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

(54) **APPARATUS FOR OPERATING A SWITCH OF A RAILWAY TRACK AND ASSOCIATED METHOD AND SWITCH**

(57) The present invention concerns an apparatus (20) for operating a switch (18) of a railway track, the switch (18) comprising blades and the apparatus (20) comprising:
- an assembly for displacing the blades,
- a locking device (36) adapted to lock the blades, the locking device (36) comprising a first unit and a second unit, the second unit being separable from the first unit and comprising a fuse element.

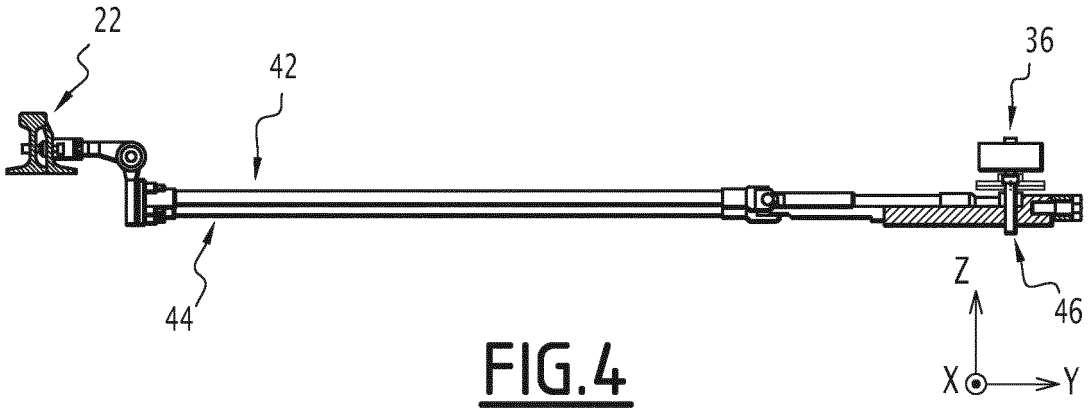

FIG.4

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns an apparatus for operating a switch of a railway track. The present invention also concerns associated second unit, kit, switch and method.

BACKGROUND OF THE INVENTION

[0002] Prior art railroad switches are basically provided in two designs, known as trailable and non-trailable switches.

[0003] The so-called trailable switches allow the switch points to be displaced from the predefined operating position, when a train coming in the direction opposite the deviation caused by the switch finds the turnout with the switch points in the improper position. In this case, the wheels of the train act on the switch points and force the switch points from the predefined - improper - position to the proper position these switch points should have. In this case, the carrier means which are dynamically connected to the drive motor are dynamically coupled to the switch point displacing drive means - typically rods or ties - by means of elastic coupling elements which, when a displacement force is exerted on the switch points that exceeds a predetermined value, releases the drive means from the carrier means, typically a carriage which is slid by a motor thanks to the action of irreversible drives, such as feed screw drives or the like. Hence, in this case, the switch points are released from the irreversible displacing mechanism acting thereon and may be displaced by the train wheels to a position differing from their former improper position.

[0004] In the so-called non-trailable switches, the switch point displacing drive means are locked in the different operating positions by substantially rigid means, which are operated when the switch points reach their respective operating positions. As a rule, the locking means consist of removable stops, such as pins, studs or bosses which are associated to stationary parts of the switch machine, for instance to its enclosure, and cooperate with appropriately positioned stops, associated to mechanical parts of the switch point displacement drive, particularly to the switch point displacing drive means. In the above conditions, when a train passes in the direction opposite the diverting direction and the switch points are in the wrong position, the switch points do not fail under the action of the train wheels unless a stress causes the failure of some mechanical elements of the displacing drive chain from the motor to the switch points.

[0005] In order to provide a single switch machine to be applied with both "trailability" and "non-trailability" functions, the provision of mechanical latches to be removably inserted between the drive means connected to the switch points and the stationary elements of the switch machine is known. In this case, when a trailing condition occurs, there is no way to determine which elements of the kinematic chain for displacing the switch points is damaged. This is a drawback, as the personnel charged of restoring the functionality of the switch machine cannot presume which type of maintenance intervention will have to be effected. Moreover, the damaged means are typically more complex, hence more expensive and difficult to replace. This obviously is a cause for higher costs and longer repair times.

BRIEF SUMMARY OF THE INVENTION

[0006] It is the object of the invention to alleviate at least some of the above disadvantages and provide an improved apparatus for operating a switch of a railway track.

[0007] To this end, the present specification describes an apparatus for operating a switch of a railway track, the switch comprising blades and the apparatus comprising an assembly for displacing the blades and a locking device adapted to lock the blades, the locking device comprising a first unit and a second unit, the second unit being separable from the first unit and comprising a fuse element.

[0008] According to further aspects of this apparatus which are advantageous but not compulsory, the apparatus for operating might incorporate one or several of the following features, taken in any technically admissible combination:

- the first unit is part of the assembly.
- the second unit is removable from the apparatus.
- the fuse element is adapted to be broken in case of a train exerting a force on the blade, the force being superior to a given threshold.
- the fuse element is a breakable pin.
- the assembly comprises the motor, a transmitting device, a transforming device, a coupling device and a detecting device.

[0009] The specification also describes a second unit adapted for an apparatus as previously described.

[0010] The specification also relates to a kit comprising an apparatus as previously described and a plurality of second units as previously described.

[0011] The specification also relates to a switch of a railway track comprises an apparatus for operating a switch, the apparatus being as previously described.

[0012] The specification also relates to a method for repairing an apparatus for operating a switch of a railway track, the switch comprising blades and the apparatus comprising an assembly for displacing the blades and a locking device adapted to lock the blades, the locking device comprising a first unit and a second unit, the second unit being separable from the first unit and comprising a fuse element. The method comprises replacing the second unit of the apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The invention will be better understood on the basis of the following description which is given in correspondence with the annexed figures and as an illustrative example, without restricting the object of the invention. In the annexed figures:

- figure 1 shows schematically a railway line segment comprising a switch,
- figure 2 shows a part of the railway line segment including the switch machine,
- figures 3 to 8 shows parts of the switch machine, and
- figures 9 to 11 show the switch machine in three different configurations of use.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

[0014] A railway line segment 10 seen from above is represented on figure 1.

