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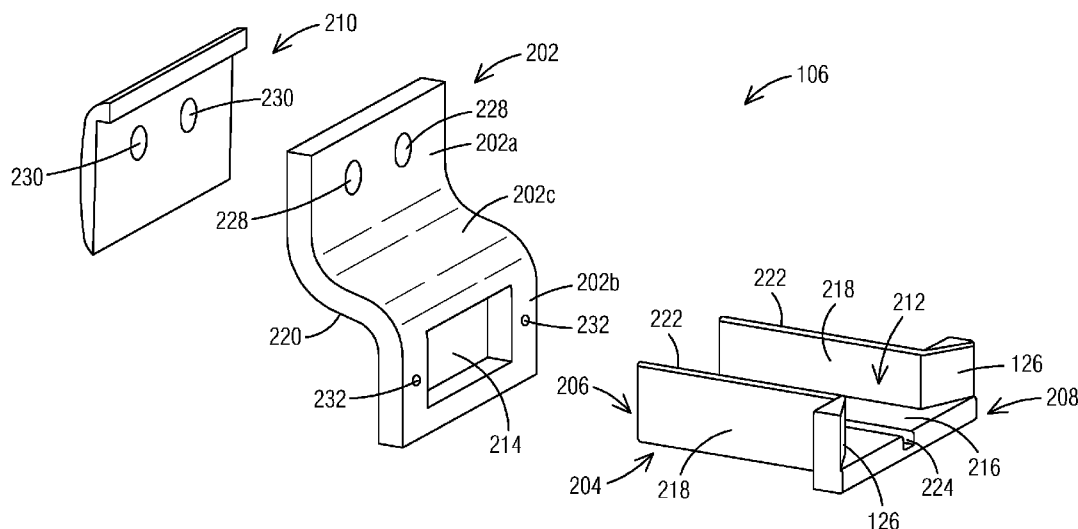
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(54) Title: LOCKING DEVICE FOR A RAILWAY SWITCH

FIG. 2



(57) Abstract: A locking device (106) for a railway switch (100) includes a main structural member (202) adapted to withstand stress loading and a replaceable guide member (204). The main structural member (202) is configured to be fastened to a stock rail (102). The guide member (204) is detachably coupled to the main structural member (202). The guide member (204) defines, at least in part, a channel (212) extending from a first end (206) to a second end (208) thereof. A locking face (126) is defined at the second end (208) of the guide member (204). Upon installation, the channel (212) is configured for guiding therethrough a simultaneous motion of a latch member (114) and an operating bar (110) of the railway switch (100). The latch member (114) has a first end (116) coupled to a switch blade (104) and a second end (118) configured as a lock catch. The locking face (126) is configured to bear against the second end (118) of the latch member (114) to lock the switch blade (104) to the stock rail (102).

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LOCKING DEVICE FOR A RAILWAY SWITCH

BACKGROUND

1. Field

5 **[0001]** The present disclosure relates to a device for locking a switch blade of a railway switch.

2. Description of the Related Art

10 **[0002]** A railway switch (also referred to as a railway turnout or a railway point) is a mechanical installation enabling trains to change from one track to another track. When operating a railway switch, a switch operating mechanism is typically used to move two, usually interconnected, switch blades from a first end position, to a second end position. In the first end position, one switch blade makes contact with the inside of one of the stock rails of the railway track. In the second end position, the other switch blade makes contact with the inside of the other stock rail of the railway track.

15 **[0003]** Railway switches are typically fitted with locking equipment for the purpose of securing one of the switch blades to the respective stock rail on the same side, when the switch blades are in either of the end positions. The locking equipment may also transfer linear movement from the operating mechanism to the switch blades in a transverse direction in relation to the railway track, between the first and second end positions.

20 **[0004]** Railway switch locking equipment include critical components for safe operation of the railway. Failure of a component of such equipment may result in an accident where a train simply falls off the track. It is therefore a design and manufacturing objective to ensure the safety of these components. Usually, these components are manufactured via casting, for example, from steel or iron, due to their complexity. Castings may often contain hidden defects, for example, shrinkage defects, gas porosity, metallurgical defects, among others. On account of these defects, the components may not be able to withstand the high operational stresses and shock loading that they are subject to.

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[0005] Currently known methods of ensuring the safety and suitability of the casting include, for example, visual inspections, x-rays, specialized casting techniques, increased factors of safety to compensate for possible defects, cutting up samples and visual examinations, among others. All these techniques are expensive and add to manufacturing time.

SUMMARY

[0006] Briefly, aspects of the present disclosure are directed to a locking device for a railway switch, which address at least some of the issues associated with conventional locking equipment described above, among others.

10 [0007] According to a first aspect, a locking device for a railway switch is provided. The locking device has a main structural member and a guide member detachably coupled to the main structural member. The main structural member is configured to be fastened to a stock rail of a railway track. The guide member defines, at least in part, a channel extending from a first end to a second end of the guide member. A locking face is defined at the second end of the guide member. Upon installation of the locking device, the channel is configured for guiding therethrough a simultaneous motion of a latch member and an operating bar of the railway switch in a transverse direction in relation to the railway track. The latch member is coupled to a switch blade at a first end of the latch member. The locking face of the guide member is configured to bear against a lock catch defined at a second end of the latch member, to lock the switch blade to the stock rail.

25 [0008] According to a second aspect, a lock assembly for a railway switch is provided. The lock assembly comprises a locking device fitted to a stock rail of a railway track and a bracket fitted to a switch blade of the railway switch. The lock assembly further comprises a latch member having a first end coupled to the bracket and a second end defining a lock catch. The latch member is configured to be moved, via a transversely driven operating bar, through the locking device. The locking device comprises a main structural member and a guide member detachably coupled to the main structural member. The main structural member is fastened to the stock rail on a side of the stock rail opposite to the switch blade. The guide member defines,

at least in part, a channel extending from a first end to a second end of the guide member in a transverse direction in relation to the railway track, the channel being configured for guiding therethrough a simultaneous motion of the latch member and the operating bar. A locking face is defined at the second end of the guide member.

- 5 The locking face is configured to bear against the lock catch defined at the second end of the latch member, to lock the switch blade to the stock rail.

