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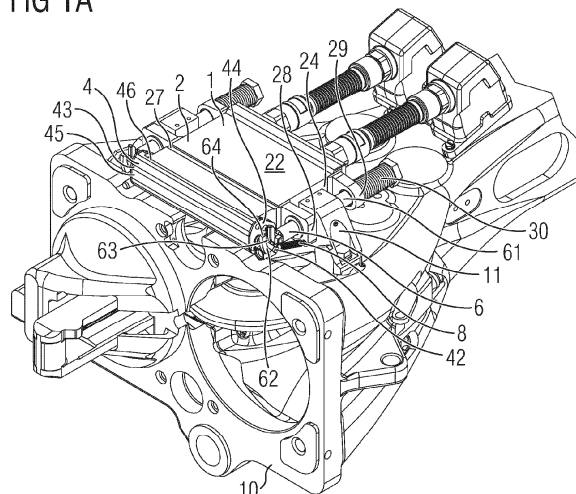
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(54) **ELECTRICAL COUPLER FOR A RAIL VEHICLE**

(57) An electrical coupler 1 for a coupler arrangement for a rail vehicle is provided, the electrical coupler 1 being configured for coupling with an opposing electrical coupler, the electrical coupler 1 comprising: a housing 2 with a front face 21, a top face 22, a bottom face 23 and two side faces 24, wherein electrical connectors 25 protrude from the front face 21 into the direction of a coupling area; a lid 4 which is rotatably mounted on the housing 2 so as to rotate about a rotational axis 41 between a closed position and an open position; and a guide rod 6 on each of the two side faces 24 of the housing 2, which guide rod 6 extends along the respective side face 24 of the housing 2 and is connected with the housing 2 in a slidable manner such that the housing 2 can move along the guide rods 6 in a direction towards and away from the coupling area, wherein each of the two guide rods 6 has an elongate cylindrical body 61 and a guide plate 62 provided at the free end of the guide rod 6 which points towards the coupling area. The guide plate 62 is provided with a guide recess 63 which runs in a top-bottom-direction or an elongate extension of the guide recess 63 comprise at least a directional component in the top-bottom-direction. The lid 4 is provided with guide projections 42 which engage in the guide recesses 63 in a slidable manner so as to translate from the closed position to the open position and vice versa, as the housing 2 slides along the cylindrical bodies 61 in the direction towards and away from the coupling area. When the respective guide projection 42 has reached, in the top-bottom-direction, its top position within the respective guide recess 63, the guide plates 62 provide for a movement of the respective guide projection 42 further into the direction towards the coupling

area.

FIG 1A



Description

[0001] The present patent application refers to an electrical coupler for a coupler arrangement for a rail vehicle, and a lid for an electrical coupler for a coupler arrangement for a rail vehicle.

BACKGROUND

[0002] Conventional coupler arrangements for rail vehicles comprise a mechanical coupler and an electrical coupler which is typically mounted above the mechanical coupler. The mechanical coupler comprises coupling elements, e. g. in form of a coupling projection and a coupling opening, which are designed to engage with a corresponding counter coupling during the coupling process. The mechanical coupler may be of the Scharfenberg type in which the coupling projection is a so-called coupling cone and the coupling opening is a circular opening. In the coupled state, the coupling cone protrudes into the circular opening of a corresponding opposing coupler, and the coupling opening receives the coupling cone of a corresponding opposing coupler. The electrical coupler comprises electrical plugs and sockets which are complementarily coupled to the opposing electrical coupler.

[0003] In such coupler arrangements, the coupling process of the electrical coupler is automatically induced by the mechanical coupling process. When the mechanical coupling process is performed, a cam which is typically provided at the bottom of the housing of the electrical coupler is rotated which allows the electrical coupler housing to move forward into the direction of the opposing electrical coupler. During the forward movement of the housing, the lid of the electrical coupler is moved upwards to uncover the electrical connectors.

[0004] An example of a conventional coupler arrangement is disclosed in WO 2024/115659 A1.

[0005] However, there is a risk of collision of the lids of the opposing electrical couplers when the forward movements of the respective electrical coupler housings or the upwards movements of the respective lids are not synchronized with each other. This problem particularly occurs when snow and ice or dirt is present in the coupling area which obstructs a smooth movement of the lid and the housing. Collision of the lids may lead to damage of the electrical couplers, particularly of the electrical connectors. Further, a collision of the lid and electrical connectors may lead to a short circuit and further damage of the electrical coupler.

[0006] It is therefore an object of the present invention to provide an electrical coupler for a coupler arrangement for a rail vehicle which resolves or at least mitigates the risk of damage of the electrical coupler during the coupling process.

SUMMARY OF THE INVENTION

[0007] According to the invention, the problem is solved by any one of the electrical coupler comprising the features of claim 1, the lid comprising the features of claim 9 and the lid according to claim 10.

[0008] According to a first aspect of the invention, an electrical coupler for a coupler arrangement for a rail vehicle is provided. The electrical coupler is configured for coupling with an opposing electrical coupler and comprises a housing with a front face, a top face, a bottom face and two side faces, wherein electrical connectors protrude from the front face into the direction of a coupling area. The electrical coupler also comprises a lid which is rotatably mounted on the housing so as to rotate about a rotational axis between a closed position in which the lid covers the electrical connectors and an open position in which the lid exposes the front face of the housing so as to allow the electrical connectors to be coupled with opposing electrical connectors of the opposing electrical coupler. Further, the electrical coupler comprises, on each of the two side faces of the housing, a guide rod which extends along the respective side face of the housing and is connected with the housing in a slidable manner such that the housing can move along the guide rods in a direction towards and away from the coupling area, wherein each of the two guide rods has an elongate cylindrical body and a guide plate.

[0009] The guide plate is provided at the free end of the guide rod which points towards the coupling area, and the guide plate is provided with a guide recess. The guide recess runs in a top-bottom-direction or an elongate extension of the guide recess comprises at least a directional component in the top-bottom-direction. The lid is provided with guide projections which engage in the guide recesses in a slidable manner so as to translate from the closed position to the open position and vice versa, as the housing slides along the cylindrical bodies in the direction towards and away from the coupling area. When the respective guide projection has reached, in the top-bottom-direction, its top position within the respective guide recess, the guide plates provide for a movement of the respective guide projection further into the direction towards the coupling area. Thereby, further movement of the housing towards the coupling area is allowed when the guide projection has reached its top position within the guide recess.

[0010] Preferably, the guide recess is provided in the form of a guide slot that extends through the guide plate. Alternatively, the guide recess may be provided in the form of a guide groove that extends on a surface of the guide plate and comprises a groove base. However, a guide slot has the advantage of a more stable construction with the guide projection extending through the guide plate.

[0011] Due to the additional freedom of movement

into the direction of the coupling area even after the guide projections have reached their top positions within the guide recesses, a longer stroke length is possible. The lid, which reaches its fully open position when the guide projections reach their top position within the guide recesses, is already fully open while the housing continues to move towards the coupling area into its final coupling position. This means that the lid is removed from the coupling area early compared to the conventional electrical couplers, so that in the event of a mis-synchronization or misalignment of the opposing electrical couplers, the respective lids do not collide with each other or with the respective electrical connectors, and they do not block the opening movement and the coupling process. Compared to conventional electrical couplers, the additional freedom of movement may add a stroke length of about 10 mm so that, e. g., a conventional stroke length of about 30 mm can be extended to about 40 mm. The chances of successful coupling of the electrical couplers when their movement is not completely synchronized is therefore enhanced, and the risk of a collision of the lid and damage of the electrical coupler can be reduced.

[0012] In a preferred embodiment, the guide plate comprises a support and sliding face on which the respective guide projection can slide further towards the coupling area when the guide projection has reached its top position within the respective guide recess. Preferably, a length of the support and sliding face in a longitudinal direction of the guide rod is at least equal to a diameter of the guide recess in the longitudinal direction of the guide rod, and more preferably the length of the support and sliding face extends the diameter of the guide recess. Particularly, the length of the support and sliding face is at least 1.5 times, preferably at least 2 times, as large as the diameter of the guide recess. The longer the support and sliding face is, the more additional stroke length can be provided.

[0013] Preferably, the respective support and sliding face is arranged in a plane which extends substantially parallelly to the longitudinal axis of the guide rod and substantially parallelly to a longitudinal axis of the respective guide projection. Further preferably the respective support and sliding face faces upwards. Following from that, in the mounted state of the electrical coupler, the support and sliding face is arranged in a substantially horizontal plane which faces upwards.

[0014] Preferably, the guide recess is open at a top side of the guide plate. This means that the guide recess does not have a closed contour, but an open contour which allows the guide projection to leave the guide recess at the top position of the guide projection within the guide recess. In this manner, the total height of the guide plate can be reduced. Further, the manufacturing of the guide plate can be facilitated. Alternatively, the guide recess may also have a closed contour which extends in the direction of the coupling area at the position where the respective guiding projection reaches its

top position within the guide recess. Thereby, the mechanical stability of the guide plate can be enhanced.

[0015] Further preferably, the electrical coupler comprises a biasing element which exerts a pulling force on the guide projection, wherein the pulling force has a directional component away from the coupling area, and, in the top-bottom-direction, the rotational axis of the lid is located such that it is above a longitudinal axis of the biasing element when the lid is in the closed position, and is below the longitudinal axis of the biasing element when the lid is the open position. The biasing element can be a spring, e. g. a coil spring, or a rubber piece. The biasing element can be mounted directly or indirectly on the guide projection, and can be mounted directly or indirectly on a housing component.

[0016] Due to this positional relationship of the rotational axis of the lid and the longitudinal axis of the biasing element, when the lid is translating from the closed position to the open position and vice versa, the biasing element pulls the lid towards the closed position when the rotational axis of the lid has reached a position above the longitudinal axis of the biasing element, and pulls the lid towards the open position when the rotational axis of the lid has reached a position below the longitudinal axis of the biasing element. The opening and closing movement of the lid is thereby facilitated. This is particularly beneficial for the opening movement, as the lid can be opened faster and avoiding of a collision is further supported.

[0017] The lid comprises a front portion and two side portions arranged on opposite sides of the front portion. In a preferred embodiment, the front portion has a convexly curved shape with a central flattened area which extends from one side portion to the other side portion and in which the outer contour of the front section is flattened. This leads to a reduced height of the lid, which is beneficial during the opening movement as well as in the fully opened position. Compared to a front portion with a convexly curved shape that does not have the central flattened area, the lid which comprises the central flattened area protrudes less into the direction of the coupling area in the closed position of the lid, which further reduces the risk of collision with the lid of the opposing electrical coupler. In addition thereto, in the opened position of the lid, the lid with the flattened central area adds less height to the electrical coupler compared to a lid that does not have the flattened area. The latter is particularly advantageous in view of the height constraints of the electrical coupler.