[0015] The railway line segment 10 comprises a main branch 12, two auxiliary branches 14 and 16, a switch 18 and an apparatus 20 for operating the switch 18.

[0016] The switch 18 enables to determine the track followed by a train, either the main branch 12 and the first auxiliary branch 16 or the main branch 12 and the second auxiliary branch 16.

[0017] A switch 18 is a mechanical installation enabling railway trains to be guided from one track to another, such as at a railway junction or where a spur or siding branches off.

[0018] The switch 18 consists of the pair of linked tapering rails, known as points (switch rails or point blades), lying between the diverging outer rails (the stock rails). These points can be moved laterally into one of two positions to direct a train coming from the point blades toward the straight path or the diverging path. A train moving from the narrow end toward the point blades (i.e. it will be directed to one of the two paths depending on the position of the points) is said to be executing a facing-point movement.

[0019] Unless the switch 18 is locked, a train coming from either of the converging directs will pass through the points onto the narrow end, regardless of the position of the points, as the vehicle's wheels will force the points to move. Passage through a switch 18 in this direction is known as a trailing-point movement.

[0020] A switch 18 generally has a straight "through" track (such as the main-line) and a diverging route. The handedness of the installation is described by the side that the diverging track leaves. Right-hand switches have a diverging path to the right of the straight track, when coming from the point blades, and a left-handed switch has the diverging track leaving to the opposite side.

[0021] A straight track is not always present, for example, both tracks may curve, one to the left and one to the right (such as for a wye switch 18), or both tracks may curve, with differing radii, while still in the same direction.

[0022] In other words, the switch 18 is adapted to move the points from a starting thrown position to the opposing thrown position.

[0023] For the remainder of the specification, the track followed by the train corresponds to the displacement direction, labeled X on figure 1.

[0024] The transverse direction is the direction which is perpendicular to the displacement direction X and which is in the plane of the railway line segment 10. This transverse direction is labeled Y on figure 1.

[0025] The vertical direction, labeled Z on figure 1, is perpendicular to the displacement direction X and to the transverse direction Y. When a movement along the vertical direction Z enables to be farther from the ground, this movement is orientated upwards while when a movement along the vertical direction Z enables to be closer to the ground, this movement is orientated downwards.

[0026] So as to ensure that a train follows the right track, the switch 18 is adapted to displace blades 22 from a first position to a second position. In the first position, the train follows the main branch 12 and the first auxiliary branch 14 while in the second position, the train follows the main branch 12 and the second auxiliary branch 16.

[0027] The displacement of the blades 22 is carried out along the transverse direction Y.

[0028] In other words, the blades 22 are so displaced from one to the other in both position, the first position being such that one blade 22 strikes against one rail and the other is at a distance from the adjacent rail and the opposite for the second position.

[0029] Both position are usually named closed position and reverse position.

[0030] The apparatus 20 is adapted to operate the switch 18.

[0031] The apparatus 20 is often named a "switch machine". This wording will be used in the remainder of the specification.

[0032] The switch machine 20 comprises a casing 24, a motor 26, a transmitting device 28, a transforming device 30, a coupling device, a detecting device and a locking device 36.

[0033] The casing 24, also named box, comprises several walls 38 which delimitate an inner space 40.

[0034] The locking device 36 is partly integrated in the inner space 40.

[0035] The transmitting device 28 and the coupling device are outside of the casing 24 while the transforming device 30 and the detecting device are inside the casing 24.

[0036] The motor 26 is an actuating motor adapted to produce a motion.

[0037] Usually, the motor 26 is producing a rotational motion.

[0038] As an example, the motor 26 is a three-phase asynchronous motor.

[0039] The transmitting device 28 and the transforming device 30 cooperate so as to ensure that the motion produced by the motor 26 be converted in a rectilinear mo-

tion.

[0040] In other words, the transmitting and transforming devices 28 and 30 are adapted to convert the rotation motion of the motor 26 in a linear motion and to convey the linear motion towards the blades 22.

[0041] According to the specific embodiment described, the transmitting device 28 and the transforming device 30 are switching rods 42.

[0042] In the illustrated example, there are two switching rods 42.

[0043] However, in another embodiment, the transmitting device 28 and the transforming device 30 are more than two switching rods 42.

[0044] Each switching rod 42 is connected to a respective blade 22 for transmitting the displacement stroke to the blade 22.

[0045] In addition, each switching rod 42 extends along the transverse direction Y.

[0046] The coupling device is adapted to couple both transmitting device 28 and transforming device 30 to the points.

[0047] The points are, for instance, bars or tie or combinations of bars and tie rods.

[0048] The coupling device is dynamically connected to the output of both transmitting device 28 and transforming device 30 on one side and to the corresponding switch point on the other side.

[0049] The detecting device is adapted to detect the position of the blade 22.

[0050] The detecting device comprises several detection rods 44 and a key 46.

[0051] The blades 22 are connected to the detection rods 44.

[0052] Each detection rod 44 is adapted to transmit the displacement stroke.

[0053] Each detection rod 44 extends along the transverse direction Y.

[0054] Each detection rod 44 comprises at its end a shaped surface 48 with slots or indentions 50.

[0055] Furthermore, as illustrated, the detection rods 44 mechanically connect the blades 22 with the locking device 36.

[0056] The key 46 has the form of a cursor with a tooth 52.

[0057] The key 46 is adapted to cooperate with a respective slot or indention 50 of one of the detection rod 44 via the tooth 52.

[0058] This cooperation is such that the key 46 can be displaced between an engaged position and a disengaged position.

[0059] In the engaged position, the key 46 is engaged in the slot or indention 50.

[0060] In the disengaged position, the key 46 is disengaged from the slot or indention 50.

[0061] The key 46 is further adapted to be displaced along the displacement direction Y.

[0062] The key 46 is a sliding key.

[0063] The key 46 is displaced from one to the other of the said two positions by the driving actuators through a mechanical link such as a cam provided on one or both switching rods 42 and cooperating with a complementary cam surface on the key 46.

