(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 412 535 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.12.2018 Bulletin 2018/50

(51) Int Cl.:
B61L 5/10 *(2006.01)*

(21) Application number: **17305682.1**

(22) Date of filing: **08.06.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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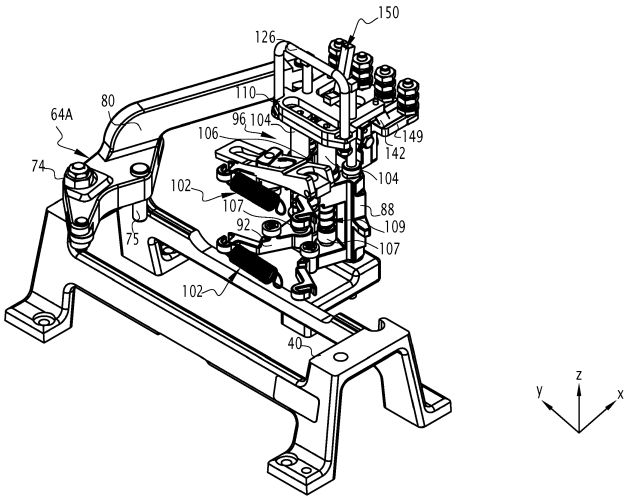
Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) SWITCHING MACHINE FOR A RAILROAD

(57) This switching machine (20) comprises a frame (40), a point detector bar (26), an indication contact assembly (62), at least one detector bar follower (64A, 64B) able to act on the indication contact assembly (62) depending on the position of the point detector bar (26) relatively to the frame (40), an inhibiting element (66) jointly movable with the detector bar follower (64A, 64B), and a cam bar (50) translatable relatively to the frame (40) between an unlock position and a lock position. The cam bar (50) comprises a tongue portion (56) which is able to be in contact with a stop (96) of the inhibiting element (66) when the cam bar (50) is in its unlock position and to be away from said stop (96) when the cam bar (50) is in its lock position. The inhibiting element (66) comprises a main body (84) relatively to which the stop (96) is vertically translatable between an active position, in which the stop (96) is in contact with the tongue portion (56) when the cam bar (50) is in the unlock position, and a passive position, in which the stop (96) is away from the tongue portion (56) of the cam bar (50) when the cam bar (50) is in the unlock position.

FIG.4



EP 3 412 535 A1

Description

[0001] The present invention concerns a switching machine for switching the position of railway tracks, the switching machine being of the type comprising:

- a frame, intended to be fixed relatively to a pair of stock rails of a railroad switch,
- a throw bar translatable relatively to the frame along a transverse direction to throw a pair of inner rails of the railroad switch, located between the stock rails, from a normal track position to a reverse track position, and from the reverse track position to the normal track position,
- a point detector bar, translatable relatively to the frame along the transverse direction between a normal detection position intended to correspond to the normal track position of the inner rails and a reverse detection position intended to correspond to the reverse track position of the inner rails,
- an indication contact assembly, fixed relatively to the frame, comprising at least one switch,
- at least one detector bar follower, movable relatively to the frame between a proximal position, in which the detector bar follower acts on the switch, and a distal position, in which the detector bar follower is away from the switch, the detector bar follower being adapted to follow displacement of the point detector bar in such a manner that, when the point detector bar is in one of its normal and reverse detection positions, the detector bar follower is in a first position among the proximal and distal positions and, when the point detector bar is in an intermediary position between its normal and reverse detection positions, the detector bar follower is in the second position among the proximal and distal positions,
- an inhibiting element jointly movable with the detector bar follower between a primary position when the detector bar follower is in its first position and a secondary position when the detector bar follower is in its second position,
- a cam bar having a kinematic connection with the throw bar in such a manner that the cam bar and the throw bar are jointly translatable relatively to the frame, the cam bar comprising a tongue portion and being translatable relatively to the frame along a longitudinal direction (X) between an unlock position in which the tongue portion is able to be in contact with a stop of the inhibiting element, preventing the inhibiting element from reaching its secondary position, and a lock position in which the tongue portion is away from the stop, allowing displacement of the inhibiting element between its primary and secondary positions.

[0002] Such switching machines are known and are generally motor driven. An example of such a switching machine is the GRANDMASTER 4000 Switch Machine of ALSTOM.

[0003] In the known switching machines, there are generally two detector bar followers, each one being rotatable relatively to the frame around a respective rotation axis and being adapted to act on a respective switch of the indication contact assembly when it is in its proximal position, the detector bar followers comprising a first detector bar follower which is adapted to be in its second position when the point detector bar is in its normal detection position and a second detector bar follower which is adapted to be in its second position when the point detector bar is in its reverse detection position.

[0004] This structure allows the switching machine to detect when the inner rails are in their normal position, in their reverse position, and in an intermediate position between their normal and reverse position. Indeed, when the inner rails are in their normal or reverse position, only one of the switches of the indication assembly will be activated by the detector bar followers; this will inform the switching machine that the railroad switch is in a safe configuration, and the switching machine will emit a signal to inform the trains circulating on the railroad that they are allowed to cross the railroad switch. Furthermore, depending on which switch is activated, the switching machine will be able to conclude if the rails are either in their normal or reverse position. When the inner rails are in an intermediate position however, either both or none of the switches will be activated by the detector bar followers, thus providing the switching machine with the information that the railroad switch is not in a safe configuration. As a result, the switching machine will emit a signal to inform the trains circulating on the railroad that they shall not go through the railroad switch.

[0005] An additional element of the known switching machines is the lock bar, which is intended to lock the inner rails after the throw bar has switched them into position. To that end, the lock bar has notches formed therein and intended to receive a lock lug of the cam bar when the cam bar is in its lock position. When the inner rails are not properly positioned at the end of the movement of the throw bar, none of the notches formed in the lock bar is aligned with the cam bar, so that the lock lug cannot be received therein; the cam bar can therefore not reach its lock position and release the inhibiting elements. In such a case, the inhibiting elements block the detector bar followers in their first position so that none of the detector bar followers can move towards its second position, even if the point detector bar is in its normal or reverse detection position. As a result, either both or none of the switches will be activated by the detector bar followers, thus providing the switching machine with the information that the railroad switch is not in a safe configuration, and the switching machine will emit a signal to inform the trains circulating on the railroad that they shall not go through the railroad switch.

[0006] As one can easily understand from the foregoing, detection by the switching machine of safe and unsafe configurations of the railroad switch depends on the

respective positioning of the point detector bar and of the lock bar, a safe configuration being detected only in the case when both the point detector bar and the lock bar respect a precise positioning relatively to the frame and relatively to each other.

[0007] In order to maintain proper operation of the switching machine, monthly inspection of the point detection system is required. Since normal operation of the switching machine involves all components moving together, it is necessary to isolate desired variables for this test. To do this, traditionally the lock bar is forced out of proper adjustment or disconnected from the rails altogether such that the switching machine can indicate a safe configuration of the railroad switch even with an obstruction in the rail, when normal operation of the lock bar would have prevented such an indication to occur. The railroad switch is then manually thrown from one position to the next to determine that the contacts are appropriately adjusted and that the point detector bar is still properly driving the indication. Everything must then be replaced to its original state before maintainers can reinstate the railroad switch and allow trains through.

[0008] To disconnect or readjust the lock bar requires numerous large tools and increases the time that maintainers are on the track. This also increases the time that trains are disallowed through that section of track, and maintainers often have to wait for long periods of time before the track is scheduled to be clear long enough for their work. Furthermore, failure to properly restore the adjustment of all components could cause a failure of the switching machine, allowing false indications and potentially causing the derailment of a passing train.

[0009] Accordingly, it is a primary object of the present invention to provide a means of disconnecting the function of the lock bar in the switching machine without the need to readjust it.

[0010] Another object of the present invention is to decrease the time it takes maintainers to prepare for the Point Detector Integrity Test.

[0011] A further object of the present invention is to decrease the number of tools required for maintainers to prepare for the Point Detector Integrity Test.

[0012] Still another object of the present invention is to ensure the machine cannot be remotely operated while the Point Detector Integrity Test is occurring.

[0013] A yet further object of the present invention is to ensure the proper adjustment of all components in the switching machine is returned before the machine is operable again.

[0014] To this end, the invention consists in a switching machine of the aforementioned type, wherein the inhibiting element comprises a main body relatively to which the stop is vertically translatable between an active position, in which the stop is in contact with the tongue portion of the cam bar when the cam bar is in the unlock position, and a passive position, in which the stop is away from the tongue portion of the cam bar when the cam bar is in the unlock position.