[0018] Preferably, an inner contour of the front portion has a convexly curved shape which is not flattened in the central area. This means that in the central area, the wall thickness of the lid is reduced compared to the wall thickness of the lid adjacent the central area, since an inner wall of the lid follows the convexly curved shape of the front portion, while an opposing outer wall of the lid follows the flat shape of the central area. Consequently, caused by the convexly curved inner contour

of the lid, an inner surface of the lid is still kept at a comparably large distance from the electrical connectors compared to a lid the inner contour of which follows the flattened shape of the outer contour. A larger distance between the inner surface of the lid and the electrical connectors further reduces the risk of collision of the lid and the electrical connectors.

[0019] In a preferred embodiment, the lid, preferably the front portion, is partly or completely made from an electrical insulating material, preferably from a reinforced polyester material, more preferably from a sheet molding compound which even more preferably comprises polyester resin and glass fibers. In case of a collision of a lid which is made from an electrical insulating material and the electrical connectors, a short circuit and corresponding damage of the electrical coupler can be avoided. Reinforcing the electrical insulating material with non-conductive rigid elements provides additional strength and form stability to the lid and which is further beneficial in the case of a collision.

[0020] Preferably, the inner surface of the front portion is coated with an electrical insulating material. This is particularly beneficial when the front portion is made from a conductive material such as metal, which provides strength to the lid while still avoiding a short circuit in case of a collision.

[0021] Further preferably, the side portions are made from aluminium or steel to add strength to the lid.

[0022] According to a second aspect of the invention, a lid for an electrical coupler for a coupling arrangement for a rail vehicle is provided, the lid comprising a front portion and two side portions arranged on opposite sides of the front portion, wherein the front portion has a convexly curved shape with a central flattened area which extends from one side portion to the other side portion and in which the outer contour of the front section is flattened, preferably while an inner contour of the front portion has a convexly curved shape which is not flattened in the central area.

[0023] Preferably, the lid, particularly the front portion, is partly or completely made from an electrical insulating material. Alternatively, or additionally, the inner surface of the front portion may be coated with an electrical insulating material. Further preferably, the side portions are made from aluminium or steel.

[0024] According to a third aspect of the invention, a lid for an electrical coupler for a coupling arrangement for a rail vehicle is provided, the lid comprising a front portion and two side portions arranged on opposite sides of the front portion, wherein the front portion comprises an inner surface, wherein the lid, preferably the front portion, is partly or completely made from an electrical insulating material, and/or the inner surface of the front portion is coated with an electrical insulating material. Further preferably, the side portions are made from aluminium or steel.

[0025] Preferred embodiments of the lid according to the second aspect of the invention and of the lid ac-

cording to the third aspect of the invention will now be described in the following:

In a preferred embodiment, the electrical insulating material is a reinforced polyester material, preferably a sheet molding compound, more preferably comprising polyester resin and glass fibers.

[0026] In a preferred embodiment, the front portion comprises an upper lip on its top end and a lower lip on its bottom end, wherein the upper lip and the lower lip preferably extend substantially parallel to each other, and wherein the upper lip extends beyond the lower lip in a direction away from the front side of the lid. In other word, the lower lip is shorter in the direction away from the front side of the lid.

[0027] Further features of the lid according to the second aspect of the invention and the lid according to the third aspect of the invention can be designed as described for the lid of the electrical coupler according to the first aspect of the invention, with the same technical benefits arising therefrom.

[0028] According to a fourth aspect of the invention, an electrical coupler for a coupler arrangement for a rail vehicle is provided. The electrical coupler is configured for coupling with an opposing electrical coupler and comprises a housing with a front face, a top face, a bottom face and two side faces, wherein electrical connectors protrude from the front face into the direction of a coupling area. The electrical coupler further comprises a lid according to the second aspect or the third aspect of the invention, wherein the lid is rotatably mounted on the housing so as to rotate about a rotational axis between a closed position in which the lid covers the electrical connectors and an open position in which the lid exposes the front face of the housing so as to allow the electrical connectors to be coupled with opposing electrical connectors of the opposing electrical coupler.

[0029] Preferred embodiments of the electrical coupler according to the first aspect of the invention and of the electrical coupler according to the fourth aspect of the invention will now be described in the following:

In a preferred embodiment, when the lid is in the closed position, a longitudinal distance from the electrical connectors to the inner surface is less than 10 mm, preferably less than 8 mm, even more preferably less than 5 mm, and more than 1 mm, preferably more than 2 mm. With such an electrical coupler, the height of the electrical coupler when the lid is in the open position can be further reduced, while having an electrical coupler which is safe for operators even if an operator is in contact with the lid. In other words, by having a lid which is relatively close to the electrical connectors, the height in open position can be kept relatively low, while still having electrical safety thanks to the electrical insulating material of the lid. The risk of wear of the lid is reduced thanks to the distance between the lid and the electrical connectors.

[0030] In a preferred embodiment, the front face of

the housing is provided with a sealing that encloses the electrical connectors and seals the electrical connectors from the environment in the coupled state of the electrical coupler. Thereby, the electrical connectors are protected from dirt and moisture from the environment.

[0031] In a preferred embodiment, the front portion of the lid comprises an upper lip on the top end of the front portion, wherein, in the closed position of the lid, an inner surface of the front portion faces the electrical connectors and the upper lip extends over the electrical connectors so as to completely cover the electrical connectors, and preferably also the sealing, from the top side. Preferably, in the closed position of the lid, the upper lip overlaps a front end of the housing in the top-bottom direction. This provides further protection of the electrical connectors against dirt and moisture from the environment.

[0032] Preferably the housing has a groove in its top face which receives the upper lip at least partially, preferably completely, when the lid is in the open position. This allows for further height reduction of the electrical coupler in the state in which the lid is completely open.

[0033] According to a fifth aspect of the invention, a coupler arrangement for a rail-vehicle is provided, comprising a mechanical coupler, e. g. a Scharfenberg-type coupler, and an electrical coupler according to the first or the fourth aspect of the invention. The electrical coupler is arranged above the mechanical coupler, preferably mounted to the mechanical coupler, and is operatively connected with the mechanical coupler such that a coupling process of the mechanical coupler automatically induces a coupling process of the electrical coupler.

[0034] In a preferred embodiment, the coupling process of the electrical coupler is induced by rotation of a cam provided at the bottom face of the housing, which rotation is caused by the coupling process of the mechanical coupler. Alternatively, the coupling process of the electrical coupler is induced by a pneumatically controlled actuator.

BRIEF DESCRIPTION OF THE DRAWING

[0035] Hereinafter the invention will be explained by way of example with reference to the accompanying figures. The accompanying figures are not drawn to scale and are of a schematic nature. Each identical or nearly identical component that is illustrated in various figures is represented by the same numeral. For purposes of clarity, not every component may be labelled in every figure. In the drawing:

Fig. 1A shows a perspective view of a coupler arrangement according to the invention.

Fig. 1B shows a side view of the coupler arrangement of Fig. 1A.

Figs. 2A to 2D show perspective views of an elec-

trical coupler according to the invention.

Figs. 3A to 3D show side views of an electrical coupler according to the invention.

Fig. 4A shows a perspective view of a guide rod for an electrical coupler according to the invention.

Fig. 4B shows a side view of the front end of the guide rod of Fig. 4A.

Fig. 5A shows a sectional side view of a lid in the closed position mounted on an electrical coupler according to the invention.

Fig. 5B shows a sectional side view of a lid in the open position mounted on an electrical coupler according to the invention.

15 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0036] In Fig. 1A, a perspective view of a coupler arrangement according to the invention is shown, while Fig. 1B shows the coupler arrangement in a side view. The coupler arrangement comprises an electrical coupler 1 which is arranged above a mechanical coupler 10. The mechanical coupler 10 comprises a front plate with coupling elements in the form of a so-called coupling cone and a corresponding coupling opening which are configured to receive opposing coupling elements of an opposing mechanical coupler.

[0037] The electrical coupler 1 comprises a housing 2 with a front face 21 (not visible) a top face 22, a bottom face 23 (only visible in Fig. 1B), and two side faces 24. The top face 22 is provided with a groove 27 which extends from one side face 24 to the other side face 24. On each side face 24, front and rear guiding elements 28, 29 are provided which are fixedly connected to the housing 2 and are provided with through holes through which a guide rod 6 extends. The housing 2 is slidably supported on the guide rods 6 via the guiding elements 28, 29. On both sides of the housing 2, between the front and rear guiding elements 28, 29 a connecting member 11 is arranged which is fixedly mounted to the mechanical coupler 10 by a screw connection. The connecting member 11 has a through hole through which the guide rod 6 extends and in which the guide rod 6 is fixedly connected with the connecting member 11, e. g. by a connecting bolt.

[0038] The guide rod 6 comprises an elongate cylindrical body 61 which extends through the through holes of the guiding elements 28, 29 and the connecting member 30, and a guide plate 62 which is provided at the free end of the guide rod 6 which points towards the coupling area. As will be shown and explained in more detail with reference to the following figures, e. g. Figs. 3A to 3D, the guide plate 62 has a guide recess 63 and a support and sliding surface 64.

[0039] A lid 4 is rotatably mounted on the housing 2 so as to cover the front face 21 of the housing 2 in a closed position, and to expose the front face 21 from which electrical connectors 25 (not visible) extend into

the direction of a coupling area in an open position (shown, e. g. in Fig. 2D). As will be shown and explained in more detail with reference to the following figures, the lid 4 is rotatable about a rotational axis 41 (not visible) and has a front portion 43, two side portions 44 and two guide projections 42 located at the side portions 44, respectively. The front portion 43 has a central area 45 and an upper lip 46 which is located at the top end of the front portion 43 and extends from one side portion 44 to the other side portion 44.

[0040] The guide projections 42 protrude, preferably perpendicularly, from the side portions 44 into and through the guide recesses 63 which are provided in the form of guide slots. The guide projections 42 can slide within the guide recesses 63 when the lid 4 is moved from the closed position to the open position and vice versa. At the free end of the guide projections 42, a biasing element 8 in the form of a tension spring is attached which connects the guide projection 42 with a part of the housing 2, in the present embodiment with the front guide element 28 to which the biasing element 8 is mounted.

