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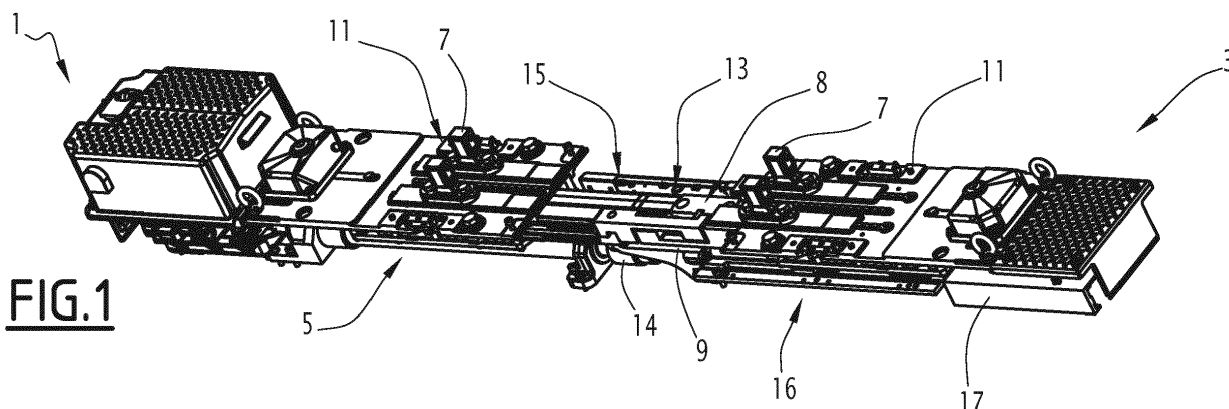
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(54) **TRAILING MODULE FOR A SWITCH MACHINE AND SWITCH MACHINE**

(57) The present invention relates to a trailing module for a switch machine (1) of a railway switch having two blades connected to a driving bar (8), the switch machine comprising a linear actuator (5) adapted to linearly move between a first position and the second position, the trailing module (16) comprising: a first member (19, 21), and a second member (19, 21), wherein the first member (19, 21) being movably connected to the second member (19, 21) via at least one trailing mechanism (30a, 30b), each trailing mechanism comprising at least one linear sliding area (34a, 34b) at the first member, a biasing device (40a, 40b) arranged between the second member (19, 21) and

an intermediate member (42a, 42b) adapted to push the intermediate member (42a, 42b) away from the second member in a trailing direction (32a, 32b) in parallel to the movement direction of the linear actuator (5), wherein the intermediate member comprises at least one slider (46a, 46b) adapted to slide on the sliding area and which is biased against the sliding area (34a, 34b), wherein the sliding area has a first portion (36a, 36b) with a first distance (d1) and a second portion (38a, 38b) with a second distance with respect to the second member (19, 21), wherein the second distance (d2) is closer to the second member than the first distance (d1).



Description

[0001] The present invention relates to a trailing module for a switch machine of a railway switch.

[0002] Further, the present invention concerns a switch machine for a railway switch.

[0003] WO 2004/074066 A1 relates to a switch machine for a railway switch. The switch machine is modular. However, the architecture does not allow for the addition of new modules at a later time.

[0004] Object of the invention is to provide a trailing module and a switch machine, which allow an easy way to provide a trailing module into the switch machine.

[0005] According to one aspect, a trailing module for a switch machine of a railway switch having two blades connected to a driving bar is provided, the switch machine comprising a linear actuator adapted to linearly move between a first position and the second position, the trailing module comprising: a first member, and a second member, wherein the first member being movably connected to the second member via at least one trailing mechanism, each trailing mechanism comprising at least one linear sliding area at the first member, a biasing device arranged between the second member and an intermediate member adapted to push the intermediate member away from the second member in a trailing direction in parallel to the movement direction of the linear actuator, wherein the intermediate member comprises at least one slider adapted to slide on the sliding area and which is biased against the sliding area, wherein the sliding area has a first portion with a first distance and a second portion with a second distance with respect to the second member, wherein the second distance is closer to the second member than the first distance, wherein the trailing mechanism has as first operation mode and a second operation mode, wherein in the first operation mode, the slider is engaged in the first portion of the sliding area, and in the second operation mode, when the second member is moved with respect to the first member in the trailing direction a predetermined distance, the slider is disengaged from the first portion of the sliding area and slides on the second portion of the sliding area, wherein a first one of the first member and the second member being adapted to be rigidly connected to the linear actuator, and a second one of the first member and the second member being adapted to be connected to the driving bar..