[0015] According to particular embodiments of the invention, the switching machine further comprises one or several of the following features, considered or alone or according to any technically possible combination:

- the inhibiting element comprises a biasing member biasing the stop toward its active position;
- the switching machine comprises a latch assembly to latch the stop in its passive position;
- the stop comprises a vertical shaft with a shaft body extending through a hole formed in the main body and, on top of the shaft body, a shaft head with a larger diameter than the diameter of the shaft body, and the switching machine comprises an actuation device to displace the stop between its active and passive positions, said actuation device comprising a plate assembly which is vertically translatable relatively to the frame, said plate assembly including a plate having a slot formed therein and through which the shaft body extends, said slot having a shape that follows the path of the shaft when the inhibiting element is displaced between its primary and secondary positions;
- the latch assembly comprises a latch with a front face and a protrusion protruding from said front face, said latch being rotatable relatively to the frame around a horizontal axis between a latching position, in which the protrusion extends within a displacement region of the plate assembly, and a liberation position, in which the protrusion is out of the displacement region of the plate assembly, the position of the plate assembly when the stop is in its passive position being above the position of the protrusion when the latch is in its latching position, and the latch assembly further comprises a biasing element biasing the latch toward its latching position;
- the switching machine comprises a safety circuit to detect when the stop is in its passive position, said safety circuit comprising at least two stationary contacts and at least one mobile contact mounted on the plate assembly in a manner that, when the stop is in one of its passive and active positions, the mobile contact bridges the two stationary contacts, thus closing the safety circuit and, when the stop is in the other one of its passive and active positions, the mobile contact is away from the stationary contacts, thus opening the safety circuit;
- the switching machine comprises two detector bar followers, each one being adapted to act on a respective switch of the indication contact assembly when it is in its proximal position, the detector bar followers comprising a first detector bar follower which is adapted to be in its second position when the point detector bar is in its normal detection position and a second detector bar follower which is adapted to be in its second position when the point detector bar is in its reverse detection position;
- the stop of the inhibiting element of each detector

bar follower is closer to the inhibiting element of the other detector bar follower when both inhibiting elements are in their secondary position than when both inhibiting elements are in their primary position, and the tongue portion of the cam bar has a median longitudinal axis which extends between both inhibiting elements;

- the point detector bar has a cylindrical surface in which a notch is formed, the detector bar follower is rotatable relatively to the frame around a vertical rotation axis between its first and second positions and has a follower part adapted for contacting the point detector bar in such a manner that, when the follower part is in contact with the cylindrical surface of the point detector bar, the detector bar follower is in its first position and, when the follower part is received in the notch, the detector bar follower is in its second position, the main body of the inhibiting element is rotatable relatively to the frame around a vertical pivoting axis, and the inhibiting element comprises a connecting rod connecting the detector bar follower to the main body; and
- the detector bar followers have a common biasing device comprising at least one spring having a first end attached to the main body of the inhibiting element of the first detector bar follower and a second end attached to the main body of the inhibiting element of the second detector bar follower, said common biasing device biasing both detector bar followers toward their second position;

[0016] These and other features and advantages of the invention will be understood by reference to the following description in conjunction with the annexed drawings, wherein:

- Figure 1 is a plan view of a railroad switch connected to a switching machine according to the invention,
- Figure 2 is a plan view of a point detection system of the switching machine of Figure 1, wherein some components have been omitted to show hidden details,
- Figure 3 is a cross-section view taken along line III-III of Figure 2,
- Figure 4 is a perspective view of some components of the point detection system of Figure 2, showing components which had been omitted in Figure 2, an inhibiting device of the point detection system being shown in an active configuration,
- Figure 5 is a plan view showing the cam bar and the components of Figure 4 seen from above,
- Figure 6 is a cross-section view of the components of Figure 5 taken along line VI-VI of Figure 5,
- Figure 7 is a perspective view of a portion of the inhibiting device of the point detection system of Figure 2,
- Figure 8 is a partially exploded perspective view of a plate assembly of the point detection system of Figure 2, and
- Figure 9 is a perspective view of a latch assembly of the point detection system of Figure 2.

[0017] The railroad switch 10 shown in Figure 1 has stock rails 12A, 12B and inner rails 14A, 14B. A front rod 16 and a second rod 18 interconnect the inner rails 14A, 14B. The inner rails 14A, 14B are movable relatively to the stock rails 12A, 12B between a reverse position, in which a first inner rail 14A is in contact with a first stock rail 12A, the second inner rail 14B being spaced from the second stock rail 12B, as shown in Figure 1, and a normal position (not shown), in which the first inner rail 14A is spaced from the first stock rail 12A, the second inner rail 14B being in contact with the second stock rail 12B.

[0018] The railroad switch 10 is operated by a switching machine 20 according to the invention and which comprises a throw bar 22, a lock bar 24, and a point detector bar 26. To that end, the throw bar 22 is connected via a throw rod 28 to a rod connector 30 fixed to the second rod 18, the lock bar 24 is connected via a lock rod 32 to a connector lug 34 fixed to the front rod 26, and the point detector bar 26 is connected via a connector rod 36 to a point detector attachment rod 38 which is fixed to one of the inner rails 14A, 14B.

[0019] The switching machine 20 comprises a fixed frame 40 elongated along a longitudinal direction X, and each one of the throw bar 22, lock bar 24, and point detector bar 26 is elongated along a transversal direction Y which is substantially perpendicular to the longitudinal direction X. The longitudinal and transversal directions X, Y define together a horizontal plane to which a vertical direction Z is perpendicular.

[0020] Each one of the throw bar 22, lock bar 24, and point detector bar 26 is translatable relatively to the frame 40 along said transversal direction Y. In particular, the lock bar 24 is translatable between a normal locking position (not shown) when the inner rails 14A, 14B are in their normal position and a reverse locking position (not shown) when the inner rails 14 are in their reverse position, and the point detector bar 26 is translatable between a normal detection position (not shown) when the inner rails 14A, 14B are in their normal position and a reverse detection position (not shown) when the inner rails 14A, 14B are in their reverse position.

[0021] Preferably, the switching machine 20 also comprises a motor (not shown) to drive the throw bar 22.

[0022] With reference to Figures 2 and 3, the lock bar 24 has a transversal groove 42 formed in a front face of the lock bar 24, said groove 42 having a vertical flat bottom joining an upper face of the lock bar 24. The lateral extension of the groove 42 is limited, in other words, the groove 42 does not extend along the whole length of the lock bar 24.

[0023] The lock bar 24 has also locking slots 44 formed in a bottom face of the lock bar 24, each locking slot 44 emerging in a back face of the lock bar 24. The lateral extension of these locking slots 44 is also limited. They

are positioned so that one of said locking slots 44 is substantially aligned with the longitudinal median axis M of the frame 40 when the lock bar 24 is in its normal locking position and when the lock bar 24 is in its reverse locking position.

[0024] The point detector bar 26 has a cylindrical surface 46 in which a notch 48 is formed. It should be noted that "cylindrical" shall here be understood in its broadest sense, including cases in which the cylindrical surface is not generated by revolution. In particular, this notch 48 is formed by a section of the point detector bar 26 which has a narrower diameter than the rest of the point detector bar 26. The lateral extension of the notch 48 is limited. The notch 48 is positioned so that it is substantially aligned with the longitudinal median axis M of the frame 40 when the point detector bar 26 is midway between its normal and reverse detection positions.

[0025] With reference to Figure 3, the switching machine 20 further comprises a cam bar 50 lying at the bottom of switching machine 20. This cam bar 50 is elongated along the longitudinal direction of the frame 40 and it has a longitudinal median axis which is substantially collinear with that of the switching machine 20. The cam bar 50 has a kinematic connection (not shown) with the throw bar 22 in such a manner that the cam bar 50 and the throw bar 22 are jointly translatable relatively to the frame 40. One end of the cam bar is an oblong cam surface (not shown) which coordinates the movement of the throw bar 22 with the motor, so that the cam bar 50 moves linearly along the longitudinal direction from a lock position to an unlock position and then back to the lock position during the switching operation. In the unlock positon, the cam bar 50 is at its furthest back position, as shown in the Figures and, in the lock position, the cam bar 50 is at its furthest forward position in the switching machine 20.

[0026] The cam bar 50 comprises a cam body 52, a lock lug 54 in the form of a block attached to the top surface of the cam body 52 at the far end opposite the cam surface. This lock lug 54 is just low enough to slide through one of the locking slots 44 when the lock bar 24 is in its normal or reverse position and just tall enough to catch on the lock bar 24 if said lock bar 24 is not in the ideal position.

[0027] The cam bar 50 further comprises a tongue portion 56 extending from a point of the top surface of the cam body 52. The tongue portion 56 consists in a flat, narrow bar positioned substantially parallel to the cam body 52 and substantially aligned with the longitudinal median axis M but raised to a higher vertical positon than the cam body 52 via a block 58 at the end of the tongue portion 56 oriented toward the cam surface. The end 60 of the tongue portion 56 opposite the block 58 features 45 degree angled edges such that the very end of the tongue portion 56 is slightly narrower than the rest of it.

[0028] Coming back to Figure 2, the switching machine 20 also comprises a contact assembly 62, two detector bar followers 64A, 64B designed to act on the contact assembly depending on the position of the point detector bar 26, and two inhibiting elements 66, each one being able to inhibit action on the contact assembly 62 of a respective one of the detector bar followers 64A, 64B depending on the position of the cam bar 50.

[0029] The contact assembly 62 comprises two push-to-open switch devices 70. Each one of these switch devices 70 is adapted so that, when a pressure is applied on this switch device 70, the switch device 70 opens a respective electrical circuit (not shown) connected to said switch device 70, so that the switch device 70 is said to be in an "off" position. When the pressure is released, the switch device 70 closes said respective electrical circuit, so that the switch device 70 is said to be in an "on" position. At least one of the switch devices 70 needs to be in an "on" position so that the switching machine 20 can detect that the railroad switch is in a safe configuration.

[0030] Each detector bar follower 64A, 64B is positioned on a respective lateral side of the longitudinal median axis M. It is positioned vertically above and clear of the lock bar 24 while being substantially at the same height as the point detector bar 26.

[0031] Each detector bar follower 64A, 64B is rotatable relatively to the frame 40 around a substantially vertical rotation axis 72 between a proximal position, in which the detector bar follower 64A, 64B acts on a respective one of the switch devices 70, and a distal position, in which the detector bar follower 64A, 64B is away from said switch device 70. The rotation axis 72 of the detector bar followers are substantially transversally aligned and are transversally spaced away from each other.

[0032] Each detector bar follower 64A, 64B has a body 71 with an elongated, diamond shape overall with two acute-angle corners and two obtuse-angle corners.

[0033] The detector bar follower 64A, 64B crosses the vertical rotation axis 72 at a pivot point 74 situated at one of the obtuse-angle corners. At the opposite obtuse-angle corner is located a correspondence pin 75 (Figure 3), protruding vertically from a lower surface of the body 71, said pin 75 being fixed to the body 71 and being adapted to engage the groove 42 of the lock bar 24 when the lock bar 24 is in one of its normal and reverse locking positions and the detector bar follower 64A, 64B is in its distal position.