[0041] The rear ends of the guide rods 6 which are opposite to the guide plates 62 are located rearwards of the rear guiding elements 29, and the rear guiding elements 29 are biased against the rear ends of the guide rods 6, in the present embodiment by a compression springs 30. In the uncoupled state of the electrical coupler 1, in which the lid 4 is closed, the housing 2 is pushed against the biasing force of the compression springs 30 by an actuator that is operatively connected with the mechanical coupler 10. For example, a cam (not shown) provided at the bottom side of the housing 2 pushes the housing 2 against the biasing force of the compression springs 30 in the rear direction in the uncoupled state. During the coupling process of the mechanical coupler 10, the cam is rotated and releases the housing 2 so that the compression springs 30 urge the housing 2 to slide along the guide rods 6 in the direction of the coupling area. Thereby, the guide projections 42 slide within the guide recess 63 in the upwards direction which opens the lid 4.

[0042] As an alternative to the cam, a pneumatically controlled actuator can be provided. While the shown mechanical coupler 10 is of the Scharfenberg-type, the described electrical coupler 1 can be used with other types as well.

[0043] The sequence of Figs. 2A to 2D illustrates an opening movement of the lid 4 and a forward movement of the electrical coupler 1 in the perspective view. Likewise, the sequence of Figs. 3A to 3D illustrates the opening movement of the lid 4 and the forward movement of the electrical coupler 1 in a side view. In this context, the forward movement is a movement towards the coupling area.

[0044] Figs. 2A and 3A show the electrical coupler 1 with the housing 2 in its rearmost position on the guide rods 6, in which the compression springs 30 provided

at the rear ends of the guide rods 6 are in their most compressed state and the lid 4 is in the fully closed position. In this position, the housing 2 is held against the biasing force of the compression springs 30 by the mechanical coupling mechanism, e. g. by the aforementioned cam. In this relative position of the housing 2 and the guide rods 6, the guide projections 42 are located closest to the respective rearmost ends of the guide recesses 63, or, depending on how far the guide recesses 63 extend towards the rear of the housing 2, about the rearmost ends of the guide recesses 63.

[0045] The guide recesses 63 extend in a top-bottom-direction of the guide plates 62 and are curved towards a rear end of the guide plates 62 so that the rearmost ends of the guide recesses 63 are at the same time the bottommost ends of the guide recesses 63. At the top of the respective guide plates 62, the guide recesses 63 are open. The front top sides of the guide plates 62, which are located front of the guide recesses 63, serve as support and sliding faces 64 for the respective guide projections 42 when the lid 4 has reached its open position (shown in Figs. 2D and 3D). In Fig. 3A, the rotational axis 41 of the lid 4 is indicated, which, in the closed position of the lid 4, is located above a longitudinal axis 81 of the tension spring 8. Thereby, the pulling force of the tension spring 8 acts in favour of the closed position of the lid 4.

[0046] Figs. 2B and 3B show the electrical coupler 1 in a first transitional position between the rearmost position of the housing 2 on the guide rods 6 (shown in Figs. 2A and 3A) and a foremost position of the housing 2 on the guide rods 6 (shown in Fig. 2D and 3D). In the position shown in Figs. 2B and 3B, the housing 2 has already advanced on the guide rods 6 towards the coupling area, wherein the forward movement is caused by the compression springs 30 after the holding force of the mechanical coupling mechanism, e. g. the cam, was released during the coupling process of the mechanical coupler 10. As the housing 2 advances on the guide rods 6 towards the coupling area, the guiding projections 42 move within the guiding recesses 63 in the upwards direction towards the top end of the guiding recesses 63, which causes the lid 4 to open and expose the front face 21 of the housing 2 which comprises the electrical connectors 25 of the electrical coupler 1.

[0047] Figs. 2C and 3C show the electrical coupler 1 in a second transitional position between the rearmost position of the housing 2 on the guide rods 6 and a foremost position of the housing 2 on the guide rods 6. In the position shown in Figs. 2C and 3C, the housing 2 has advanced further on the guide rods 6 towards the coupling area, caused by the biasing force of the compression springs 30. In the shown position, the guiding projections 42 have almost reached their top position within the guiding recesses 63, and the lid is almost fully open. The longitudinal axis 81 of the tension spring 8 is now located above the rotational axis 41 of the lid 4

so that the pulling force of the tension spring 8 supports the opening movement of the lid 4.

[0048] During the opening movement of the lid 4, the longitudinal axis 81 of the tension spring 8 translates from a position below the rotational axis 41 of the lid 4 to a position above the rotational axis 41 of the lid 4, and, vice versa during the closing movement. The tension spring 8 thus always supports the favoured movement direction of the lid and stabilizes the end positions of the lid 4, i. e. the fully open state and the fully closed state.

[0049] Figs. 2D and 3D show the electrical coupler 1 with the housing 2 in its foremost position on the guide rods 6, in which the compression springs 30 provided at the rear ends of the guide rods 6 are in their least compressed state, and the lid 4 is in the fully open position in which the front face 21 and the electrical connectors 25 are completely exposed and ready for the coupling process of the electrical coupler 1.

[0050] In the foremost position, the guiding projections 42 have reached their topmost positions within the guiding recesses 63 and continued their forward movement towards the coupling area on the support and sliding surfaces 64. In the topmost positions of the guiding projections 42, the lid 4 is in its fully opened state. The continued movement of the guiding projections 42 towards the coupling area after the guiding projections 42 have reached their topmost positions allows the housing 2 to move further towards the coupling area with an already fully opened lid 4. Thereby, a full stroke length can be achieved and the lid 4 can be kept away from the coupling area before the electrical coupler 1 gets into contact with the opposing electrical coupler 1 during the coupling process of the electrical coupler 1.

[0051] As will be seen more clearly in Fig. 5B, in the opened state of the lid 4, the lid 4 is partly received by the groove 27 provided on the top face 22 of the housing 2, allowing the front portion 43 of the lid 4 to move closer towards the top face 22 of the housing 2 and reduce the overall height of the electrical coupler 1.

[0052] Fig. 4A shows a perspective view of a further embodiment of a guide rod 6 for an electrical coupler 1 according to the invention. Fig. 4B shows a closer side view of the front end of the guide rod 6 of Fig. 4A. The guide rod 6 of this embodiment equals the guide rod 6 described with reference to Figs. 1A to 3D, except for the guide plate 62 which distinguishes from the guide plate 62 disclosed in the previous Figs. 1A to 3D by an extended support and sliding face 65 of the guide plate 62.

[0053] The support and sliding face 65 extends the support and sliding face 64 of the previously described embodiments in a longitudinal direction of the guide rod 6, which is the direction towards the coupling area in the mounted state of the guide rod 6. In the longitudinal direction of the guide rod 6, the support and sliding face 65 has a length which exceeds a gap width of the guide

recess 63 in the longitudinal direction of the guide rod 6 and at a height position of the support and sliding face 65 in the top-bottom-direction. It is preferred that the length of the extended support and sliding face 65 is about twice the gap width of the guide recess 63. However, it is also feasible that the length of the extended support and sliding face 65 is between 1.5 and 3 times the gap width of the guide recess 63. In the embodiment shown, the guide projection 42 has a diameter of 6 mm, the support and sliding face 65 has a length of 17,7 mm and the guide recess 63 has a gap width of 6,5 mm, which means that the extended support and sliding face 65 is about 2.7 times the gap width of the guide recess 63.

[0054] In the embodiment of Figs. 4A and 4B, the extended support and sliding face 65 is provided in the form of a projection on the front side of the guide plate 62. However, the support and sliding face 65 can also be provided and shaped differently. As can be seen in Fig. 4A, the cylindrical body 61 has a through hole for fixing the cylindrical body 61 to the connecting member 11, e. g. by a connecting bolt, so that the connecting member 11 and the guide rod 6 are fixed relative to each other.

[0055] Fig. 5A shows a sectional side view of a lid 4 in the closed position mounted on an electrical coupler 1 according to the invention, and Fig. 5B shows a sectional side view of the lid 4 in the open position. In the closed position, the lid 4 covers the front face 21 of the housing 2 on which the sealing 26 and electrical connectors 25 are provided, and in the open position the lid 4 exposes the front face 21, sealing 26 and electrical connectors 25 so that the electrical coupler 1 can be coupled with an opposing electrical coupler.

[0056] The lid 4 comprises a front portion 43 with a convexly curved shape and two side portions 44 on opposite side ends of the front portion 43. At the top end of the front portion 43 an upper lip 46 is provided, and at the bottom end of the front portion 43 a lower lip 48 is provided. The front portion 43, the upper lip 46 and the lower lip 48 extend from one side portion 44 to the other side portion 44. The upper lip 46 exceeds the length of the lower lip 48 in the direction away from the front portion 43. The inner contour of the front portion 43 follows the convexly curved shape of the front portion 43 so that the inner surface 47 of the lid 4 can be kept at a distance to the electrical connectors 25 in the closed position of the lid 4. A greater distance between the inner surface 47 and the electrical connectors 25 is beneficial in case of a collision of two opposing lids in order to avoid a direct contact between the lid 4 and the electrical connectors 25. The outer contour of the front portion 43 is flattened in a central area 45 which extends from one side portion 44 to the other side portion 44 of the lid 4.

[0057] As can be seen in Fig. 5A, in the closed position of the lid 4 the flattened central area 45 leads to a reduced extension of the lid 4 in the direction of the

coupling area compared to a lid which does not have a flattened central area. Further, it can be seen in Fig. 5A that the upper lip 46 overlaps the front end of the housing 2 so as to completely cover the sealing 26 and the electrical connectors 25 from a top side. In the open position of the lid 4 which is shown in Fig. 5B, the upper lip 46 is received by the groove 27 provided in the tip face 22 of the housing 2, allowing the lid 4 to move closer towards the housing 2. The groove 27 and the flattened central area 25 lead to reduced overall height of the electrical coupler 1 in the open position of the lid 4.

[0058] The front portion 43 is made from a non-conductive material, e. g. from reinforced polyester. Particularly suitable are sheet molding compounds which may comprise a polyester resin and glass fibers. The side portions 44 can be made from non-conductive material, e. g. from the same material as the front portion 43, but may also be made from a metal.