[0006] Further embodiments may relate to one or more of the following features, which may be combined in any technical feasible combination:

- the second portion is disposed after the first portion in the trailing direction;
- each linear sliding area extends in trailing direction;
- the first member is arranged inside the second member;
- the intermediate member comprises a second biasing device, for example a spring, to press the slider

against the sliding area;

- the slider is rotatably fixed to the intermediate member; and/or
- the trailing module comprises two trailing mechanisms having opposite trailing directions.

[0007] According to another aspect, a switch machine is provided for a railway switch a railway switch having two blades connected to a driving bar, the switch machine comprising: a driving chain adapted to displacing the driving bar of the switch between two positions, wherein the driving chain comprises a linear actuator adapted to linearly move between a first position and a second position; and a housing adapted to receive a trailing module according to an embodiment disclosed herein, wherein the trailing module is adapted to be rigidly connected to the linear actuator and to the driving bar.

[0008] Further embodiments may relate to one or more of the following features, which may be combined in any technical feasible combination:

- the housing is further adapted to receive a stabilization module, wherein the stabilization module is rigidly connected to the linear actuator, wherein the stabilization module is adapted to releasably lock the linear actuator either in the first position or the second position.
- the stabilization module is adapted to be rigidly connected to the linear actuator via the trailing module; and/or
- the housing has the form of a railroad tie.

[0009] Further advantages, features, aspects and details are evident from the dependent claims, the description and the drawings.

[0010] So that the manner in which the above recited features of the present invention can be understood in detail, a more particular description of the invention, briefly summarized above, may be read by reference to embodiments. The accompanying drawings relate to embodiments of the invention and are described in the following:

Fig. 1 is a schematical perspective view of a switch machine;

Fig. 2 is a schematical perspective view of a switch machine

Fig. 3 shows a cross section through a trailing module; and

Fig. 4 shows a cross section through a stabilization module.

[0011] Figure 1 and 2 show a switch machine 1. The switch machine has housing 3 in the form and the dimensions of a railroad tie. For example, the housing 3 has the form of a channel. Thus, the switch machine 1 can be placed on the track like a tie. The switch machine 1 comprises a linear actuator 5 or motorized driving means

for displacing blades (not shown) of a switch between two opposite position. For example the blades of the switch may be rigidly connected to the connection devices 7 of a driving bar 8.

[0012] Further, the switch machine 1, in particular the driving bar 8 comprises a stroke limitation module 9. The stroke limitation module 9 is provided in a central part of the switch machine to enable a limited movement of one blade to the other, in order to avoid a destruction of locking modules 11. For example, the stroke limitation module 9 is provided for induced blade displacements due to mechanical stresses which are caused by a trailing action allowing compensate for displacements having limited strokes. When the switch machine 1 is subject to a trailing event, the open blade will be able to move without pulling the closed blade locking module.

[0013] Further, the switch machine 1 includes a driving shaft 13. The driving shaft 13 is driven by the linear actuator 5 and can be driven in a linear direction back and forth between a first position and a second position.

[0014] Trailing is called the possibility that a railway vehicle moves with its wheels the switch from one position to another position, for example if the train traverses the switch in a direction in which two tracks converge to one track. In other words, the wheels of the railway vehicle exercise a force on the blades by pushing the blades from a current position against the opposite rail.

[0015] In an embodiment, the driving bar 8 of the open and closed blade can be directly and rigidly connected, for example via a fix stroke module (not shown) in place of the stroke limitation module 9. In this case, the switch is not designed for trailing. In this non-trailable configuration the driving shaft 13 is connected to the linear actuator 5 through a fix element (not shown) and is linked to the blades and/or the driving bar 8 by means of hammers contained in the locking modules (not shown).

[0016] According to an embodiment, the interface of the driving shaft 13 and the linear actuator 5 are adapted to be connected to a trailing module 16 and/or a stabilization module 17 instead of being directly connected to each other. In this embodiment of the invention, the switch machine further comprises the trailing module 16 and/or the stabilization module 17. The trailing module 16 is rigidly connected to the driving shaft 13 and the linear actuator 5. According to an embodiment, the stabilization module 17 is also rigidly connected to the linear actuator 5, for example via the trailing module 16. For example the trailing module 16 may be mounted into the switch, in particular a driving chain of the switch comprising also the linear actuator 5, the driving shaft 13 and the driving bar 8, in case trailability is desired.