[0034] Thus, in case the lock bar 24 and the point detector bar 26 are out of correspondence with respect to each other at the end of a rail switching operation, one of the detector bar followers 64A, 64B will have its correspondence pin 75 resting on the lock bar 24 outside of the groove 42 and will thus be prevented from reaching its distal position. As a consequence, both detector bar followers 64A, 64B will keep acting on their respective switch devices 70, so that the switching machine 20 will not be able to indicate a "safe condition" of the railroad switch until the situation is corrected.

[0035] At one of the acute-angle corners a roller 76 is positioned, adjacent to the point detector bar 26, and

forms a follower part intended to be in contact with the point detector bar 26. At the opposite acute-angle corner is an attachment point 78 which is rotatably attached to an end of a respective one of the inhibiting elements 66.

[0036] Each detector bar follower 64A, 64B further includes a switch arm 80 protruding from a top surface of the body 71 and extending substantially horizontally away from the follower part 76. The switch arm 80 has a free end 82 opposite the body 71 with a roller defining the contact surface of the detector bar follower 64A, 64B with the respective switch device 70 when the detector bar follower 64A, 64B it in its proximal position.

[0037] The respective positions of the follower part 76 and of the switch arm 80 are adapted so that, when the follower part 76 is in contact with the cylindrical surface 46 of the point detector bar 26, the detector bar follower 64A, 64B is in its proximal position and, when the follower part 76 is received in the notch 48 of the point detector bar 26, the detector bar follower 64A, 64B is in its distal position.

[0038] Furthermore, the respective positions of the detector bar followers 64A, 64B and of the point detector bar 26 are adapted so that reception in the notch 48 of the follower part 76 of a first one of the detector bar followers 64A is possible only when the point detector bar 26 is in its normal detection position, so that reception in the notch 48 of the follower part 76 of a second one of the detector bar followers 64B is possible only when the point detector bar 26 is in its reverse detection position, and so that none of the follower parts 76 of both detector bar followers 64A, 64B can be received in the notch 48 without unmounting the switching machine 20 when the point detector bar 26 is in its intermediary position.

[0039] Each inhibiting element 66 is positioned on a respective lateral side of the longitudinal median axis M. It comprises a main body 84 which is pivotally mounted on the frame 40 around a substantially vertical pivoting axis 86 between a primary position shown in Figure 2 and a secondary position (not shown). This pivoting axis 86 is nearer from the longitudinal median axis M than the rotation axis 72 of the respective detector bar follower 64A, 64B.

[0040] With reference to Figure 3, the main body 84 comprises a vertical pivot shaft 88 and two horizontal arms 90, 92. The pivot shaft 88 is vertically aligned with the pivoting axis 86 and cooperates with a corresponding vertical pole (not shown) fixed to the frame 40 to allow rotation of the main body 84 relatively to the frame 40. The arms 90, 92 are vertically aligned and are vertically spaced away from each other, a top arm 90 extending substantially horizontally from a top end of the pivot shaft 88 and a lower arm 92 extending substantially horizontally from a lower end of the pivot shaft 88. In particular, the top arm 90 is positioned above the tongue portion 56 of the cam bar 50, and the lower arm 92 is positioned under said tongue portion 56. Each arm 90, 92 has a free end 94, opposite the pivot shaft 88, provided with a hook.

[0041] Each inhibiting element 66 further comprises a stop 96 mounted on the main body 84 so that it follows the same horizontal displacement as the main body 84. This stop 96 is positioned so that it is able to abut against the tongue portion 56 of the cam bar 50 when the main body 84 is in its primary position and the cam bar 50 is in its unlock position, and so that it is away from the tongue portion 56 of the cam bar 50 when the main body 84 is in its primary position and the cam bar 50 is in its lock position.

[0042] Each inhibiting elements 66 is articulated so that its stop 96 remains on a same lateral side of the longitudinal median axis M between the primary and secondary positions of the main body 84, the stop 96 being closer to the median longitudinal axis M when the main body 84 in its secondary position than when the main body 84 is in its primary position. Thus, the median longitudinal axis M extends between the stops 96 of the inhibiting elements 66 whatever the position of these inhibiting elements 66, and these stops 96 are closer to each other when the main bodies 84 of the inhibiting elements 66 are in their secondary positions than when these main bodies 84 are in their primary position. This has the consequence that, when the cam bar 50 is in its unlock position, its tongue portion 56 prevents the inhibiting elements 66 and thus the main bodies 84 from reaching their secondary positions. However, when the cam bar 50 is in its lock position, its tongue portion 56 being away from the stops 96, displacement of the inhibiting elements 66 between their primary and secondary positions is allowed.

[0043] As a consequence, in case the lock bar 24 and the point detector bar 26 are out of correspondence with respect to each other at the end of a rail switching operation, the lock bar 24 preventing the cam bar 50 from reaching its lock position because the lock lug 54 is not able to engage one of the locking slots 44, both stops 96 will abut against the tongue portion 56 of the cam bar 50, thus preventing both detector bar followers 64A, 64B from reaching their distal positions. Both detector bar followers 64A, 64B will therefore keep acting on their respective switch devices 70, so that the switch machine 20 will not be able to indicate a "safe condition" of the railroad until the situation is corrected.

[0044] Each inhibiting element 66 is jointly movable with its respective detector bar follower 64A, 64B so that its main body 84 is in its primary position when the detector bar follower is in its proximal position and in its secondary position when the detector bar follower 64A, 64B is in its distal position. To that end, each inhibiting element 66 comprises a connecting rod 98 connecting the main body 84 to the respective detector bar follower 64A, 64B.

[0045] This connecting rod 98 is attached at one end to the respective detector bar follower 64A, 64B via the attachment point 78 described above, and at the other end to the top and lower arms 90, 92 of the main body 84 via rotatable connections 99 which are further away from the pivot shaft 88 than the stops 96.

[0046] The connecting rod 98 extends substantially parallel to the point detector bar 26, from the attachment point 78 toward the longitudinal median axis M.

[0047] Advantageously, the connecting rod 98 is adjustable in length.

[0048] The switching machine 20 further comprises a biasing device 100 biasing the detector bar followers 64A, 64B toward their distal positions. This biasing device 100 comprises two extension springs 102, each one having a first end attached to the main body 84 of a first one of the inhibiting elements 66 and a second end attached to the main body 84 of a second one of the inhibiting elements 66. In particular, a first one of the springs 102 has its ends attached to the hooks provided at the free ends 94 of the top arms 90 of both main bodies 84, and a second one of the springs 102 has its ends attached to the hooks provided at the free ends 94 of the lower arms 92 of both main bodies 84.

[0049] The two springs 102 are therefore stretched horizontally between the arms 90, 92 of the two main bodies 84, roughly parallel to the point detector bar 26. These springs 102 thus work to draw the free ends 94 of the arms 90, 92 toward each other, biasing these main bodies 84 toward their secondary positions. This has the consequence that the connector rods 98 of both inhibiting elements 66 are pulled toward each other, these connector rods 98 thus applying a biasing force on the detector bar followers 64A, 64B, at the attachment points 78, this force biasing the detector bar followers 64A, 64B toward their distal position.

[0050] Turning now to Figures 4 to 7, there is shown that the stop 96 of each inhibiting element 66 (even though only one of these inhibiting elements 66 is shown of these figures, the other one is the symmetrical counterpart of the shown inhibiting element 66) comprises a mobile shaft 104 and a roller 107 attached at a lower end of said mobile shaft 104. The mobile shaft 104 has a shaft body 105 extending substantially vertically through a hole 106 in the top arm 90 of the main body 84 and, at the top of said shaft body 105, a flat, round head 108. The stop 96 is therefore vertically translatable relatively to the main body 84 between an active position, shown in Figures 4 and 7, in which the stop 96 rests on the lower arm 92 of the main body 84, and a passive position, shown in Figures 3 and 6, in which the stop 96 is at distance from the lower arm 92, said distance being greater than the thickness of the tongue portion 56 of the cam bar 50. When the stop 96 is in its active position, the roller 107 is able to be in contact with the tongue portion 56 of the cam bar 50 when the cam bar 50 is in the unlock position, thus hindering displacement of the main body 84 toward its secondary position, and, when the stop 96 is in its passive position, the roller 107 is not able to be in contact with the tongue portion 56 of the cam bar 50 even when the cam bar 50 is in the unlock position, thus allowing displacement of the main body 84 toward its secondary position even when the cam bar 50 is in the unlock position.

[0051] A compression spring 109 is also mounted coaxially on said mobile shaft 104 between the hole 106 and the roller 107 with a washer (not shown) between the spring 109 and the roller 107 so that it acts as a biasing member biasing said stop 96 toward its active position.

[0052] The switching machine 20 further comprises an actuation device to move the stops 96 of the inhibiting elements 66 between their active and passive positions. This actuation device comprises a plate assembly 110 which is vertically translatable relatively to the frame 40 in a displacement region constituted by the space extending vertically above and under the plate assembly 110.

[0053] This plate assembly 110 comprises a bottom plate 112 and a top plate 114 connecting the mobile shafts 104 of both inhibiting elements 66.

[0054] With reference to Figure 8, the bottom plate 112 comprises a slot 116 through which the shaft bodies 105 of the mobile shafts 104 extend. Said slot 116 is a symmetrical shape specially designed to allow the mobile shafts 104 to move normally during normal operation. As such, said slot 116 has a swept shape that follows the path of the mobile shafts 104 when the main bodies of the inhibiting members 66 are pivoted between their primary and secondary positions.

