box ends, the slot of the stretcher bar locks the connecting rod in the lock box, and the tongue is firmly tightened against the stock rail. On the opposite side of the switch device, the open tongue has been moved towards the central axis of the turnout, driven by the connecting rod, in turn moved towards the central axis of the turnout by the slot of the stretcher bar. By means of a suitable combination of distance between the slots of the stretcher bar, the width of said slots and the hub of the bar, different degrees of opening of the tongue and locking safety can be achieved.

[0006] In a traditional clamp lock, the connecting rod rotates in the horizontal plane. The longitudinal movements of the tongues due to the expansions and shrinkages of a thermal origin are absorbed by means of grooved attachment lugs for attaching the connecting rod to the tongue, such that the articulation of the connecting rod with the lug is sliding and allows the longitudinal movement of the tongue without blocking the working of the lock.

[0007] The clamp lock is a well known element in the field of railroads due to its simply working and simple manufacture, but it does have some drawbacks:

- Since the rotation or pivoting of the connecting rod is in the horizontal plane, both the stems of the connecting rods and the stretcher bar are in the same horizontal plane, and both must slide through the grooves of the lock boxes. As a result, the lock boxes must have of a considerable width in practice, in many cases about 140 mm. Said width, combined with the need to have enough space for the operating rod, the detecting rods and additional space for being able to introduce tools for the assembly and disassembly of the elements of the lock, have the consequence that the horizontal space necessary for being able to assemble the clamp lock and the associated devices is considerable. The locks can be assembled between two normal sleepers of the switch device, although the latest tendency is to assemble the locks and their associated elements inside what is referred to as "hollow sleepers", which allow the mechanical tamping of the area in which the lock is assembled without having to disassemble it. The ideal configuration of the hollow sleeper is for it to have the same outer dimensions as a sleeper of the turn-

out, for the purpose of facilitating the mechanical tamping operations of said area of the turnout, and for the purpose of not causing variations of the vertical elasticity of the turnout, which may cause unwanted dynamic effects during the passage of rail traffic. With the current state of the art of clamp locks, this objective is difficult to achieve, the hollow sleepers intended for housing the clamp lock generally having a greater width than the normal sleepers of the turnout, causing the aforementioned drawbacks.

- In the conventional clamp lock, in the maintenance operations the control of the clearance between the tongue and the stock rail is usually performed by means of manual grinding or built-up welding of the end of the connecting rod or of the area of the box of the lock in which the end of the connecting rod is coupled with the box. Since the adjustment operation is manual-type labor, it does not assure optimal results for the adjustment of the lock, especially if they are performed on the spot. On the other hand, this adjustment system tends to produce clearance after a certain service time, therefore being a system with enormous maintenance needs.
- On the other hand, the so-called "vertical latch locks" are known. The working principle of these locks is similar to that of the clamp lock. The connecting rods are replaced with respective latches which have the same function, but they move in a vertical plane, driven by a stretcher bar transverse to the main track of the turnout, located in said vertical plane. The so-called "lock boxes" (or "fixed lock elements") have respective vertical openings or grooves so that both the corresponding latch and the stretcher bar can slide in said grooves, In order to absorb the longitudinal shifts of the tongues due to the expansions and shrinkages of a thermal origin, the inner opening of the lock boxes has a greater width in the direction of the axis of the stock rail of the turnout than the thickness of the stretcher bar and the latch, such that both can be moved longitudinally -i.e., in the direction of the axis of the track- driven by the movements of a thermal origin of the tongues, thus preventing the locking mechanism from being blocked in the moment of operating the tongues. This type of lock has at least two drawbacks:
- On one hand, the inside of the lock box has a greater width than the width of the stretcher bar for the purpose of being able to absorb therein the longitudinal movement of the latch and the stretcher bar, this width being a critical factor for integrating said lock in restricted spaces such as hollow sleepers which, in their ideal configuration, must have the same width as normal sleepers.
- On the other hand, the attachment lug between the latch and the tongue conventionally has a configuration which does not allow the relative longitudinal shifting of the articulation of the latch with respect to the tongue, furthermore it is not possible to articulate the detecting rods therein, which prevents detecting failures in the tongues due to the expansions thereof. This means that the detecting rods have to be attached directly to the tongue and not integrated in the mechanism of the lock, being driven longitudinally by the movements of a thermal origin of the tongues themselves. Said movement, especially in very long tongues such as those of high speed turnouts, can cause problems for detecting the position of the tongue itself in those moments in which the ambient temperature is very high or very low, producing an incident in the turnout which could force interrupting railway traffic to perform repair work on the incident.
- There are also completely encapsulated locks. In recent years encapsulated locks proclaiming a low maintenance level among their main features have emerged. In said locks, the locking mechanism is completely covered and is not visible from the outside. Said locks have a set of sealed joints which attempt to keep dirt, dust and water from entering the lock, damaging the locking mechanism. In said mechanism, the active elements are either circular sectors or balls, or rollers, which perform the same task as the connecting rods of a conventional clamp lock. Among the main drawbacks of this new technology, the following can be mentioned:
  - It is not possible for maintenance personnel to perform an external visual inspection of the locking mechanism. As a result, it is not possible to perform minor interventions in the track itself to solve minor adjustment problems or breakdowns of the lock, so in these cases it is always necessary to completely replace the lock, which involves interrupting the traffic on the concerned line. An interruption of a line involves high costs for the railway administration and a loss of earnings in their exploitation.
  - By integrating said locks with conventional setting motors, the detecting rods have not been suitably integrated in the attachment of the lock with the tongues, the latter having to be attached directly to the tongues themselves. As mentioned above, the longitudinal movements of the tongues of a thermal origin, especially those which are very long, such as those of high speed turnouts, can lead to problems in checking the tongues when the ambient temperature is very high or very low.

[0008] Patent EP-0723901-B1 and patent application EP-1110840-Al describe actuating and locking devices based on the latch lock. As can be observed in these documents, the attachment lug for attaching the connecting rod or latch to the tongue is fixed and not sliding in the mentioned patents. Therefore, due to the longitudinal shifts of the tongue (especially in the case of very long tongues) with respect to the stock rail caused by temperature variations, the set formed by the lug, the connecting rod and the stretcher bar itself is driven by the tongue in

its longitudinal expansion. To prevent the device from being blocked, it is necessary in this latch lock conception to provide the inner openings of the lock boxes with a greater width so that the set formed by the connecting rod and the stretcher bar which slide inside said lock boxes can move in the longitudinal direction of the tongues. This latch lock conception has several drawbacks:

- The box of the lock is less compact in width, which is a drawback when installing the device in places with restricted space, such as the aforementioned hollow sleepers.
- When the connecting rod and the stretcher bar are locked in the box, they have greater resistance to moving in the longitudinal direction of the tongues due to their wedging in their respective box. On the opposite side of the switch device, the other connecting rod and the stretcher bar itself are unlocked, with less resistance to moving in the longitudinal direction of the tongue, so due to the longitudinal movements of the tongues caused by the thermal variations, the possibility that the stretcher bar could stagger with respect to the two lock boxes is very high, especially in very long tongues, such as those of high speed turnouts. This is also due to the lack of side guidance of the connecting rods and the stretcher bar in the side walls of the lock boxes. As a result, the blocking possibility of this device can be high. Likewise, the wedging produced in the box in which the connecting rod is locked introduces stresses in the device as the tongue tries to overcome said wedging in its longitudinal movement. Said stresses can be the cause of breakdowns and blocking of the device, especially in its use with very long tongues.

Description of the Invention

[0009] The invention relates to an actuating and locking device (or system) for a railroad switch device, comprising:

two lock boxes configured to be attached (or which are attached) to respective stock rails of the switch device, each lock box (2) having an inner opening;
a stretcher bar extending between said lock boxes and which is arranged to be slid in a direction substantially transverse or transverse to a railroad track, in said inner openings;
two connecting rods, said connecting rods being configured to be attached (or said connecting rods being attached) to respective tongues of the switch device, each connecting rod being arranged to be shifted in said transverse direction in the inner opening of one of said lock boxes, said connecting rods being arranged to be shifted driven by said stretcher bar (which in turn can be shifted driven by the lever box or motor, through an operating rod), between a coupling position in which the connecting rod maintains the corresponding tongue coupled to the corresponding stock rail, and a decoupling position in which the connecting rod maintains the corresponding tongue at a predetermined distance from the corresponding stock rail. The transverse movement of the stretcher bar, moved by the actuating rod, is thus transmitted to the tongues, alternatively coupling and decoupling said tongues on their respective stock rails on either side of the switch, as is conventional in devices of this type.

[0010] The connecting rods are arranged such that they can pivot in a vertical plane, as is conventional in devices of this type.

[0011] According to the invention, each of said connecting rods is configured to be attached (or is attached) to the corresponding tongue through a sliding attachment configured to allow the tongue to slide in a longitudinal direction of the tongue (i.e., in a direction substantially parallel to the longitudinal axis of the tongue), with respect to the connecting rod.

