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(54) **ENDPIECE FOR A COUPLING ROD, DRAFT GEAR FOR A COUPLING ROD, COUPLER FOR A MULTI-CAR VEHICLE AND METHOD FOR BUILDING A DRAFT GEAR OR COUPLER**

(57) Endpiece (4) for a coupling rod (2), the endpiece (4) being suitable to be used as part of a draft gear (1) for a coupling rod (2), the endpiece (4) comprising

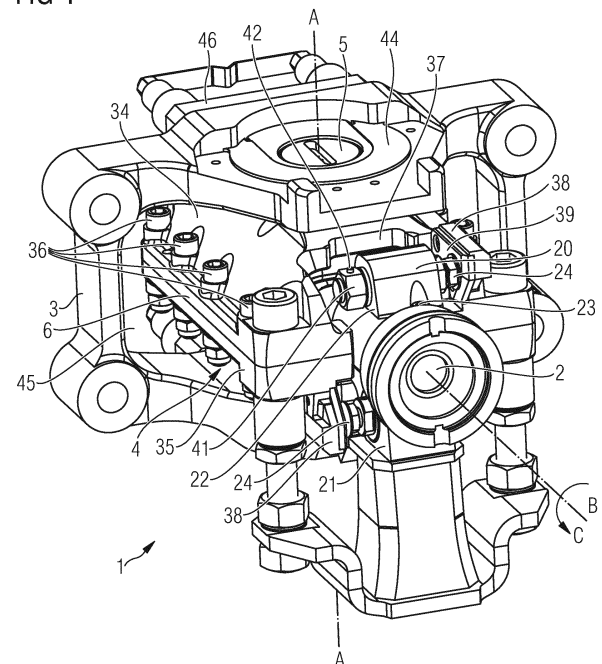
- a housing (6),
- a rod (2, 13), the rod (2, 13) having a housing part (14) that is arranged inside the housing (6),
- an elastic connection (15) that connects the housing part (14) to the housing (6), the elasticity of the elastic connection (15) allowing the rod (2, 13) to swivel about its longitudinal axis (B) relative to the housing (6),

the endpiece comprises moreover

an element (20) that is suitable to create a spreading force (F), the element (20) having

- a first end (22) that is in contact with a part of the rod (2, 13) and
- a second end (24) that is in contact with a part of the housing (6),
- a spring element (25) being arranged between the first end (22) and the second end (24), the spring element (25) generating a spreading force (F) that is directed to increasing the distance between the first end (22) and the second end (24), if the first end (22) is moved towards the second end (24).

FIG 1



Description

[0001] The invention pertains to an endpiece for a coupling rod. The invention also pertains to a draft gear for a coupling rod. The invention also pertains to a coupler for a multi-car vehicle. The invention also pertains to a method for building a draft gear or a coupler.

[0002] From EP 1 719 684 B1, an endpiece for a coupling rod is known. The endpiece is suitable to be used as part of a draft gear for a coupling rod. The draft gear being shown for example in Fig. 5 and Fig. 6 of EP 1 719 684 B1. The endpiece comprises a housing that forms part of the "Anlenkung" and is not further designated in the Figs. of EP 1 719 684 B1. The endpiece of EP 1 719 684 B1 has a rod referred to as "Kupplungsschaft 1" or "hinteres Ende des Kupplungsschafts 3", the rod having a housing part that is arranged inside the housing of the endpiece. The endpiece, by way of the rubber donuts called "Federringe 13", has an elastic connection that connects the housing part of the rod to the housing of the endpiece. The elasticity of the elastic connection allows the rod to swivel about its longitudinal axis relative to the housing. The housing part of the rod has circumferential grooves between circumferential ridges ("Ringwülste 14") and the housing of the endpiece has an inward-facing surface with circumferential grooves arranged between the circumferential ridges arranged on the inward-facing surface. The doughnut-shaped elastic elements "Federringe 13" each have an inner part arranged in one of the circumferential grooves of the housing part and an outer part arranged in one of the circumferential grooves of the inward-facing surface of the endpiece. The draft gear of EP 1 719 684 B1 has a bearing bracket referred to as "Lagerbock 4", the above-described endpiece and a joint ("Drehzapfen 16") arranged between the bearing bracket and the housing of the endpiece, whereby the joint allows the housing to swivel relative to the bearing bracket.

[0003] From WO 2019/045634, a coupler for a multi-car vehicle is known, the coupler comprising a main buffer 2 mounted between a coupler head 4 and a car body attachment 5. In order to support the main buffer 2 in an uncoupled state, support dampers 3 are arranged underneath, with a rear end mounted on the car body attachment 5 and a front end mounted on the main buffer 2 by means of a holder 6.

[0004] From WO 2021/249954 A1, a coupler for a multi-car vehicle is known having a coupling rod which has a first rod part and a second rod part, whereby the coupler head is attached to the second rod part, whereby the coupling rod has a rod joint being arranged between the first rod part and the second rod part, the rod joint allowing the second rod part to be folded backwards towards the first rod part. Similar designs are known from EP 3 992 054 A1 and CN 112896224 A. Designs of couplers as they are shown in WO 2021/249954 A1 have the problem that in a state where the coupler head is folded backwards (e.g. Fig. 1 of WO 2021/249954 A1), the coupler head is

arranged off-centre of the longitudinal axis of the first rod part and hence of the draft gear. This leads to the effect that the weight of the coupler head that now is off-centre applies a torsional force onto the first rod part and the draft gear.

[0005] From WO 2017/076871 A1 a draft gear for a coupling rod is known. The draft gear has a base plate (Grundplatte 20) that surrounds the coupler rod (Kupplungsstange 10). Different from the two-part housing known from EP 1 719 684 B1, which has two housing halves fixed by way of screws (see Fig. 4,5 of EP 1 719 684 B1), in the design known from WO 2017/076871 A1 the base plate has a one-piece element that has a hole through which the coupler rod passes. A bearing element (Lagerelement 30) is arranged between the inward-facing surface of the hole of the base plate and the outer circumferential surface of the coupler rod. The bearing element comprises an elastic element (Rueckstellkomponente 32). An inward-facing surface of the elastic element is arranged on the outer circumferential surface of the coupler rod so as not to rotate relative to the outer circumferential surface of the coupler rod via the design of an end wall of the bearing element (Stuetzkomponente 31) that sits on the outer circumferential surface of the coupler rod and on which the inward-facing surface of the elastic element sits. An outward-facing surface of the elastic element is arranged to contact the inward-facing surface of the hole of the base plate so as not to rotate relative to the inward-facing surface. A rotational movement of the outward-facing surface of the coupler rod relative to the inward-facing surface of the hole will lead to the elastic element being deformed, whereby the deformation creates a restoring force directed to rotate the coupler rod back.