[0009] According to a third aspect, a method is provided for assembling a lock for a railway switch. The method comprises installing a locking device on a stock rail of a railway track. The locking device comprises a main structural member and a guide member detachably coupled to the main structural member. The installation comprises fastening the main structural member to the stock rail on a side of the stock rail opposite to a switch blade of the railway switch. Upon installation, the guide member defines, at least in part, a channel extending from a first end to a second end of the guide member in a transverse direction in relation to the railway track. A locking face is defined at the second end of the guide member.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The invention is shown in more detail by help of figures. The figures show preferred configurations and do not limit the scope of the invention.

[0011] FIG. 1 depicts a plan view of a portion of a railway switch according to one embodiment,

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[0012] FIG. 2 depicts an exploded view of a locking device according to one embodiment;

[0013] FIG. 3 depicts a perspective view of the locking device of FIG. 2 after assembly;

25 [0014] FIG. 4 depicts a side view of the assembled locking device of FIG. 3;

[0015] FIG. 5 depicts an end view of the assembled locking device of FIG. 3;

[0016] FIG. 6 depicts a vertical cross-sectional view, through a railway track, of a lock assembly; and

[0017] FIG. 7 depicts a flowchart illustrating an example method of assembling a lock for a railway switch.

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DETAILED DESCRIPTION

[0018] In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration, and not by way of limitation, a specific embodiment in which the invention may be practiced. It is to be understood that other
10 embodiments may be utilized and that changes may be made without departing from the spirit and scope of the present invention.

[0019] The present disclosure is directed to a fabricated locking device, that obviates many of the technical problems discussed above in connection with conventionally cast locking equipment, thus providing increased safety and
15 robustness. A fabricated locking device, as per the present disclosure, utilizes a main structural member and a guide member, which is detachably coupled to the main structural member. The guide member defines a bearing surface (referred herein as a “locking face”) of the locking device. In many embodiments, the guide member is a non-structural component and is replaceable. The main structural member and the
20 guide member may thereby be formed of different materials. The main structural member may be formed as a monolithic plate, for example and without limitation, made of wrought steel or rolled steel. The guide member may, for example and without limitation, be formed of a conventional casting, such as an iron or bronze casting.

25 [0020] A main structural member, such as a wrought or rolled steel plate among others, is better suited to handle stresses in a shock environment and is inherently free of the defects that plague castings. A replaceable guide member with a locking face enables the contact stresses and loads to be distributed and handled primarily by the main structural member. A replaceable guide member with a locking face enables a

better selection of materials more suited to those functions rather being a compromise with the structural element. Furthermore, a replaceable guide member with a locking face may enable simple changeout during maintenance, as this is component that undergoes wear.

5 **[0021]** Referring now to FIG. 1, a portion of a railway switch 100 is illustrated according to one embodiment. The railway switch 100 includes a pair of switch blades 104 positioned between a pair of stock rails 102 of a railway track. During a switching operation, the switch blades 104 are moved in a transverse direction T (i.e., perpendicular) in relation to the railway track, by an operating bar 110, which is
10 driven by a point machine 120. The point machine 120 may comprise electrical, hydraulic or other mechanism to actuate the operating bar 110 in the transverse direction. FIG. 1 illustrates a first end position of the switch 100, when the right switch blade 104 contacts the inside of the right stock rail 102. In this position, the right switch blade 104 is locked to the right stock rail by a right lock assembly. In a
15 second end position (not shown), the left switch blade 104 contacts the inside of the left stock rail 102. In this position, the left switch blade 104 may be locked to the left stock rail by a left lock assembly.

[0022] The description provided herein pertains to the right lock assembly, it being understood that a corresponding description may apply to the left lock
20 assembly. The terms “right” and “left” are defined herein in relation to a forward direction of the railway track. As shown, the right lock assembly includes a locking device 106 fitted to the right stock rail 102 for example via bolts 122. A bracket 108 is fitted to the right switch blade 104, for example, via bolts 124. The lock assembly also includes a latch member 114 having a first end 116, which is coupled the bracket 108,
25 and a second end 118, which is enlarged, defining a lock catch. The lock catch may have any suitable shape to provide a robust locking interface with the locking device 106.

[0023] The latch member 114 may be pivoted at the first end 116 to the bracket 108, for example, via a pin 128, allowing the latch member 114 to swing in a
30 horizontal plane. The latch member 114 is configured to be moved linearly through the locking device 106 by the operating bar 110, which is driven by the point machine

120. The linear motion is transferred from the latch member 114 to the switch blade 104 via the bracket 108. The operating bar 110 may be provided with a first notch 112 located near a right end of the operating bar 110. The notch 112 is shaped and configured to receive a portion of the lock catch at second end 118 of the latch member 114, allowing the operating bar 110 to move the latch member 114 therewith through a channel 212 defined in the locking device 106. The channel 212 is not visible in FIG. 1 and is described subsequently referring to FIG. 2-5. On account of the pivoted connection of the latch member 114, the second end 118 of the latch member 114 is configured to be received in the notch 112 of the operating bar 110 when it is inside the channel 212 of the locking device 106, and is configured to be released from the notch 112 when it exits the channel 212.

[0024] In the configuration shown in FIG. 1, the right lock assembly is in a locked position where the right switch blade 104 is pushed into contact with the right stock rail 102. In this configuration, the second end 118 of the latch member 114 has exited the channel 212 of the right locking device 106, been released from the notch 112, and is made to bear against a locking face 126 of the right locking device 106, thereby locking the right switch blade 104 to the right stock rail 102. In FIG. 1, the left lock assembly is in an unlocked position, where the left switch blade 104 has moved a distance between from the left stock rail 102. In the shown configuration, the second end of the left latch member 114 is within the channel of the left locking device 106 (hence not visible), being received in a second notch located near the left end of the operating bar 110. The notches 112 thus help transfer linear movement from the operating bar 110 to the switch blades 104, enabling the switch blades 104 to be moved between the first and second end positions.