[0012] The connecting rods are thus not shifted in the longitudinal direction of the track due to the longitudinal expansion or shrinkage of the tongue as a result of thermal variations. This implies a series of advantages. For example:

- The lock boxes can be made more compact (in the longitudinal direction of the track), this being advantageous when installing the device in areas with restricted space, such as hollow sleepers.
- Effective side guidance of the stretcher bar and the connecting rod can be established inside the lock boxes, because there can be little clearance between the stretcher bar and the connecting rod and the walls of the inner opening of the lock box. This can give rise to a smoother operation that is free of blocking possibilities because the tendency of the stretcher bar to stagger with respect to the two lock boxes is eliminated.
- Longitudinal stresses in the direction of the tongues are prevented because the compensation of the longitudinal movement of the tongues with respect to the stock rails is done in the sliding attachment between the connecting rod and the tongue. Thus, the risk of wedging in the mechanism is prevented (or is reduced). Another cause of the blocking and breakdowns of the device is therefore prevented, which can be especially advantageous in high speed turnout, in which the tongues are often long.

[0013] According to the invention, the sliding attachment between each connecting rod and the corresponding tongue comprises a first lug (or attachment part) coupled in a longitudinal guide attached to said tongue (for example, by screws or similar means) such that said first lug can slide along said guide, said first lug being coupled to the connecting rod. This form of coupling the connect-

ing rods to the tongues is simple and practical.

[0014] According to the invention, each connecting rod is coupled to the corresponding first lug by means of a horizontal (or substantially horizontal) hinge pin such that said connecting rod can pivot in the vertical plane about said hinge pin. The pivotability of the connecting rod in the vertical plane is thus established, while at the same time allowing the tongue to be longitudinally shifted with respect to the connecting rod.

[0015] The device additionally comprises two detecting rods (of the type used for being able to detect the actual position of the tongues, as is conventional in devices of this type, see what has been described above), each of said detecting rods being articulated to one of said first lugs. It is thus achieved that the tongues can be longitudinally shifted also with respect to the detecting rods, whereby preventing the detecting rods from being driven by the tongues when the latter expand and shrink with temperature changes. In other words, the attachments of the detecting rods to the tongues can be integrated in the attachment lug for attaching the connecting rods to the same, the lugs being of the type which slide in the longitudinal direction, being able to absorb the longitudinal movements of the tongues of a thermal origin, which are considerable in very long tongues, without the possibility of blocking the mechanism. Thus, not only is the possible blocking of the mechanism resolved, but rather possible errors in checking the position of the tongues are also prevented.

[0016] Each of said detecting rods is articulated, by means of a corresponding second lug, on said hinge pin of the corresponding first lug, such that both the connecting rod and the detecting rod are articulated on the corresponding first lug by means of one and the same common hinge pin, said hinge pin allowing the pivoting, in the vertical plane, both of the detecting rod and of the connecting rod.

[0017] Both the connecting rods and the detecting rods, the latter through the second lugs, are articulated on the respective hinge pin by means of bearings between which there are separating means for maintaining the relative distance between the articulation of the connecting rod and the articulation of the detecting rod.

[0018] The bearings corresponding to the detecting rods are configured to allow a rotation (at least a small rotation or pivoting) in the horizontal plane (parallel to the running surface of the track) for the purpose of compensating for the rotation experienced by the tongues in said horizontal plane when they are opened or closed during an operation of the switch device.

[0019] Each connecting rod has a first end and a second end, each connecting rod being articulated for pivoting in the vertical plane in correspondence with said first end, each connecting rod having, in correspondence with said second end, a protrusion (or "Gfaw'") configured to fit in a corresponding notch of the stretcher bar (having two of said notches, one for each protrusion or claw of the connecting rod), such that each connecting rod moves with the stretcher bar when its protrusion is fitted in the respective notch of the stretcher bar, driving the tongue in its movement. This configuration establishes the base for a simple locking/unlocking mechanism.

[0020] Said second end is configured to apply pressure against a part (which can be called the heel) of the lock box in a locking position of the connecting rod, for the purpose of maintaining the tongue coupled and fixed securely against the corresponding stock rail.

[0021] The notch and/or the protrusion has an inclined surface configured such that when the stretcher bar is shifted, driving one of the connecting rods towards the corresponding lock box, when the tongue abuts against the corresponding stock rail, after the shifting of the stretcher bar causes the second end of the connecting rod to pivot upwards, towards the locking position.

[0022] This is another difference with respect to conventional systems. For example, in the system described in EP-0723901-B1, the locking function is performed by a connecting rod or latch which, moved by the stretcher bar, is fixed or locked on the heel of the lock box, similarly to that of the present invention, according to this embodiment thereof. However, the operation for releasing or unlocking of the latch is performed in the backward movement of the stretcher bar, when the latter contacts with a protrusion of said latch located close to the articulation thereof.

[0023] In the actuating and locking device of the present invention, according to a possible embodiment thereof, the process of locking and unlocking the active element or connecting rod is controlled by the contact of the claw or protrusion of the connecting rod with a notch of the stretcher bar. The inclined surfaces of the notch can correspond to the outer section of the protrusion, so both the locking and the unlocking of the connecting rod with respect to the lock box can be controlled through this notch in the forward and backward movement of the stretcher bar. Thus, a simple inspection of these active areas of the stretcher bar, of the lock box and of the connecting rod is possible, these areas being accessible both visually and mechanically for maintenance personnel, who can perform simple cleaning, repair and greasing operations in the mentioned areas.

[0024] For the purpose of reducing maintenance needs, it is possible to apply coatings of solid self-lubricating materials in the parts subjected to contact and wear, or to use wear resistant materials in such areas for the purpose of preventing the need for greasing.

[0025] In many latch locks of the state of the art, the active areas in the process of locking are not the same as in the process of unlocking, the inspection of said active areas in the process of unlocking being more complex due to worse visual and mechanical accessibility.

[0026] In contrast, the actuating and locking device of the invention is conceived for maximum execution and maintenance simplicity, and it allows the use of materials known in railroad technology, preferably rolled and cast steel, spheroidal graphite cast iron, and even bronze and

plastic materials or others.

[0027] On the other hand, according to the invention, each connecting rod has two guiding flanges on both sides of the connecting rod and in its lower area, configured to maintain the relative position of the connecting rod with respect to the stretcher bar, preventing the connecting rod from becoming misaligned with respect to the stretcher bar due to the longitudinal shifts of a thermal origin of the tongue.

[0028] Each of the lock boxes comprises a first part which is coupled to the corresponding stock rail, and a second part configured so that the connecting rod applies pressure thereon in the locking position (this second part can be referred to as "heel").

[0029] The second part can be adjustably shiftable with respect to said first part of the lock box by means of an eccentric shaft.

[0030] The second part can be made of a wear resistant material, preferably hard steel.

[0031] In side and/or lower walls of said inner opening of the lock box there can be at least one plate made of wear resistant material, preferably hard steel.

[0032] The stretcher bar can have metal inserts made of wear resistant material, preferably hard steel, in edges of the notches (and especially in the edges in which the claws or protrusions of the connecting rods contact when the movement towards their locking position occurs).

[0033] At least some of the contact surfaces between the stretcher bar, the connecting rods and the lock boxes can be coated with a solid lubricant coating (which serves to prevent or at least reduce the need for the greasing thereof).

[0034] At least some of the contact surfaces between the first lugs and the guides can be coated with a solid lubricant coating (which serves to prevent or at least reduce the need for the greasing thereof) (furthermore, the guides can be made of a wear resistant material, preferably hard steel).

[0035] The operating and locking principle is simple and is similar to that of the conventional clamp lock, the connecting rod of which rotates in the horizontal plane, and which is widely known by the personnel in charge of the installation and maintenance thereof. However, it does not have the drawbacks of this device, which requires more space and a high level of maintenance. Thus, said installation and maintenance operations are simplified given that it is not necessary to perform a specific coaching and training program for this type of actuating and locking device, on the other hand facilitating its future implementation in railway administrations.

[0036] This actuating and locking device object of the invention can be used both in conventional, high performance and in high speed turnouts, in which it is especially advantageous due to the long length of its tongues.

Description of the Drawings

[0037] To complement the description and for the purpose of aiding to better understand the features of the invention according to practical embodiments thereof, a set of drawings is attached as an integral part of the description, in which the following has been depicted in an illustrative and non-limiting manner:

Figure 1 depicts a cross-section of the actuating and locking device object of the invention according to a first embodiment thereof, along a vertical plane including the axis of the hollow sleeper. The electric setting motor is depicted.

Figure 2 depicts a plan view of the actuating and locking device object of the invention according to the first embodiment thereof, integrated in a hollow sleeper. The electric setting motor is depicted.

Figure 3 depicts a plan detail view of the left side of the actuating and locking device object of the invention according to the first embodiment thereof, in which the representation of the tongue and the stock rail has been omitted for greater clarity.

Figure 4 depicts a cross-section of the actuating and locking device object of the invention according to a second embodiment thereof, along a vertical plane including the axis of the hollow sleeper. The electric setting motor is depicted.

Figure 5 depicts a plan view of the improved actuating and locking device object of the invention according to the second embodiment thereof, integrated in a hollow sleeper. The electric setting motor is depicted.

Figure 6 depicts a plan detail view of the left side of the actuating and locking device object of the invention according to the second embodiment thereof, in which the representation of the tongue and the stock rail has been omitted for greater clarity.

Figure 7 depicts a cross-section of the actuating and locking device object of the invention according to the second embodiment thereof, integrated between two conventional sleepers, along a vertical plane including the axis of the stretcher bar. The representation of the electric setting motor is omitted.