[0006] Given this background, the problem to be solved by the invention is to provide means that reduce asymmetric loads on a draft gear.

[0007] This problem is solved by an endpiece, a draft gear and a coupler or method according to the appending independent claims. Preferred embodiments are described in the subordinate claims and the description following hereafter.

[0008] The invention is based on the basic idea of providing the endpiece with an additional element which is suitable to create a spreading force. The additional element has a first end that is in contact with a part of the rod and a second end that is in contact with a part of the housing of the endpiece. According to the invention, a spring element is arranged between the first and second end of the additional element, the spring element generating a spreading force that is directed to again increasing the distance between the first and second end of the additional element, if the first end is moved towards the second end. The invention identifies that a tendency for the rod to swivel about its longitudinal axis relative to the housing of the endpiece, as it may occur in designs as shown in WO 2021/249954 A1 for cases where the coupler head has been folded back, can be countered by

providing the additional element that is suitable to create a spreading force as described above. The tendency of the rod to swivel about the longitudinal axis relative to the housing of the endpiece will lead to a part of the rod to come closer to a certain part of the housing. If - as the invention suggests - a spring element is provided that generates a spreading force if a certain part of the rod that is in contact with the first end of the additional element is moved towards the part of the housing that is in contact with the second end, the movement of the rod relative to the housing can be countered and the twisting effect is hence at least reduced or even completely countered.

[0009] The invention is directed to a new design for an endpiece of a coupling rod. It is believed that a new design for such an endpiece is a marketable good in itself. The endpiece modified according to the invention can, for example, be used as a replacement piece for the endpiece that is disclosed as part of the draft gear shown in EP 1 719 684 B1. The "Lagerbock 4" and the "Drehzapfen 16" of the design shown in EP 1 719 684 B1 can remain the same if the draft gear according to EP 1 719 684 B1 is modified according to the invention. All key elements of the invention are realized within the endpiece. The twisting forces applied to the rod that are to be counteracted by the additional element provided according to the invention are fully offset with the additional element provided to the endpiece.

[0010] The endpiece comprises a housing. This housing can be a unitary body. In a preferred embodiment, the housing is made up of two shells that are connected to one another, for example an upper shell and a lower shell that are screwed together in a horizontal parting plane. In a preferred embodiment, the housing, preferably the shells that make up the housing, are either machined out of solid pieces or are cast pieces (that after the casting are possibly being further machined). In a preferred embodiment, the housing has a longitudinal shape and extends along a longitudinal axis.

[0011] The endpiece according to the invention further has a rod. The rod has a housing part that is arranged inside the housing of the endpiece. The rod can be a rod that is attached to a coupling rod. The design shown in EP 1 719 684 B1 in Figs. 4 to 6 shows such a shorter rod. The item is being referred to as "hinteres Ende des Kupplungsschafts 3" in EP 1 719 684 B1 and terminates in an enlarged part that can be connected to a further part of the coupling rod. Such a design with a shorter rod that has the housing part arranged in the housing of the endpiece allows for the draft gear to be manufactured separately and, once it is finished, for the remainder of the coupling rod and the coupling head to be attached to it. Designs are also feasible, however, where the rod that forms part of the endpiece is the coupling rod itself. In such a design, the rod would have an end to which the coupler head is connected. In the preferred embodiment, where the coupling rod has a first rod part and a second rod part, whereby the coupler head is attached to the second rod part and whereby the coupling rod has a rod

joint being arranged between the first rod part and the second rod part, so as to allow the second rod part to be folded backwards towards the first rod part, the rod of the endpiece could be the first rod part. Alternatively, the first rod part in such a design can be attached to the rod of the endpiece.

[0012] The endpiece according to the invention has an elastic connection that connects the housing part to the housing, the elasticity of the elastic connection allowing the rod to swivel about its longitudinal axis relative to the housing. The swivel-movement preferably is a rotational movement around the longitudinal axis. The elastic connection between the housing part of the rod and the housing preferably is provided between an outer circumferential surface of the housing part of the rod and an inward-facing surface of the housing. The elastic connection can be provided by way of rubber material attached to the outer circumferential part of the housing part on the one side and the inward-facing surface of the housing on the other side.

[0013] In a preferred embodiment, the elastic connection is provided by way of ring-shaped elastic elements. In a preferred embodiment, the housing part of the rod has one or several circumferential grooves and the housing has an inward-facing surface that has one or several circumferential grooves arranged on the inward-facing surface, whereby the elastic connection comprises ring-shaped elastic elements, each ring-shaped elastic element having an inner part being arranged in one of the circumferential grooves of the housing part and an outer part being arranged in one of the circumferential grooves of the inward-facing surface.

[0014] In a preferred embodiment, the elastic connection is provided by way of several elements that each have the shape of a circular ring section. For example, two elements that each have the shape of a circular ring section that spans over 180° can be placed together at their ends to form a ring-shaped elastic element. The individual elements that each have the shape of a circular ring section are sometimes referred to as "banana-shaped" or "telephone receiver"-shaped (in German: "telefonhörerförmig").

[0015] In a preferred embodiment, the housing part of the rod has one or several circumferential grooves and the housing has an inward-facing surface that has one or several circumferential grooves arranged on the inward-facing surface, whereby the elastic connection comprises ring-shaped elastic elements that each are made up of a number of elements that each have the shape of a circular ring section, each such composed ring-shaped elastic element having an inner part being arranged in one of the circumferential grooves of the housing part and an outer part being arranged in one of the circumferential grooves of the inward-facing surface.

[0016] Such a design is for example shown in Fig. 6 of EP 1 719 684 B1 by way of the "Federringe 13".

[0017] In a preferred embodiment, at least two circumferential grooves and two ring-shaped elastic elements

are provided (be it two one-piece ring-shaped elements or be it two composite ring-shaped elements, each being made up of a number of elements that each have the shape of a circular ring section). In a preferred embodiment, at least three circumferential grooves and three ring-shaped elastic elements are provided. In a preferred embodiment, fewer than 15, preferably fewer than 10, circumferential grooves and ring-shaped elastic elements are provided.