[0059] Preferred embodiments of the invention are also defined in the following paragraphs:

1. An electrical coupler 1 for a coupler arrangement for a rail vehicle, the electrical coupler 1 being configured for coupling with an opposing electrical coupler, the electrical coupler 1 comprising:

- a housing 2 with a front face 21, a top face 22, a bottom face 23 and two side faces 24, wherein electrical connectors 25 protrude from the front face 21 into the direction of a coupling area,
- a lid 4 which is rotatably mounted on the housing 2 so as to rotate about a rotational axis 41 between a closed position in which the lid 4 covers the electrical connectors 25 and an open position in which the lid 4 exposes the front face 21 of the housing 2 so as to allow the electrical connectors 25 to be coupled with opposing electrical connectors of the opposing electrical coupler,
- a guide rod 6 on each of the two side faces 24 of the housing 2, which guide rod 6 extends along the respective side face 24 of the housing 2 and is connected with the housing 2 in a slidable manner such that the housing 2 can move along the guide rods 6 in a direction towards and away from the coupling area, wherein each of the two guide rods 6 has an elongate cylindrical body 61 and a guide plate 62 provided at the free end of the guide rod 6 which points towards the coupling area, wherein the guide plate 62 is provided with a guide recess 63 which runs in a top-bottom-direction or an elongate extension of the guide recess 63 comprise at least a directional component in the top-bottom-direction,

wherein the lid 4 is provided with guide projections 42 which engage in the guide recesses 63 in a slidable manner so as to translate from the closed position to the open position and vice versa, as the housing 2 slides along the cylindrical bodies 61 in the direction towards and away from the coupling area, and wherein,

when the respective guide projection 42 has reached, in the top-bottom-direction, its top position within the respective guide recess 63, the guide plate 62 provides for a movement of the respective guide projection 42 further into the direction towards the coupling area.

2. The electrical coupler 1 of para. 1, wherein the guide plates 62 comprise a support and sliding face 64, respectively, on which the respective guide projection 42 can slide further towards the coupling area when the guide projection 42 has reached its top position within the respective guide recess 63.

3. The electrical coupler 1 of para. 2, wherein a length of the support and sliding face 64 in a longitudinal direction of the guide rod 6 is at least equal to a diameter of the guide recess 63 in the longitudinal direction of the guide rod 6.

4. The electrical coupler 1 of para. 3, wherein the length of the support and sliding face 64 extends the diameter of the guide recess 63.

5. The electrical coupler 1 of para. 4, wherein the length of the support and sliding face 64 is at least 1.5 times as large as the diameter of the guide recess 63.

6. The electrical coupler 1 of para. 5, wherein the length of the support and sliding face 64 is at least 2 times as large as the diameter of the guide recess 63.

7. The electrical coupler 1 of any one of paras. 1 to 6, wherein the guide recess 63 is open at a top side of the guide plate 62.

8. The electrical coupler 1 of any one of paras. 1 to 7, further comprising a biasing element 8 which exerts a pulling force on the guide projection 42, wherein the pulling force has a directional component away from the coupling area, and, in the top-bottom direction, the rotational axis 41 of the lid 4 is located such that it is above a longitudinal axis 81 of the biasing element 8 when the lid 4 is in the closed position, and is below the longitudinal axis 81 of the biasing element 8 when the lid 4 is the open position.

9. The electrical coupler 1 of any one of paras. 1 to 8, wherein the biasing element 8 is mounted directly or indirectly on the guide projection 42.

10. The electrical coupler 1 of any one of paras. 1 to 9, wherein the biasing element 8 is mounted directly or indirectly on a housing component. 5

11. The electrical coupler 1 of any one of paras. 1 to 10, wherein the lid 4 comprises a front portion 43 and two side portions 44 arranged on opposite sides of the front portion 43, wherein the front portion 43 comprises an inner surface 47. 10

12. The electrical coupler 1 of para. 11, wherein the front portion 43 has a convexly curved shape with a central flattened area 45 which extends from one side portion 44 to the other side portion 44 and in which the outer contour of the front section 43 is flattened. 15 20

13. The electrical coupler 1 of para. 12, wherein, an inner contour of the front portion 43 has a convexly curved shape which is not flattened in the central area 45. 25

14. The electrical coupler 1 of any one of paras. 11 to 13, wherein the lid 4, preferably the front portion 43, is partly or completely made from an electrical insulating material. 30

15. The electrical coupler 1 of para. 14, wherein the electrical insulating material is a reinforced polyester material. 35

16. The electrical coupler 1 of para. 15, wherein the reinforced polyester material is a sheet molding compound.

17. The electrical coupler 1 of para. 16, wherein the sheet molding compound comprises polyester resin and glass fibers. 40

18. The electrical coupler 1 of any one of paras. 11 to 17, wherein the inner surface 47 of the front portion 43 is coated with an electrical insulating material. 45

19. The electrical coupler 1 of any one of paras. 11 to 18, wherein the side portions 44 are made from aluminium or steel. 50

20. A lid 4 for an electrical coupler 1 for a coupling arrangement for a rail vehicle, the lid 4 comprising a front portion 43 and two side portions 44 arranged on opposite sides of the front portion 43, wherein the front portion 43 comprises an inner surface 47, 55

wherein the front portion 43 has a convexly curved shape with a central flattened area 45 which extends from one side portion 44 to the other side portion 44 and in which the outer contour of the front section 43 is flattened.

21. The lid 4 of para. 20, wherein an inner contour of the front portion 43 has a convexly curved shape which is not flattened in the central area 45.

22. The lid 4 of paras. 20 or 21, wherein the lid 4, preferably the front portion 43, is partly or completely made from an electrical insulating material.

23. The lid 4 of any one of claims 20 to 22, wherein the inner surface 47 of the front portion 43 is coated with an electrical insulating material.

24. The lid 4 of any one of paras. 20 to 23, wherein the side portions 44 are made from aluminium or steel.

25. A lid 4 for an electrical coupler 1 for a coupling arrangement for a rail vehicle, the lid 4 comprising a front portion 43 and two side portions 44 arranged on opposite sides of the front portion 43, wherein the front portion 43 comprises an inner surface 47, wherein the lid 4, preferably the front portion 43, is partly or completely made from an electrical insulating material, or the inner surface 47 of the front portion 43 is coated with an electrical insulating material.

26. The lid 4 of para. 22 or 25, wherein the electrical insulating material is a reinforced polyester material.

27. The lid 4 of para. 23 or 26, wherein the reinforced polyester material is a sheet molding compound.

28. The lid 4 of para. 24 or 27, wherein the sheet molding compound comprises polyester resin and glass fibers.

29. The lid 4 of paras. 20 or 25, wherein the front portion 43 comprises an upper lip 46 on its top end and a lower lip 48 on its bottom end, wherein the upper lip 46 and the lower lip 48 preferably extend substantially parallel to each other, and wherein the upper lip 46 extends beyond the lower lip 48 in a front-rear direction of the lid 4.

30. An electrical coupler 1 for a coupler arrangement for a rail vehicle, the electrical coupler 1 being configured for coupling with an opposing electrical coupler, the electrical coupler comprising:

- a housing 2 with a front face 21, a top face 22, a bottom face 23 and two side faces 24, wherein electrical connectors 25 protrude from the front face 21 into the direction of a coupling area, and
- a lid 4 according to any one of paras. 20 to 29, wherein the lid 4 is rotatably mounted on the housing 2 so as to rotate about a rotational axis 41 between a closed position in which the lid 4 covers the electrical connectors 25 and an open position in which the lid 4 exposes the front face 21 of the housing 2 so as to allow the electrical connectors 25 to be coupled with opposing electrical connectors 25 of the opposing electrical coupler.

31. The electrical coupler of para. 30, wherein, when the lid 4 is in the closed position, a longitudinal distance from the electrical connectors 25 to the inner surface 47 is less than 10 mm, preferably less than 8 mm, even more preferably less than 5 mm, and more than 1 mm, preferably more than 2 mm.

32. The electrical coupler 1 of any one of paras. 1 to 19, 30 and 31, wherein the front face 21 of the housing 2 is provided with a sealing 26 that encloses the electrical connectors 25 and seals the electrical connectors 25 from the environment in the coupled state of the electrical coupler 1.

33. The electrical coupler 1 of any one of paras. 11 to 19 and 30 to 32, wherein the front portion 43 comprises an upper lip 46 on its top end, wherein, in the closed position of the lid 4, the inner surface 47 of the front portion 43 faces the electrical connectors 25 and the upper lip 46 extends over the electrical connectors 25 so as to completely cover the electrical connectors 25 from the top side.

34. The electrical coupler 1 of para. 33, wherein, in the closed position of the lid 4, the upper lip 46 overlaps a front end of the housing 2 in the top-bottom direction.

34. The electrical coupler 1 of para. 32 or 33, wherein the housing 2 has a groove 27 in its top face 22 which receives the upper lip 46 at least partially when the lid 4 is in the open position.

35. A coupler arrangement for a rail-vehicle comprising a mechanical coupler 10 and an electric coupler 1 according to any one of paras. 1 to 19 and 30 to 34, wherein the electrical coupler 1 is arranged above the mechanical coupler 10 and is operatively connected with the mechanical coupler 10 such that a coupling process of the mechanical coupler 10 automatically induces a coupling process of the electrical coupler 1.

cess of the electrical coupler 1.

37. The coupler arrangement of para. 36, wherein the mechanical coupler 10 is of the Scharfenberg type.

38. The coupler arrangement of para. 36 or 37, wherein the coupling process of the electrical coupler 1 is induced by rotation of a cam provided at the bottom face 23 of the housing 2, which rotation is caused by the coupling process of the mechanical coupler 10, or by a pneumatically controlled actuator.