[0017] The trailing module 16 allows releasing or freeing the blades, the driving shaft 13 and the driving bar 8 from the remaining driving chain such as the linear actuator 5 to avoiding damages since the blades are free to be displaced.

[0018] Figure 3 shows a cross section through the trailing module 16. The trailing module comprises a first

member 19, which is arranged within a second member 21. The first member 19 and the second member 21 are movable with respect to each other, in a direction parallel to the stroke of the blades or the movement direction of the driving shaft 13 and/or the driving bar 8. In other words, the second member 21 may guide the relative movement of the first member 19. The first member 19 has a bar shape. The second member 21 has also an elongated shape.

[0019] The first member 19 is rigidly connected to the linear actuator 5. For example they are connected via a bolt or a screw connection.

[0020] The second member 21 is rigidly connected to the driving shaft 13, which is connected to driving bar 8 through the hammers (not shown) contained in the locking module. The driving bar 8 may include the stroke limitation module 9. According to an embodiment a first end 23 of the second member 21 extending in direction of the linear actuator 5 extends between the connection point 14 of the linear actuator 5 and the connection point 15 of the driving shaft 13. The first end 23 of the second member 21 is rigidly connected to the connection point 15 of the driving bar 8.

[0021] The first member 19 has a first end 25 and a second end 27 in the movement direction of the driving shaft 13. The first end 25 is rigidly connected to the connection point 14 of the linear actuator 5. The second end 27 is adapted to be connected to the stabilization module 17 as it will be explained later.

[0022] Thus, according to an embodiment, the first end 25 of the first member 19 is connected to the linear actuator 5 below the connection between the first end 23 of the second member 21 and the connection point 15 of the driving shaft 13.

[0023] The first member 19 and the second member are mechanically linked by at least one trailing mechanism 30a, 30b, which allows the first and/or second member 19, 21 free to move with respect to each other only if a predetermined force is exerted. The predetermined force corresponds to a predetermined distance the second member 21 is moved with respect to the first member 19 in a trailing direction being parallel to the movement direction of the driving shaft 13, the driving bar 8 and/or the linear actuator 5.

[0024] In the embodiment shown in Figure 3, two trailing mechanisms 30a, 30b are shown, each having a trailing direction in opposite directions. For example, the first trailing mechanism 30a has a trailing direction in direction of the arrow 32a and the second trailing mechanism 30b has a trailing direction in direction of the arrow 32b.

[0025] Each trailing mechanism 30a, 30b comprises a linear sliding area 34a, 34b on the first member 19. The linear sliding area extends in the trailing direction 32a, 32b. Each sliding area 34a, 34b has a first portion 36a, 36b with a first distance d1 and a second portion 38a, 38b with a second distance d2 with respect to the second member 21, wherein the second distance d2 is closer to the second member 21 than the first distance d1. For

example the first portion 36a, 36b of the sliding area may be realized as a groove. A step is arranged between the first portion 36a, 36b and the second portion 38a, 38b of the sliding area 34a, 34b. According to some embodiments, the first portion 36a, 36b of the sliding area 34a, 34b has a length in opposite direction of the trailing direction 32a, 32b corresponding to the length of the trailing movement of the respective other trailing mechanism 30a, 30b. For example the length of the first portion 36a of the sliding area 34a of the first trailing mechanism 30a corresponds to the maximal lengths of the trailing movement of the second trailing mechanism 30b and vice versa. In some embodiments, the first portion 36a, 36b of the sliding area 34a, 34b has substantially the same lengths in trailing direction 32a, 32b as the second portion 38a, 38b of the sliding area 34a, 34b.

[0026] According to some embodiments, the sliding area 34a of the first trailing mechanism 30a is arranged on the opposite side of the first member 19 with respect to the sliding area 34b of the second trailing mechanism 30b. For example, in figure 2, the sliding area 34a of the first trailing mechanism 30a is arranged on the upper side of the first member 19 and the sliding area 34b of the second trailing mechanism 30b is arranged on the lower side of the first member 19.

[0027] Further, the each trailing mechanism 30a, 30b includes a biasing device 40a, 40b, for example a first spring, in particular a helical spring, arranged between the second member 21 and the intermediate member 42a, 42b adapted to push the intermediate member 42a, 42b away from the second member 21 in a trailing direction 32a, 32b. For that purpose, the first member 19 includes for each biasing device 40a, 40b a supporting surface 44a, 44b in the trailing direction to support the respective biasing devices 40a, 40b.