[0055] Extending along the bottom planar edge of the slot 116 is a ridge 118 on which the round heads 108 of the mobile shafts 104 are adjacent. The height of the slot 116 above the ridge 118 is sized such that the heads 108 of the mobile shafts 104 have enough room to move between the bottom and top plates 112, 114 without excessive friction preventing motion.

[0056] The top plate 114 comprises an oval slot 120 with no ridge such that it sandwiches the shaft heads 108 when connected to said bottom plate 112 without pressing on said shaft heads 108. Said slot 120 is just narrower than the heads 108 of the mobile shafts 104 such that it forms a lip to hold the mobile shafts 104. The bottom and top plates 112, 114 each feature a pair of two holes 122, with the top plate 112 featuring a cutout 124 around said holes 122.

[0057] These bottom and top plates 112, 114 are held together via a vertical handle 126, which also acts to enable maintenance personnel to lift the aforementioned plates 112, 114. Pulling said handle 126 up pulls the mobile shafts 104, thereby lifting the stops 96 and compressing the springs 109.

[0058] The handle 126 is in the form of a round bar, bent at 90 degree angles 128 in two places, with a length 130 at each end that is of a smaller diameter than the main bar 132 such that a lip 134 is formed where the smaller diameter end 130 meets the larger diameter main bar 132. The smaller ends 130 are inserted through the holes 122 in the bottom and top plates 112, 114, with the lip 134 abutting against the top surface of the cutout 124 on the top plate 112. Bolts 136 are threaded onto the ends 130 of said handle 126 to hold the top and bottom plate 112, 114 together against the lip 134 and to hold said handle 126 to said plates 112, 114.

[0059] The top plate 114 also comprises two arms 140 extending horizontally toward the front, each with a metal mobile contact 142 mounted to the underside via a rivet 144. Each mobile contact 142 is in the shape of an inverted V with a flat bottom 146. These mobile contacts 142 are part of a safety circuit which must be closed for remote electrical operation of the switching machine 20 to take place, said safety circuit further comprising stationary contacts 148 (Figure 5) mounted to the top of a back plate 149 (Figure 6) which is fixed relatively to the frame 40. These mobile contacts 142 are positioned so that, in the active position of the stops 96, they each bridge two of the stationary contacts 148 to close the safety circuit and, in the passive position of the stops 96, they both are away from the stationary contacts 148, thus letting the safety circuit open. Maintainers' safety from sudden switch machine operation which could be triggered by a remote dispatcher is therefore ensured when the stops 96 are in their passive position.

[0060] Returning to Figure 4 to 7, the switching machine 20 further comprises a latch assembly 150 for locking the plate assembly 110 in place.

[0061] With reference to Figure 9, this latch assembly 150 comprises a latch 152 having a flat vertical shape and mounted on a horizontal shaft 154 with a torsion spring 156 onto a bracket 158, said bracket 158 being fixed relatively to the frame 40. In particular, the bracket 158 features a pair of holes 160 for mounting to the pivot shafts 88 of the main bodies 84 of the inhibiting elements 66.

[0062] The latch 152 comprises a front face 161 and a protrusion 162 protruding from said front face 161, the protrusion 162 having a top face 164 and a bottom face 166. These two faces 164, 166 are not quite parallel. If the top surface 164 is said to be horizontal, the bottom surface 166 angles up slightly so as to be in the correct position for holding said plate assembly 110 either up or down.

[0063] This latch 152 is rotatable relatively to the frame 40 around the horizontal shaft 154 between a latching position, in which the protrusion 162 extends within the displacement region of the plate assembly 110, and a liberation position, in which the protrusion 162 is excluded from said displacement region.

[0064] The position of the plate assembly 110 when the stops 96 are in their passive position is above the position of the protrusion 162 when the latch 152 is in its latching position, and the position of the plate assembly 110 when the stops 96 are in their active position is under the position of the protrusion 162 when the latch 152 is in its latching position. The top face 164 of the protrusion 152 constitutes a resting surface on which the bottom plate 112 rests when the stops 96 are in their passive position, thus preventing the stops 96 from coming back to their active position, and the bottom face 166 constitutes a pressing surface which rests on top of the top plate 114 when the stops 96 are in their active position, thus preventing the stops 96 from being dislodged from their active position.

[0065] The front face 161 of the latch 152 comprises a flat front portion 168 just below the protrusion 162. This flat portion 168 pushes against a back side of the plates 112, 114 when the stops 96 are in their active position, so that the spring 156 does not lose tension. The front face 161 further comprises a curved front portion 170 below the flat portion 168; this curved front portion 170 is designed to prevent collision with the top plate 114 when the stops 96 are in their active position.

[0066] The latch 152 further comprises an angled area 172 at its top, above the protrusion 162, and a spring rest area 174 at its back, behind the curved front portion 170. The angled area 172 functions as a handle to pull said latch 152 out of the way to lift the handle 126 when the stops 96 are in their active position. The spring rest area 174 consists in a slot receiving a part of the torsion spring 156.

[0067] The torsion spring 156 acts as a biasing element biasing the latch 152 toward its latching position. To that end, the torsion spring 156 features two tail ends 176, which go into small holes located at the outer edge of the bracket 158, and a middle loop 178 which applies pressure to the spring rest area 174 to hold the latch 152 into positon up against the aforementioned plate assembly 110. Thus, when the latch 152 is pulled to rotate back, the torsion spring 156 is tightened, increasing the spring tension. The torsion spring 156 is also adapted to provide consistent rotational pressure into the latch 152.

[0068] Thanks to the invention described above, preparing the switching machine 20 for the Point Detector Integrity Test is facilitated. Indeed, to disconnect the functions of the point detector bar 26 and of the lock bar 24, the maintainers merely need to displace the stops 96 toward their passive position by pulling the handle 124 up while pushing on the angled area 172 of the latch 152. When the handle 124 has been pulled up, the latch 152 will return in its latching position, thus insuring that the stops 96 remain in their passive position.

[0069] There is in particular no need to disconnect the lock bar 24 or the point detector bar 26 from the rails 14A, 14B, and therefore no need to readjust the position of these bars 24, 26 relative to the rails 14A, 14B after the switching machine 20 has been tested. Indeed, since, when the stops 96 are in their passive position, displacement of the main bodies 84 between their primary and secondary positions is no longer conditioned on the cam bar 50 being in its lock position, i.e. the positioning of the lock bar 24 relative to the came bar 50 and notably of the lock lug 54 relative to locking slots 44 does not limit the movement of the main bodies 84 between their primary and secondary positions, actuation of the contact assembly 62 by the detector bar followers 64A, 64B is consequently not conditioned on the lock bar 24 having reached its normal or reversed position: the point detector bar 26 is thus isolated from the lock bar 24, so that a test can be run without both the point detector bar 26 and the lock bar 24 respecting a precise positioning relatively to the

frame 40 or relatively to each other. As a consequence thereof, the number of tools is decreased, as well as the time spent by the maintainers to realize the Point Detector Integrity Test. Furthermore, there is no risk that the components of the switching machine 20 are not returned to their proper adjustment after the test.

[0070] In addition, the switching machine 20 provides enhanced security to the maintainers, since remote operation of the switching machine 20 is impossible when the stops 96 are in their passive position, which condition is necessary for the Point Detector Integrity Test to be conducted. There is therefore no risk that the maintainers are injured by a displacement of components of the switching machine 20 caused by a remote operation of the switching machine 20 during the test.

Claims

1. A switching machine (20) for switching the position of railway tracks, the switching machine (20) comprising:

- a frame (40), intended to be fixed relatively to a pair of stock rails (12A, 12B) of a railroad switch (10),
- a throw bar (22) translatable relatively to the frame (40) along a transverse direction (Y) to throw a pair of inner rails (14A, 14B) of the railroad switch (10), located between the stock rails (12A, 12B), from a normal track position to a reverse track position, and from the reverse track position to the normal track position,
- a point detector bar (26), translatable relatively to the frame (40) along the transverse direction (Y) between a normal detection position intended to correspond to the normal track position of the inner rails (14A, 14B) and a reverse detection position intended to correspond to the reverse track position of the inner rails (14A, 14B),
- an indication contact assembly (62), fixed relatively to the frame (40), comprising at least one switch (70),
- at least one detector bar follower (64A, 64B), movable relatively to the frame (40) between a proximal position, in which the detector bar follower (64A, 64B) acts on the switch (70), and a distal position, in which the detector bar follower (64A, 64B) is away from the switch (70), the detector bar follower (64A, 64B) being adapted to follow displacement of the point detector bar (26) in such a manner that, when the point detector bar (26) is in one of its normal and reverse detection positions, the detector bar follower (64A, 64B) is in a first position among the proximal and distal positions and, when the point detector bar (26) is in an intermediary position between its normal and reverse detection positions, the detector bar follower (64A, 64B) is in the second position among the proximal and distal positions,
- an inhibiting element (66) jointly movable with the detector bar follower (64A, 64B) between a primary position when the detector bar follower (64A, 64B) is in its first position and a secondary position when the detector bar follower (64A, 64B) is in its second position,
- a cam bar (50) having a kinematic connection with the throw bar (22) in such a manner that the cam bar (50) and the throw bar (22) are jointly translatable relatively to the frame (40), the cam bar (50) comprising a tongue portion (56) and being translatable relatively to the frame (50) along a longitudinal direction (X) between an unlock position in which the tongue portion (56) is able to be in contact with a stop (96) of the inhibiting element (66), preventing the inhibiting element (66) from reaching its secondary position, and a lock position in which the tongue portion (56) is away from the stop (96), allowing displacement of the inhibiting element (66) between its primary and secondary positions,

characterized in that the inhibiting element (66) comprises a main body (84) relatively to which the stop (96) is vertically translatable between an active position, in which the stop (96) is in contact with the tongue portion (56) of the cam bar (50) when the cam bar (50) is in the unlock position, preventing the inhibiting element (66) from reaching its secondary position, and a passive position, in which the stop (96) is away from the tongue portion (56) of the cam bar (50) when the cam bar (50) is in the unlock position, allowing displacement of the inhibiting element (66) between its primary and secondary positions.