Figure 8 depicts a plan view of the actuating and locking device object of the invention according to the second embodiment thereof, integrated between two conventional sleepers. The representation of the tongue and the stock rail and the representation of the electric setting motor are omitted for the sake of clarity.

Figure 9 depicts a section along a vertical plane of the left side of the actuating and locking device object of the invention according to the first embodiment thereof. The right side would have a configuration that is similar but mirror image of the one depicted.

Figure 10 depicts an elevation view from outside the track of the left side of the actuating and locking device object of the invention according to the first embodiment thereof.

Figure 11 depicts a section along a vertical plane of

the lock box and its stock rail of the left side of the actuating and locking device object of the invention, according to the first embodiment thereof.

Figure 12 depicts a section along a vertical plane of the left side of the second embodiment of the actuating and locking device object of the invention. The right side would have a configuration that is similar but mirror image of the one depicted.

Figure 13 depicts an elevation view from outside the track of the left side of the second embodiment of the actuating and locking device object of the invention.

Figure 14 depicts a section along a vertical plane of the box and its stock rail of the left side of the actuating and locking device object of the invention, according to the second embodiment thereof.

Figure 15 depicts a section along a vertical plane of the actuating and locking device object of the invention according to the first or second embodiment thereof, including the hinge pin of the sliding lug.

Preferred Embodiments of the Invention

[0038] According to a first embodiment of the invention (illustrated in Figures 1-3 and 9-11 and 15), a stretcher bar (1) sliding through the inside (through an inner opening (2A) forming a passage channel for the stretcher bar) of two outer boxes or lock boxes (2) attached to the stock rails (3) of the switch device has been provided. The stretcher bar can be moved by an electric motor (30), through an operating rod (10), as is conventional.

[0039] Said stretcher bar (1) is provided with two recesses or notches (4) in which the claws or protrusions (16) of the two connecting rods (5) can fit; the protrusions (16) are located in correspondence with a second end (5B) of the corresponding connecting rod, opposite a first end (5A) in which the pivoting shaft of the connecting rod (5) is located. The connecting rods (5) are located on both sides of the switch device and are articulated on respective sliding lugs (7). Said lugs (7) can slide in the longitudinal direction in respective guides (8) attached to the tongues (9). Thus, the transverse movement of the stretcher bar (1), moved by the actuating rod (10), is transmitted to the tongues (9), alternatively coupling and decoupling the tongues (9) on their respective stock rails (3) on either side.

[0040] Respective lugs (11A, 11B) of the detecting rods (12, 13), i.e., of the bars which are used to check the correct positioning of the tongues, are also articulated on the sliding lugs (7). Both the connecting rods (5) and the lugs (11A, 11B) of the detecting rods are articulated to the sliding lugs (7) by means of common hinge pins (14) both for the respective lugs (11A, 11B) of the detecting rods (12. 13) and for the connecting rods (5). Said hinge pins (14) allow the rotation or pivoting in the vertical plane both of the lugs (11A, 11B) of the detecting rods and of the connecting rods (5). The articulations both of the connecting rods (5) and of the lugs (11A, 11B) of the detecting rods on the hinge pins (14) are carried out in this embodiment of the invention by means of bearings (15A) and (15B). Between said bearings (15A) and (15B) there are ring-shaped spacers (6) or similar means which maintain the relative distance between the articulations of the connecting rods and those of the lugs of the detecting rods, inside the sliding lugs (7). The bearings (15A) of the lugs (11A, 11B) of the detecting rods allow a certain rotation in the horizontal plane. This compensates for the rotation experienced by the tongues (9) in the horizontal plane of the switch when they are opened or closed by the actuating and locking device.

[0041] The two connecting rods (5) on both sides of the switch device slide together with the stretcher bar (1) inside (i.e., through an inner opening (2A)) of the lock boxes (2) which, in turn, are integrally attached to the stock rails (3).

[0042] As has been indicated, the second end (513) of the connecting rods (5) (opposite the first end (5A) in which the connecting rods are articulated with the sliding lugs (7)), have claws or protrusions (16) (see, for example, Figure 9) which, in their unlocked position, fit in the notches (4) of the stretcher bar (1) such that both the connecting rods (5) and the stretcher bar (1) move integrally when the protrusion (15) is fitted in the respective notch (4), driving the tongue (9) in its movement. If the movement of the stretcher bar (1) is towards the outside of the box (2), there will come a time when the protrusion (16) comes out through the outer side of the box (2), and due to the effect of the inclined shape of the protrusion (16) and of the notch (4), the claw (16) is moved towards the heel (17) of the box (2), both entering into contact. The stretcher bar (1) continues its movement towards the outside and the claw (16) can no longer fit in the notch (4) of the stretcher bar (1), the connecting rod (5) being securely locked (as is seen in Figure 9) and the tongue (9) being securely fixed and coupled to the stock rail (3).

[0043] For the purpose of assuring correct guidance of the connecting rod (5) in its transverse movement, preventing it from staggering due to the possible driving of the longitudinal movement of the tongues (9) due to thermal stresses, especially when the tongues are very long, or due to the vibration or impact induced by the passage of the rail traffic, the connecting rods (5) have two guiding flanges (18) on both sides, at the end opposite that of the protrusion (16) and in their lower area, which encompass the stretcher bar (1) (see Figure 9). Thus, the movement of the connecting rods (5) is guided in the transverse direction by the stretcher bar (1).

[0044] With this configuration of the actuating and locking device, several of the problems existing in the current state of the art are resolved:

- Due to the arrangement of the stretcher bar (1) sliding through the lower part of the connecting rod (5), a lock box (2) design having smaller width, even being narrower than that used in the latch lock, can be used given that in the device object of the invention,

the longitudinal shifts of a thermal origin of the tongues (9) are absorbed by means of the sliding lugs (7), and not inside the lock boxes (2) themselves, the latter being able to be narrower. Said preferred configuration allows the necessary space between two sleepers of the switch device or in a metallic hollow sleeper to be smaller than in the clamp or latch lock designs currently known. On the other hand, the arrangement of the articulation bearings (15A) of the lugs (11A, 11B) of the detecting rods (12, 13) and of the connecting rod (5) on a common hinge pin (14) assembled in the sliding lug (7) contributes to the configuration of the device being more compact.

- The assembly of the common hinge pin (14) for the connecting rods (5) and for the lugs (11A, 11B) of the detecting rods on the sliding lugs (7) allows absorbing the longitudinal movements of a thermal origin of the tongues (9) with respect to the stock rails (3) by means of the sliding lugs (7), preventing both the blocking of the actuating and locking device object of the present invention patent and problems of detecting the position of the tongues (9) which can occur in the event that the detecting rods (12, 13) tend to stagger driven by the longitudinal movements of a thermal origin of the tongues (9). Therefore the service incidents, which are a cause of interventions in the track itself by maintenance personnel, are reduced, increasing the availability of the system. The described arrangement of the lug (7) common both for the detecting rods (12, 13) and for the connecting rod (5) also simplifies the adjustment and set up of the actuating and locking device, being especially advantageous in high performance and high speed turnouts, in which the tongues are very long.
- The main components of the actuating and locking device object of the invention, i.e., the stretcher bar (1), the boxes (2), the connecting rods (5), the sliding lugs (7) and their articulations, are visible and inspectable without needing to disassemble the device, which facilitates adjustment and maintenance jobs, enabling simple interventions on the spot by maintenance personnel without needing to interrupt line service, and if such interruptions are necessary, it shortens the time necessary for line interruptions.

[0045] In the described configuration, the clearance between the set formed by the stretcher bar (1) and the connecting rod (5) on one hand and the side walls of the box (2) on the other is reduced to the minimum. A slight clearance can be maintained to reduce the risk that the locking mechanism becomes blocked, but nevertheless a reduction of the width of the box to a small value, for example, about 110 mm approximately, can be achieved, facilitating the installation of the lock object of the invention in places with little space, such as hollow sleepers.

[0046] All the previously described types of lock are subjected to wear throughout their service life. In the actuating and locking device of the invention, said wear can be especially significant in the contact area between the claw or protrusion (16) of the connecting rod (5) and the heel (17) of the lock box (2), in which the locking occurs, and has as a consequence the occurrence of a separation or clearance between the tongue (9) and the stock rail (3) when they are coupled together. Said clearance could be dangerous and be the cause of the derailing of the railway units when passing though the switch device.

[0047] Therefore, it may be desirable to correct and eliminate said clearance in the adjustment and maintenance jobs of the actuating and locking device of the invention.

[0048] According to a second embodiment of the device object of the invention (see Figures 4-8 and 12-15), a series of modifications aimed at reducing maintenance costs, increasing the availability of the system, can be incorporated.

[0049] In this sense, an improvement on the configuration of the first embodiment consists of providing the lock box (2) with a heel (17) that can be adjusted by means of an eccentric bolt (19). It is thus possible to move and fit the heel (17) in the transverse direction with respect to the protrusion (16) of the connecting rod (5), such that during the adjustment and maintenance jobs, the clearance between the heel (17) and the protrusion or claw (16) of the connecting rod (5) can be eliminated, and therefore, a dangerous clearance between the tongue (9) and the stock rail (3) in their coupled position prevented.