[0028] In an embodiment, the biasing device 40a, 40b partially surrounds the first member 19.

[0029] The intermediate members 42a, 42b are adapted to move with respect to the first member 19 and the second member 21. For example, the intermediate members 42a, 42b may surround the first member 19 and/or are arranged within the second member 21, so that they can only perform a guided movement. In another embodiment, the intermediate members 42a, 42b may move in specifically arranged guides of the first and/or second member 19, 21.

[0030] Each intermediate member 42a, 42b comprises at least one slider 46a, 46b adapted to slide on the sliding area 34a, 34b and which is biased against the sliding area 34a, 34b. In an example, the slider 46a, 46b may be biased against the sliding area by a second spring (not shown). According to an embodiment, the slider 46a, 46b are movable in a direction orthogonal to the trailing direction. For example, in the drawings, the slider 46a, 46b are movable in a vertical direction. Thus, the slider 46a, 46b may either slide or engage the first portion 36a, 36b of the sliding area 34a, 34b, or the slider 46a, 46b may slide on the second portion 38a, 38b of the sliding

area 34a, 34b. The slider may have a slightly rounded surface for better moving over the step in the sliding area 34a, 34b.

[0031] In some embodiments, the predetermined force depends on the spring constants of first spring 40a, 40b and/or the second spring

[0032] Each trailing mechanism 30a, 30b has as first operation mode and a second operation mode. In the first operation mode, the slider is engaged in the first portion 36a, 36b of the sliding area 34a, 34b. In the first operation mode, the second member is prevented to move in the trailing direction 32a, 32b, beyond the step between the first portion 36a, 36b and the second portion 38a, 38b of the sliding area 34a, 34b. In particular as the force acting on the second member 21 in the sliding direction 32a, 32b is below the predetermined force. However, the biasing member 40a, 40b of one of the trailing mechanism may be already compressed so that the second member 21 already moves into the trailing direction 32a, 32b of one of the trailing mechanism.

[0033] In the second operation mode, when the second member 21 is moved with respect to the first member 19 in one of the trailing directions 32a, 32b more than a predetermined distance, the slider of one of the trailing mechanism is disengaged from the first portion 36a, 36b of the sliding area 34a, 34b by moving towards the second member 21 against the force of the second spring and slides on the second portion 38a, 38b of the sliding area 34a, 34b. For example, in case the first trailing mechanism 30 is used, the second member 21 is moved in the trailing direction. If the distance exceeds a predetermined distance and/or a force acting on the second member 21 in the trailing direction 32a exceeds a predetermined force, the slider 46a is not any more engaged by the step between the first and second portions 36a, 38a, but moves, in Figure 2, upwards towards the intermediate and the second member 21, 42a, so that it can slide on the second portion 38a. During this movement, the slider 46b of the second trailing mechanism 30b slides in the trailing direction 32a of the first trailing mechanism 30a within the first portion 36b of the sliding area 34b of the second trailing mechanism 30b.

[0034] Figure 4 shows schematically a cross section of the stabilization module 17. The stabilization module 17 has the task of avoiding that the trailing mechanism will be activated if a force lower than a certain value is exerted on the blades. Further, the stabilization module 17 defines two positions, in particular of the linear actuator 5, namely a first position and a second position. The two positions are stable if a certain force is not exceeded. For that purpose, the stabilization module has a housing 50 which may be fixed to the housing 3 of the switch machine 1 and a moving member 52, which is rigidly connected to the linear actuator 5. For example, the moving member 52 is rigidly connected to the first member 19 of the trailing module 16. The moving member 52 is guided within the housing 50 by the means of guides 56.

[0035] The housing is provided with at least two re-

cesses or notches 54 at two positions defining the first and second position. The moving member 52 is provided with at least, in particular two opposite rolls 58. Instead of rolls other sliding means 58 may be used. The rolls 58 are biased against the housing 50, for example with a third spring 60. For example the spring biases the two opposite rolls 58 against two opposite walls of the housing 50 and/or the guides 56. The recesses are provided in the lateral walls of the housing along which the rolls 58 moves. If the third biasing means or spring 60 pushes the rolls in the notches a non-permanent lock of the moving member 52 is obtained.