2. The switching machine (20) of claim 1, wherein the inhibiting element (66) comprises a biasing member biasing the stop (96) toward its active position.

3. The switching machine (20) of claim 1 or 2, comprising a latch assembly (150) to latch the stop (96) in its passive position.

4. The switching machine (20) of any one of the preceding claims, wherein the stop (96) comprises a vertical shaft (104) with a shaft body (105) extending through a hole (106) formed in the main body (84) and, on top of the shaft body (105), a shaft head (108) with a larger diameter than the diameter of the shaft body (105), and the switching machine (20) comprises an actuation device to displace the stop (96) between its active and passive positions, said actuation device comprising a plate assembly (110) which is vertically translatable relatively to the frame

(40), said plate assembly (110) including a plate (112) having a slot (116) formed therein and through which the shaft body (105) extends, said slot (116) having a shape that follows the path of the shaft (104) when the inhibiting element (66) is displaced between its primary and secondary positions.

5. The switching machine (20) of claims 3 and 4 considered together, wherein the latch assembly (150) comprises a latch (152) with a front face (161) and a protrusion (162) protruding from said front face (161), said latch (152) being rotatable relatively to the frame (40) around a horizontal axis between a latching position, in which the protrusion (162) extends within a displacement region of the plate assembly (110), and a liberation position, in which the protrusion (162) is out of the displacement region of the plate assembly (110), the position of the plate assembly (110) when the stop (96) is in its passive position being above the position of the protrusion (162) when the latch (152) is in its latching position, and the latch assembly (150) further comprises a biasing element (156) biasing the latch (152) toward its latching position.

6. The switching machine (20) of claim 4 or 5, comprising a safety circuit to detect when the stop (96) is in its passive position, said safety circuit comprising at least two stationary contacts (148) and at least one mobile contact (142) mounted on the plate assembly (110) in a manner that, when the stop (96) is in one of its passive and active positions, the mobile contact (142) bridges the two stationary contacts (148), thus closing the safety circuit and, when the stop (96) is in the other one of its passive and active positions, the mobile contact (142) is away from the stationary contacts (148), thus opening the safety circuit.

7. The switching machine (20) of any one of the preceding claims, comprising two detector bar followers (64A, 64B), each one being adapted to act on a respective switch (70) of the indication contact assembly (62) when it is in its proximal position, the detector bar followers (64A, 64B) comprising a first detector bar follower (64A) which is adapted to be in its second position when the point detector bar (26) is in its normal detection position and a second detector bar follower (64B) which is adapted to be in its second position when the point detector bar (26) is in its reverse detection position.

8. The switching machine (20) of claim 7, wherein the stop (96) of the inhibiting element (66) of each detector bar follower (64A, 64B) is closer to the inhibiting element (66) of the other detector bar follower (64A, 64B) when both inhibiting elements (66) are in their secondary position than when both inhibiting elements (66) are in their primary position, and the tongue portion (56) of the cam bar (50) has a median longitudinal axis which extends between both inhibiting elements (66).

9. The switching machine (20) of any one of the preceding claims, wherein the point detector bar (26) has a cylindrical surface (46) in which a notch (48) is formed, the detector bar follower (64A, 64B) is rotatable relatively to the frame (40) around a vertical rotation axis (72) between its first and second positions and has a follower part (76) adapted for contacting the point detector bar (26) in such a manner that, when the follower part (76) is in contact with the cylindrical surface (46) of the point detector bar (26), the detector bar follower (64A, 64B) is in its first position and, when the follower part (76) is received in the notch (48), the detector bar follower (64A, 64B) is in its second position, the main body (84) of the inhibiting element (66) is rotatable relatively to the frame (40) around a vertical pivoting axis (86), and the inhibiting element (66) comprises a connecting rod (98) connecting the detector bar follower (64A, 64B) to the main body (84).

10. The switching machine (20) of claims 8 and 9 considered together, wherein the detector bar followers (64A, 64B) have a common biasing device (100) comprising at least one spring (102) having a first end attached to the main body (84) of the inhibiting element (66) of the first detector bar follower (64A) and a second end attached to the main body (84) of the inhibiting element (66) of the second detector bar follower (64B), said common biasing device (100) biasing both detector bar followers (64A, 64B) toward their second position.

Amended claims in accordance with Rule 137(2) EPC.

1. A switching machine (20) for switching the position of railway tracks, the switching machine (20) comprising:

- a frame (40), intended to be fixed relatively to a pair of stock rails (12A, 12B) of a railroad switch (10),
- a throw bar (22) translatable relatively to the frame (40) along a transverse direction (Y) to throw a pair of inner rails (14A, 14B) of the railroad switch (10), located between the stock rails (12A, 12B), from a normal track position to a reverse track position, and from the reverse track position to the normal track position,
- a point detector bar (26), translatable relatively to the frame (40) along the transverse direction (Y) between a normal detection position intended to correspond to the normal track position of

the inner rails (14A, 14B) and a reverse detection position intended to correspond to the reverse track position of the inner rails (14A, 14B),
- an indication contact assembly (62), fixed relatively to the frame (40), comprising at least one switch (70),
- at least one detector bar follower (64A, 64B), movable relatively to the frame (40) between a proximal position, in which the detector bar follower (64A, 64B) acts on the switch (70), and a distal position, in which the detector bar follower (64A, 64B) is away from the switch (70), the detector bar follower (64A, 64B) being adapted to follow displacement of the point detector bar (26) in such a manner that, when the point detector bar (26) is in one of its normal and reverse detection positions, the detector bar follower (64A, 64B) is in a first position among the proximal and distal positions and, when the point detector bar (26) is in an intermediary position between its normal and reverse detection positions, the detector bar follower (64A, 64B) is in the second position among the proximal and distal positions,
- an inhibiting element (66) having a main body (84) and being jointly movable with the detector bar follower (64A, 64B) so that its main body (84) is in a primary position when the detector bar follower (64A, 64B) is in its first position and in a secondary position when the detector bar follower (64A, 64B) is in its second position,
- a cam bar (50) having a kinematic connection with the throw bar (22) in such a manner that the cam bar (50) and the throw bar (22) are jointly translatable relatively to the frame (40), the cam bar (50) comprising a tongue portion (56) and being translatable relatively to the frame (50) along a longitudinal direction (X) between an unlock position in which the tongue portion (56) is able to be in contact with a stop (96) of the inhibiting element (66), preventing the main body (84) of the inhibiting element (66) from reaching its secondary position, and a lock position in which the tongue portion (56) is away from the stop (96), allowing displacement of the main body (84) of the inhibiting element (66) between its primary and secondary positions,

characterized in that the stop (96) is vertically translatable relatively to the main body (84) between an active position, in which the stop (96) is in contact with the tongue portion (56) of the cam bar (50) when the cam bar (50) is in the unlock position, preventing the main body (84) from reaching its secondary position, and a passive position, in which the stop (96) is away from the tongue portion (56) of the cam bar (50) when the cam bar (50) is in the unlock position, allowing displacement of the main body (84) between its primary and secondary positions.

2. The switching machine (20) of claim 1, wherein the inhibiting element (66) comprises a biasing member biasing the stop (96) toward its active position.

3. The switching machine (20) of claim 1 or 2, comprising a latch assembly (150) to latch the stop (96) in its passive position.

4. The switching machine (20) of any one of the preceding claims, wherein the stop (96) comprises a vertical shaft (104) with a shaft body (105) extending through a hole (106) formed in the main body (84) and, on top of the shaft body (105), a shaft head (108) with a larger diameter than the diameter of the shaft body (105), and the switching machine (20) comprises an actuation device to displace the stop (96) between its active and passive positions, said actuation device comprising a plate assembly (110) which is vertically translatable relatively to the frame (40), said plate assembly (110) including a plate (112) having a slot (116) formed therein and through which the shaft body (105) extends, said slot (116) having a shape that follows the path of the shaft (104) when the main body (84) of the inhibiting element (66) is displaced between its primary and secondary positions.

5. The switching machine (20) of claims 3 and 4 considered together, wherein the latch assembly (150) comprises a latch (152) with a front face (161) and a protrusion (162) protruding from said front face (161), said latch (152) being rotatable relatively to the frame (40) around a horizontal axis between a latching position, in which the protrusion (162) extends within a displacement region of the plate assembly (110), and a liberation position, in which the protrusion (162) is out of the displacement region of the plate assembly (110), the position of the plate assembly (110) when the stop (96) is in its passive position being above the position of the protrusion (162) when the latch (152) is in its latching position, and the latch assembly (150) further comprises a biasing element (156) biasing the latch (152) toward its latching position.

6. The switching machine (20) of claim 4 or 5, comprising a safety circuit to detect when the stop (96) is in its passive position, said safety circuit comprising at least two stationary contacts (148) and at least one mobile contact (142) mounted on the plate assembly (110) in a manner that, when the stop (96) is in one of its passive and active positions, the mobile contact (142) bridges the two stationary contacts (148), thus closing the safety circuit and, when the stop (96) is in the other one of its passive and active positions, the mobile contact (142) is away from the stationary

contacts (148), thus opening the safety circuit.

7. The switching machine (20) of any one of the preceding claims, comprising two detector bar followers (64A, 64B), each one being adapted to act on a respective switch (70) of the indication contact assembly (62) when it is in its proximal position, the detector bar followers (64A, 64B) comprising a first detector bar follower (64A) whose main body (84) is adapted to be in its second position when the point detector bar (26) is in its normal detection position and a second detector bar follower (64B) whose main body (84) is adapted to be in its second position when the point detector bar (26) is in its reverse detection position.