[0064] The locking device 36 is adapted to lock the point in the thrown position. The locking device 36 is automatically releasable when the device is actuated to move the points from a starting thrown position to the opposing thrown position.

[0065] Typically, locking device 36 is driven into the released condition by the translational motion of the coupling device.

[0066] The locking device 36 is known in the special railroad jargon as "switch point locks".

[0067] In other words, the locking device 36 is a blade 22 locking mechanism for blocking the blades 22 in one of the two positions described before.

[0068] The locking device 36 comprises a lever 54, a pusher 56, an axial guide 58, a slider 60, a pin 62, a breakable pin 64, the electric contacts 66 and the spring 68.

[0069] Breakable pin 64 can notably be seen in figures 6 and 7. The electric contacts 66 are notably represented on figure 8.

[0070] The lever 54 is a driving lever.

[0071] The lever 54 comprises a lever pin 70 and a slot 72.

[0072] The lever pin 70 is mounted rotatably around an axis passing through an intermediate point between two ends of the said lever pin 70.

[0073] The opposite free end of the lever pin 70 is intended for cooperating with the pusher 56.

[0074] The axial guide 58 is delimitated by a wall.

[0075] The pin 62 is a retaining pin. This notably means that this is an element of a key retaining mechanism.

[0076] The key 46 is subjected to the key retaining mechanism which prevents the key 46 from being able to be displaced by means of the pin 62.

[0077] The pin 62 is formed by two parts which are a lower pin 82 and upper pin 84.

[0078] The pin 62 extends along the vertical direction Z.

[0079] The pin 62 is oriented perpendicularly to the slider 60 and perpendicularly to a face of the key 46.

[0080] The lower pin 82 is mounted in the slider 60

[0081] The upper pin 84 is mounted in the axial guide 58.

[0082] The lower pin 82 and the upper pin 84 are connected together outside the slider 60 by a breakable pin 64.

[0083] The upper pin 84 has a distal end which is opposite to the lower pin 82.

[0084] The upper pin 84 part bears in a laterally cantilevered position a cam 86 driving two counterposed electrical contacts.

[0085] The electrical contacts are adapted to be commutated by the cam 86 during axial displacement of the pin 62.

[0086] The electric contacts 66 are adapted for generating control signal for signaling the condition of locked or unlocked blades 22.

[0087] The upper pin 84 also bears at least one lateral element which engages the slot 72 at one end of the lever pin 70.

[0088] The lateral element is, for instance, a radial lateral pin.

[0089] Alternatively, the lateral element is two lateral radial and diametric opposite pins.

[0090] The spring 68 is provided between the end of the upper pin 84 and wall of the axial guide 58.

[0091] The spring 68 is adapted to urge the upper pin 84 and the lower pin 82 against a face of the key 46.

[0092] The elements of the locking device 36 are shared between a first unit 90 and a second unit 92.

[0093] The first unit 90 is in in the inner space 40 of the casing 24.

[0094] The second unit 92 is a separate unit.

[0095] The second unit 92 can be dismounted from the casing 24.

[0096] The second unit 92 comprises at least a mechanical fuse 94, a mechanical link 96 and the electric contacts 66.

[0097] This fuse is a structurally weakened retainer pin 62 or other kind of mechanical link 96 between the mechanical elements of the locking mechanism of the blade 22 which are broken in case of a trailing event by the force exerted on the blade 22.

[0098] In the current case, the fuse is a breakable pin 64.

[0099] The mechanical link 96 is a link to the actuators for controlling activation and deactivation.

[0100] The mechanical link 96 of the locking device 36 comprises only a transmission by contact of a pusher 56 driven by the actuator chain with a lever 54 of the locking mechanism, which causes the locking device 36 to be commutated in the active or inactive condition.

[0101] Thus, in the current case, the mechanical link 96 is a lever 54 and a pusher 56 Lever 54 and pusher 56 have a predefined spatial relative position which allows the pusher 56 to act by contact on the lever 54 for activating/deactivating the locking means.

[0102] When the mechanical fuse 94 is broken, the lever 54 is displaced in a position in which it does not anymore cooperate with the pusher 56 and at the same time a first control signal is emitted. So if a trailing has occurred the control on the switch 18 is irreversibly lost and an intervention on site is requested. The first control signal corresponds to the unlocked state.

[0103] More precisely, in the illustrated example, the second unit 92 of the locking device 36 comprises the lever 54, the pusher 56, the axial guide 58, the slider 60, the upper pin 84, the breakable pin 64, the electric contacts 66 and the spring 68.

[0104] The first unit 90 comprises the lower pin 82.

[0105] Operating of the switching machine 20 is now described in reference to figures 9 to 11 which illustrates three operating condition of the switching machine 20.

[0106] Figure 9 illustrates the operating condition during displacement of the blades 22. The pusher 56 acts on the lever 54. This results in a displacement of the pin 62 against the spring 68.

[0107] The key 46 is then free to slide towards the disengaged position.

[0108] The lower pin 82 is driven outside the upper slot 72 in the key 46.

[0109] The cam 86 commutates the electric contact in a position generating a second control signal corresponding to the locked state.

[0110] Figure 10 illustrates the operating condition when the displacement stroke has ended.

[0111] The pusher 56 is displaced back and the lever 54 lowers so that the pin 62 comes to a position in which the lower pin 82 part engages the slot 72 in the key 46.

[0112] The key 46 is then prevented from sliding and the detection rod 44 is also locked.

[0113] By reference to figure 11, when a trailing action occurs on the blades 22, the force exerted is transmitted through the rods to the key 46 and to the lower pin 82. By sufficient force intensity the breaking pin 62 brakes and the lower pin 82 can freely be displaced by the blades 22, while the upper pin 84 is pushed down by the spring 68 in a condition in which it forms a lateral stop for the lower pin 82.

[0114] The cam 86 reaches a position in which the first control signal is emitted.

[0115] The lever 54 is driven upwardly by the upper pin 84 in a spatial position in which the lever 54 cannot anymore cooperate with the pusher 56. The control of the contact is irreversibly lost.