[0018] In a preferred embodiment, the elastic connection that connects the housing part to the housing has a design that allows the rod to swivel about its longitudinal axis relative to the housing due to the elasticity of the elastic connection, leading to a deformation of the material that provides the elastic connection. If a rubber material is used as material for the elastic connection, the swivel movement of the rod about its longitudinal axis relative to the housing will lead to a deformation of the rubber material. The design can also foresee that if the swivel movement of the rod about its longitudinal axis relative to the housing is larger than a predetermined amount, an outward-facing surface of the material that provides the elastic connection (for example the rubber material) that initially is in surface contact with an outward-facing surface of the rod or an inward-facing surface of the housing, loses the surface contact; for example lifts off or slips into a new position of surface contact.

[0019] In a preferred embodiment, the rod is moveable in linear direction relative to the housing at least to a certain degree. In a preferred embodiment, the elastic connection not only by its elasticity allows the rod to swivel about its longitudinal axis relative to the housing but also allows for the rod to move along the rod's longitudinal axis relative to the housing at least to a certain degree.

[0020] In a preferred embodiment, the element is arranged outside of the housing.

[0021] According to the invention, the endpiece is provided with an additional element. This additional element is arranged separately from the elastic connection that connects the housing part to the housing. The additional element provided is suitable to create a spreading force. According to the invention, the element has a first end that is in contact with a part of the rod. In a preferred embodiment, the first end is connected to a part of the rod. In a preferred embodiment, an additional plate can be provided on the outer circumference of the rod. This additional plate attached to the circumferential surface of the rod can be considered the first end. In a preferred embodiment, the first end that is in contact with a part of the rod is attached to the rod but is attached to the rod in a releasable manner. For example, the first end can be screwed to the outer circumference of the rod, allowing maintenance to the element should the element become damaged.

[0022] According to the invention, the additional element has a second end that is in contact with a part of the housing. In a preferred embodiment, the second end

of the additional element is a free surface that is in surface contact with a part of the housing. In a preferred embodiment, the second end that is in contact with a part of the housing can slide along a surface of the housing.

[0023] In a preferred embodiment, the first end of the additional element is fixedly, but preferably releasably, attached to a part of the rod, while the second end of the additional element is in surface contact with a part of the housing, but not attached to a part of the housing. Such a design, where the additional element is attached to the rod, but only in surface contact with the housing allows for movements of the rod to take place relative to the housing along the longitudinal axis of the rod.

[0024] According to the invention, a spring element is arranged between the first end and the second end, the spring element generating a spreading force that is directed to again increase the distance between the first end and the second end, if the first end is moved towards the second end. In a preferred embodiment, the spring element is designed and arranged in such a manner that starting from an initial position, where the spring element might be relaxed or might be loaded to a smaller extent, the spring element is loaded or loaded further, if the first end is moved towards the second end. (Further) loading the spring element leads to the spring element providing the spreading force. In a preferred embodiment, the spring element is arranged in such a manner that the spring force that it generates is directed in a plane perpendicular to the longitudinal axis, preferably in a tangential direction to a circular shaped outer circumference of the rod, if the rod in a preferred embodiment is designed to have such a circular shaped outer circumference.

[0025] The spring element can be a damper, for example a gas hydraulic damper. In a preferred embodiment, the spring element is a spring. The spring element can for example be a coil spring. Preferably, the spring element is a disc spring or a series of disc springs arranged along a line.

[0026] Designs of the additional element are feasible, where the parts of the additional element are uncovered. As suggested above, the first end of the additional element can be provided by a plate that is attached to a part of the rod. In the simplest design, a coil spring is attached to this plate, whereby the free end of the coil spring forms the second end, the second end being in surface contact with a part of the housing.

[0027] In a preferred embodiment, the spring element is, however, arranged within a housing. Given the dirty environments of couplers for multi-car vehicles, for example for trains, the risk exists that the spring element may become dirty and may lose its functionality. In a preferred embodiment, the element has an element housing with a chamber, whereby the chamber has a chamber endwall. An element rod is arranged to be at least partially arranged in the chamber and movable relative to the chamber endwall. In a preferred embodiment, the spring element is arranged at least partially, preferably com-

pletely, inside the chamber. The spring element preferably is arranged between the chamber endwall and a holding part of the element rod. The holding part of the element rod can be a fixed connection between an end of the spring element and the element rod. For example, a straight line endpiece of a coil spring can be inserted into a hole in the element rod, the hole hence forming the holding part of the element rod and the coil spring in this embodiment being arranged between the chamber endwall and this hole of the element rod, with the linear endpiece of the coil spring being arranged in the hole. In a preferred hole, the holding part is a protruding part that protrudes over other parts of the surface of the element rod. Such a protruding part can be a simple pin that protrudes radially over other parts of the surface of the element rod. Preferably, the protruding part is a rim that circumferentially extends around the remaining parts of the element rod and protrudes radially outward from these remaining parts of the element rod. Such a rim provides a good countersurface for a spring element.

[0028] In a preferred embodiment, the spring element comprises one disc spring or several disc springs, whereby the one disc spring or the several disc springs are arranged between the chamber endwall and a holding part that radially extends from the element rod, preferably a rim shaped holding part that radially extends from the element rod.

[0029] In a preferred embodiment, the rim-shaped protruding element that forms the holding part of the element rod has a circumferential sealing element arranged around its most outward end. Said sealing element is arranged to seal against the wall of the chamber of the element. With the spring element being arranged within the chamber and with the sealing element sealing against the circumferential wall of the chamber, the sealing element prevents dirt from entering into the chamber and from coming into contact with the spring element.

[0030] The element rod is designed to be movable relative to the chamber endwall. In a preferred embodiment, the chamber endwall has a through-hole and the element rod is arranged to extend through the through-hole. In a preferred embodiment, a blocking element is arranged on that part of the element rod that is arranged outside of the chamber, the blocking element stopping the element rod from being pulled through the through-hole. Such a blocking element can be a nut that is screwed onto an outside thread on an end of the element rod.

[0031] In a preferred embodiment, a thread is provided in the element rod that extends from an end of the element rod along the longitudinal axis of the element rod, whereby a screw is screwed into the thread, the screw having a head. Designs are feasible, where a free end of the element rod provides the second end of the element that is in contact with a part of the housing, preferably in a surface contact with a part of the housing, and preferably able to slide along that part of the housing. However, providing a screw screwed into a thread of the element rod allows the element to be better adapted to its sur-

roundings. In a preferred embodiment, the second end of the element is provided by an end surface of the head of the screw. By way of screwing the screw further into the thread or by way of screwing the screw out of the thread, the length of the element rod including the screw can be changed. This design allows the element to be adapted to individual building scenarios and especially to adapt two tolerances.

[0032] In a preferred embodiment, a lock screw is provided in a radially extending inner thread of the element rod, whose inner thread terminates in the thread that takes up the screw. Said lock screw can be used to lock the position of the screw in the thread.