[0036] Force needed to unlock the moving member 52 from the recesses 54 is set in such a way that when the linear actuator 5 has enough power to overcome the stabilization force thus allowing the displacement of the moving member 52 and the driving of the blades.

[0037] In the case of a trailing action the force needed to overcome the link between first member 19 and the second member 21 of the trailing module 16 is not sufficient to unlock the moving member of the stabilizing module 17, too. Therefore the first member 19 does not move during a trailing action.

[0038] When mechanical stresses are transmitted to the blades determining small displacements and/or less mechanical forces on the driving organs the moving member 52 will not be unlocked. In this case the trailing module 16 compensates this small displacement and the first member 19 remains locked in the current end of stroke position corresponding to the current position of the blades.

[0039] The stabilization module compensates displacements of lesser stroke which the blades might suffer due to mechanical stresses not caused by a trailing action. This avoids that in this case the trailing module 16 is activated and the mechanical connection between blades and driving chain is lost.

[0040] According to the invention, a rigid connection is a connection wherein the connected parts do not move with respect to each other. For example a rigid connection is a screw connection, a soldered connection, or a bolt connection. In contrast, in a movable connection, the connected parts may move with respect to each other.

[0041] According to an embodiment, the driving bar 8 and the driving shaft 13 may be directly connected to each other for a non-trailable configuration even if the trailing module 15 is present in the housing, in case a trailing function is not needed in the railway switch. In other words, the trailing function may be dynamically enabled and disabled by short circuiting or adding modules in the driving chain of the switch. Thus, a user has not to decide from the very beginning which kind of switch machine he needs:ailable or nonailable and has the opportunity to carry out upgrade interventions for adding or eliminating such functions.

[0042] According to the invention mechanical interfaces are provided in the driving chain of the blades which allow insertion of optional units allowing the switch ma-

chine to be trailed.

[0043] The functions of providing secure end of stroke positions of the actuator and allowing compensation of minor stresses and the trailing function are divided on two simple modules which can be mounted at any time.

[0044] According to the invention it is possible to leave the choice open for the user to operate retrofitting actions on the switch box for implementing further functionalities due to the mounting in a second moment of modular units for carrying out the further functions.

[0045] For example, the dimensions of a tie are maintained, in particular in a way to comply with the prescribed security levels.

Claims

1. Trailing module (16) for a switch machine (1) of a railway switch having two blades connected to a driving bar (8), the switch machine comprising a linear actuator (5) adapted to linearly move between a first position and the second position, the trailing module (16) comprising:

a first member (19,21), and
a second member (19, 21), wherein
the first member (19, 21) being movably connected to the second member (19, 21) via at least one trailing mechanism (30a, 30b), each trailing mechanism comprising at least one linear sliding area (34a, 34b) at the first member, a biasing device (40a, 40b) arranged between the second member (19, 21) and an intermediate member (42a, 42b) adapted to push the intermediate member (42a, 42b) away from the second member in a trailing direction (32a, 32b) in parallel to the movement direction of the linear actuator (5), wherein the intermediate member comprises at least one slider (46a, 46b) adapted to slide on the sliding area and which is biased against the sliding area (34a, 34b), wherein the sliding area has a first portion (36a, 36b) with a first distance (d1) and a second portion (38a, 38b) with a second distance with respect to the second member (19, 21), wherein the second distance (d2) is closer to the second member than the first distance (d1), wherein the trailing mechanism (30a, 30b) has as first operation mode and a second operation mode, wherein in the first operation mode, the slider (46a, 46b) is engaged in the first portion of the sliding area, and in the second operation mode, when the second member (19, 21) is moved with respect to the first member in the trailing direction (32a, 32b) a predetermined distance, the slider is disengaged from the first portion of the sliding area and slides on the second portion (38a, 38b) of the sliding area, wherein a first one of the first