[0116] In other words, the mechanical fuse 94, which is broken by a mechanical action exercised on the blades 22 during a trailing event, when the force exercised on the blade 22 exceeds a certain value. As a result of the breaking of the mechanical fuse 94, which is a weakened point or element of a mechanical locking mechanism, the blades 22 are free to travel from to the other position and the electric contacts 66 are irreversibly commutated for generating the unlocked control signal.

[0117] In such case, the second unit 92 can be separated from the switch 18 machine and substituted by another one.

[0118] Indeed, only the components of the second unit 92 are affected by the trailing event.

[0119] Such configuration of the locking device in two units 90 and 92 enables to recover of the operation of the apparatus 20 in a very rapid way.

[0120] In addition, the reconditioning of the second unit 92 by providing an integer mechanical fuse 94 can be carried out on a remote site.

[0121] Furthermore, the apparatus 20 has three operating configuration which enables to detect that the second unit 92 is to be replaced in an easier way with comparison with the prior art. Indeed, the detecting that the second unit 92 should be replaced is carried out in a

manual way in the prior art.

Claims

1. An apparatus (20) for operating a switch (18) of a railway track, the switch (18) comprising blades (22) and the apparatus (20) comprising:

   - an assembly for displacing the blades (22),
   - a locking device (36) adapted to lock the blades (22), the locking device (36) comprising a first unit (90) and a second unit (92), the second unit (92) being separable from the first unit (90) and comprising a fuse element (94).

2. The apparatus according to claim 1, wherein the first unit (90) is part of the assembly.

3. The apparatus according to claim 1 or 2, wherein the second unit (92) is removable from the apparatus (20).

4. The apparatus according to any one of claims 1 to 3, wherein the fuse element (94) is adapted to be broken in case of a train exerting a force on the blade (22), the force being superior to a given threshold.

5. The apparatus according to any one of claims 1 to 4, wherein the fuse element (94) is a breakable pin (64).

6. The apparatus according to any one of claims 1 to 5, wherein the assembly comprises the motor (26), a transmitting device (28), a transforming device (30), a coupling device and a detecting device.

7. A second unit (92) adapted for an apparatus (20) according to any one of claims 1 to 6.

8. A kit comprising an apparatus (20) according to any one of claims 1 to 6 and a plurality of second units (92) according to claim 7.

9. A switch (18) of a railway track comprises an apparatus (20) for operating a switch (18), the apparatus (20) being according to any one of the claims 1 to 6.

10. A method for repairing an apparatus (20) for operating a switch (18) of a railway track, the switch (18) comprising blades (22) and the apparatus (20) comprising:

    - an assembly for displacing the blades (22),
    - a locking device (36) adapted to lock the blades (22), the locking device (36) comprising a first unit (90) and a second unit (92), the second unit (92) being separable from the first unit (90) and comprising a fuse element (94), the method comprising:
    - replacing the second unit (92) of the apparatus (20).

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

1. An apparatus (20) for operating a switch (18) of a railway track, the switch (18) comprising blades (22) and the apparatus (20) comprising:

   - an assembly for displacing the blades (22),
   - a locking device (36) adapted to lock the blades (22), the locking device (36) comprising a first unit (90) and a second unit (92), the second unit (92) being separable from the first unit (90) and comprising a fuse element (94), and the second unit (92) being removable from the apparatus (20).

2. The apparatus according to claim 1, wherein the first unit (90) is part of the assembly.

3. The apparatus according to claim 1 or 2, wherein the fuse element (94) is adapted to be broken in case of a train exerting a force on the blade (22), the force being superior to a given threshold.

4. The apparatus according to any one of claims 1 to 3, wherein the fuse element (94) is a breakable pin (64).

5. The apparatus according to any one of claims 1 to 4, wherein the assembly comprises the motor (26), a transmitting device (28), a transforming device (30), a coupling device and a detecting device.

6. A second unit (92) adapted for an apparatus (20) according to any one of claims 1 to 5.

7. A kit comprising an apparatus (20) according to any one of claims 1 to 5 and a plurality of second units (92) according to claim 6.

8. A switch (18) of a railway track comprises an apparatus (20) for operating a switch (18), the apparatus (20) being according to any one of the claims 1 to 5.

9. A method for repairing an apparatus (20) for operating a switch (18) of a railway track, the switch (18) comprising blades (22) and the apparatus (20) comprising:

   - an assembly for displacing the blades (22),
   - a locking device (36) adapted to lock the blades (22), the locking device (36) comprising a first

unit (90) and a second unit (92), the second unit (92) being separable from the first unit (90) and comprising a fuse element (94), and the second unit (92) being removable from the apparatus (20), the method comprising:

- replacing the second unit (92) of the apparatus (20).