15 LIST OF REFERENCE SIGNS

[0060]

1	electrical coupler
2	housing
21	front face
22	top face
23	bottom face
24	side face
25	electrical connector
26	sealing
27	groove
28	front guiding element
29	rear guiding element
30	compression spring
4	lid
41	rotational axis
42	guide projection
43	front portion
44	side portion
45	central area
46	upper lip
47	inner surface
48	lower lip
6	guide rod
61	cylindrical body
62	guide plate
63	guide recess
64, 65	support and sliding face
8	biasing element
81	longitudinal axis
10	mechanical coupler
11	connecting member

50 Claims

1. An electrical coupler (1) for a coupler arrangement for a rail vehicle, the electrical coupler (1) being configured for coupling with an opposing electrical coupler, the electrical coupler (1) comprising:

- a housing (2) with a front face (21), a top face (22), a bottom face (23) and two side faces

(24), wherein electrical connectors (25) protrude from the front face (21) into the direction of a coupling area,

- a lid (4) which is rotatably mounted on the housing (2) so as to rotate about a rotational axis (41) between a closed position in which the lid (4) covers the electrical connectors (25) and an open position in which the lid (4) exposes the front face (21) of the housing (2) so as to allow the electrical connectors (25) to be coupled with opposing electrical connectors of the opposing electrical coupler,

- a guide rod (6) on each of the two side faces (24) of the housing (2), which guide rod (6) extends along the respective side face (24) of the housing (2) and is connected with the housing (2) in a slidable manner such that the housing (2) can move along the guide rods (6) in a direction towards and away from the coupling area, wherein each of the two guide rods (6) has an elongate cylindrical body (61) and a guide plate (62) provided at the free end of the guide rod (6) which points towards the coupling area, wherein the guide plate (62) is provided with a guide recess (63) which runs in a top-bottom-direction or an elongate extension of the guide recesses (63) comprise at least a directional component in the top-bottom-direction,

wherein the lid (4) is provided with guide projections (42) which engage in the guide recesses (63) in a slidable manner so as to translate from the closed position to the open position and vice versa, as the housing (2) slides along the cylindrical bodies (61) in the direction towards and away from the coupling area, and

characterized in that,

when the respective guide projection (42) has reached, in the top-bottom-direction, its top position within the respective guide recess (63), the guide plate (62) provides for a movement of the respective guide projection (42) further in the direction towards the coupling area.

2. The electrical coupler (1) of claim 1, wherein the guide plates (62) comprise a support and sliding face (64), respectively, on which the respective guide projection (42) can slide further towards the coupling area when the guide projection (42) has reached its top position within the respective guide recess (63).
3. The electrical coupler (1) of claim 2, wherein a length of the support and sliding face (64) in a longitudinal direction of the guide rod (6) is at least equal to a diameter of the guide recess (63) in the longitudinal direction of the guide rod (6).

4. The electrical coupler (1) of claim 3, wherein the length of the support and sliding face (64) extends the diameter of the guide recess (63) and is preferably at least 1.5 times, more preferably at least 2 times, as large as the diameter of the guide recess (63).

5. The electrical coupler (1) of any one of claims 1 to 4, wherein the guide recess (63) is open at a top side of the guide plate (62).

6. The electrical coupler (1) of any one of claims 1 to 5, further comprising a biasing element (8) which exerts a pulling force on the guide projection (42), wherein the pulling force has a directional component away from the coupling area, and, in the top-bottom direction, the rotational axis (41) of the lid (4) is located such that it is above a longitudinal axis (81) of the biasing element (8) when the lid (4) is in the closed position, and is below the longitudinal axis (81) of the biasing element (8) when the lid (4) is in the open position.

7. The electrical coupler (1) of any one of claims 1 to 6, wherein the lid (4) comprises a front portion (43) and two side portions (44) arranged on opposite sides of the front portion (43), wherein the front portion (43) comprises an inner surface (47) and has a convexly curved shape with a central flattened area (45) which extends from one side portion (44) to the other side portion (44) and in which the outer contour of the front section (43) is flattened, while an inner contour of the front portion (43) preferably has a convexly curved shape which is not flattened in the central area (45).

8. The electrical coupler (1) of any one of claims 1 to 7, wherein the lid (4), preferably the front portion (43), is partly or completely made from an electrical insulating material, or wherein the inner surface (47) of the front portion (43) is coated with an electrical insulating material, wherein the side portions (44) are preferably made from aluminium or steel.

9. A lid (4) for an electrical coupler (1) for a coupling arrangement for a rail vehicle, the lid (4) comprising a front portion (43) and two side portions (44) arranged on opposite sides of the front portion (43), wherein the front portion (43) comprises an inner surface (47),

characterized in that the front portion (43) has a convexly curved shape with a central flattened area (45) which extends from one side portion (44) to the other side portion (44) and in which the outer contour of the front section (43) is flattened, while an inner contour of the front portion (43) preferably has a convexly curved shape which is not flattened in the central area (45).

10. A lid (4) for an electrical coupler (1) for a coupling arrangement for a rail vehicle, the lid (4) comprising a front portion (43) and two side portions (44) arranged on opposite sides of the front portion (43), wherein the front portion (43) comprises an inner surface (47),
characterized in that the lid (4), preferably the front portion (43), is partly or completely made from an electrical insulating material, or the inner surface (47) of the front portion (43) is coated with an electrical insulating material.
11. The lid (4) of claim 10, wherein the electrical insulating material is a reinforced polyester material, preferably a sheet molding compound which more preferably comprises a polyester resin and glass fibers.
12. An electrical coupler (1) for a coupler arrangement for a rail vehicle, the electrical coupler (1) being configured for coupling with an opposing electrical coupler, the electrical coupler comprising:
- a housing (2) with a front face (21), a top face (22), a bottom face (23) and two side faces (24), wherein electrical connectors (25) protrude from the front face (21) into the direction of a coupling area, and
 - a lid (4) according to any one of claims 9 to 11, wherein the lid (4) is rotatably mounted on the housing (2) so as to rotate about a rotational axis (41) between a closed position in which the lid (4) covers the electrical connectors (25) and an open position in which the lid (4) exposes the front face (21) of the housing (2) so as to allow the electrical connectors (25) to be coupled with opposing electrical connectors (25) of the opposing electrical coupler.
13. The electrical coupler of claim 12, wherein, when the lid (4) is in the closed position, a longitudinal distance from the electrical connectors (25) to the inner surface (47) is less than 10 mm, preferably less than 8 mm, even more preferably less than 5 mm, and more than 1 mm, preferably more than 2 mm.
14. The electrical coupler (1) of any one of claims 1 to 8, 12 and 13, wherein the front portion (43) comprises an upper lip (46) on its top end, wherein, in the closed position of the lid (4), the inner surface (47) of the front portion (43) faces the electrical connectors (25) and the upper lip (46) extends over the electrical connectors (25) so as to completely cover the electrical connectors (25) from the top side and preferably overlaps a front end of the housing (2) in the top-bottom direction.
15. The electrical coupler (1) of claim 14, wherein the housing (2) has a groove (27) in its top face (22) which receives the upper lip (46) at least partially when the lid (4) is in the open position.
16. A coupler arrangement for a rail-vehicle comprising a mechanical coupler, preferably of the Scharfenberg type, (10) and an electrical coupler (1) according to any one of claims 1 to 8 and 12 to 15, wherein the electrical coupler (1) is arranged above the mechanical coupler (10) and is operatively connected with the mechanical coupler (10) such that a coupling process of the mechanical coupler (10) automatically induces a coupling process of the electrical coupler (1).