- member and the second member being adapted to be rigidly connected to the linear actuator (5), and a second one of the first member and the second member being adapted to be connected to the driving bar (8). 5
2. Trailing module according to claim 1, wherein the second portion (38a, 38b) is disposed after the first portion (36a, 36b) in the trailing direction. 10
3. Trailing module according to claim 1 or 2, wherein each linear sliding area extends in trailing direction (32a, 32b).
4. Trailing module according to one of the preceding claims, wherein the first member (19) is arranged inside the second member (21). 15
5. Trailing module according to one of the preceding claims, wherein the intermediate member comprises a second biasing device, for example a spring, to press the slider (46a, 46b) against the sliding area (34a, 34b). 20
6. Trailing module according to one of the preceding claims, wherein the slider is rotatably fixed to the intermediate member (42a, 42b). 25
7. Trailing module according to one of the preceding claims, comprising two trailing mechanisms (30a, 30b) having opposite trailing directions. 30
8. Switch machine (1) for a railway switch a railway switch having two blades connected to a driving bar (8), the switch machine comprising: 35
- a driving chain (5) adapted to displacing the driving bar (8) of the switch between two positions, wherein the driving chain (5) comprises a linear actuator (5) adapted to linearly move between a first position and a second position; and 40
- a housing (3) adapted to receive a trailing module (16) according to claim 1, wherein the trailing module is adapted to be rigidly connected to the linear actuator (5) and to the driving bar (8). 45
9. Switch machine for a railway switch according to claim 8, wherein the housing is further adapted to receive a stabilization module (17), wherein the stabilization module is rigidly connected to the linear actuator (5), wherein the stabilization module is adapted to releasably lock the linear actuator (5) either in the first position or the second position. 50
10. Switch machine according to claim 8 or 9, wherein the stabilization module (17) is adapted to be rigidly connected to the linear actuator (5) via the trailing module (16). 55
11. Switch machine according to one of the claims 8 to 10, wherein the housing (3) has the form of a railroad tie.