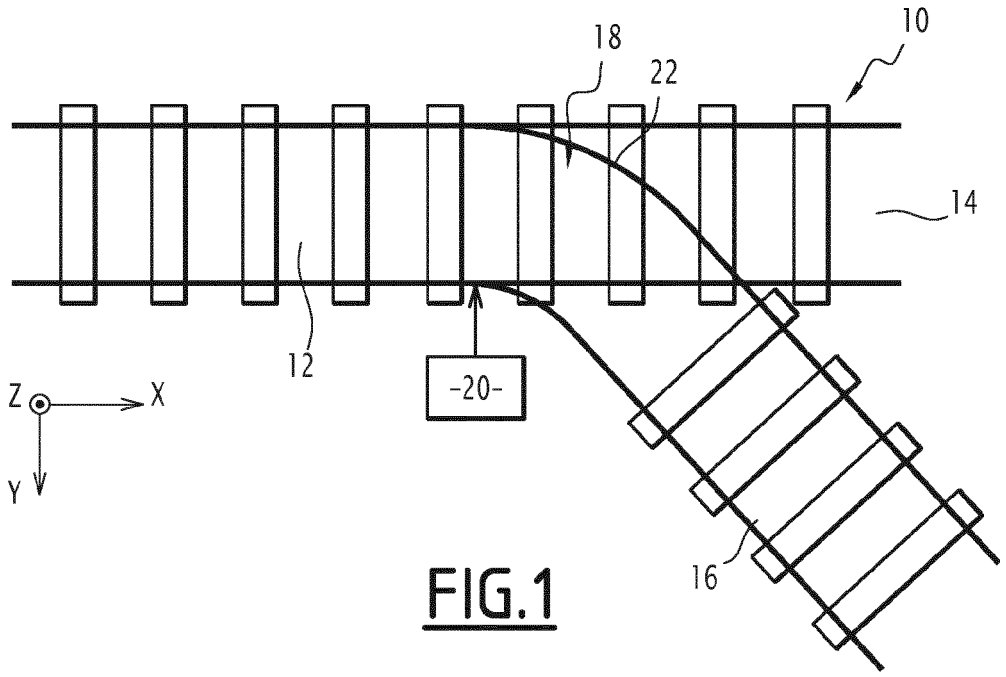

FIG.1

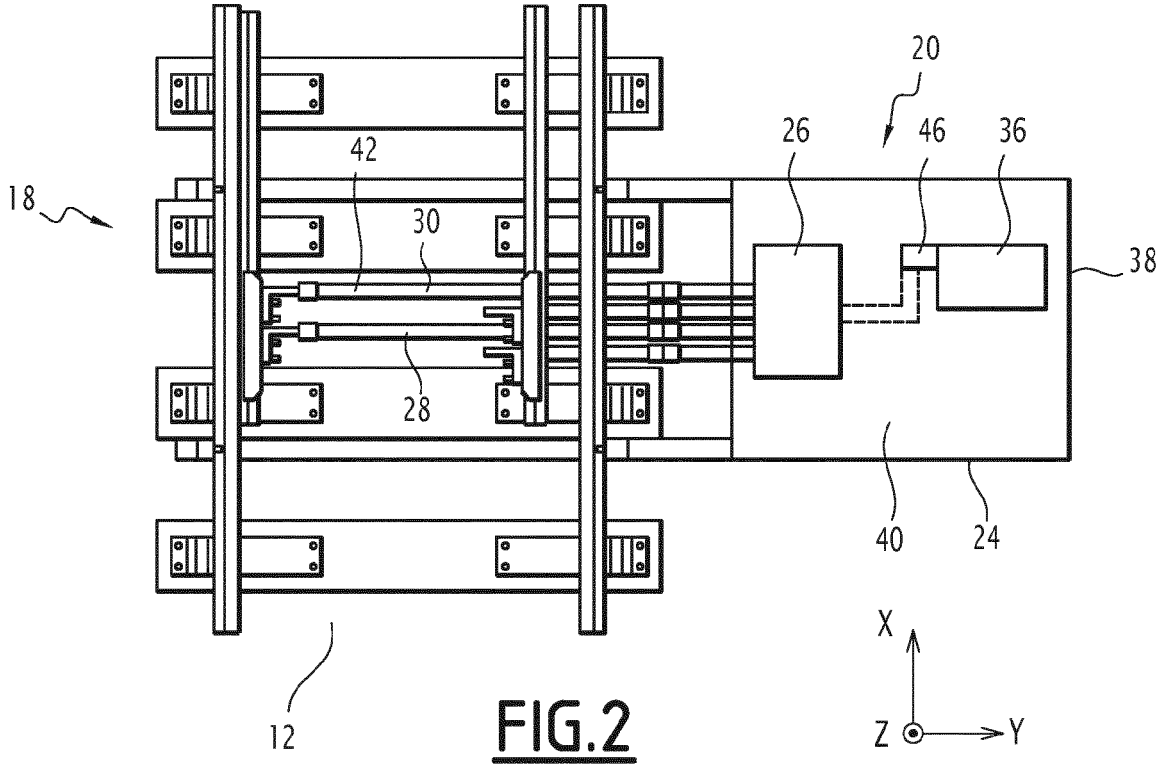

FIG.2

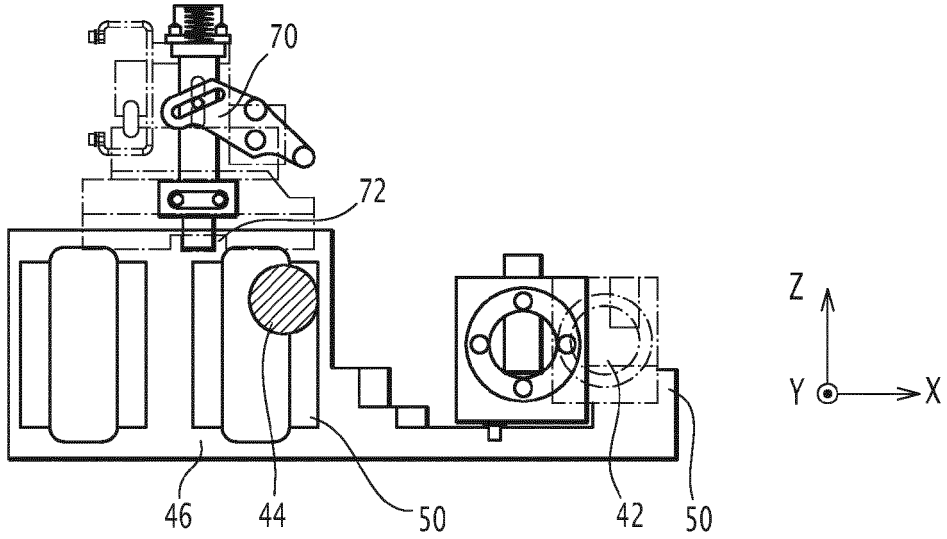

FIG.3

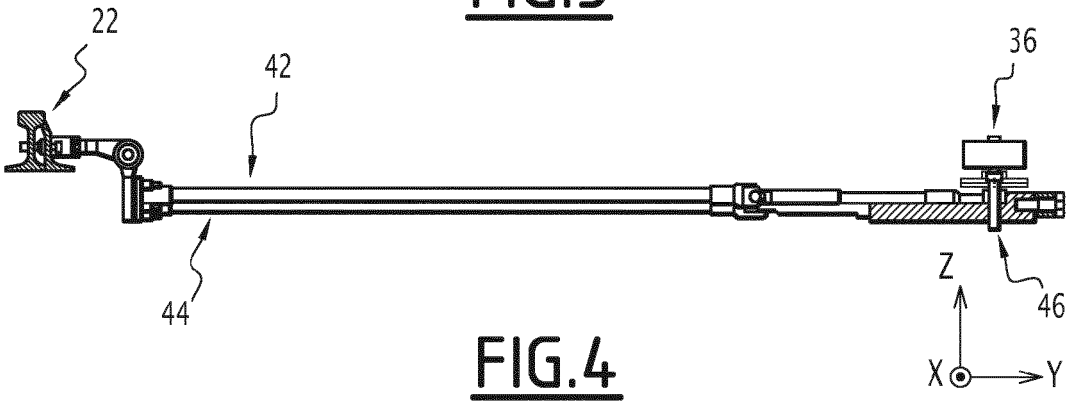

FIG.4

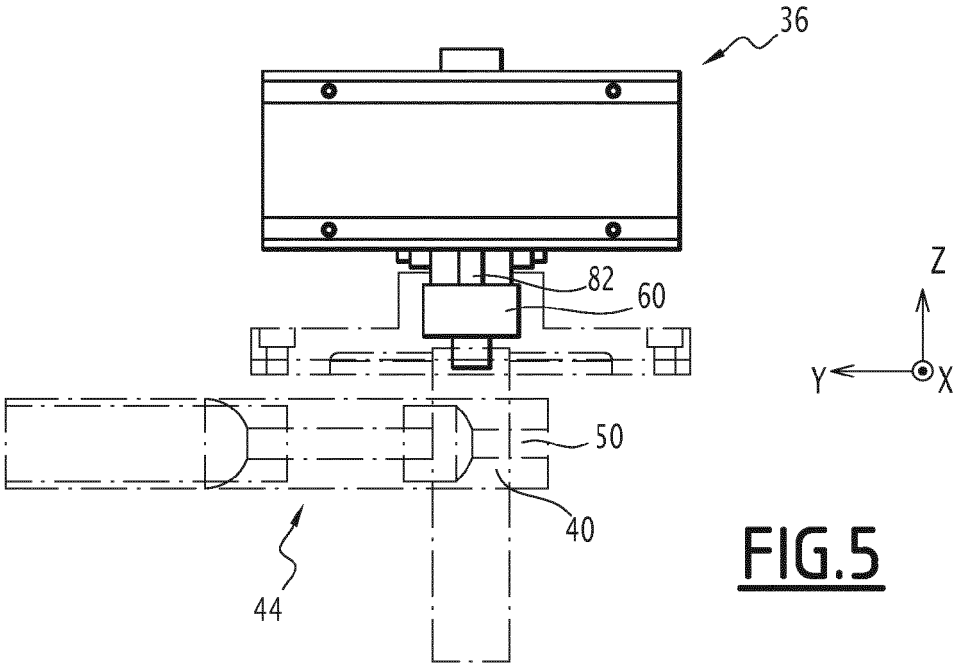

FIG.5

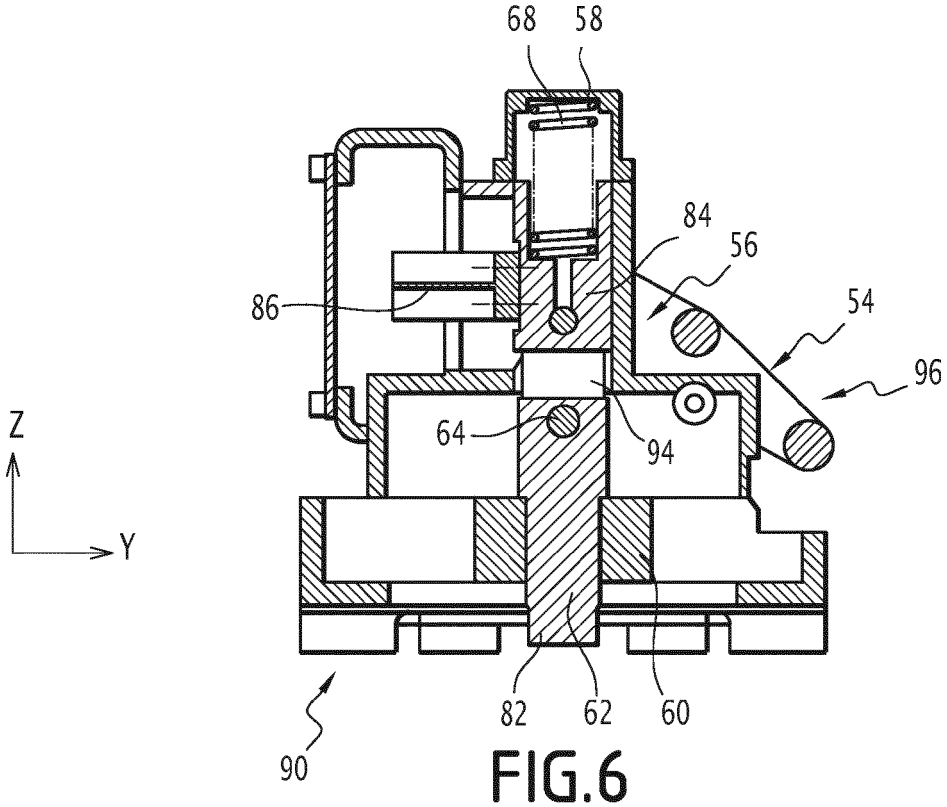