8. The switching machine (20) of claim 7, wherein the stop (96) of the inhibiting element (66) of each detector bar follower (64A, 64B) is closer to the inhibiting element (66) of the other detector bar follower (64A, 64B) when the main bodies (84) of both inhibiting elements (66) are in their secondary position than when the main bodies (84) of both inhibiting elements (66) are in their primary position, and the tongue portion (56) of the cam bar (50) has a median longitudinal axis which extends between both inhibiting elements (66).

9. The switching machine (20) of any one of the preceding claims, wherein the point detector bar (26) has a cylindrical surface (46) in which a notch (48) is formed, the detector bar follower (64A, 64B) is rotatable relatively to the frame (40) around a vertical rotation axis (72) between its first and second positions and has a follower part (76) adapted for contacting the point detector bar (26) in such a manner that, when the follower part (76) is in contact with the cylindrical surface (46) of the point detector bar (26), the detector bar follower (64A, 64B) is in its first position and, when the follower part (76) is received in the notch (48), the detector bar follower (64A, 64B) is in its second position, the main body (84) of the inhibiting element (66) is rotatable relatively to the frame (40) around a vertical pivoting axis (86), and the inhibiting element (66) comprises a connecting rod (98) connecting the detector bar follower (64A, 64B) to the main body (84).

10. The switching machine (20) of claims 8 and 9 considered together, wherein the detector bar followers (64A, 64B) have a common biasing device (100) comprising at least one spring (102) having a first end attached to the main body (84) of the inhibiting element (66) of the first detector bar follower (64A) and a second end attached to the main body (84) of the inhibiting element (66) of the second detector bar follower (64B), said common biasing device (100) biasing both detector bar followers (64A, 64B) toward their second position.

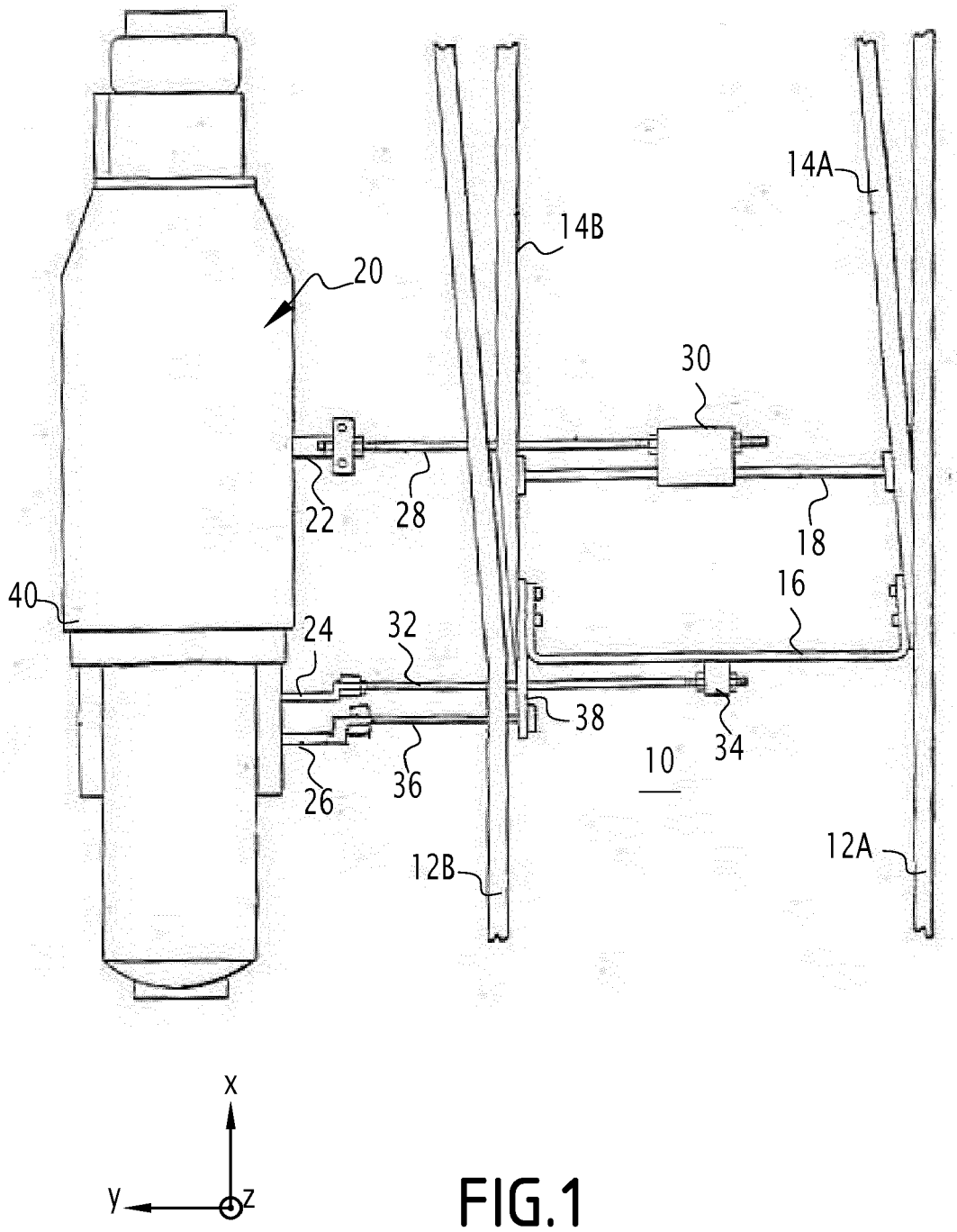
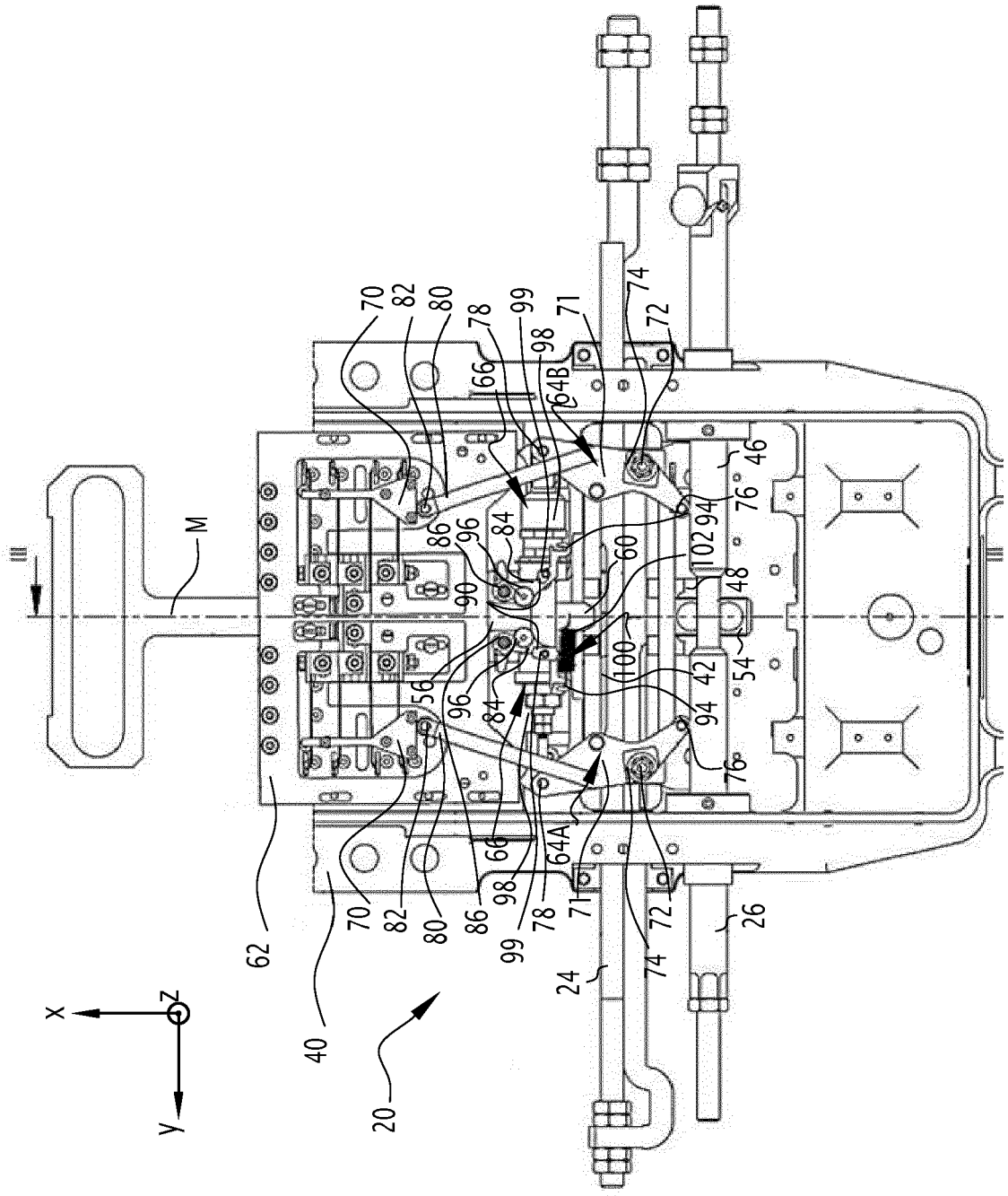