FIG 1A

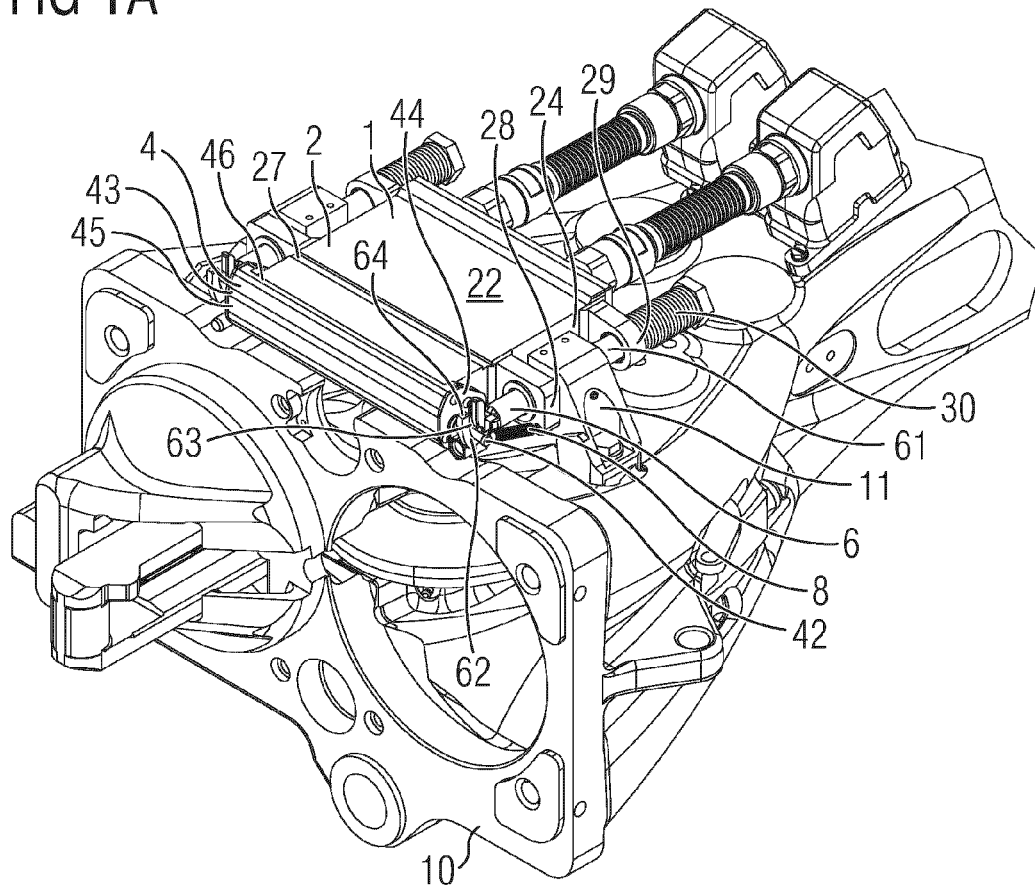


FIG 1B

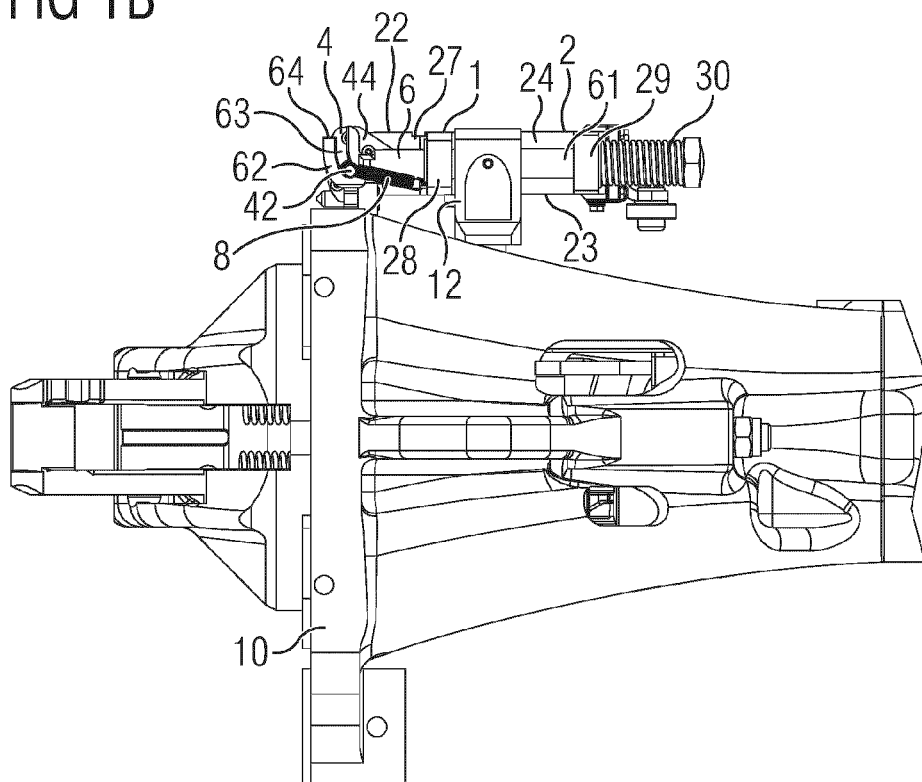


FIG 2A

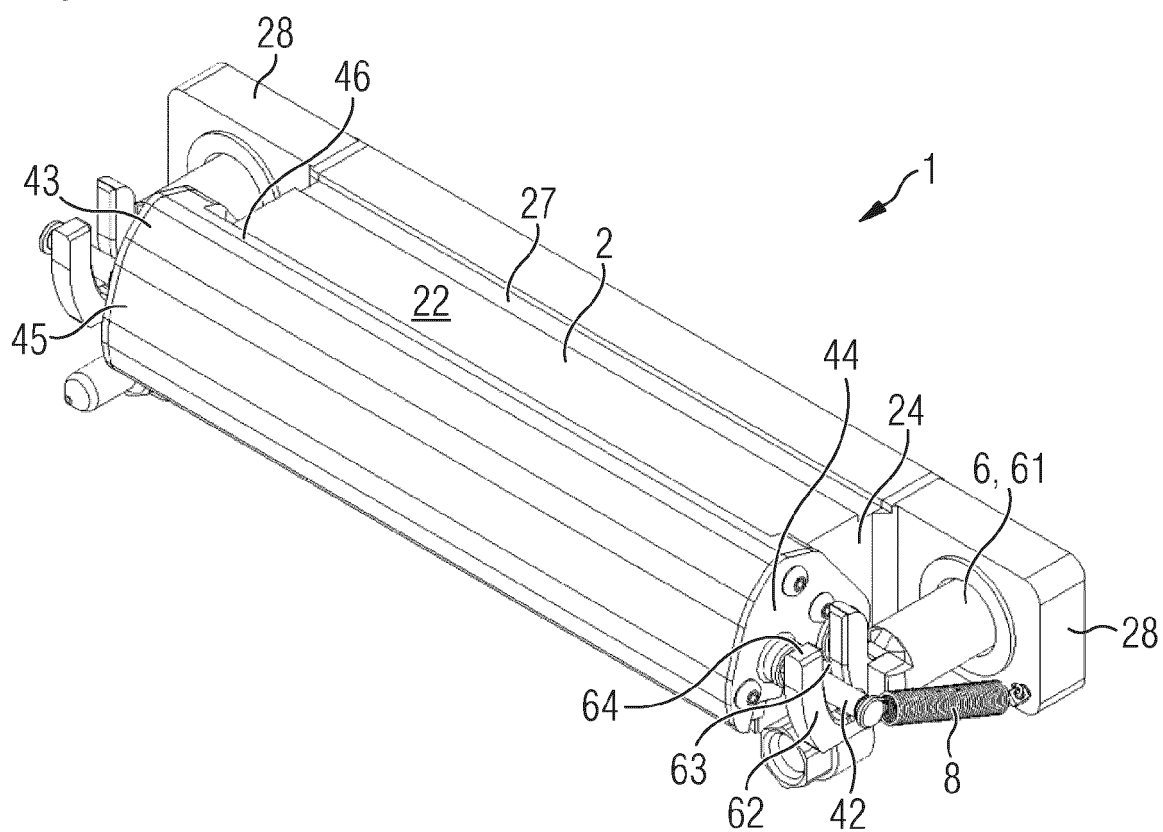


FIG 2B

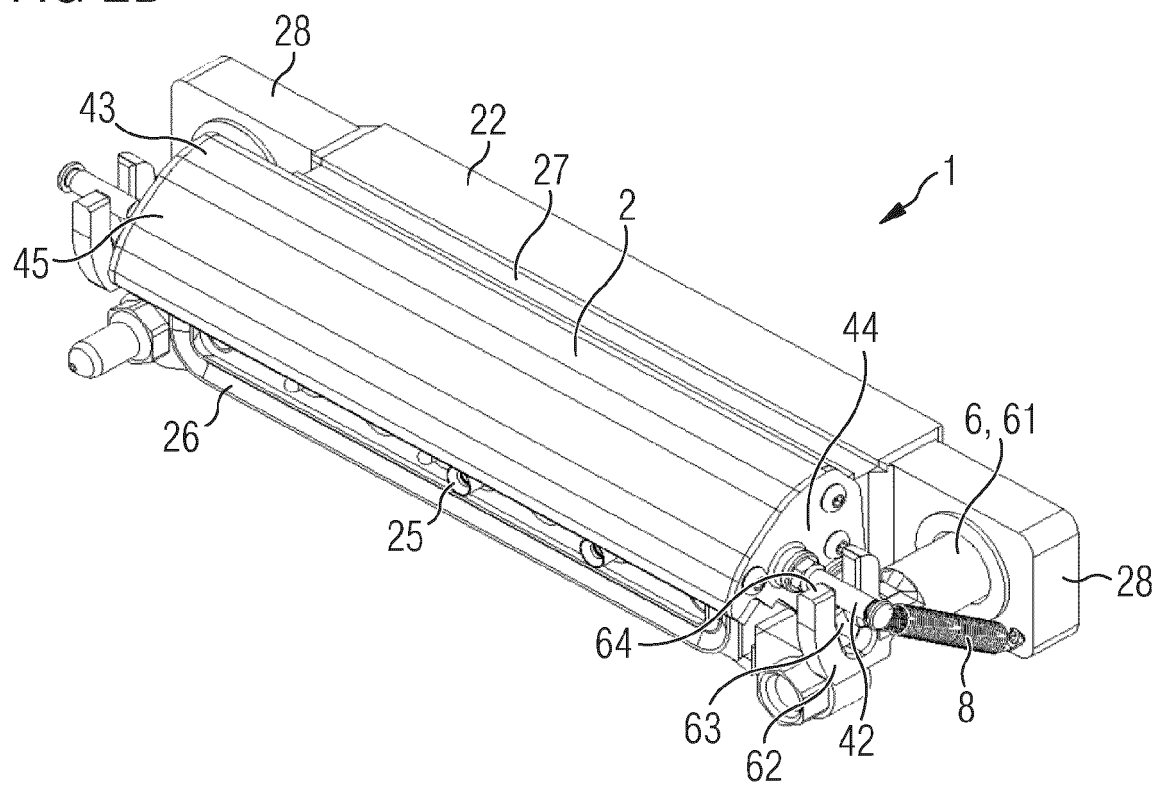


FIG 2C

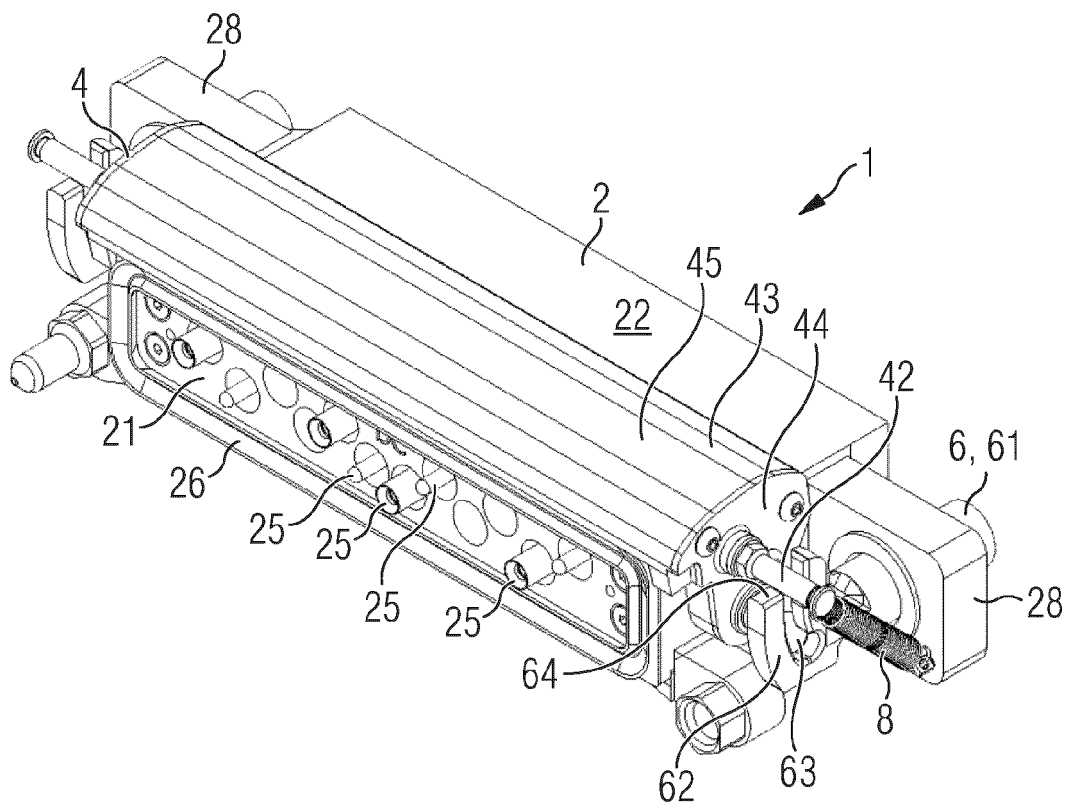


FIG 2D

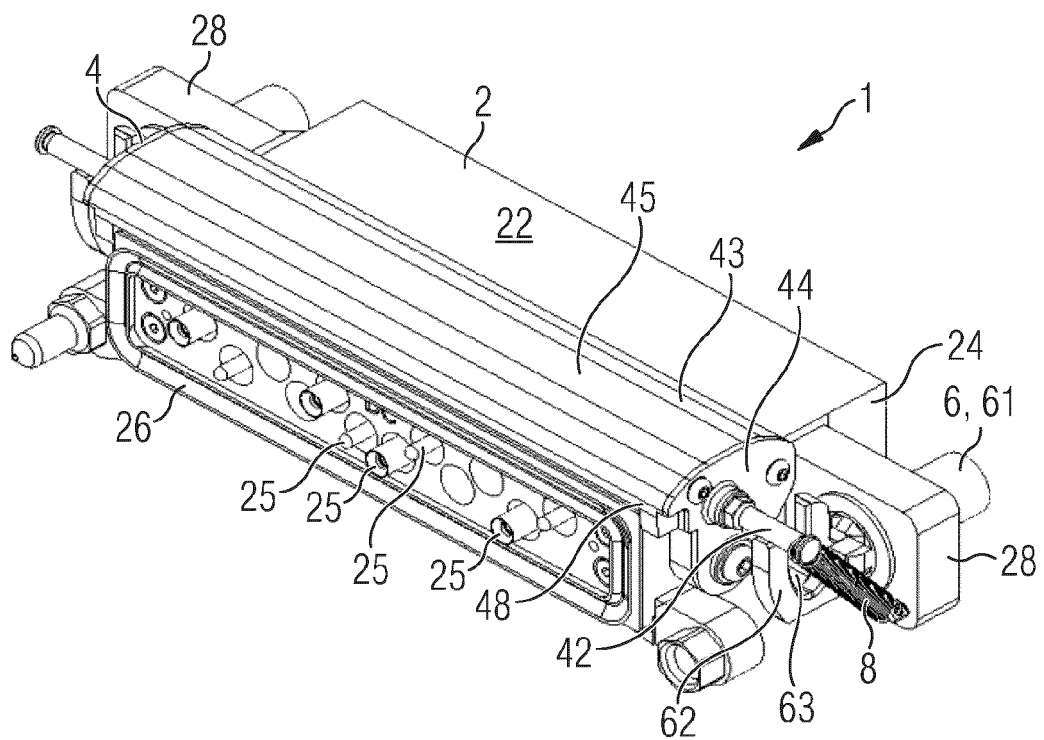


FIG 3A

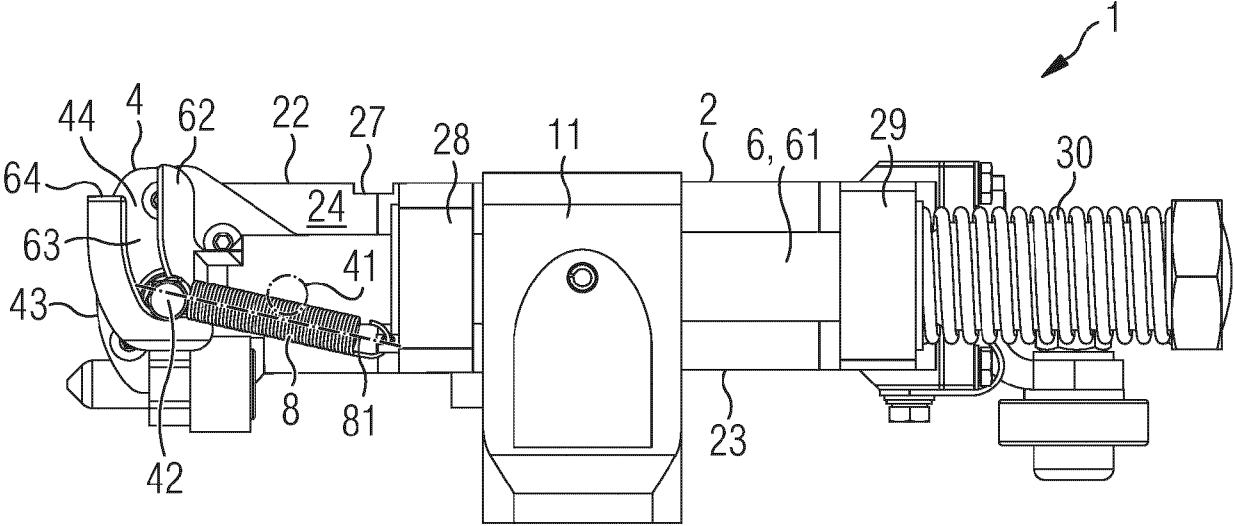


FIG 3B

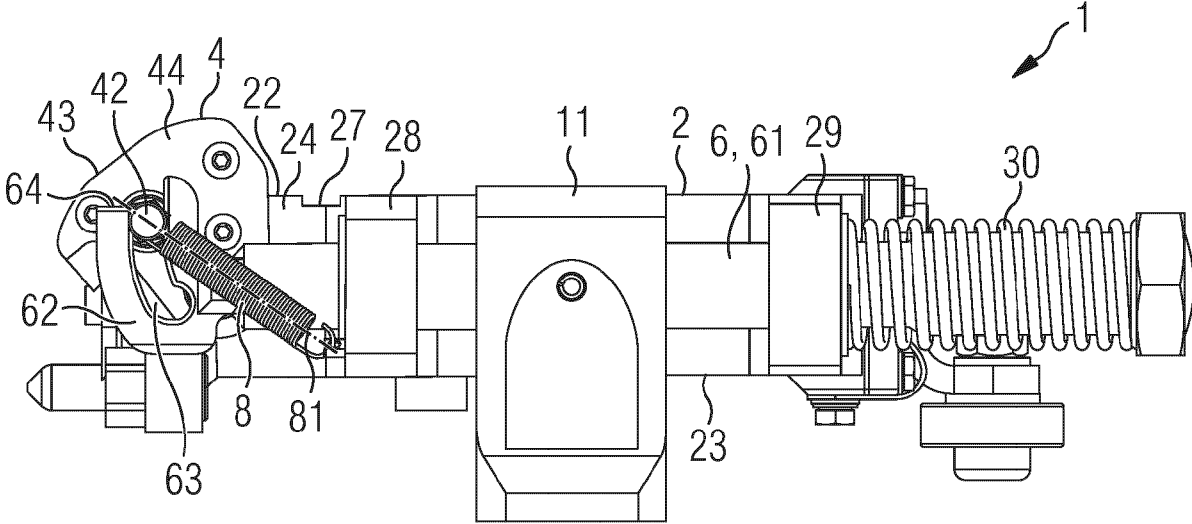


FIG 3C

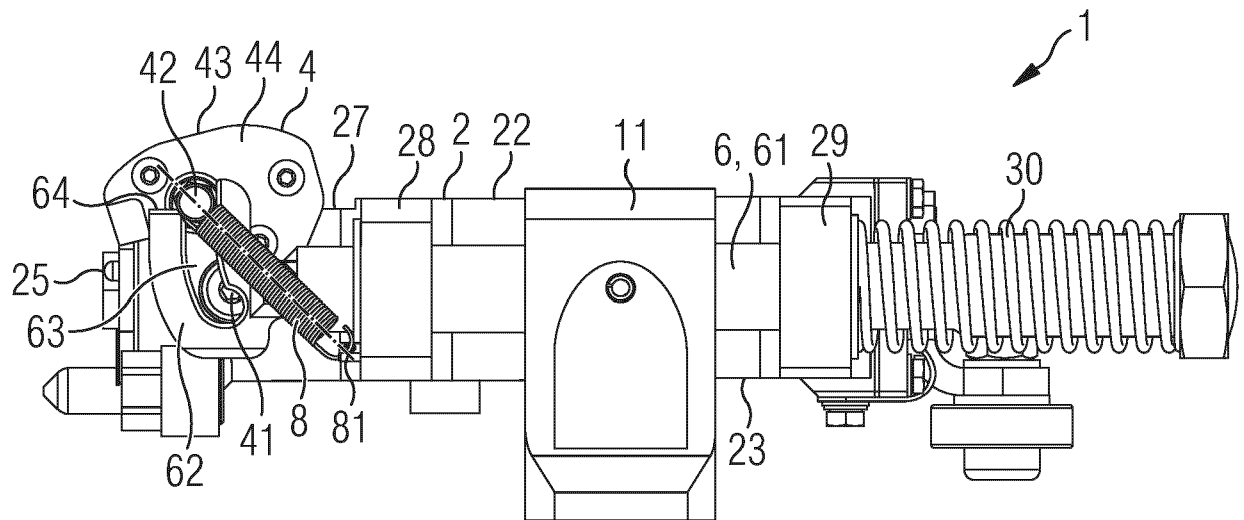


FIG 3D

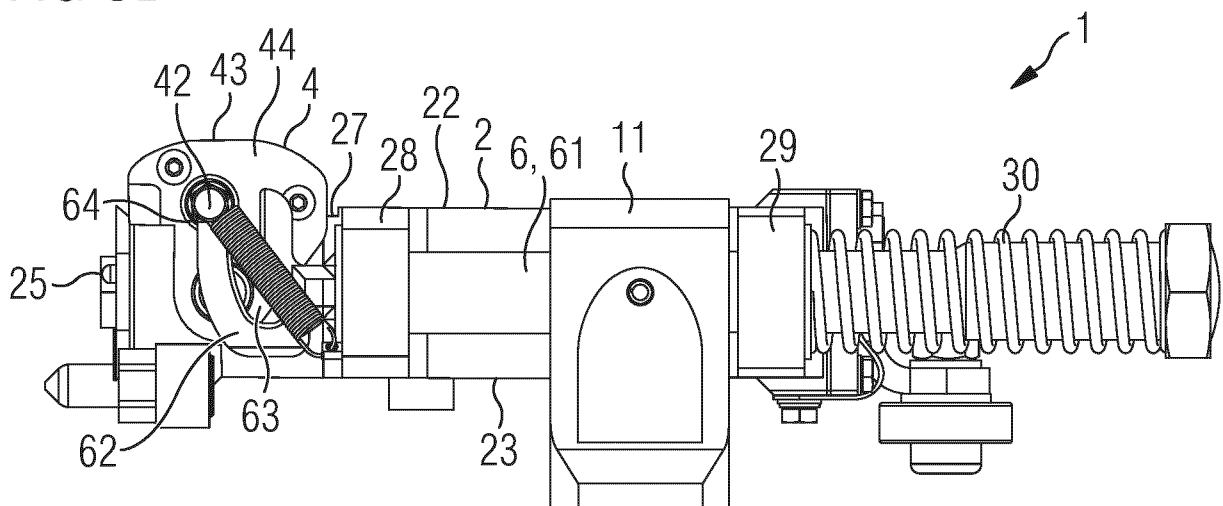


FIG 4A

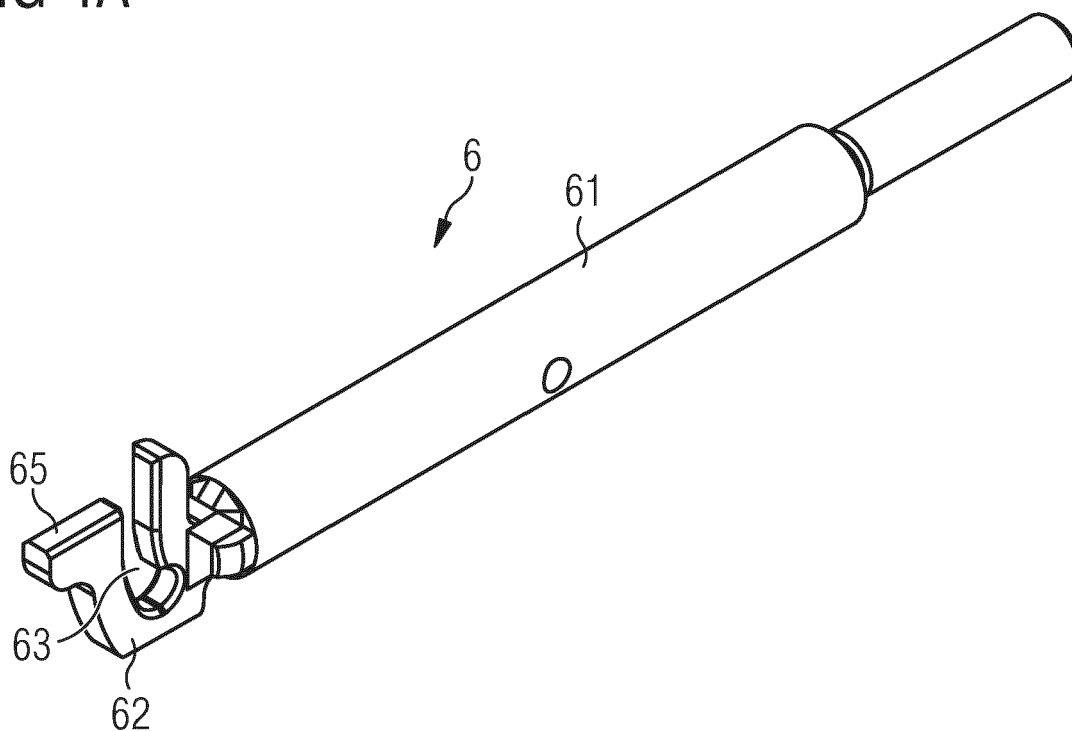


FIG 4B

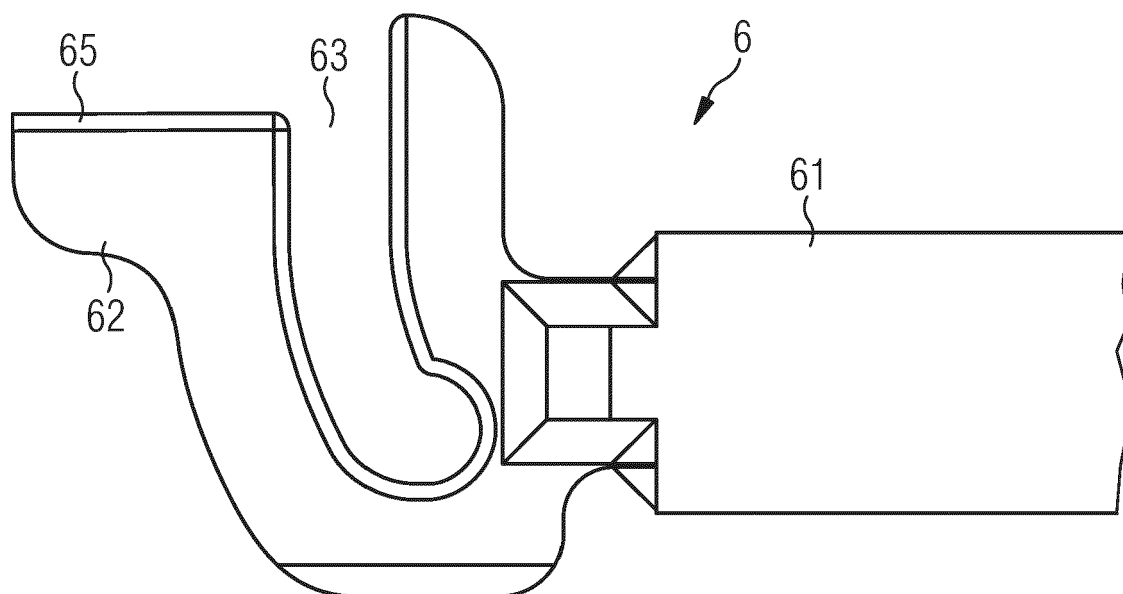


FIG 5A

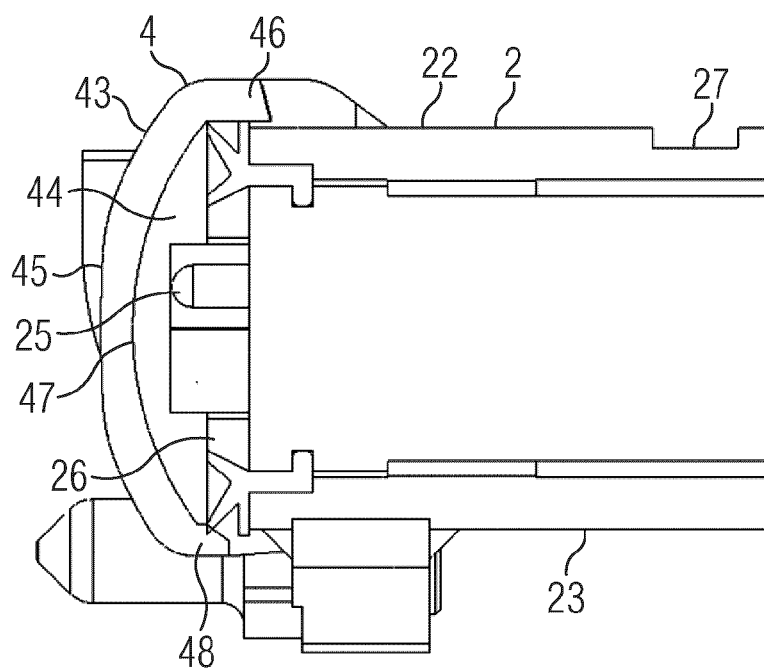
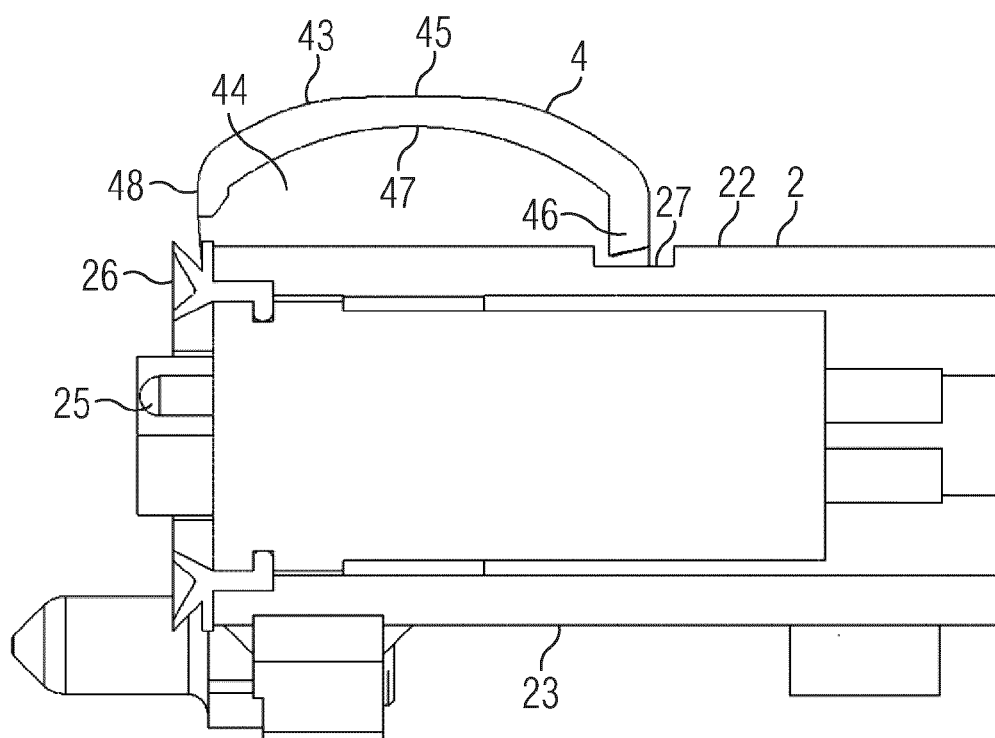


FIG 5B





EUROPEAN SEARCH REPORT

Application Number

EP 25 17 0962

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	CN 217 435 722 U (CRRC BRAKE SYSTEMS CO LTD) 16 September 2022 (2022-09-16) * figures 1-5 *	1-8, 14-16	
X	WO 2021/110660 A1 (VOITH PATENT GMBH [DE]) 10 June 2021 (2021-06-10) * figures 1-6 *	10-16	
X	US 1 790 292 A (WILLIAM E. VAN DORN) 27 January 1931 (1931-01-27) * page 3, lines 19-20; figures 1-5 *	10-16	
X	WO 2021/260018 A1 (DELLNER COUPLERS AB [SE]) 30 December 2021 (2021-12-30) * page 7, line 39; figures 1a, 2-12, 14, 15, 43 *	10-16	TECHNICAL FIELDS SEARCHED (IPC) B61G
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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 9 December 2025	Examiner Denis, Marco
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



Application Number

EP 25 17 0962

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

1-8, 10-16

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 25 17 0962

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-8, 14-16**An electrical coupler for a rail vehicle coupler**

2. claim: 9**A lid for an electrical coupler of a rail vehicle coupler
having a specific shape**

3. claims: 10-13**A lid for an electrical coupler of a rail vehicle coupler
being made of or coated in electrical insulating material**

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 25 17 0962

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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09-12-2025

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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