[0033] In a preferred embodiment, a further element that is suitable to create a spreading force is provided, the further element having

- a first end that is in contact with a part of the rod and
- a second end that is in contact with a part of the housing,
- a spring element being arranged between the first end and the second end, the spring element generating a spreading force that is directed to again increasing the distance between the first end and the second end, if the first end is moved towards the second end.

[0034] In a preferred embodiment, the first end of the element is in contact with a first part of the rod and the first end of the further element is in contact with a second part of the rod, the first part of the rod being arranged on a first side of the rod and the second part of the rod being arranged on a second side of the rod, the second side being the opposite side of the first side. For example, the first end of the element can be in contact with an upper part of the rod, while the first end of the further element is in contact with a lower part of the rod. Or the first end of the element is in contact with a leftward part of the rod, when viewed along the longitudinal axis of the rod, and the first end of the further element is in contact with a rightward part of the rod, when viewed along the longitudinal axis of the rod.

[0035] In a preferred embodiment, the second end of the element is in contact with a first part of the housing and the second end of the further element is in contact with a second part of the housing, the rod being arranged between the first part of the housing and the second part of the housing. In a preferred embodiment, the first part of the housing is arranged on one side of a vertical plane that contains the longitudinal axis of the rod and the second end is arranged on the opposite side of such a vertical plane. In addition or as an alternative, the first part of the housing is arranged on one side of a horizontal plane that contains the longitudinal axis of the rod and the second part of the housing is arranged on the other side of such a horizontal plane.

[0036] The draft gear according to the invention comprises

- a bearing bracket suitable to be attached to a car of a multi-car vehicle,
- an endpiece according to the invention and
- a joint arranged between the bearing bracket and the housing of the endpiece, whereby the joint allows the housing to swivel relative to the bearing bracket.

[0037] In a preferred embodiment, the bearing bracket has an opening and the endpiece is arranged partially within said opening.

[0038] In a preferred embodiment, the joint comprises

- an upper joint pin protruding from the top of the housing along a vertical axis, the upper joint pin being held in a hole of an upper bracket of the bearing bracket, such that the upper joint pin can swivel in the hole about the vertical axis and
- a lower joint pin protruding from the bottom of the housing in the direction of the vertical axis, the lower joint pin being held in a hole of a lower bracket of the bearing bracket, such that the lower joint pin can swivel in the hole about the vertical axis.

[0039] In a preferred embodiment, the upper bracket and the lower bracket have a break-away section each, said break-away section containing the hole. The break-away section can extend through an opening in the bearing bracket to a plate that is screwed to the back of the bearing bracket. The screws can be designed to break upon the application of a certain linear force; breaking away of the screws setting free the plate and the break-away sections, allowing the endpiece to move relative to the remainder of the bearing bracket.

[0040] In a preferred embodiment, the longitudinal axis B of the rod is a horizontal axis.

[0041] In a preferred embodiment, the element rod extends along the longitudinal axis C, whereby in a preferred embodiment, the longitudinal axis C is a horizontal axis. In a preferred embodiment, the longitudinal axis B is arranged in a first vertical plane and the longitudinal axis is arranged in a second vertical plane, whereby the angle between the first vertical plane and the second vertical plane is $>0^\circ$ and $<180^\circ$, preferably $>25^\circ$ and $<150^\circ$ and preferably $>45^\circ$ and $<135^\circ$, and preferably is 90° .

[0042] The coupler according to the invention comprises a draft gear according to the invention, the rod of the endpiece either forming a part of a coupling rod or the rod of the endpiece being attached to a coupling rod, whereby a coupler head is attached to the coupling rod.

[0043] In a preferred embodiment, the coupling rod has a first rod part and a second rod part, whereby the first rod part is either attached to the rod of the endpiece or is formed by the rod of the endpiece, and whereby the coupler head is attached to the second rod part, whereby the coupling rod has a rod joint being arranged between the first rod part and the second rod part, the rod joint allowing the second rod part to be folded backwards to-

wards the first rod part.

[0044] In the method according to the invention a draft gear according to the invention or a coupler according to the invention is built, whereby the term "built" includes the new building of a draft gear or a coupler during the rehaul or repair of a draft gear. The method comprises the steps of

- providing a draft gear according to the invention or a coupler according to the invention,
- removing the element from the draft gear,
- providing a corresponding element,
- and attaching the element to the draft gear.

[0045] In a preferred embodiment, the multi-car vehicle is a train.

[0046] In the following, the invention will be described by reference to figures that only show exemplary embodiments. In the figures

Fig. 1 shows a schematic perspective view onto a draft gear according to the invention;

Fig. 2 a sectional side view through parts of the draft gear according to Fig. 1;

Fig. 3 a sectional front view through parts of the draft gear according to Fig. 1;

Fig. 4 a perspective schematic view onto a detail of the draft gear shown in Fig. 1;

Fig. 5 a perspective schematic view onto a coupler according to the invention.

[0047] Fig. 1 to 4 show draft gear 1 for a coupling rod 2. The draft gear 1 comprises a bearing bracket 3 suitable to be attached to a car of a multi-car vehicle. The draft gear 1 further comprises an endpiece 4 and a joint 5. The joint 5 is arranged between the bearing bracket 3 and a housing 6 of the endpiece 4, whereby the joint 5 allows the housing 6 to swivel about the vertical axis A relative to the bearing bracket 3.

[0048] In the design shown in Fig. 1 to 4, the joint 5 comprises

- an upper joint pin 7 protruding from the top of the housing 6 in the direction of the vertical axis A, the upper joint pin 7 being held in a hole 8 of an upper bracket 9 of the bearing bracket 3, such that the upper joint pin 7 can swivel in the hole 8 about the vertical axis A and
- a lower joint pin 10 protruding from the bottom of the housing 6 in the direction of the vertical axis A, the lower joint pin 10 being held in a hole 11 of a lower bracket 12 of the bearing bracket 3, such that the lower joint pin 10 can swivel in the hole 11 about the vertical axis A.

[0049] The upper bracket 9 and the lower bracket 12 can be designed to have a break-away section 44 each, said break-away section 44 containing the hole 8, 11.

The break-away section 44 can extend through an opening 45 in the bearing bracket 3 to a plate 46 that is screwed to the back of the bearing bracket 3. The screws (not shown in Fig. 1) can be designed to break upon the application of a certain linear force; breaking away of the screws setting free the plate 46 and the break-away sections 44, allowing the endpiece 4 to move relative to the remainder of the bearing bracket 3.