FIG.1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M
70
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80
78
99
71
74
72
98
66
64B
46
76
94
102
48
60
86
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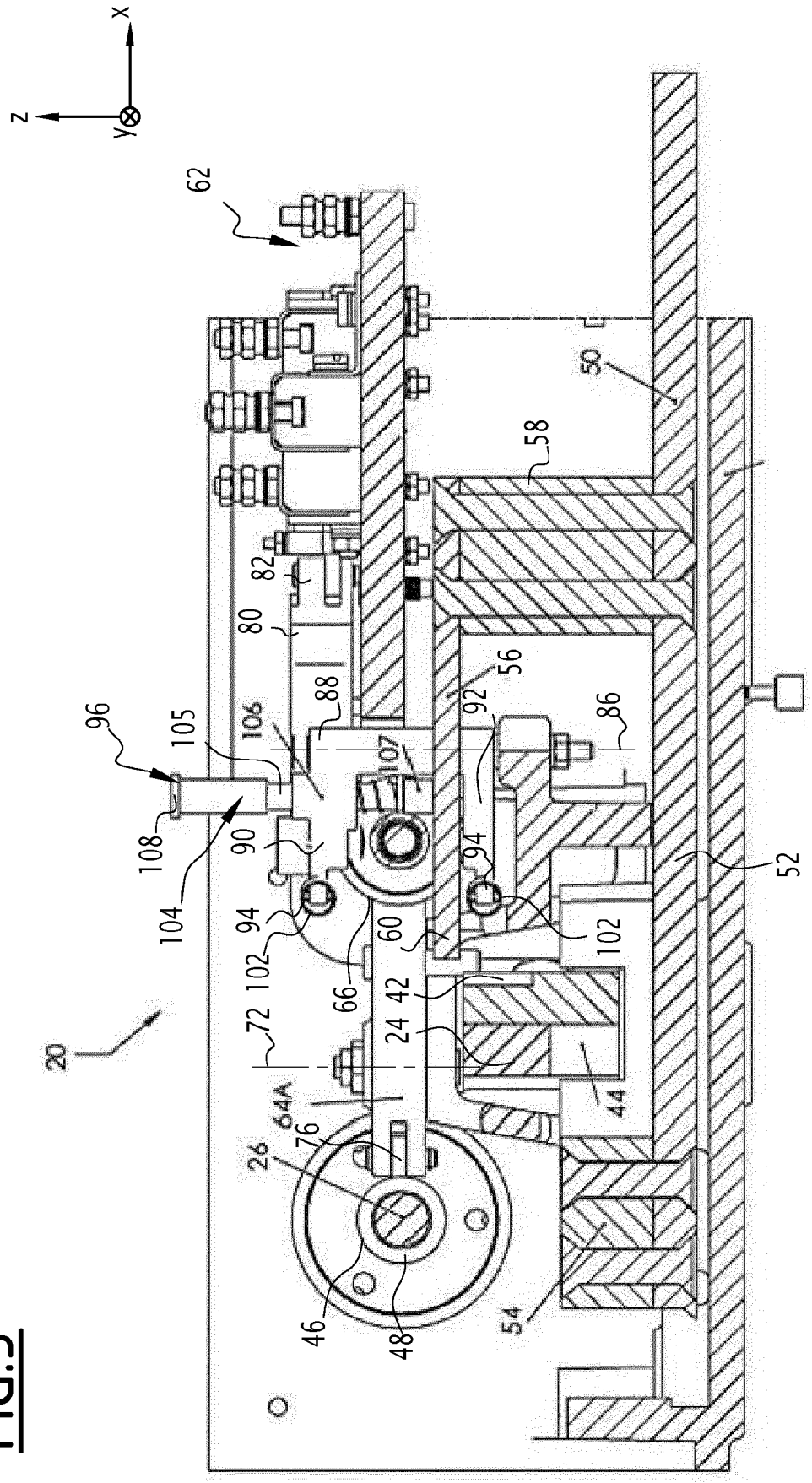
84
90
100
54
42
56
62
40
64A
26
24
20
X
Z
Y

FIG.2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Z
Y
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82
80
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86
96
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107
108
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94
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104
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102
66
42
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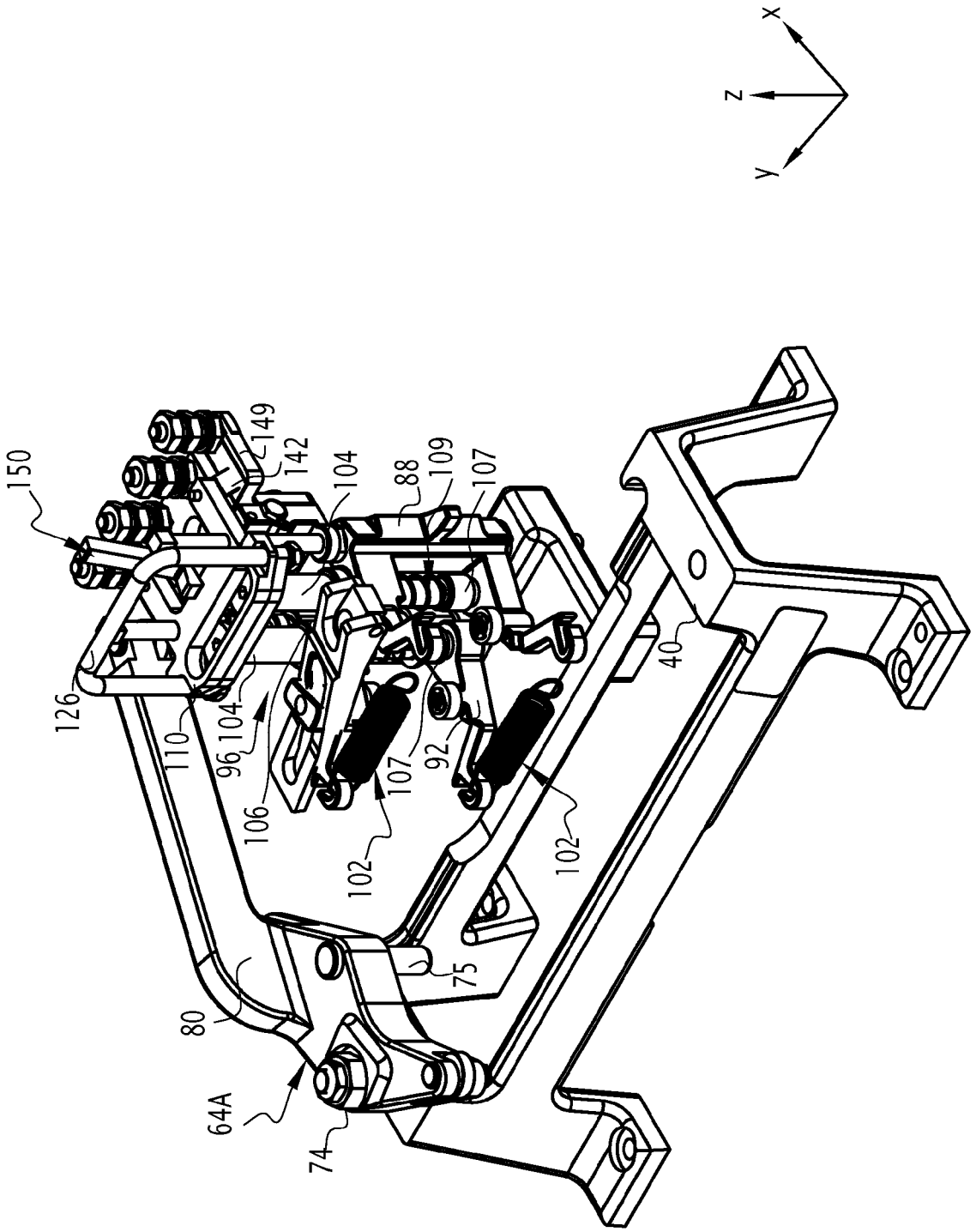
20
64A
76
26
44
46
48
54

FIG.3


X
Z
Y
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149
142
104
88
109
107
126
110
96
104
106
107
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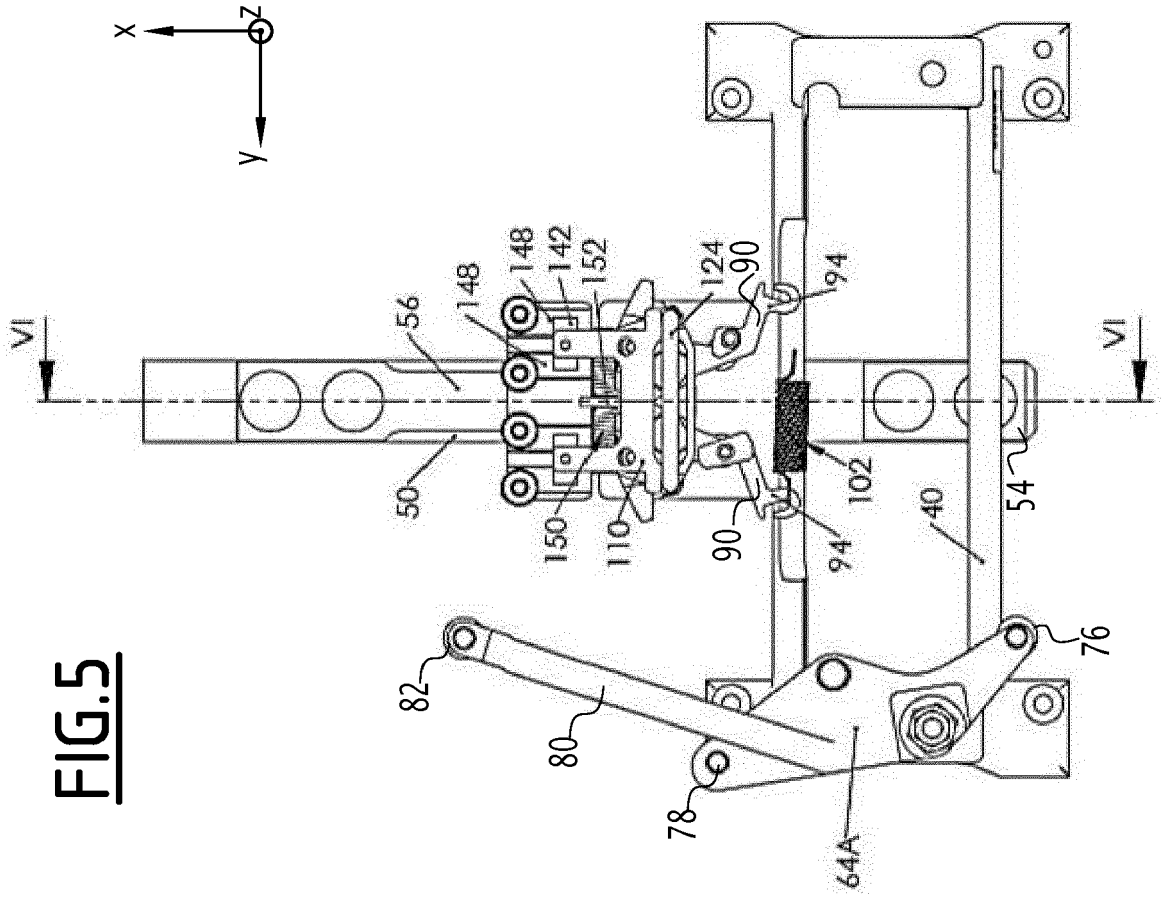
102
102
40
75
80
64A
74