[0050] On the other hand, the most widely known maintenance jobs of the locks require greasing the fixed and mobile parts in the areas in which there is sliding, friction and wear every so often. Said jobs require maintenance personnel being taken on the spot, involving a cost for both personnel taken out and track interruption time.

[0051] For the purpose of preventing the greasing in the actuating and locking device object of the invention, another technical improvement on the configuration of the first embodiment of the invention is provided, consisting of using plates (20A, 20B, 20C) made of wear resistant material, which can preferably be hard steel, and which are fixed inside the side and lower walls of the lock box (2), such that both the stretcher bar (1) and the connecting rod (5) in their transverse movement do not directly rub on the box (2), but rather on the material of the plates (20A, 20B, 20C). Thus, on one hand the greasing and maintenance jobs of the actuating and locking device of the invention are prevented (or reduced), and on the other hand the wear of the mobile elements, stretcher bar (1) and connecting rod (5), and of the fixed element of the box (2) is prevented.

[0052] The configuration of the plates (20A, 20B, 20C) allows a contact surface between such plates and the mobile elements of the actuating and locking device object of the invention that is larger than that described, for example, in patent EP-0723901-B1. In the device of the

invention, the wear can thus be reduced since the contact surface is larger, the need for adjustment and maintenance being less than in the device described in patent EP-0723901-B1

[0053] The adjustable heel (17) of the box (2) can be made of wear resistant material, preferably hard steel, for the purpose of preventing its greasing and premature wear since it is in contact with the claw (16) of the connecting rod (5) in movement and rubs with the same. The articulations (15B) of the connecting rod (5) and (15A) of the lugs (11A, 11B) of the detecting rods (12, 13) are also made up of sealed bearings without greasing.

[0054] Another area in which friction and wear are produced in service is located in the contact between the protrusion (16) of the connecting rod (5) and the stretcher bar (1) itself, in the locked configuration or position. In order to reduce the need for maintenance and adjustment, another improvement can be made on the first embodiment described, based on providing the stretcher bar (1) with metal inserts (21) made of wear resistant material, preferably hard steel, in the edges of the notches (4), in which the protrusions (15) contact in their locked position. The life cycle costs are thus reduced based on decreasing the wear in the stretcher bar and preventing the need for the greasing thereof.

[0055] In order to prevent the need for greasing the actuating and locking device of the invention, another improvement is provided based on applying a permanent solid lubricant coating in the areas of the connecting rod and the stretcher bar subjected to contact and mutual friction or in contact with the lock box (2) and its components. Thus, a part made of wear resistant material, preferably hard steel (either the heel (17), the plates (20A, 20B, 20C), or the metal insert (21) of the stretcher bar (1)) and, on the other hand, a part coated with permanent solid lubricant, either the connecting rod (5) or the stretcher bar (1), participate in the contact between mobile parts. This combination of contacts allows the coefficient of friction and the wear to be reduced, thus eliminating (or at least reducing) the need for greasing.

[0056] Such solid lubricant can be applied on the mutual sliding and contact surfaces between the sliding lugs (7) and their guides (8), these guides being able to be made of wear resistant hard steel, and the sliding lugs (7) being coated with permanent solid lubricant in those areas which are in contact with the guides.

[0057] In this text the word "comprises" and its variants (such as "comprising", etc.) must not be interpreted in an exclusive manner, i.e., they do not exclude the possibility that what has been described can include other elements, steps etc.

[0058] On the other hand, the invention is not limited to the specific embodiments which have been described but rather also includes, for example, the variants which can be carried out by the person having ordinary skill in the art (for example, with regard to the choice of materials, dimensions, components, configuration, etc.), within what is inferred from the claims.

Claims

1. Actuating and locking device for a railroad switch device, comprising:

two lock boxes (2) configured to be attached to respective stock rails (3) of the switch device, each lock box (2) having an inner opening (2A);
a stretcher bar (1) extending between said lock boxes (2) and which is arranged to be slid in a direction substantially transverse to a train track, in said inner openings (2A);
two connecting rods (5), said connecting rods (5) being configured to be attached to respective tongues (9) of the switch device, each connecting rod (5) being arranged to be shifted in said transverse direction in the inner opening (2A) of one of said lock boxes (2), said connecting rods (5) being arranged to be shifted driven by said stretcher bar (1), between a coupling position in which the connecting rod (5) maintains the corresponding tongue (9) coupled to the corresponding stock rail (3), and a decoupling position in which the connecting rod maintains the corresponding tongue (9) at a predetermined distance from the corresponding stock rail (3), said connecting rods (5) being arranged such that they can pivot in a vertical plane;
characterized in that
each of said connecting rods (5) is configured to be attached to the corresponding tongue (9) through a sliding attachment (7, 8) configured to allow the tongue (9) to slide in a longitudinal direction of the tongue, with respect to the connecting rod (5);
in that
the sliding attachment between each connecting rod (5) and the corresponding tongue (9) comprises a first lug (7) coupled in a longitudinal guide (8) attached to said tongue (9) such that said first lug (7) can slide along said guide (8), said first lug (7) being coupled to the connecting rod (5);
in that
each connecting rod (5) is coupled to the corresponding first lug (7) by means of a horizontal hinge pin (14) such that said connecting rod (5) can pivot in the vertical plane about said hinge pin (14);
in that
the device additionally comprises two detecting rods (12, 13), each of said detecting rods being coupled to one of said first lugs (7);
in that
each of said detecting rods (12, 13) is articulated, by means of a corresponding second lug (11A, 11B), in said hinge pin (14) of the corresponding first lug (7), such that both the con-

necting rod (5) and the detecting rod (12, 13) are articulated in the corresponding first lug (7) by means of one and the same common hinge pin (14), said hinge pin (14) allowing the pivoting, in the vertical plane, both of the detecting rod (12, 13) and of the connecting rod (5);
in that
both the connecting rods (5) and the detecting rods (12, 13), through the second lugs (11 A, 11 B), are articulated on the respective hinge pin (14) by means of bearings (15A, 15B) between which there are separating means (6) for maintaining the relative distance between the articulation of the connecting rod (5) and the articulation of the detecting rod (12, 13);
in that
the bearings (15A) corresponding to the detecting rods are configured to allow a rotation in the horizontal plane, for the purpose of compensating for the rotation experienced by the tongues (9) in said horizontal plane when they are opened or closed during a setting operation of the switch device;
in that
each connecting rod (5) has a first end (5A) and a second end (5B), each connecting rod being articulated for pivoting in the vertical plane in correspondence with said first end (5A), each connecting rod (5) having, in correspondence with said second end (5B), a protrusion (16) configured to fit in a corresponding notch (4) of the stretcher bar (1), such that each connecting rod (5) is moved with the stretcher bar (1) when its protrusion (16) is fitted in the respective notch (4) of the bar, driving the tongue (9) in its movement;
in that
said second end (5B) is configured to apply pressure against a part (17) of the lock box (2) in a locking position of the connecting rod, for the purpose of maintaining the tongue (9) coupled and fixed securely against the corresponding stock rail (3);
in that
said notch (4) and/or said protrusion (15) has an inclined surface configured such that when the stretcher bar (1) is shifted, driving one of the connecting rods (5) towards the corresponding lock box (2), when the tongue (9) abuts against the corresponding stock rail (3), a continuation of the shifting of the stretcher bar (1) causes the second end (5B) of the connecting rod (5) to pivot upwards, towards the locking position;
in that
each connecting rod (5) has two guiding flanges (18) on both sides of the connecting rod (5) and in its lower area, configured to maintain the relative position of the connecting rod (5) with respect to the stretcher bar (1), preventing the connecting rod from becoming misaligned with respect to the stretcher bar (1) due to the longitudinal shifts of a thermal origin of the tongue (9); and **in that**
each of the lock boxes (2) comprises a first part which is coupled to the corresponding stock rail (3), and a second part (17) configured so that the connecting rod applies pressure thereon in the locking position.

2. Device according to claim 1, wherein said second part (17) is adjustably shiftable with respect to said first part of the lock box (2) by means of an eccentric bolt (19).

3. Device according to claim 1 or 2, wherein said second part (17) is made of a wear resistant material, preferably hard steel.

4. Device according to any of the previous claims, wherein in side and/or lower walls of said inner opening (2A) of the lock box (2) there is at least one plate (20A, 20B, 20C) made of wear resistant material, preferably hard steel.

5. Device according to any of the previous claims, wherein the stretcher bar (1) has metal inserts (21) made of wear resistant material, preferably hard steel, in edges of the notches (4).

6. Device according to any of the previous claims, wherein at least some of the contact surfaces between the stretcher bar (1), the connecting rods (5) and the lock boxes (2) are coated with a solid lubricant coating.

7. Device according to any of the previous claims, wherein at least some of the contact surfaces between the lugs (7) and the guides (8) are coated with a solid lubricant coating.