[0050] The endpiece 4 comprises the housing 6 and a rod 13, which in the embodiment shown in Fig. 1 to 4 is a detachable endpiece of the coupler rod 2. The rod 13 has a housing part 14 that is arranged inside the housing 6. An elastic connection 15 connects the housing part 14 to the housing 6. The elasticity of the elastic connection 15 allows the rod 13 to swivel about its longitudinal axis B relative to the housing 6. The swivel movement is a rotational movement around the longitudinal axis B as indicated by the arrow C in Fig. 1.

[0051] The housing part 14 of the rod has circumferential grooves 16 and the housing 6 has an inward-facing surface with circumferential grooves 17 arranged on the inward-facing surface. The elastic connection 14 comprises ring-shaped elastic elements 18. Each ring-shaped elastic element 18 has an inner part being arranged in one of the circumferential grooves 16 of the housing part 14 and an outer part being arranged in one of the circumferential grooves 17 on the inward-facing surface of the housing 6.

[0052] The endpiece 4 has an element 20 and a further element 21, each being suitable to create a spreading force F. The element 20 has a first end 22 that is connected to a part of rod 15 by way of a screw 23. The element 20 also has a second end 24 that is in surface contact with a part of the housing 6. As part of the element 20 a spring element 25 is arranged between the first end 22 and the second end 24, the spring element 25 generating a spreading force F that is directed to again increasing the distance between the first end 22 and the second end 24, if the first end 22 is moved towards the second end 24. The first end 22 comprises two perpendicular or substantially perpendicular contact surfaces, where one of said contact surfaces is parallel to or substantially parallel to a surface of the second end and the second one is used to contact to the rod.

[0053] The element 21 is designed in the same manner as the element 20 and hence has a first end 22 that is connected to a part of rod 15 by way of a screw 23. The element 21 also has a second end 24 that is in surface contact with a part of the housing 6. As part of the element 21 a spring element 25 is arranged between the first end 22 and the second end 24, the spring element 25 generating a spreading force F that is directed to again increasing the distance between the first end 22 and the second end 24, if the first end 22 is moved towards the second end 24.

[0054] The element 20, 21 has an element housing 26 with a chamber 27, whereby the chamber 27 has a chamber endwall 28. An element rod 29 is partially arranged

in the chamber 27 and moveable relative to the chamber endwall 28. The spring element 25 is arranged between the chamber endwall 27 and a holding part 30 of the element rod 29. In the embodiment of Fig. 1 to 4, the spring element 25 comprises several disc springs 31. The several disc springs 31 are arranged between the chamber endwall 27 and a holding part 30 that in the embodiment of Fig. 1 to 4 radially extends from the element rod 29.

[0055] As can best be seen in Fig. 3, a thread 32 is provided in the element rod 29 that extends from an end of the element rod 29 along the longitudinal axis C of the element rod 29, whereby a screw 33 is screwed into the thread 32. The screw 33 has a head. The second end 24 is provided by an end surface of the head of the screw 33. A lock screw 40 can be used to lock the position of the screw 33 in the thread 32.

[0056] As can be best seen from Fig. 3, the first end 22 of the element 20 is in contact with a first part of the rod 13, and the first end 22 of the further element 21 is in contact with a second part of the rod 13, the first part of the rod 13 being arranged on a first side of the rod 13 (in the embodiment of Fig. 3 on the top of the rod 13; which can also be described as being on one side of a horizontal plane that contains the longitudinal axis B of the rod 13) and the second part of the rod 13 being arranged on a second side of the rod 13 (in the embodiment of Fig. 3 on the bottom of the rod 13; which can also be described as being on another side of a horizontal plane that contains the longitudinal axis B of the rod 13), the second side being the opposite side to the first side.

[0057] As can be best seen from Fig. 3, the second end 24 of the element 20 is in contact with a first part of the housing 6, and the second end 24 of the further element 21 is in contact with a second part of the housing 6, the rod 13 being arranged between the first part of the housing 6 and the second part of the housing 6. The arrangement can also be described such that the first part of the housing 6 is arranged on one side of a vertical plane that contains the longitudinal axis B of the rod 13 and the second part of the housing 6 is arranged on the opposite side of this vertical plane.

[0058] As can best be seen from Fig. 1, the housing 6 can be made up of an upper shell 34 and a lower shell 35 being screwed together by screws 33. The housing can have a recess 36 adapted to receive the element housing 26 if the rod 13 is made to move linearly relative to the housing 6 for a certain distance.

[0059] The part of the housing 6 that the second end 24 of the element 20 is in contact with (the end surface of the screw 33) can be a plate 38 protruding from the remainder of the housing. The plate 38 can have a wear plate 39 of a plastic material attached to it to facilitate the movement of the second end 24 relative to the housing 6. Fig. 1 and 4 show that the wear plate 39 can have a chamfered front edge that facilitates the head of the screw 33 coming into contact with the wear plate 39 for situations where in certain driving conditions the rod 13

has moved out of the housing 6 so much that the head of the screw 33 leaves contact with the wear plate 39.

[0060] Fig. 3 shows that the head of the screw 33 can have a crowned surface that forms the second end 24.

[0061] Fig. 1, 3 and 4 best show that a thread can be provided on the element rod 29 at the end opposite the second end 24. A nut 41 with a locking screw 42 arranged in the nut 41 can be arranged on the thread. This nut 41 can be used to define the position of the element rod 29 relative to the elements housing 26 and for pre-tensioning of the disc springs 31. As can also be seen from Fig. 3, the chamber endwall 28 can have a hole through which the element rod 29 passes from inside the chamber 27 to the outside of the chamber 27. The nut 41 is arranged on that part of the element rod 29 that is outside the chamber 27.

[0062] The holding part 30 that in the embodiment of Fig. 1 to 4 extends radially from the element rod 29 can be used to seal the open end of the chamber 27 by way of arranging a circular sealing element, such as the wearing ring 43, on the outer ring-shaped circumferential surface of the holding part 30. A wearing ring 43, however, does not achieve a fluid tight seal as there remains a small gap, but the gap is sufficiently small to prevent dirt, dust, grease, etc. from entering the chamber 27.

[0063] Fig 5 shows a coupler 100 according to the invention. The coupler 100 has a draft gear 1 according to the invention and a coupling rod 2 being attached to the rod 13 of the endpiece. A coupler head 101 is attached to the coupling rod 2. In the embodiment shown in Fig. 5, the coupling rod 2 has a first rod part 2a and a second rod part 2b, whereby the first rod part 2a is attached to the rod 13 of the endpiece 4. The coupler head 101 is attached to the second rod part 2b, whereby the coupling rod 2 has a rod joint 102 being arranged between the first rod part 2a and the second rod part 2b, the rod joint 102 allowing the second rod part 2b to be folded backwards towards the first rod part 2a.