FIG.4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z
y
VI
VI
148
142
152
148
56
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94
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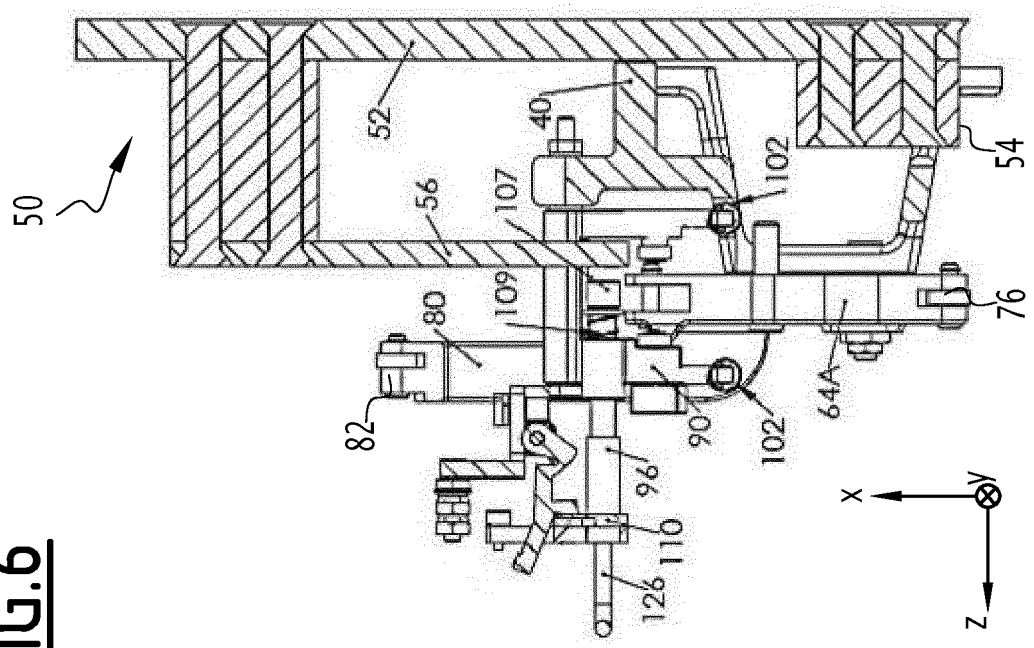
150
110
90
94
102
40
54
82
80
78
64A
76

FIG.5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52
40
54
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56
107
109
80
76
82
64A
90
102
98
110
126
x
y
z

FIG.6

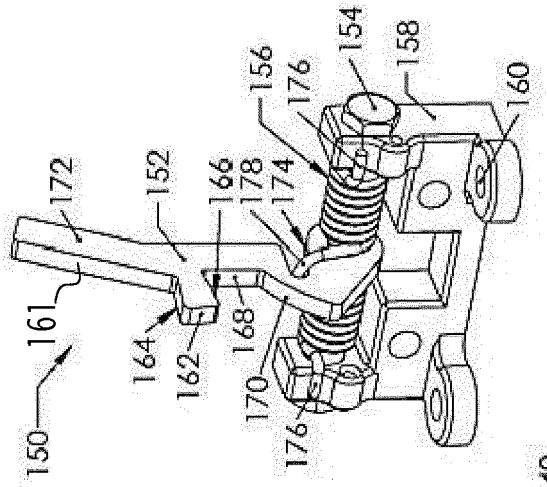

FIG.9

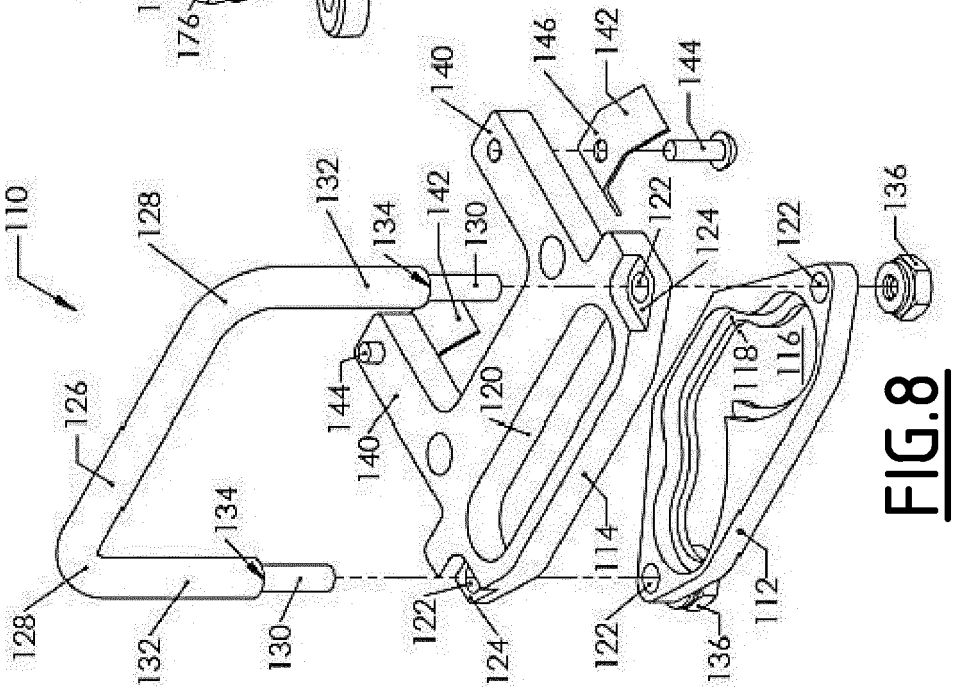

FIG.8

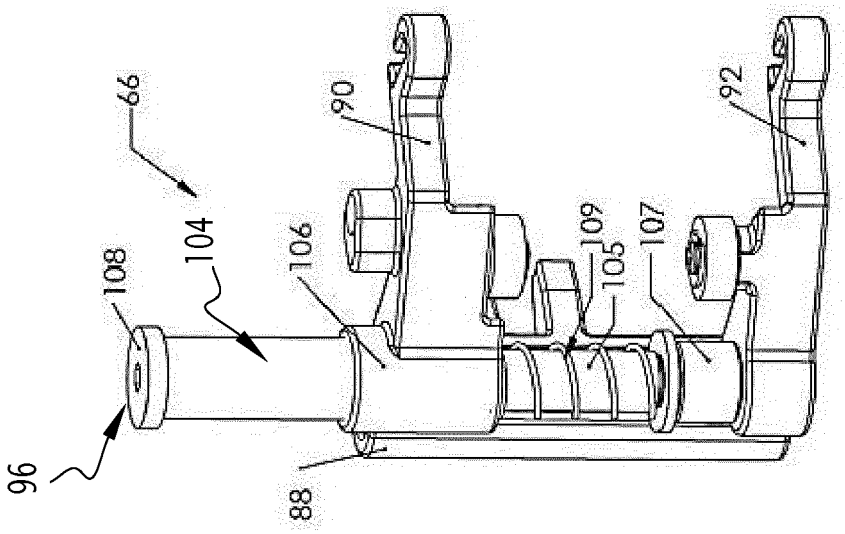

FIG.7

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EUROPEAN SEARCH REPORT

Application Number
EP 17 30 5682

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	Alstom: "4000 Switch Machine Installation and Maintenance Manual P2444", , 31 January 2007 (2007-01-31), pages 1-131, XP055430307, USA Retrieved from the Internet: URL:http://s1.manualzz.com/store/data/008197941.pdf?key=5c140f2e645f1e9506f4adceb9ad267b&r=1&fn=8197941.pdf&t=1511967996790&p=86400 [retrieved on 2017-11-29] * figures 3-1 and 7-1 *	1-10	INV. B61L5/10
A	EP 1 574 413 A1 (SIEMENS AG [DE]; FRIEDRICH HIPPE MASCHINENFABRI [DE]) 14 September 2005 (2005-09-14) * paragraphs [0003] - [0005] and [0010] *	1-10	
A	EP 2 923 914 A1 (SIEMENS SCHWEIZ AG [CH]) 30 September 2015 (2015-09-30) * figures 1 -3; paragraphs [0014], [0018] and [0019] *	1-10	TECHNICAL FIELDS SEARCHED (IPC) B61L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 November 2017	Plützer, Stefan

CATEGORY OF CITED DOCUMENTS

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 30 5682

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