[0025] FIG. 2-5 illustrate various views of a locking device 106 in accordance with one embodiment. As shown, the locking device 106 has a modular construction, comprising a main structural member 202 and a guide member 204. As stated above, the main structural member 202 and the guide member 204 serve essentially different functions, and may hence be made of different materials in various embodiments. During installation, the main structural member 202 is fastened to the stock rail 102 on a side of the stock rail 102 opposite to the switch blade 104, for example, via bolts 122 (see FIG. 1 and 6). The guide member 204 is detachably coupled to the main

structural member 202. The guide member 204 defines, at least in part, a channel 212 extending from a first end 206 to a second end 208 of the guide member 204. When installed, the channel 212 extends in a transverse direction in relation to the railway track. The channel 212 is configured for guiding therethrough a simultaneous motion of the latch member 114 and the operating bar 110. At the second end 208 of the guide member 204, a locking face 126 is defined, which is suitably shaped and configured to bear against the lock catch defined at the second end 118 of the latch member 114 (see FIG. 1), to lock the switch blade 104 to the stock rail 102.

[0026] In the shown embodiment, for maximum stress absorption, the main structural member 202 is formed as a monolithic plate having a generally Z-shaped or S-shaped cross-section. The plate 202 includes a first planar section 202a, a second planar section 202b and a third section 202c. The first planar section 202a is oriented vertically and is provided with attachment points 228 (e.g., bolt holes) for fastening the plate 202 to the stock rail 102. The second planar section 202b is located below the first planar section 202a. The second planar section 202b is also oriented vertically and configured to engage with the second end 208 of the guide member 204. The third section 202c is an intermediate portion connecting the first planar section 202a and the second planar section 202b. In many embodiments, the interfaces between the adjacent sections may be rounded off. As shown in FIG. 2, the second planar section 202b may be provided with an opening 214 configured to allow insertion of the guide member 204 therethrough. The opening 214 may be sized to allow the guide member 204 to be positioned such that a backside of the locking face 126 is engaged with the second planar section 202b of the main structural member 202 (see FIG. 3). In one embodiment, for attaching the guide member 204 to the main structural member 202, the back side of the locking faces 126 of the guide member 204 may be provided with studs, screws or other attachment means (not visible in the drawings), for which corresponding holes 232 may be provided on the second planar section 202b of the main structural member 202.

[0027] In the illustrated embodiment, the guide member 204 comprises a horizontal channel floor 216 flanked on opposite sides by a pair of vertical side walls 218, which define the channel 212. When assembled with the main structural member 202, the channel floor 216 is positioned opposite to a bottom surface 220 of the third

section 202c of the main structural member 202. The bottom surface 220 of the third section 202c is vertically spaced from respective top surfaces 222 of the side walls 218 of the guide member 204, to define a gap 402 therebetween (see FIG. 4). The gap 402 is sized to allow a base portion of the stock rail 102 to be positioned therein.

5 When installed, the guide member 202 is positioned below a base portion 602 of the stock rail 102 (see FIG. 6), such that the stock rail 102 extends through the gap 402. The channel floor 216 of the guide member 204 may be provided with a groove 224 for retaining the operating bar 110 in position during motion through the channel 212. The side walls 218 are spaced to define a width W of the channel 212. The channel
10 212 may be sized to have a width W to tightly accommodate a combined width of the latch member 114 and the operating bar 110, when the second end 118 of the latch member 114 is contained, in part, in the notch 112 of the operating bar 110.

[0028] As a further feature, as shown in FIG. 2-5, the locking device 106 may comprise an interfacing member 210, configured to interface between the main
15 structural member 202 and the stock rail 102 at the time of assembly. The interfacing member 210 may include, for example, a conventional cast part. The interfacing member 210 may be customized to fit the size of the stock rail, allowing standard functional components of the locking device 106 (namely parts 202 and 204) to be used for various rail sizes. The interfacing member 210 may be provided with
20 attachment points 230 (e.g., bolt holes) that are aligned with the attachment points 228 on the main structural member 202, to facilitate connection of the locking device 106 to the stock rail 102.

[0029] FIG. 6 depicts a cross-sectional view of a lock assembly 600 in accordance with the illustrated embodiments. FIG. 7 depicts a flowchart illustrating an example
25 method 700 for assembling a lock for a railway switch. The method 700 may be best understood referring jointly to FIG. 1, 6 and 7. The particular sequence of the activity blocks depicted in FIG. 7 is exemplary and not meant to be construed as limiting.

[0030] Block 702 of the method 700 involves installing a locking device 106 on a stock rail 102 of a railway track. The locking device 106 may be in accordance with
30 the embodiments described above. At installation, the main structural member 202 of the locking device 106 is fastened to a side of the stock rail 102 opposite to a switch

blade 104 of the railway switch, for example, via bolts 122. Upon installation, the channel 212 defined by the guide member 204 of the locking device 106 extends in a transverse direction in relation to the railway track. In the illustrated embodiment, an interfacing member 210 is positioned between the main structural member 202 and the stock rail 102 prior to fastening the main structural member 202 to the stock rail 102. The guide member 204 may be preassembled with the main structural member 202 prior to installation of the locking device 106. Upon installation, the guide member 204 is positioned below a base portion 602 of the stock rail 102.

[0031] Block 704 of the method 700 involves fitting a bracket 108 to the switch blade 104, for example, via bolts 124. Block 706 of the method 700 involves fitting a latch member 114 to the bracket 108. The latch member 114 has a first end 116 which is coupled to the bracket 108 and a second end 118 which is enlarged to define a lock catch. In this example, the latch member 114 is pivotably coupled to the bracket 108, for example via a pin 128, whereby the latch member 114 is configured to swing in a horizontal plane. Block 708 of the method 700 involves positioning an operating bar 110 of the railway switch through the channel 212 defined by the guide member 204. The operating bar 110 is configured to be driven transversely by a point machine 120 and to move the latch member 114 therewith through the channel 212 defined by the guide member 202. In the illustrated embodiment, the operating bar 110 comprises a notch 112 configured to receive a portion of the second end 118 of the latch member 114.

[0032] Block 710 of the method 700 involves driving the operating bar 110, for example, via the point machine 120, to move the latch member 114 through the channel 212 from the first end 206 through the second end 208 of the guide member 204. During this time, lock catch at the second end 118 of the latch member 114 is contained, in part, in the notch 112. The motion of the operating bar 110 is thus transferred to the switch blade 104, which is pushed into contact with the stock rail 102. At block 712 of the method 700, upon exiting channel 212, the lock catch is released from the notch 112 and is made to bear against the locking face 126 of the guide member 204, to lock the switch blade 104 to the stock rail 102.