[0064] The coupler 100 can be brought into its operational state by aligning the first rod piece 2a and the second rod piece 2b into a straight line (not shown in Fig. 5). The coupler 100 also has a non-operational state shown in Fig. 5. In the non-operational state, the second rod piece 2b has been swivelled to the side about the rod joint 102. The weight of the second rod piece 2b and the weight of the coupler head 101 in the non-operational state are out of the line relative to the longitudinal axis B and hence create a momentum around the longitudinal axis B that is directed to rotate the rod 13 around the longitudinal axis B. The spreading force F created by the element 20 and the further element 21 at least partially counteracts this momentum.

Claims

1. Endpiece (4) for a coupling rod (2), the endpiece (4) being suitable to be used as part of a draft gear (1)

for a coupling rod (2), the endpiece (4) comprising

- a housing (6),
- a rod (2, 13), the rod (2, 13) having a housing part (14) that is arranged inside the housing (6),
- an elastic connection (15) that connects the housing part (14) to the housing (6), the elasticity of the elastic connection (15) allowing the rod (2, 13) to swivel about its longitudinal axis (B) relative to the housing (6),

characterized by

an element (20) that is suitable to create a spreading force (F), the element (20) having

- a first end (22) that is in contact with a part of the rod (2, 13) and
- a second end (24) that is in contact with a part of the housing (6),
- a spring element (25) being arranged between the first end (22) and the second end (24), the spring element (25) generating a spreading force (F) that is directed to increasing the distance between the first end (22) and the second end (24), if the first end (22) is moved towards the second end (24).

2. Endpiece according to claim 1, **characterized in that** the element (20) has

- an element housing (26) with a chamber (27), whereby the chamber (27) has a chamber endwall (28), and
- an element rod (29) partially arranged in the chamber (27) and moveable relative to the chamber endwall (28),

whereby the spring element (25) is arranged between the chamber endwall (28) and a holding part (30) of the element rod (29).

3. Endpiece according to claim 2, **whereby** the spring element (25) comprises one disc spring or several disc springs (31), whereby the one disc spring or the several disc springs (31) are arranged between the chamber endwall (28) and the holding part (30), whereby the holding part (30) radially extends from the element rod (29).

4. Endpiece according to claim 2 or 3, **characterized in that** a thread (32) is provided in the element rod (29) that extends from an end of the element rod (29) along the longitudinal axis (C) of the element rod (29), whereby a screw (33) is screwed into the thread (32), the screw (33) having a head.

5. Endpiece according to claim 4, **characterized in that** the second end (24) is provided by an endsur-

face of the head of the screw (33).

6. Endpiece according to any one of claims 1 to 5, **characterized in that** a further element (21) that is suitable to create a spreading force (F) is provided, the further element (21) having

- a first end (22) that is in contact with a part of the rod (2, 13) and
- a second end (24) that is in contact with a part of the housing (6),
- a spring element (25) being arranged between the first end (22) and the second end (24), the spring element (25) generating a spreading force (F) that is directed to increasing the distance between the first end (22) and the second end (24), if the first end (22) is moved towards the second end (24).

7. Endpiece according to claim 6, **characterized in that**

- the first end (22) of the element (20) is in contact with a first part of the rod (2, 13) and the first end (22) of the further element (21) is in contact with a second part of the rod (2, 13), the first part of the rod (2, 13) being arranged on a first side of the rod (2, 13) and the second part of the rod (2, 13) being arranged on a second side of the rod (2, 13), the second side being the opposite side to the first side;
- the second end (24) of the element (20) is in contact with a first part of the housing (6) and the second end (24) of the further element (21) is in contact with a second part of the housing (6), the rod (2, 13) being arranged between the first part of the housing (6) and the second part of the housing (6).

8. Endpiece according to claims 1 to 7, **characterized in that**

- the housing part (14) of the rod (2, 13) has circumferential grooves (16),
- the housing (6) has an inward-facing surface with circumferential grooves (17) arranged on the inward-facing surface,
- the elastic connection (15) comprising ring-shaped elastic elements (18), each ring-shaped elastic element (18) having an inner part being arranged in one of the circumferential grooves (16) of the housing part (14) and an outer part being arranged in one of the circumferential grooves (17) on the inward-facing surface.

9. Endpiece according to any one of claims 1 to 8, **characterized in that** the element (20, 21) that is suitable to create a spreading force (F) is arranged separately

to the elastic connection (15) that connects the housing part (14) to the housing (6).

10. Endpiece according to any one of claims 1 to 9, **characterized in that** the first end (22) comprises two perpendicular or substantially perpendicular contact surfaces, where one of said contact surfaces is parallel to or substantially parallel to a surface of the second end (24).

11. Draft gear (1) for a coupling rod (2), the draft gear (1) comprising

- a bearing bracket (3) suitable to be attached to a car of a multi-car vehicle,
- an endpiece (4) of any one of claims 1 to 10 and
- a joint (5) arranged between the bearing bracket (3) and the housing (6) of the endpiece (4), whereby the joint (5) allows the housing (6) to swivel relative to the bearing bracket (3).

12. Coupler (100) for a multi-car vehicle, the coupler comprising a draft gear (1) according to claim 11 and a coupling rod (2) being attached to the rod (13) of the endpiece, whereby a coupler head (101) is attached to the coupling rod (2).

13. Coupler according to claim 12, **characterized in that** the coupling rod (2) has a first rod part (2a) and a second rod part (2b), whereby the first rod part (2a) is either attached to the rod (13) of the endpiece (4) or is formed by the rod of the endpiece, and whereby the coupler head (101) is attached to the second rod part (2b), whereby the coupling rod (2) has a rod joint (102) being arranged between the first rod part (2a) and the second rod part (2b), the rod joint (102) allowing the second rod part (2b) to be folded backwards towards the first rod part (2a).

14. Method for building a draft gear (1) according to claim 11 or a coupler according to claim 12 or 13, comprising the steps of

- providing a draft gear (1) according to claim 11 or a coupler according to claim 12 or 13,
- removing the element (20, 21) from the draft gear (1),
- providing a corresponding element (20, 21),
- and attaching the element (20, 21) to the draft gear (1).