FIG.6

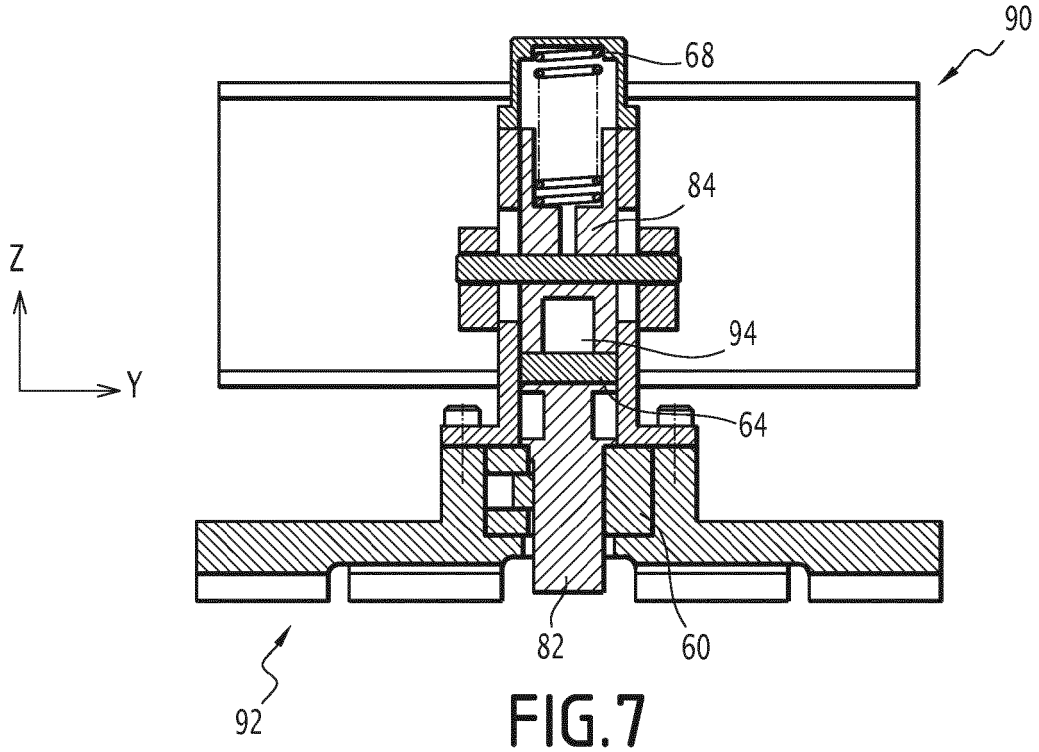

FIG.7

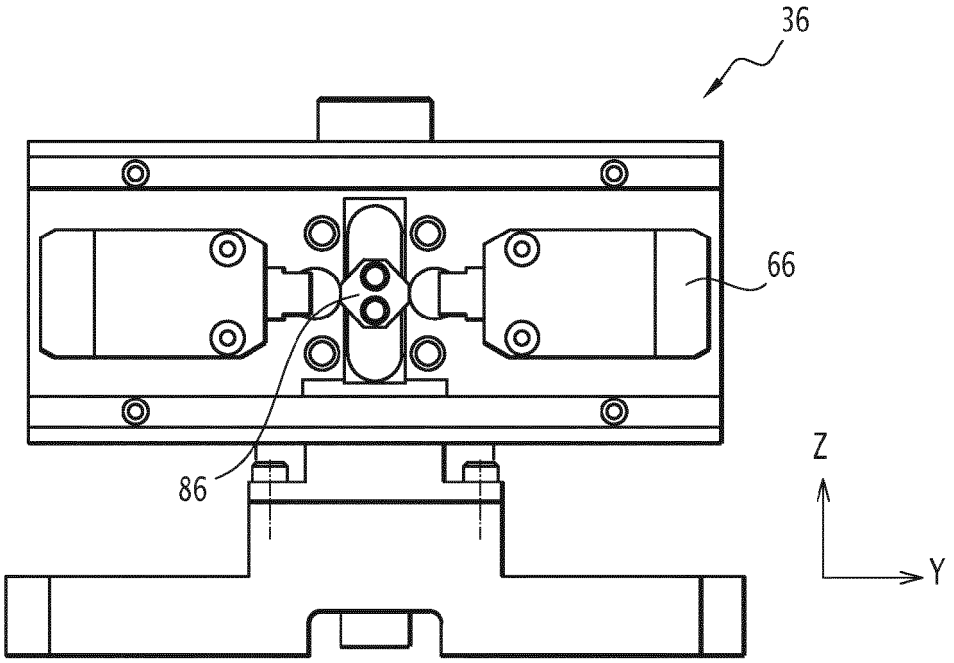

FIG.8

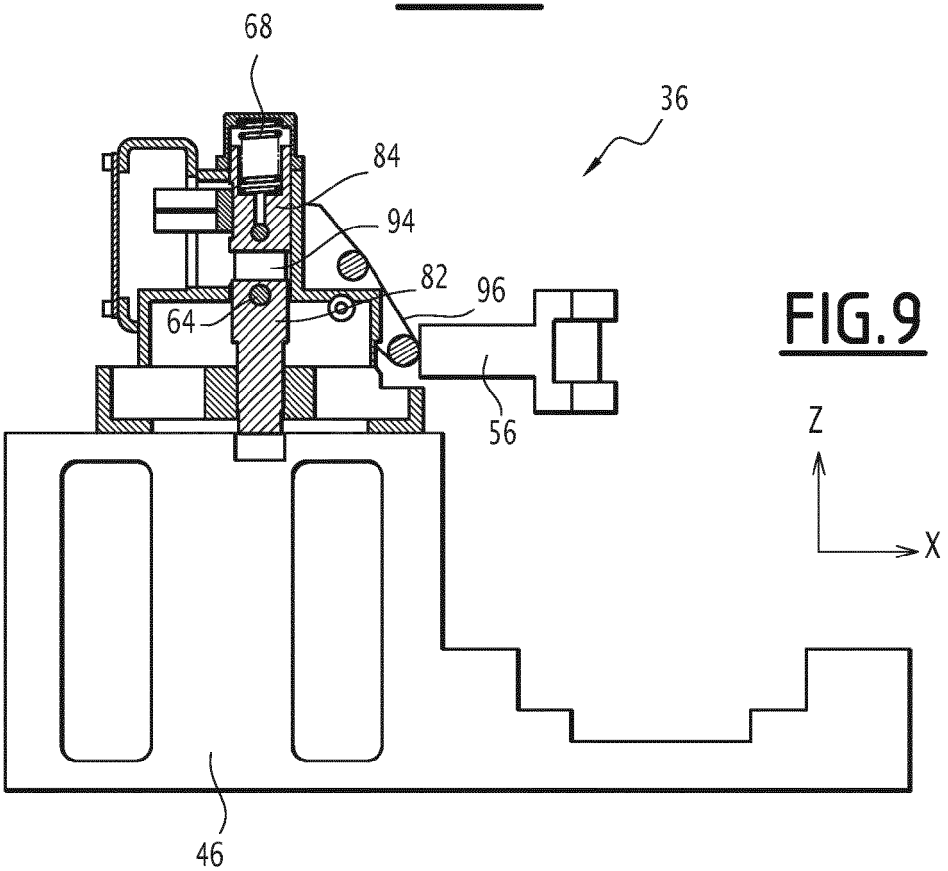

FIG.9

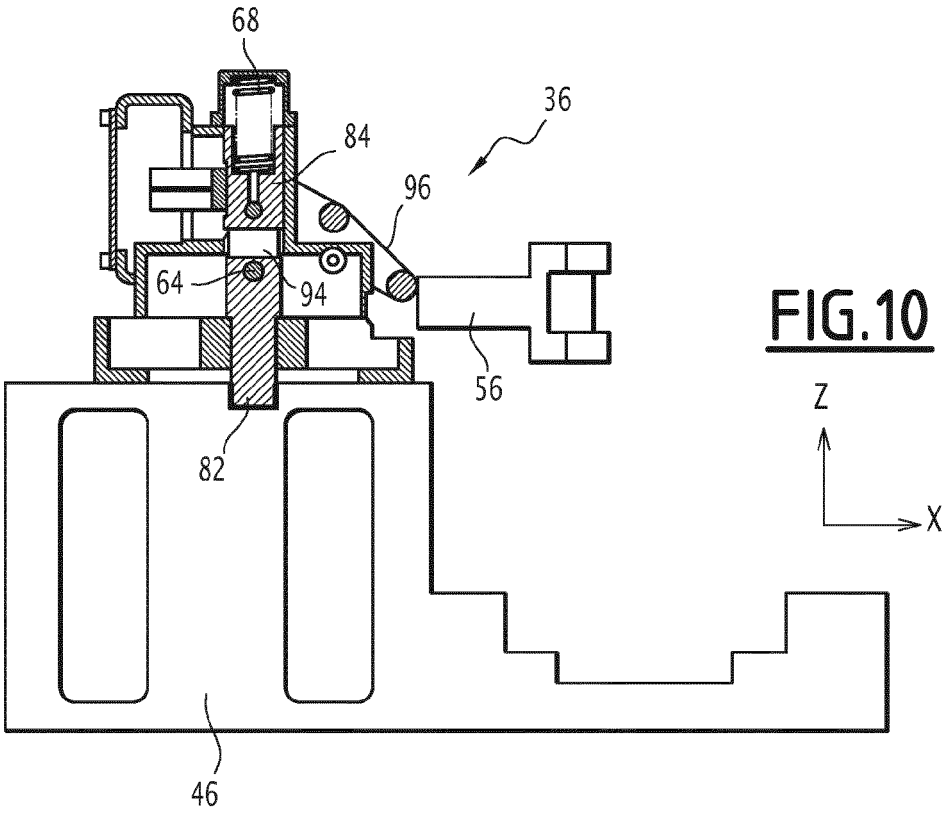

FIG.10

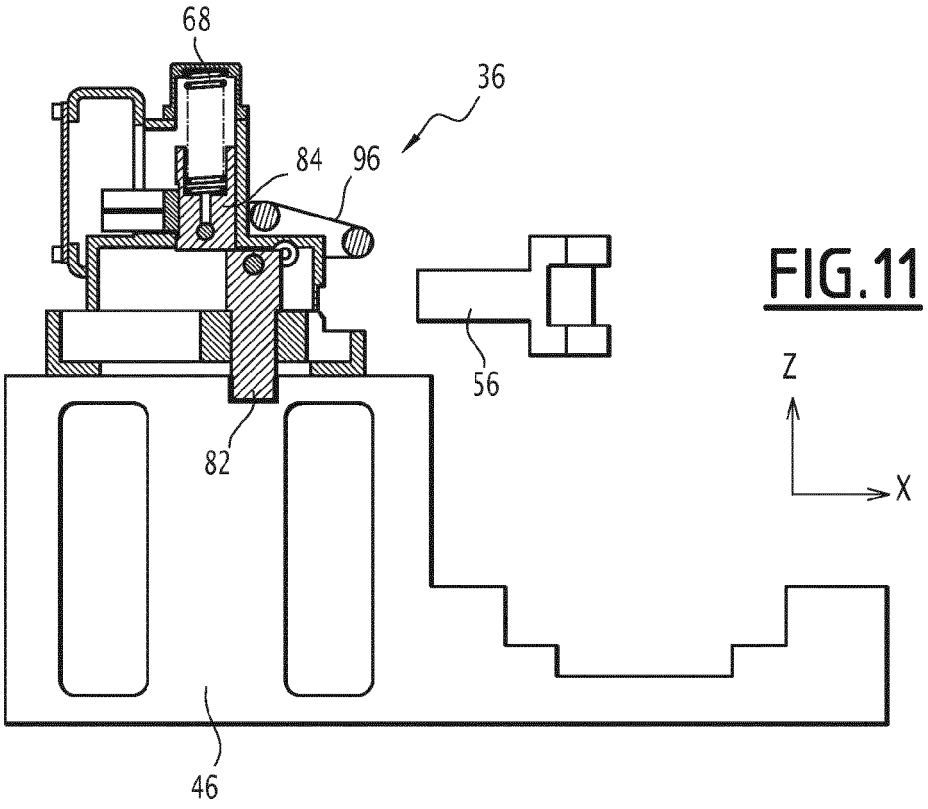

FIG.11

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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 6911

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	EP 0 457 754 A2 (ALCATEL AUSTRIA AG [AT]) 21 November 1991 (1991-11-21) * column 1, line 1 - line 9 * * column 2, line 35 - column 3, line 11 * * figures 1-4 * -----	1-4,6-10 5	INV. B61L5/10
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 March 2016	Janhsen, Axel

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X : particularly relevant if taken alone
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