[0033] While specific embodiments have been described in detail, those with

ordinary skill in the art will appreciate that various modifications and alternative to those details could be developed in light of the overall teachings of the disclosure. Accordingly, the particular arrangements disclosed are meant to be illustrative only and not limiting as to the scope of the invention, which is to be given the full breadth
5 of the appended claims, and any and all equivalents thereof.

CLAIMS

1. A locking device (106) for a railway switch (100), comprising:
a main structural member (202) configured to be fastened to a stock
5 rail (102) of a railway track, and
a guide member (204) detachably coupled to the main structural
member (202), the guide member (204) defining, at least in part, a channel (212)
extending from a first end (206) to a second end (208) of the guide member (204),
wherein a locking face (126) is defined at the second end (208) of the guide member
10 (204),
wherein, upon installation of the locking device (106), the channel (212) is
configured for guiding therethrough a simultaneous motion of a latch member (114)
and an operating bar (110) of the railway switch (100) in a transverse direction in
relation to the railway track, the latch member (114) being coupled to a switch blade
15 (104) at a first end (116) of the latch member (114),
wherein the locking face (126) of the guide member (204) is
configured to bear against a lock catch defined at a second end (118) of the latch
member (114), to lock the switch blade (104) to the stock rail (102).
- 20 2. The locking device (106) according to claim 1, wherein the main
structural member (202) and the guide member (204) are formed from different
materials.
3. The locking device (106) according to claim 2, wherein the main
25 structural member (202) is formed from wrought steel or rolled steel.
4. The locking device (106) according to claim 2, wherein the guide
member (204) is formed from an iron casting or a bronze casting.
- 30 5. The locking device (106) according to any of claims 1 to 4, wherein
the main structural member (202) comprises a monolithic plate, comprising:
a first planar section (202a) oriented vertically and comprising attachment
points (228) for fastening to the stock rail (102),

a second planar section (202b) located below the first planar section (202a), the second planar section (202b) being oriented vertically and configured to engage with the second end (208) of the guide member (204), and

5 a third section (202c) connecting the first (202a) and second (202b) planar sections.

6. The locking device (106) according to claim 5, wherein the second planar section (202b) is provided with an opening (214) configured to allow insertion of the guide member (204) therethrough, the opening (214) being sized to allow the
10 guide member (204) to be positioned such that a backside of the locking face (126) is engaged with the second planar section (202b).

7. The locking device (106) according to any of claims 5 and 6, wherein the guide member (204) comprises a horizontal channel floor (216) flanked on
15 opposite sides by a pair of vertical side walls (218), the channel floor (216) being positioned opposite to a bottom surface (220) of the third section (202c) of the main structural member (202).

8. The locking device (106) according to claim 7, wherein the bottom
20 surface (220) of the third section (202c) of the main structural member (202) is vertically spaced from respective top surfaces (222) of the side walls (218) of the guide member (204) to define a gap (402) therebetween, the gap (402) being sized to allow a base portion (602) of the stock rail (102) to be positioned therein.

25 9. The locking device (106) according to any of claims 7 and 8, wherein the channel floor (216) of the guide member (204) is provided with a groove (224) for retaining the operating bar (110) in position during motion through the channel (212).

10. The locking device (106) according to any of claim 1 to 9, wherein the
30 channel (212) has a width (W) configured to accommodate a combined width of the latch member (114) and the operating bar (110).

11. The locking device (106) according to any of claim 1 to 10, further comprising an interfacing member (210) configured to be positioned between the main structural member (202) and the stock rail (102).

5 12. The locking device (106) according to claim 11, wherein the interfacing member (210) is custom sized in dependence of a size of the stock rail (102).

10 13. A lock assembly (600) for a railway switch (100), comprising:
a locking device (106) fitted to a stock rail (102) of a railway track,
a bracket (108) fitted to a switch blade (104) of the railway switch (100), and
a latch member (114) having a first end (116) coupled to the bracket (108) and
a second end (118) defining a lock catch, the latch member (114) being configured to
be moved, via a transversely driven operating bar (110), through the locking device
15 (106),

the locking device (106) comprising:

a main structural member (202) fastened to the stock rail (102) on a
side of the stock rail (102) opposite to the switch blade (104), and

20 a guide member (204) detachably coupled to the main structural
member (202), the guide member (204) defining, at least in part, a channel (212)
extending from a first end (206) to a second end (208) of the guide member (204) in a
transverse direction in relation to the railway track, the channel (212) being
configured for guiding therethrough a simultaneous motion of the latch member (114)
and the operating bar (110),

25 wherein a locking face (126) is defined at the second end (208) of the
guide member (204), the locking face (126) being configured to bear against the lock
catch defined at the second end (118) of the latch member (114), to lock the switch
blade (104) to the stock rail (102).

14. A method (700) for assembling a lock for a railway switch (100), comprising:

installing (702) a locking device (106) on a stock rail (102) of a railway track, the locking device (106) comprising a main structural member (202) and a guide member (204) detachably coupled to the main structural member (202), the installation (702) comprising fastening the main structural member (202) to the stock rail (102) on a side of the stock rail opposite to a switch blade of the railway switch, wherein upon installation (702), the guide member (204) defines, at least in part, a channel (212) extending from a first end (206) to a second end (208) of the guide member (204) in a transverse direction in relation to the railway track, wherein a locking face (126) is defined at the second end (208) of the guide member (204).

15. The method (700) according to claim 14, wherein the installation (702) of the locking device (106) comprises positioning an interfacing member (210) between the main structural member (202) and the stock rail (102) prior to fastening the main structural member (202) to the stock rail (102).

16. The method (700) according to any of claims 14 and 15, wherein the guide member (204) is preassembled with the main structural member (202) prior to installation (702) of the locking device (106).

17. The method (700) according to any of claims 14 to 16, wherein the guide member (204) is positioned below a base portion (602) of the stock rail (102).