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

1. Endpiece (4) for a coupling rod (2), the endpiece (4) being suitable to be used as part of a draft gear (1) for a coupling rod (2), the endpiece (4) comprising

- a housing (6),
- a rod (2, 13), the rod (2, 13) having a longitudinal axis (B) and a housing part (14) that is arranged inside the housing (6),
- an elastic connection (15) that connects the housing part (14) to the housing (6), the elasticity of the elastic connection (15) allowing the rod (2, 13) to swivel about its longitudinal axis (B) relative to the housing (6),

characterized by

an element (20) arranged separately from the elastic connection (15), wherein the element (20) is suitable to create a spreading force (F) between the rod (2, 13) and the housing (6) in a plane perpendicular to the longitudinal axis (B) of the rod (2, 13) so as to counteract twisting forces applied to the rod (2, 13), the element (20) having

- a first end (22) that is in contact with a part of the rod (2, 13) and
- a second end (24) that is in contact with a part of the housing (6),
- a spring element (25) being arranged between the first end (22) and the second end (24), the spring element (25) generating a spreading force (F) that is directed to increasing the distance between the first end (22) and the second end (24), if the first end (22) is moved towards the second end (24).

2. Endpiece according to claim 1, characterized in that the element (20) has

- an element housing (26) with a chamber (27), whereby the chamber (27) has a chamber endwall (28), and
- an element rod (29) partially arranged in the chamber (27) and moveable relative to the chamber endwall (28),

whereby the spring element (25) is arranged between the chamber endwall (28) and a holding part (30) of the element rod (29).

3. Endpiece according to claim 2, whereby the spring element (25) comprises one disc spring or several disc springs (31), whereby the one disc spring or the several disc springs (31) are arranged between the chamber endwall (28) and the holding part (30), whereby the holding part (30) radially extends from the element rod (29).

4. Endpiece according to claim 2 or 3, characterized in that a thread (32) is provided in the element rod (29) that extends from an end of the element rod (29) along the longitudinal axis (C) of the element rod (29), whereby a screw (33) is screwed into the thread

(32), the screw (33) having a head.

5. Endpiece according to claim 4, characterized in that the second end (24) is provided by an end surface of the head of the screw (33).

6. Endpiece according to any one of claims 1 to 5, characterized in that a further element (21) that is suitable to create a spreading force (F) is provided, the further element (21) having

- a first end (22) that is in contact with a part of the rod (2, 13) and
- a second end (24) that is in contact with a part of the housing (6),
- a spring element (25) being arranged between the first end (22) and the second end (24), the spring element (25) generating a spreading force (F) that is directed to increasing the distance between the first end (22) and the second end (24), if the first end (22) is moved towards the second end (24).

7. Endpiece according to claim 6, characterized in that

- the first end (22) of the element (20) is in contact with a first part of the rod (2, 13) and the first end (22) of the further element (21) is in contact with a second part of the rod (2, 13), the first part of the rod (2, 13) being arranged on a first side of the rod (2, 13) and the second part of the rod (2, 13) being arranged on a second side of the rod (2, 13), the second side being the opposite side to the first side;
- the second end (24) of the element (20) is in contact with a first part of the housing (6) and the second end (24) of the further element (21) is in contact with a second part of the housing (6), the rod (2, 13) being arranged between the first part of the housing (6) and the second part of the housing (6).

8. Endpiece according to claims 1 to 7, characterized in that

- the housing part (14) of the rod (2, 13) has circumferential grooves (16),
- the housing (6) has in inward-facing surface with circumferential grooves (17) arranged on the inward-facing surface,
- the elastic connection (15) comprising ring-shaped elastic elements (18), each ring-shaped elastic element (18) having an inner part being arranged in one of the circumferential grooves (16) of the housing part (14) and an outer part being arranged in one of the circumferential grooves (17) on the inward-facing surface.

9. Endpiece according to any one of claims 1 to 8, **characterized in that** the element (20, 21) that is suitable to create a spreading force (F) is arranged separately to the elastic connection (15) that connects the housing part (14) to the housing (6). 5
10. Endpiece according to any one of claims 1 to 9, **characterized in that** the first end (22) comprises two perpendicular or substantially perpendicular contact surfaces, where one of said contact surfaces is parallel to or substantially parallel to a surface of the second end (24). 10
11. Draft gear (1) for a coupling rod (2), the draft gear (1) comprising 15
- a bearing bracket (3) suitable to be attached to a car of a multi-car vehicle,
 - an endpiece (4) of any one of claims 1 to 10 and
 - a joint (5) arranged between the bearing bracket (3) and the housing (6) of the endpiece (4), whereby the joint (5) allows the housing (6) to swivel relative to the bearing bracket (3). 20
12. Coupler (100) for a multi-car vehicle, the coupler comprising a draft gear (1) according to claim 11 and a coupling rod (2) being attached to the rod (13) of the endpiece, whereby a coupler head (101) is attached to the coupling rod (2). 25
13. Coupler according to claim 12, **characterized in that** the coupling rod (2) has a first rod part (2a) and a second rod part (2b), whereby the first rod part (2a) is either attached to the rod (13) of the endpiece (4) or is formed by the rod of the endpiece, and whereby the coupler head (101) is attached to the second rod part (2b), whereby the coupling rod (2) has a rod joint (102) being arranged between the first rod part (2a) and the second rod part (2b), the rod joint (102) allowing the second rod part (2b) to be folded backwards towards the first rod part (2a). 30 35 40
14. Method for building a draft gear (1) according to claim 11 or a coupler according to claim 12 or 13, comprising the steps of 45
- providing a draft gear (1) according to claim 11 or a coupler according to claim 12 or 13,
 - removing the element (20, 21) from the draft gear (1), 50
 - providing a corresponding element (20, 21),
 - and attaching the element (20, 21) to the draft gear (1). 55