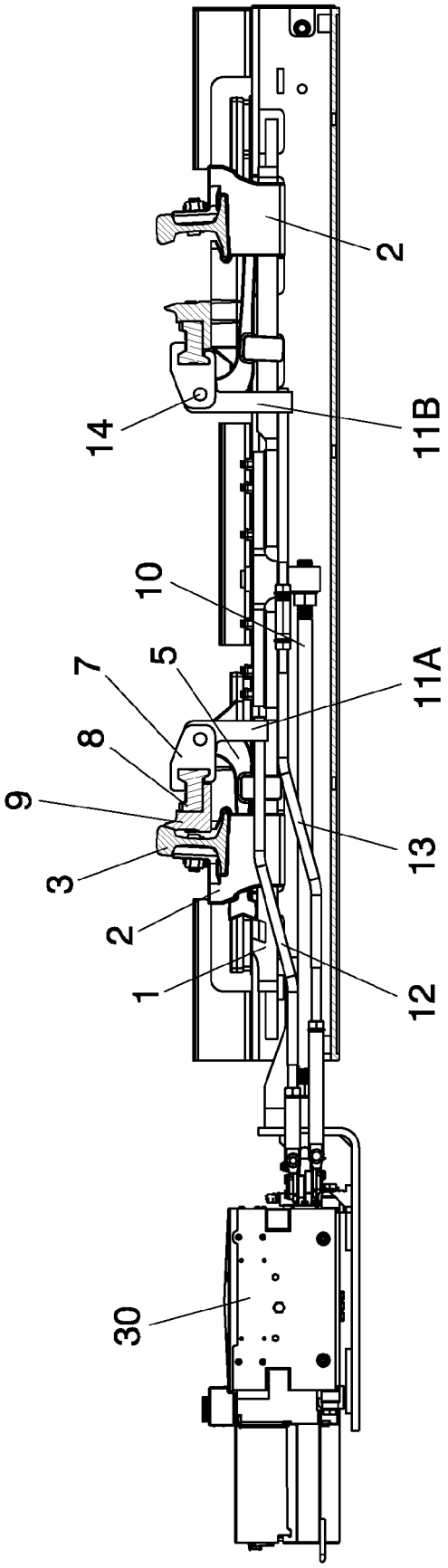

FIG. 1

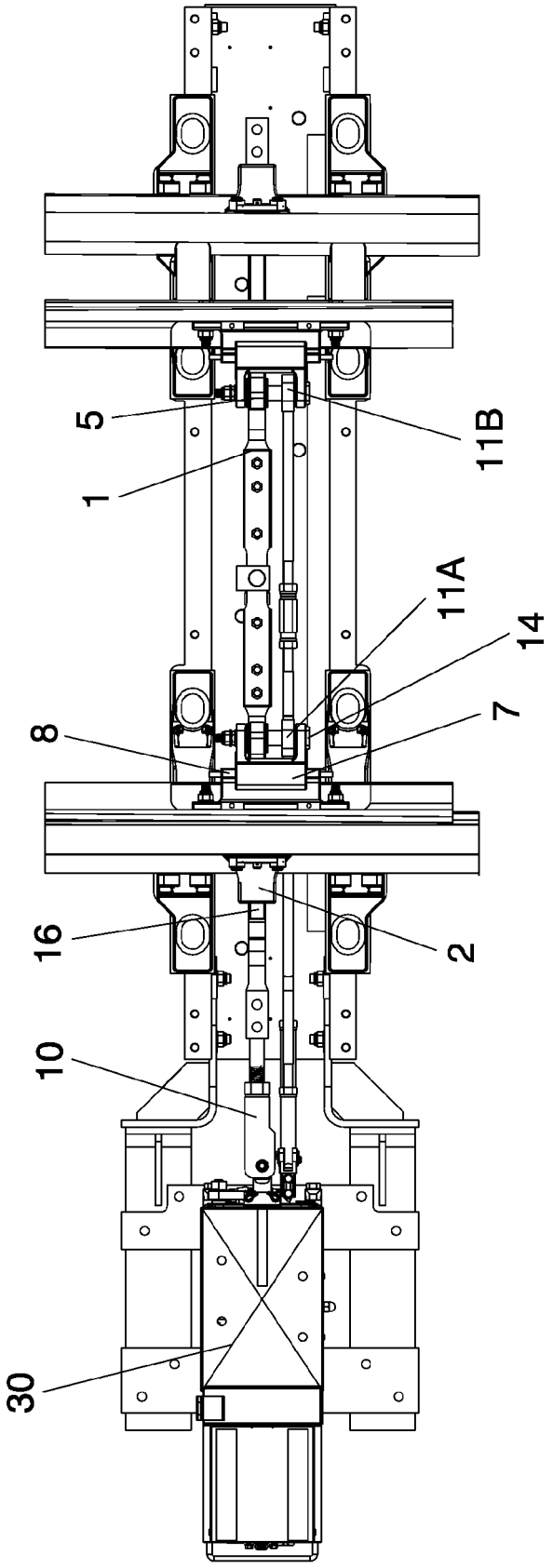

FIG. 2

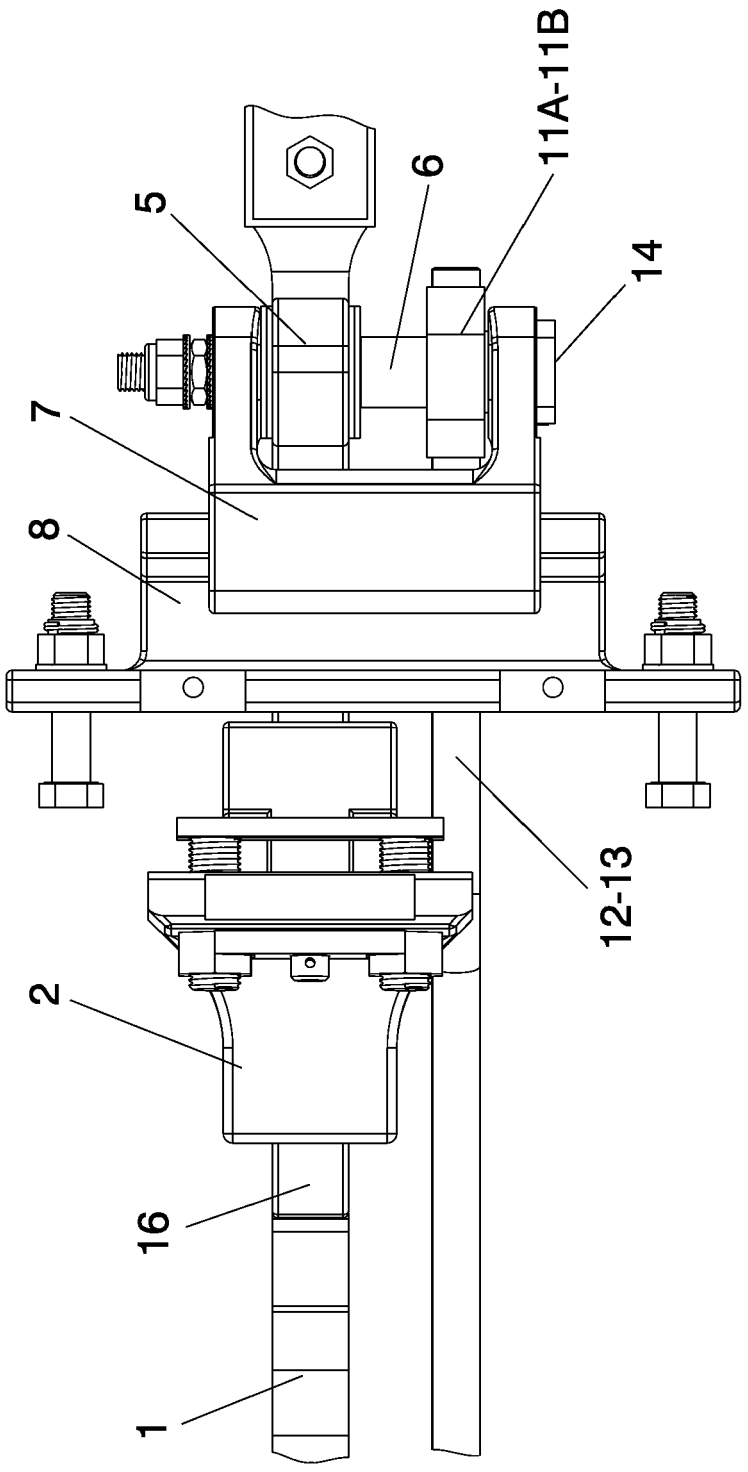

FIG. 3

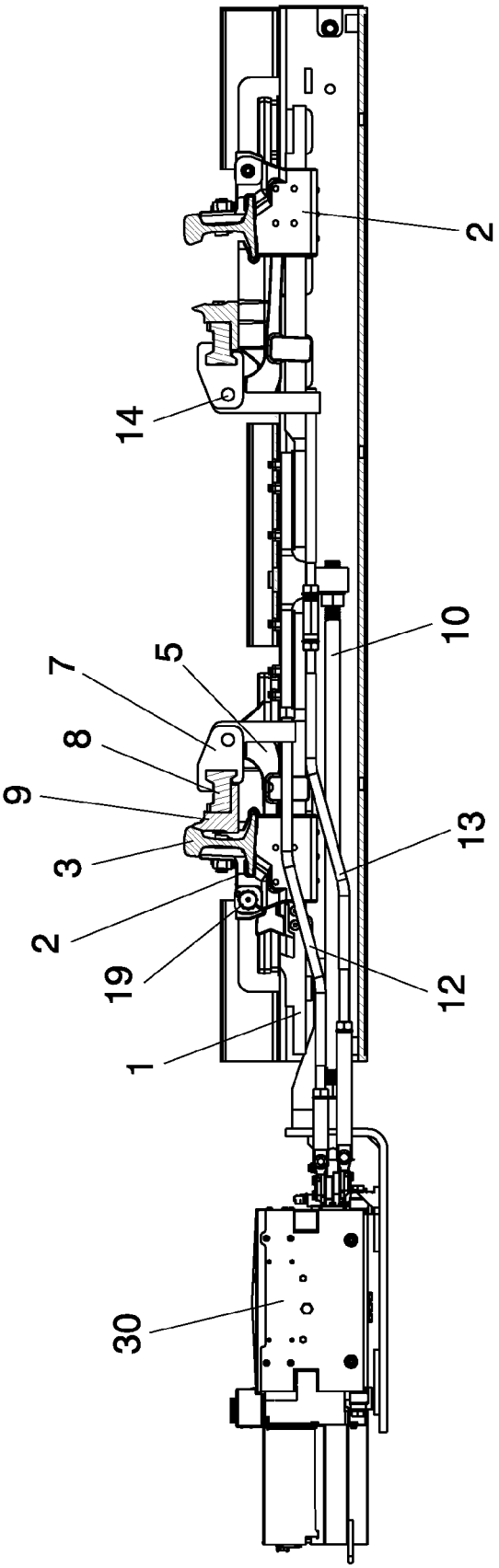

FIG. 4

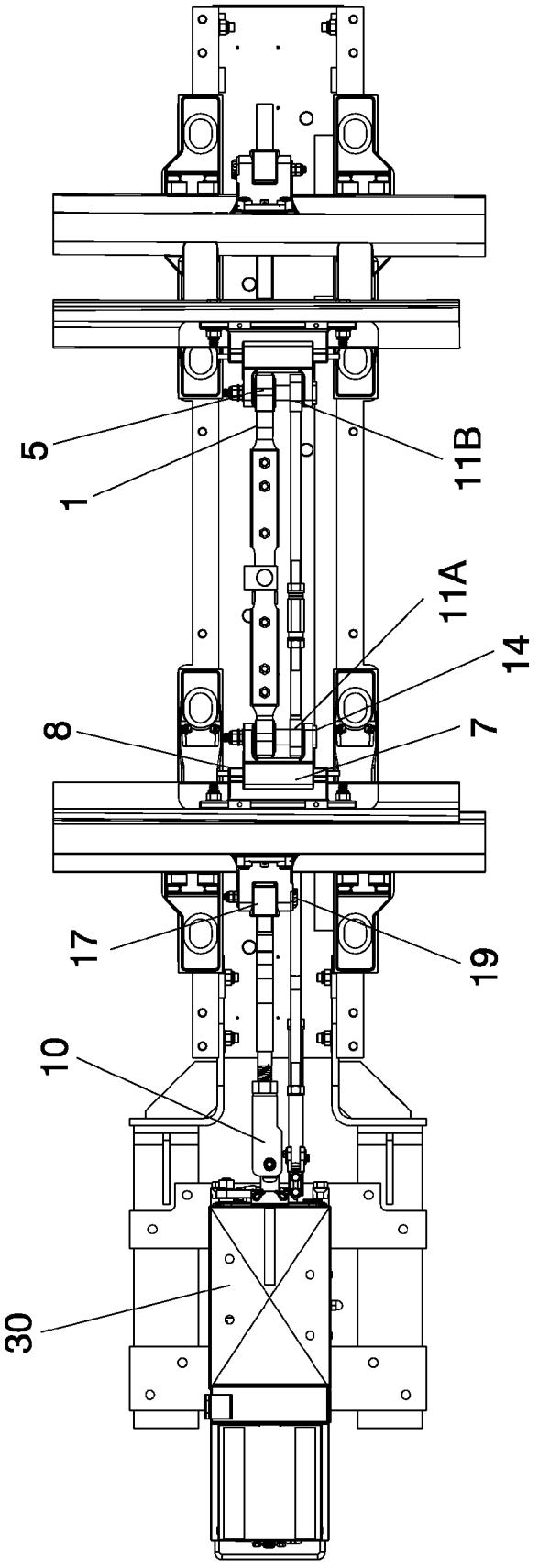

FIG. 5

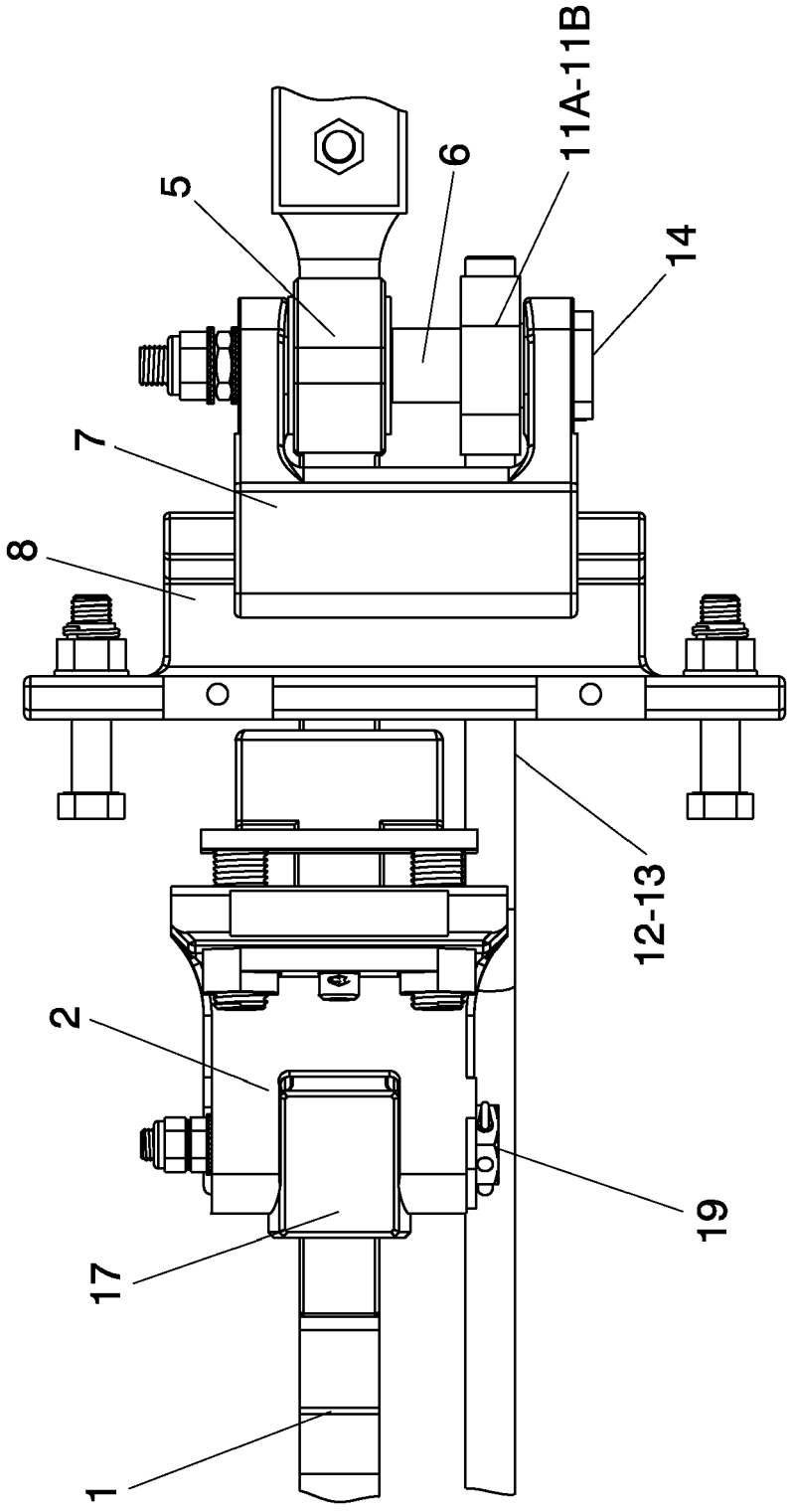

FIG. 6

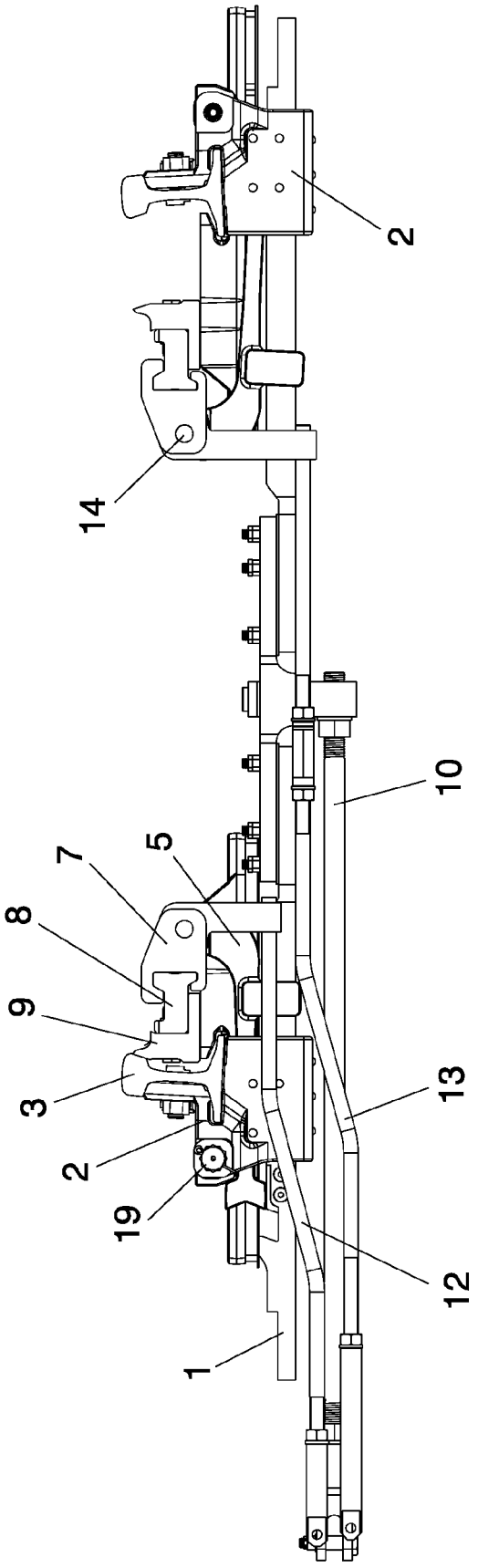

FIG. 7

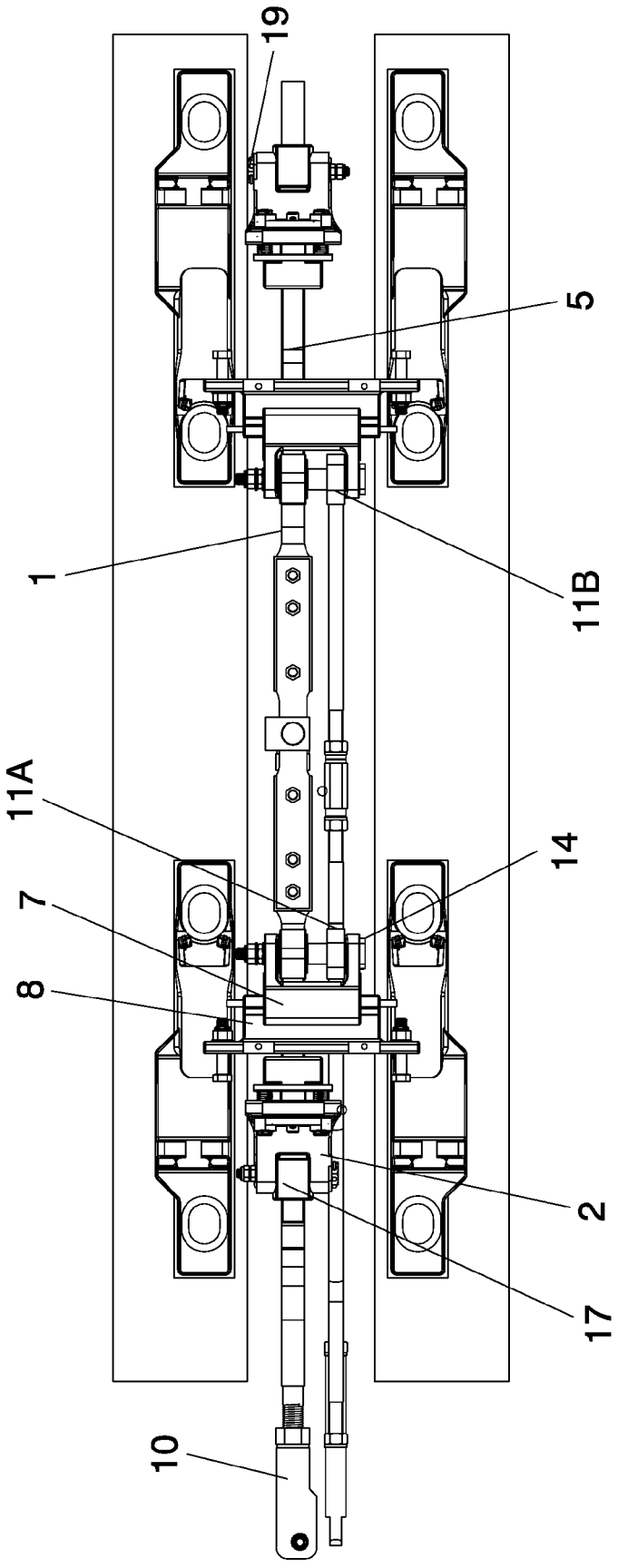

FIG. 8