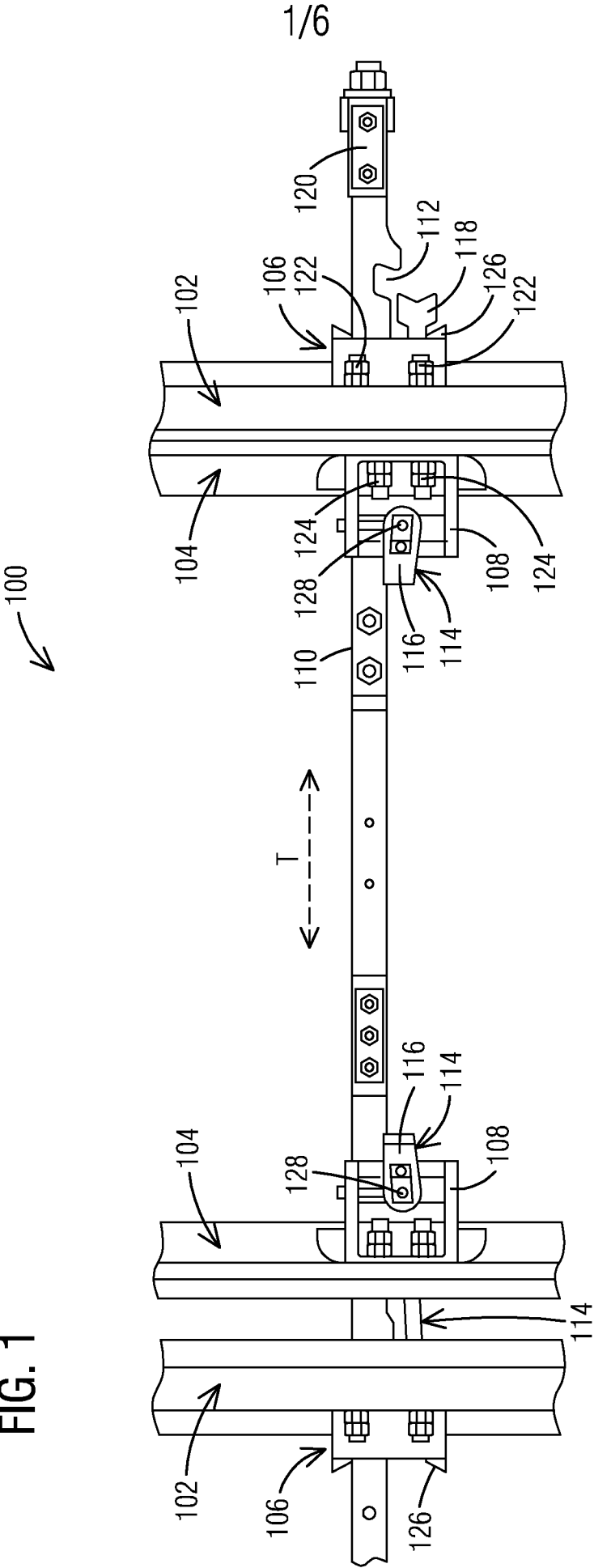
18. The method (700) according to any of claims 14 to 17, further comprising:

fitting (704) a bracket (108) to the switch blade (104),
fitting (706) a first end (116) of a latch member (114) to the bracket (108), wherein a second end (118) of the latch member (114) defines a lock catch, and positioning (708) an operating bar (110) of the railway switch (100) through the channel (212) defined by the guide member (204), wherein the operating bar (110) is configured to be driven transversely and to move the latch member (114) therewith through the channel (212) defined by the guide member (204).

19. The method (700) according to claim 18, wherein fitting (706) the first end (116) of the latch member (114) comprises pivoting the first end (116) of the latch member (114) to the bracket (108), whereby the latch member (114) is
5 configured to swing in a horizontal plane.

20. The method (700) according to claim 19, wherein the operating bar (110) comprises a notch (112) configured to receive a portion of the second end (118) of the latch member (114), the method (700) further comprising:
10 driving (710) the operating bar (110) to move the latch member (114) through the channel (212) from the first end (206) through the second end (208) of the guide member (204), with the second end (118) of the latch member (114) being received, in part, in the notch (112),
wherein upon exiting channel (212), the second end (118) of the latch
15 member (114) is released (712) from the notch (112) of the operating bar (110) and is made to bear against the locking face (126) of the guide member (204), to lock the switch blade (104) to the stock rail (102).