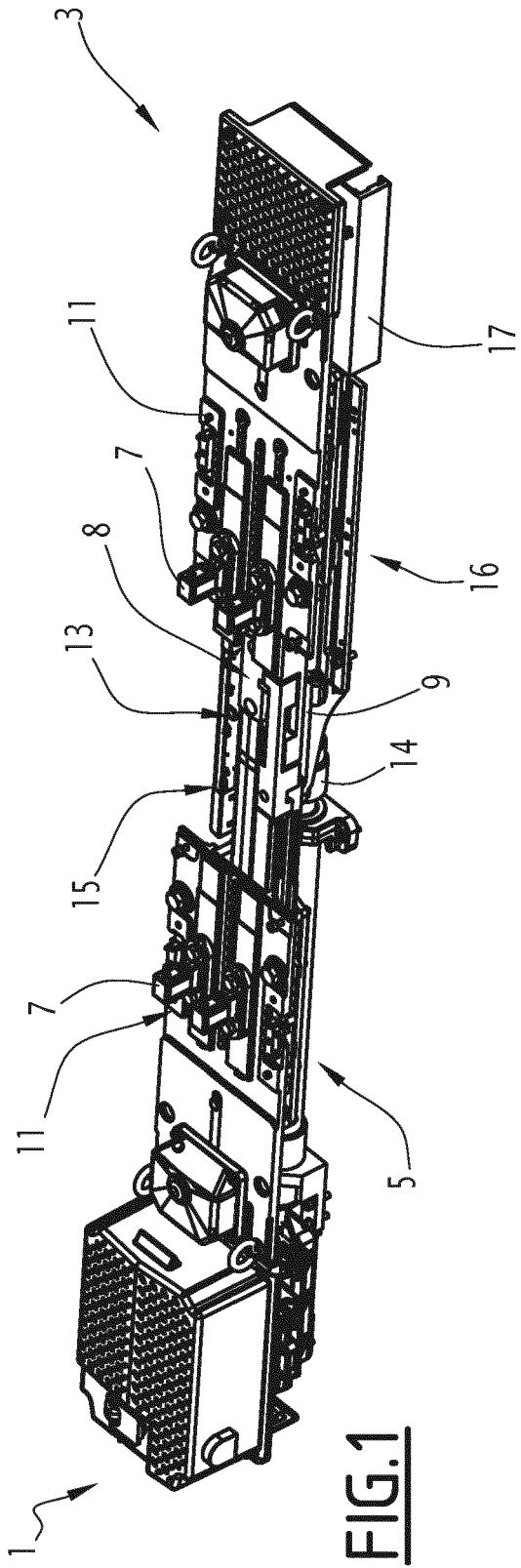


FIG.1

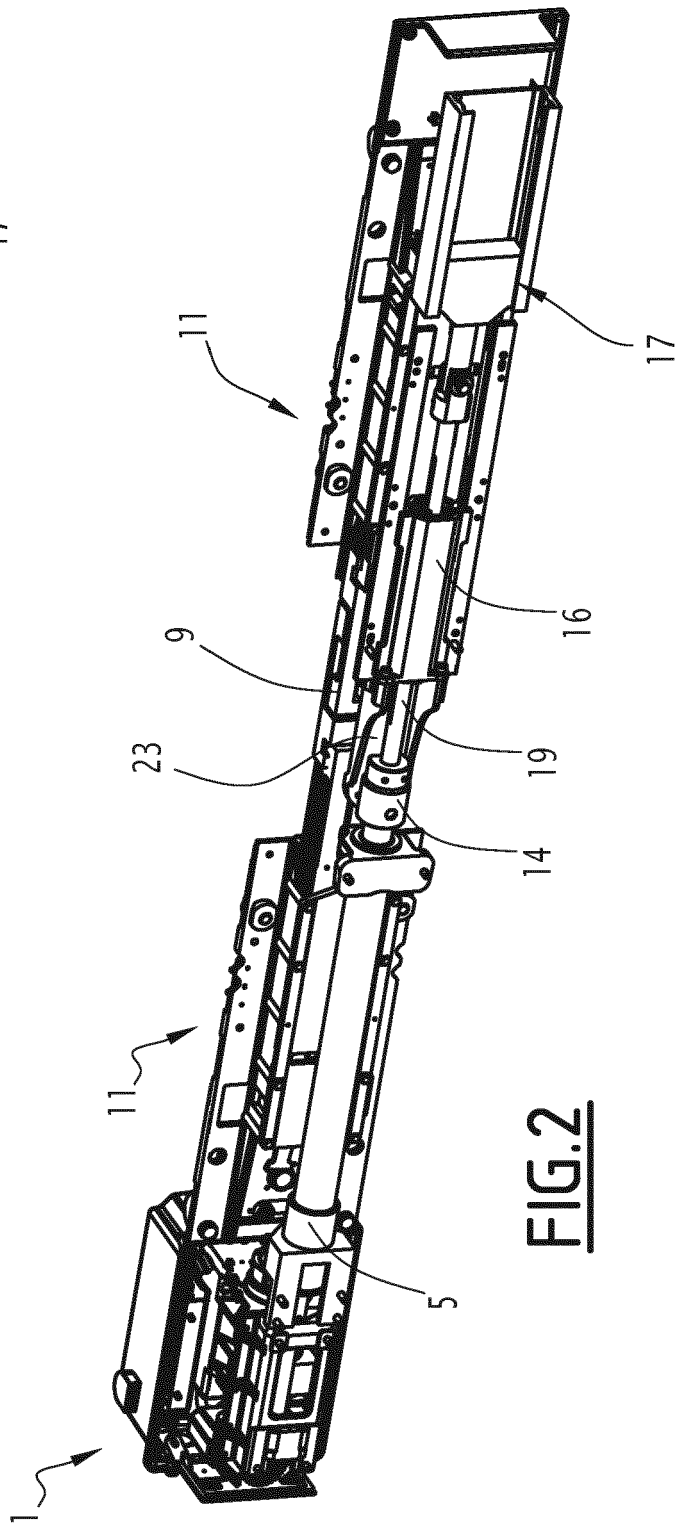


FIG.2

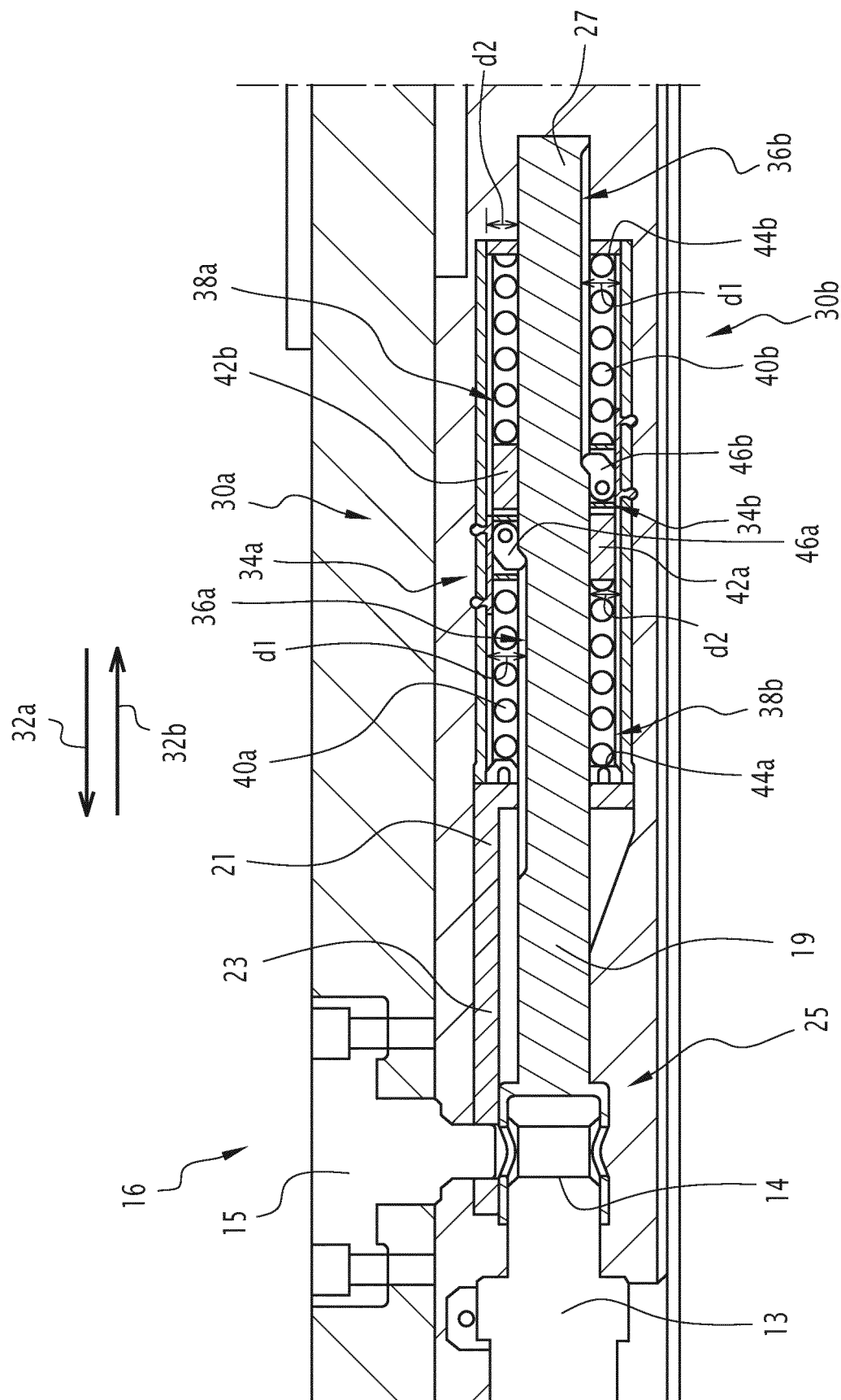


FIG. 3

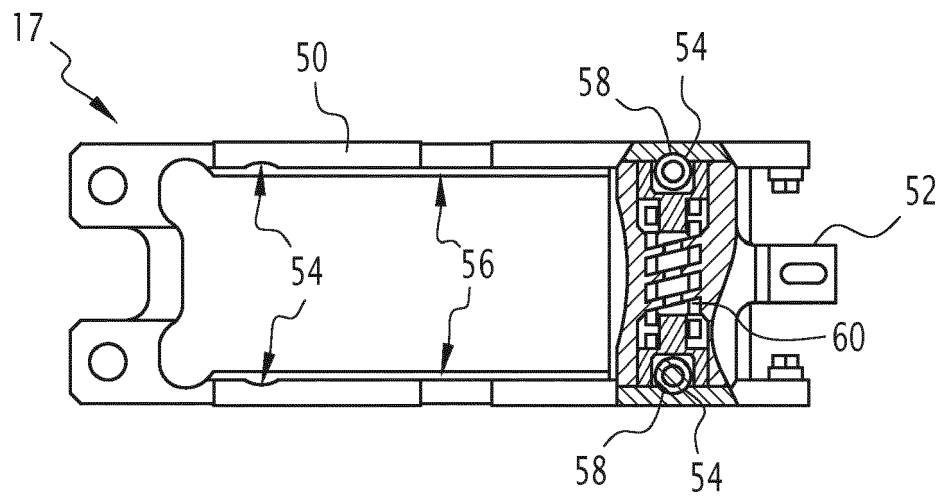


FIG.4



EUROPEAN SEARCH REPORT

 Application Number
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 25 October 2016	Examiner Janhsen, Axel
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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