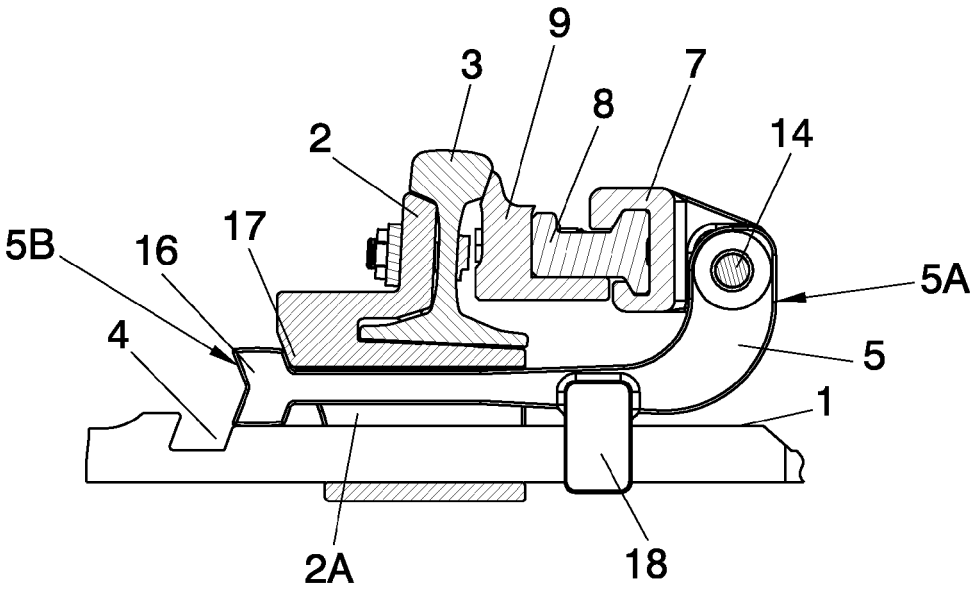

FIG. 9

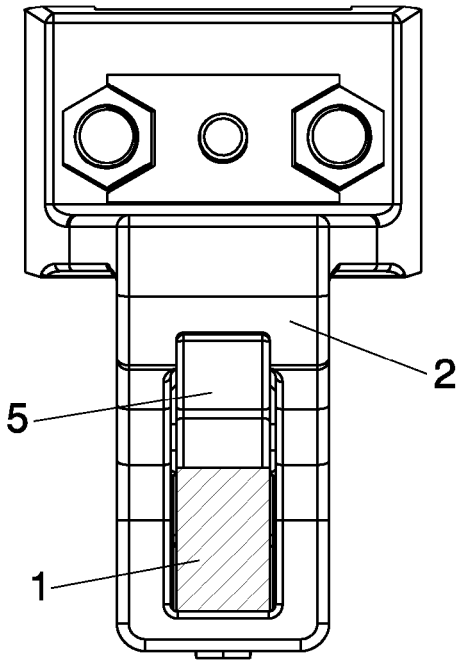

FIG. 10

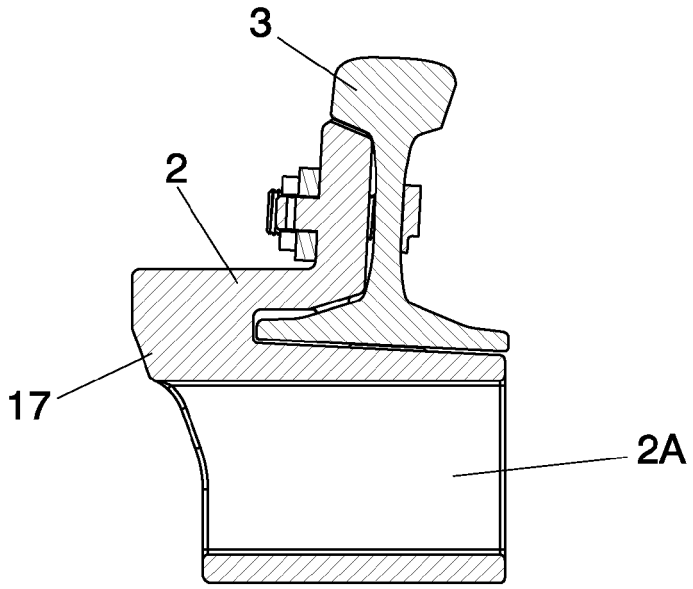

FIG. 11

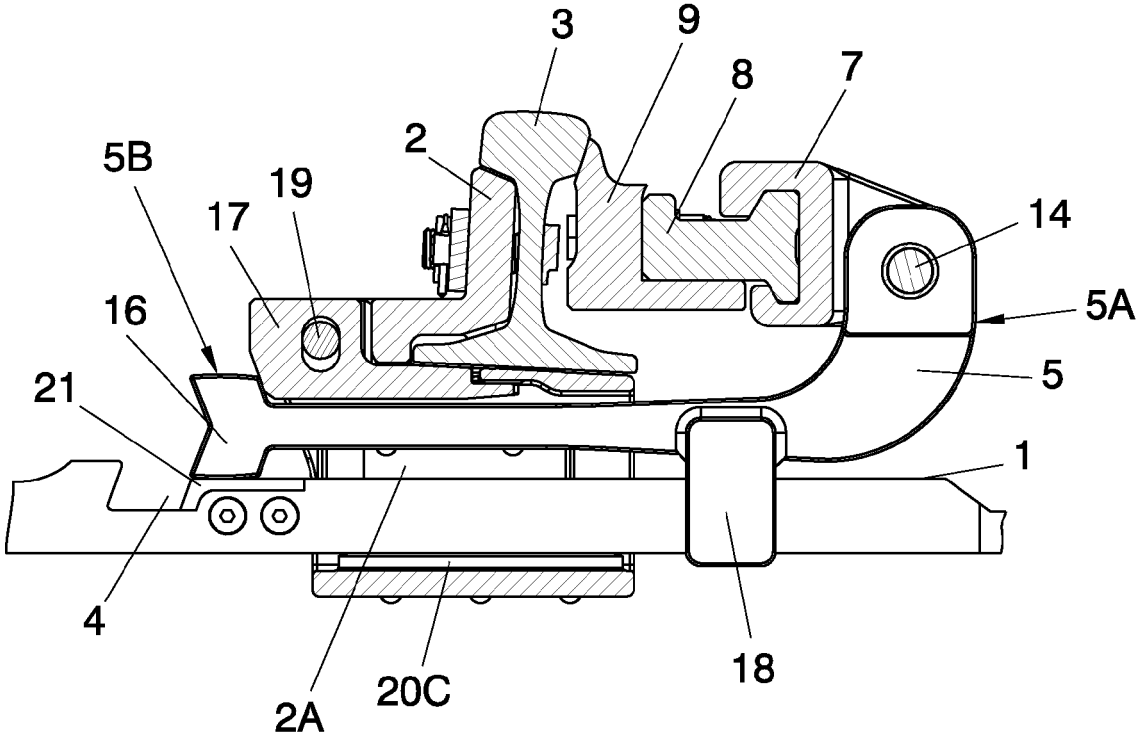

FIG. 12

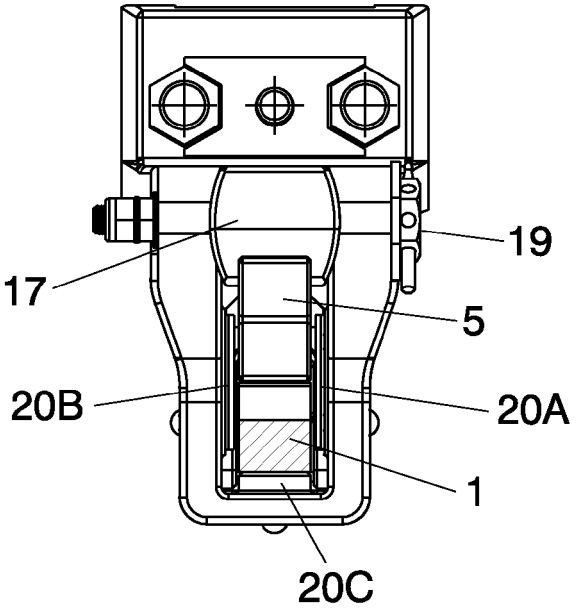

FIG. 13

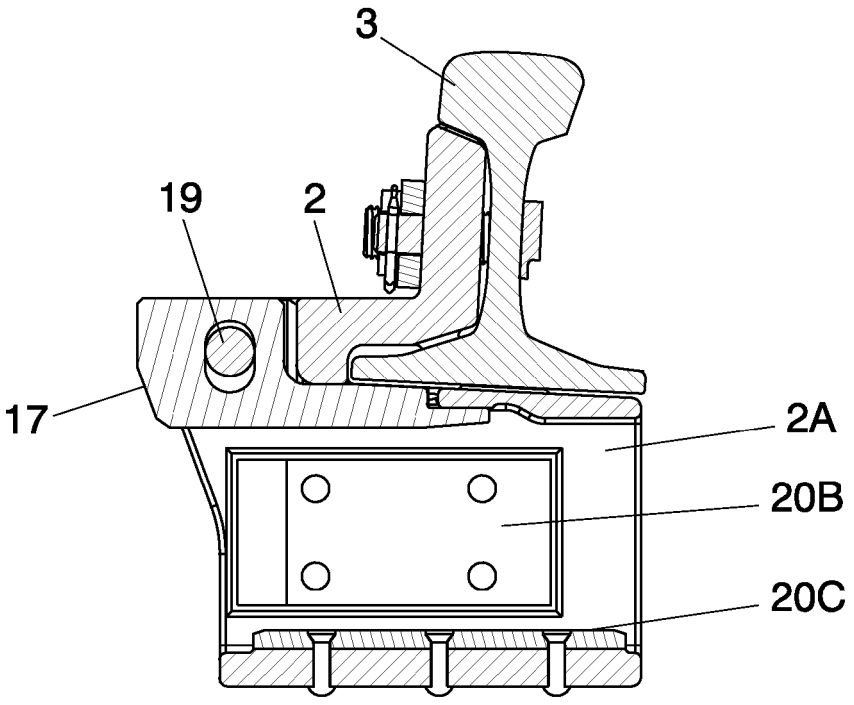

FIG. 14

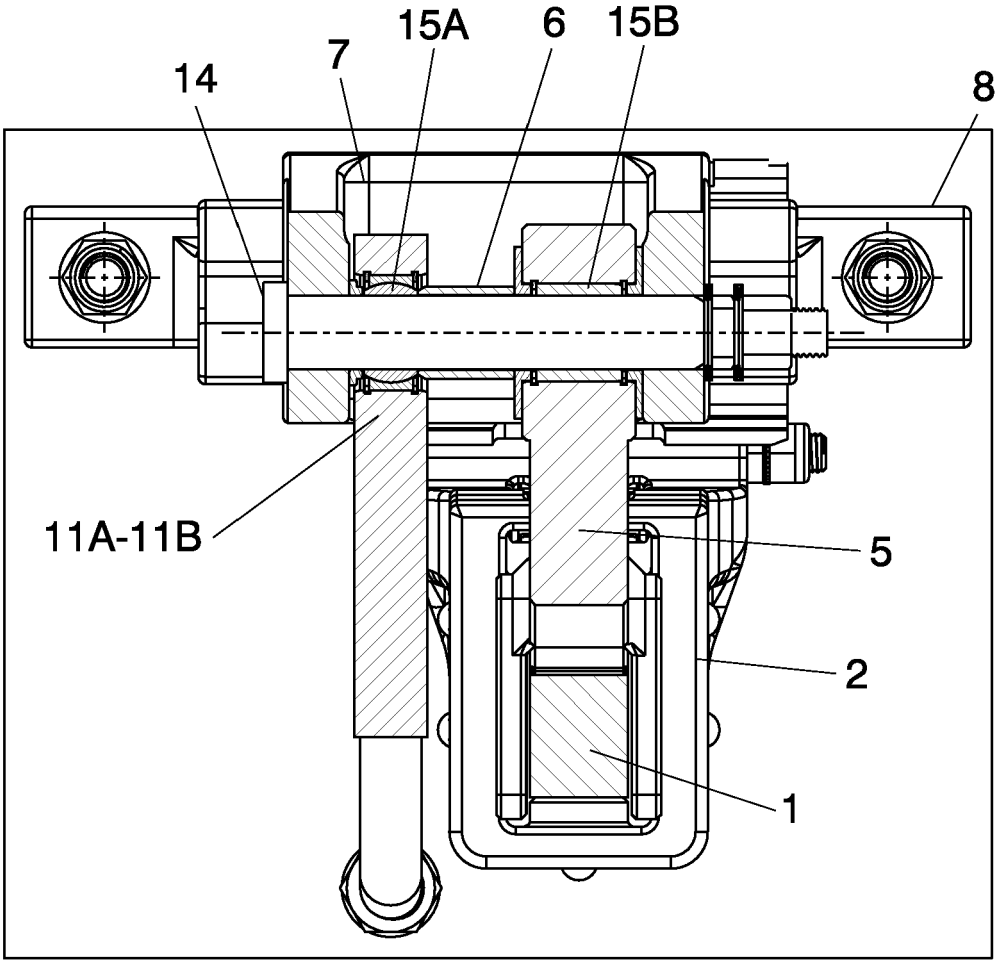

FIG. 15

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EUROPEAN SEARCH REPORT

Application Number
EP 10 38 2186

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 0 723 901 B1 (PEDDINGHAUS CARL DAN GMBH [DE]) 17 April 2002 (2002-04-17) * figures 1-7 * -----	1	INV. E01B7/02 B61L5/10
A	WO 94/27853 A1 (ABB SIGNAL AB [SE]; BERGGREN CLARENCE [SE]; EKLUND LARS [SE]; NORRGAAR) 8 December 1994 (1994-12-08) * figures 1-8 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

E01B
B61L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 December 2010	Fernandez, Eva

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

& : member of the same patent family, corresponding document

1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 38 2186

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03-12-2010

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- EP 1110840 A1 **[0008]**