FIG. 1



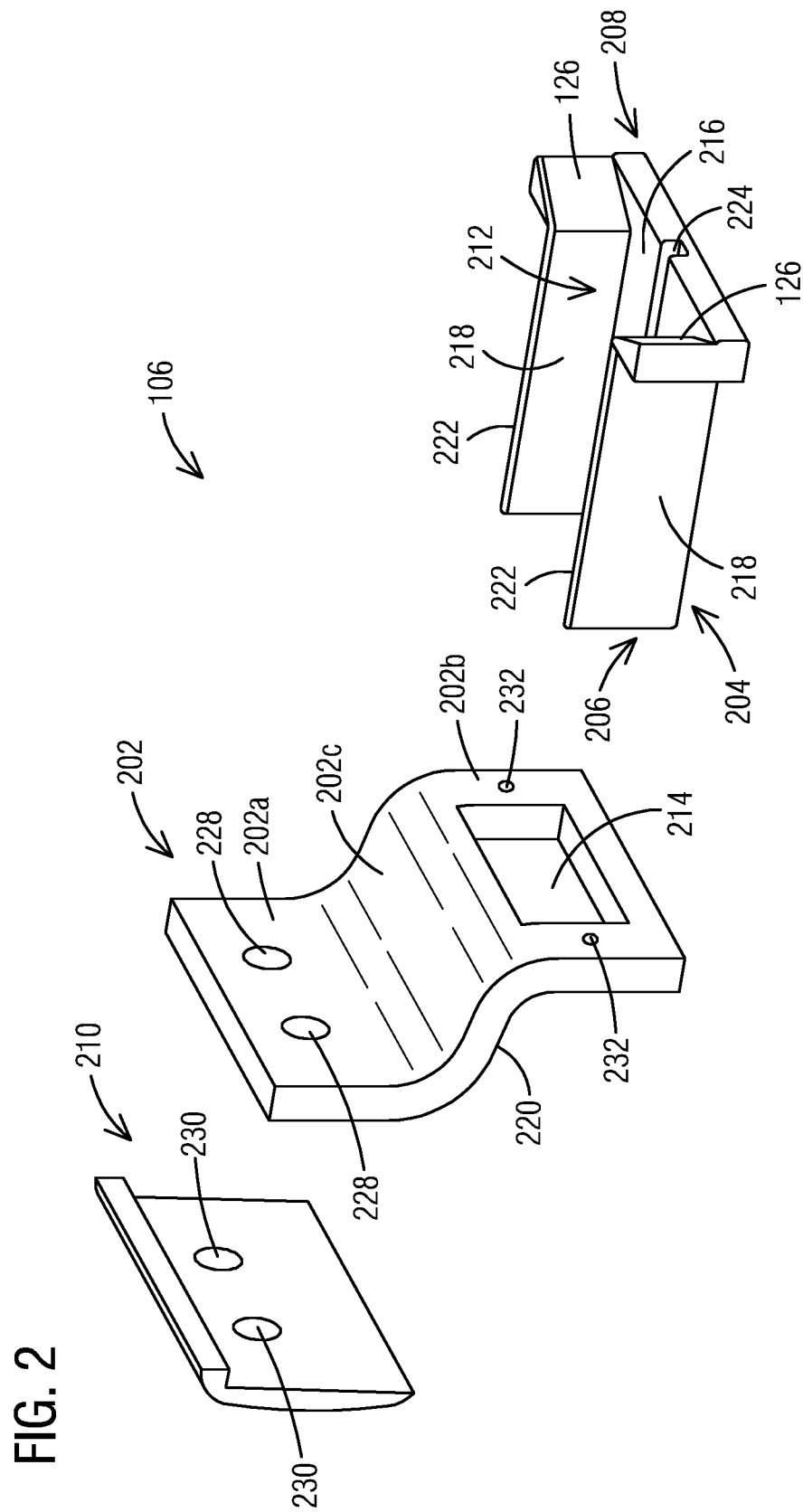
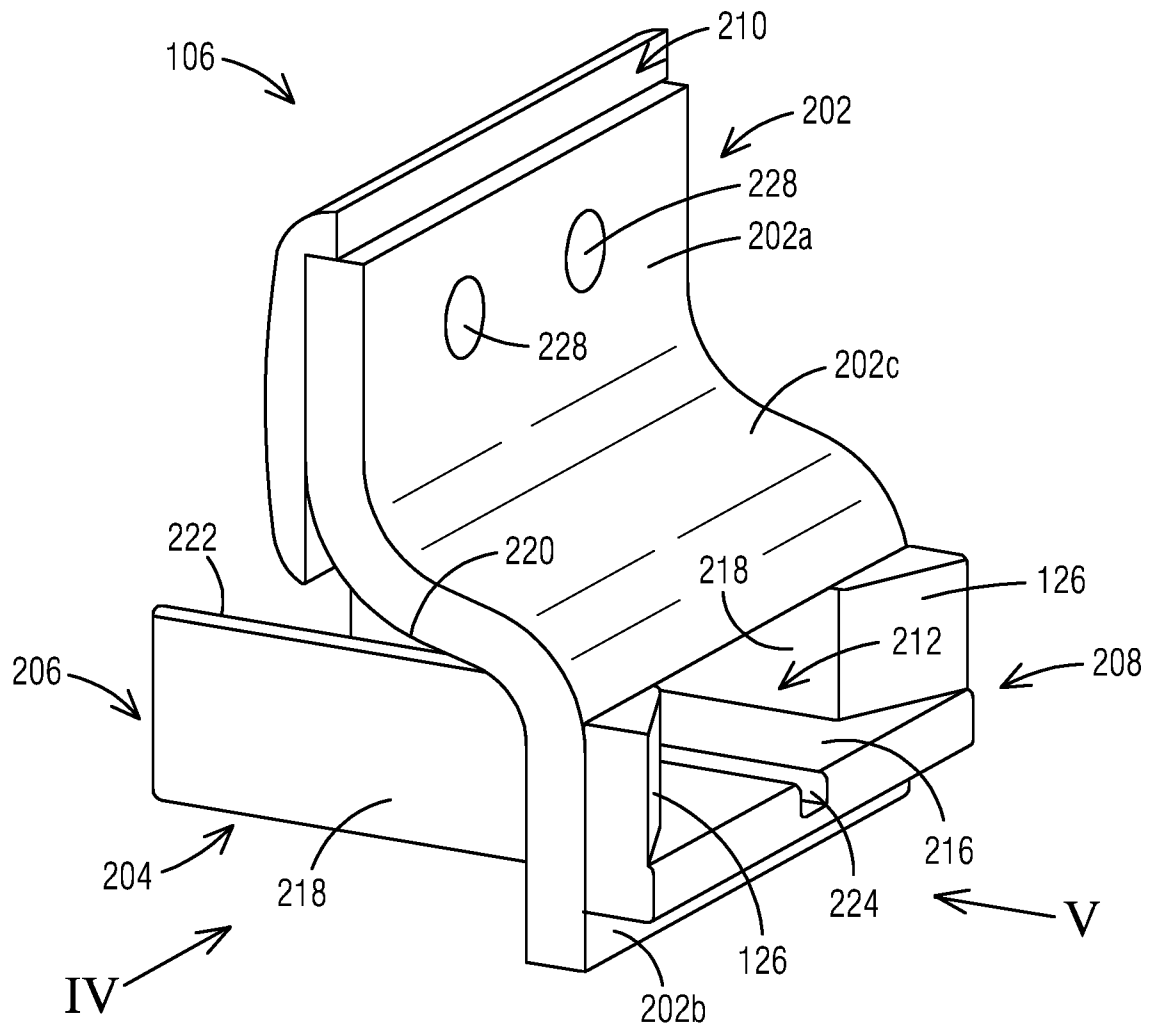


FIG. 3



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FIG. 4
View IV

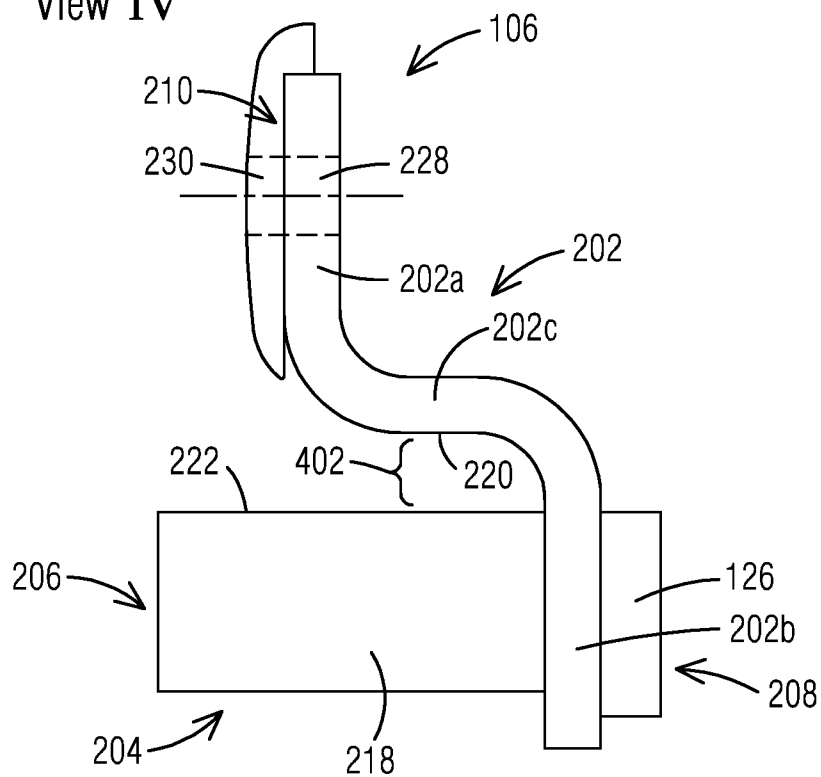


FIG. 5
View V

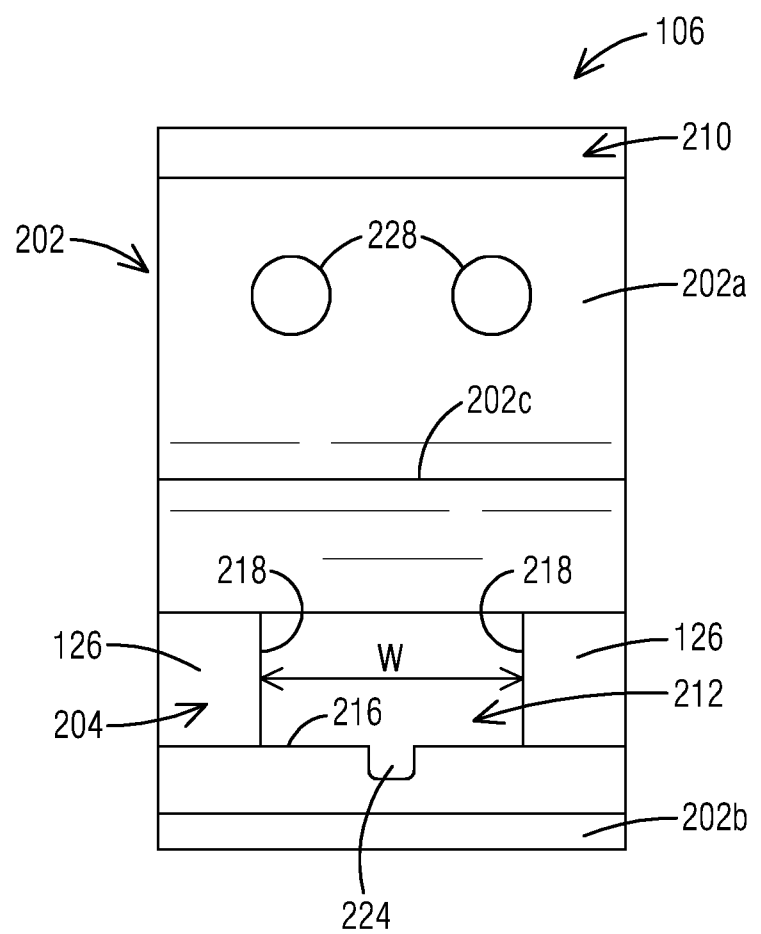
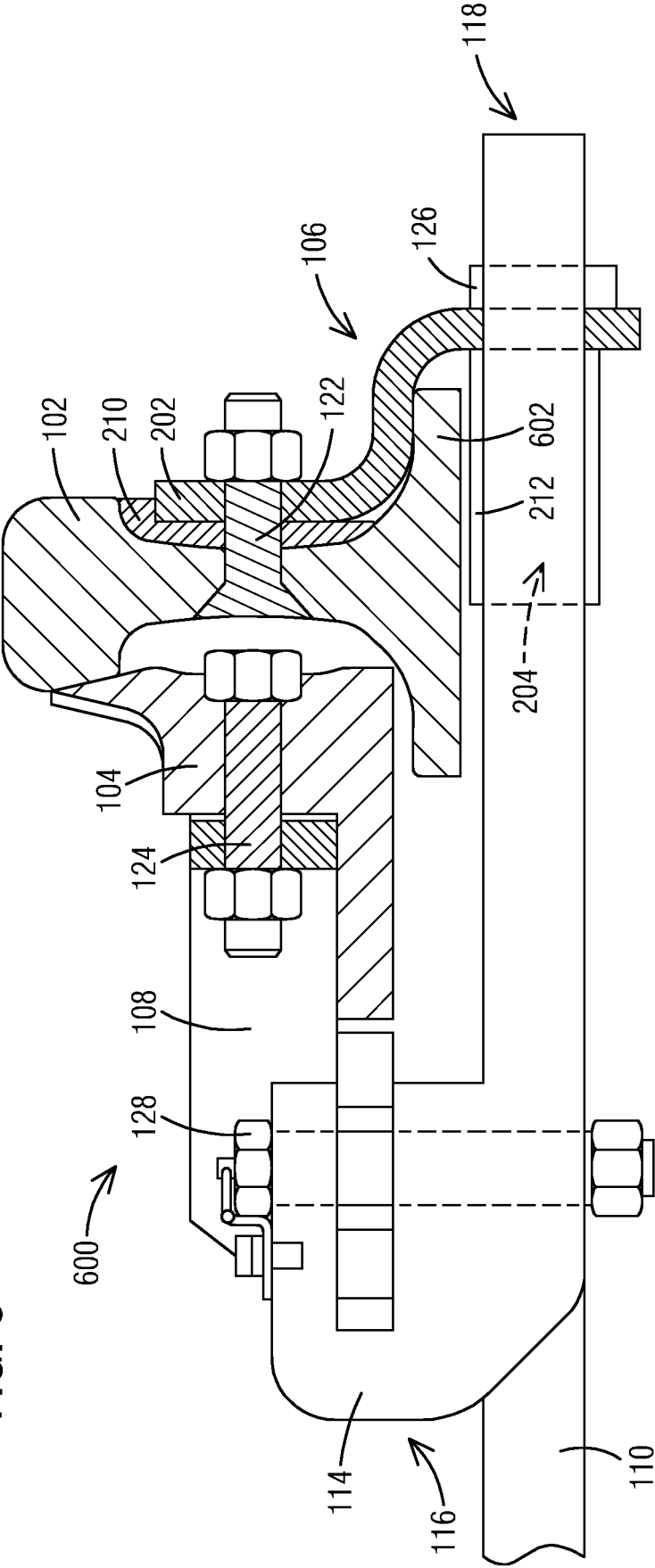
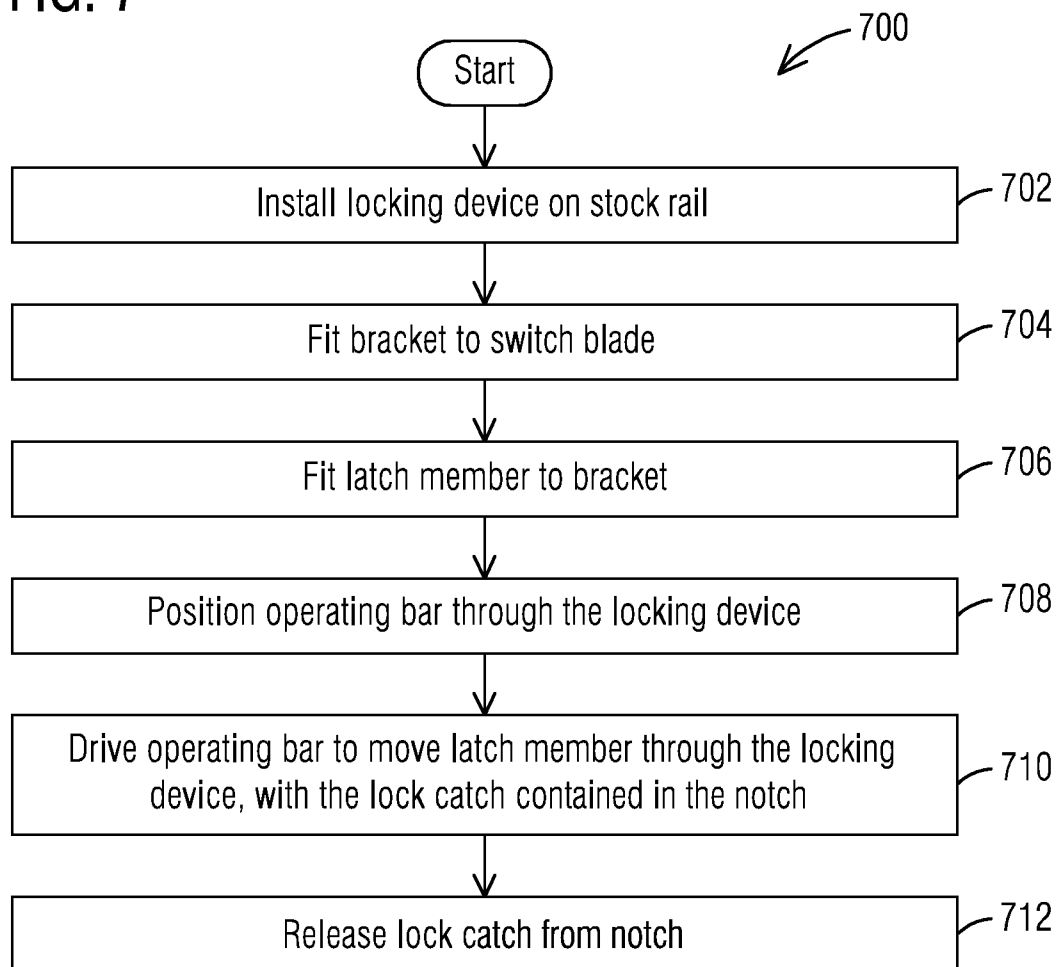


FIG. 6



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FIG. 7



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2019/048304

A. CLASSIFICATION OF SUBJECT MATTER
INV. B61L5/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 402 505 B1 (JEZ SIST S FERROVIARIOS S L [ES]) 17 December 2014 (2014-12-17) paragraph [0023] - paragraph [0026] paragraph [0035] figures 5, 12,13 -----	1-12, 14-20
X	EP 2 412 602 A1 (ALSTOM TRANSPORT SA [FR]) 1 February 2012 (2012-02-01) paragraph [0010] - paragraph [0011] paragraph [0024] - paragraph [0027] figures 2-4 -----	1-6,11, 12,14-17



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

22 June 2020

Date of mailing of the international search report

10/12/2020

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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Authorized officer

Janssen, Axel

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2019/048304

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 13
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 13

1. The international search Authority confirmed that the preliminary search made by this Authority, pursuant to Art. 15 PCT, has revealed that the description, claims or drawings fail to comply with the PCT requirements to such an extent that a meaningful search cannot be carried out in relation to this international application (Art. 17(2)(a)(ii) PCT). Pursuant to paragraph 9.34 and 9.35 of the PCT international search and examination guidelines, this authority required some further clarification.

2. The set of claims does comprise two independent apparatus claims 1 and 13 with different scope. This creates doubt about the invention to be claimed, rendering all apparatus claims 1-13 unclear according to Art. 6 PCT. The set of claims should only comprise one single independent claim per category of claims for reasons of conciseness.

3. The applicant was invited to indicate, which one of the above mentioned groups of claims should be search and examined. In his response dated the 17-06-2020, the applicant indicated that only the first set of system claims 1-12 should be search and examined together with the method claims 14-20.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guidelines C-IV, 7.2), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2019/048304

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
EP 2402505	B1	17-12-2014	EP	2402505 A1		04-01-2012
			ES	2529727 T3		25-02-2015

EP 2412602	A1	01-02-2012	EP	2412602 A1		01-02-2012
			FR	2963307 A1		03-02-2012