FIG 1

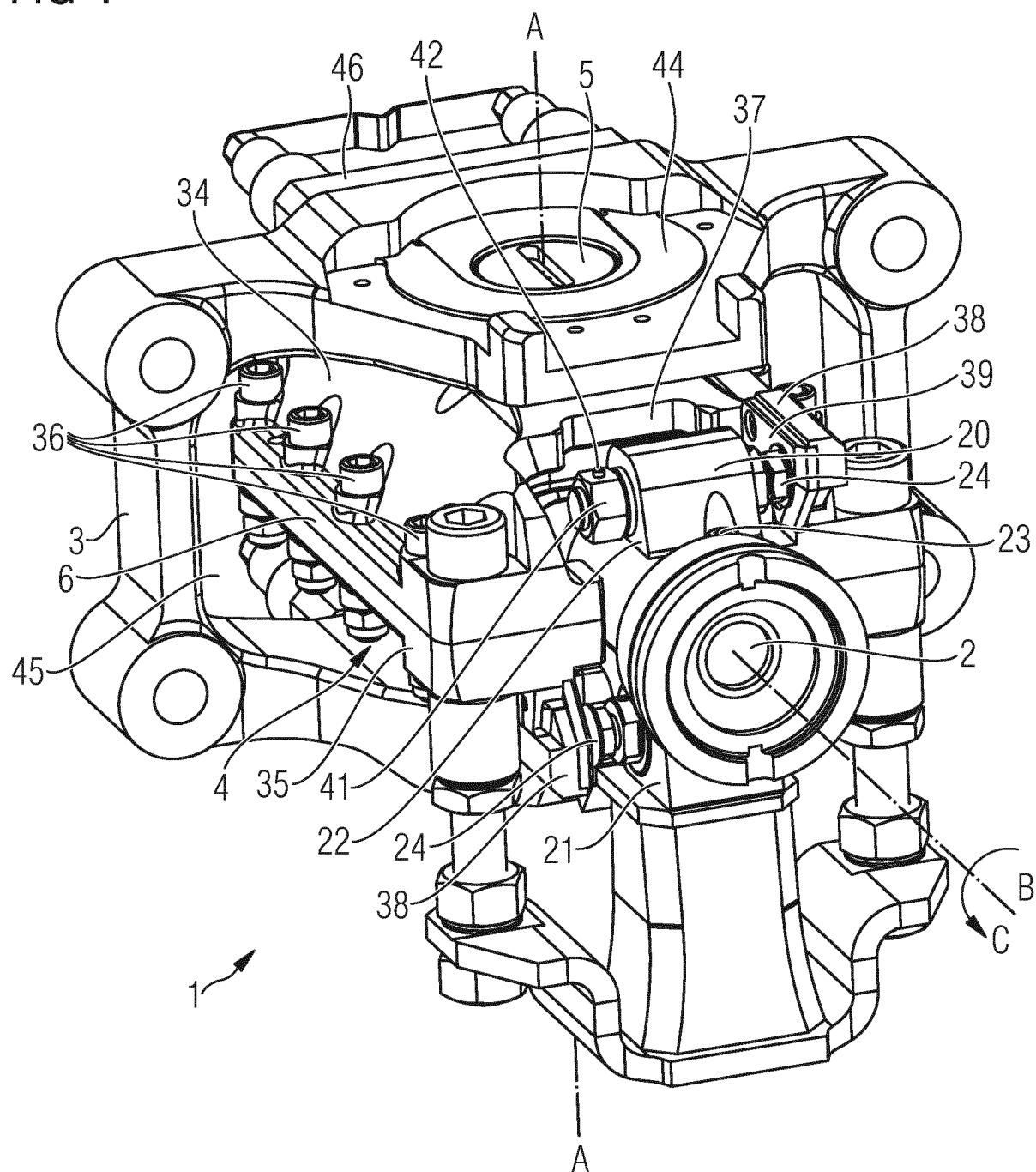


FIG 2

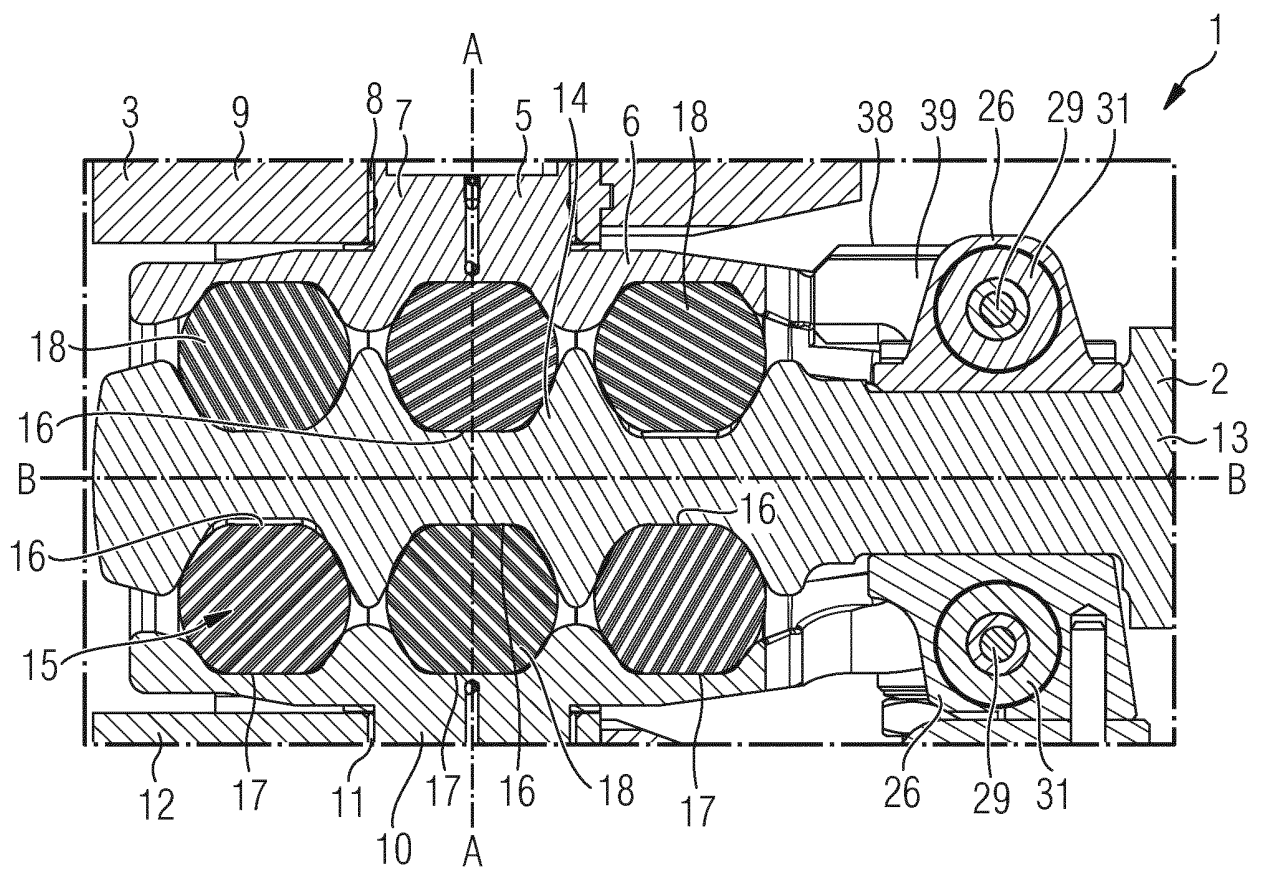


FIG 3

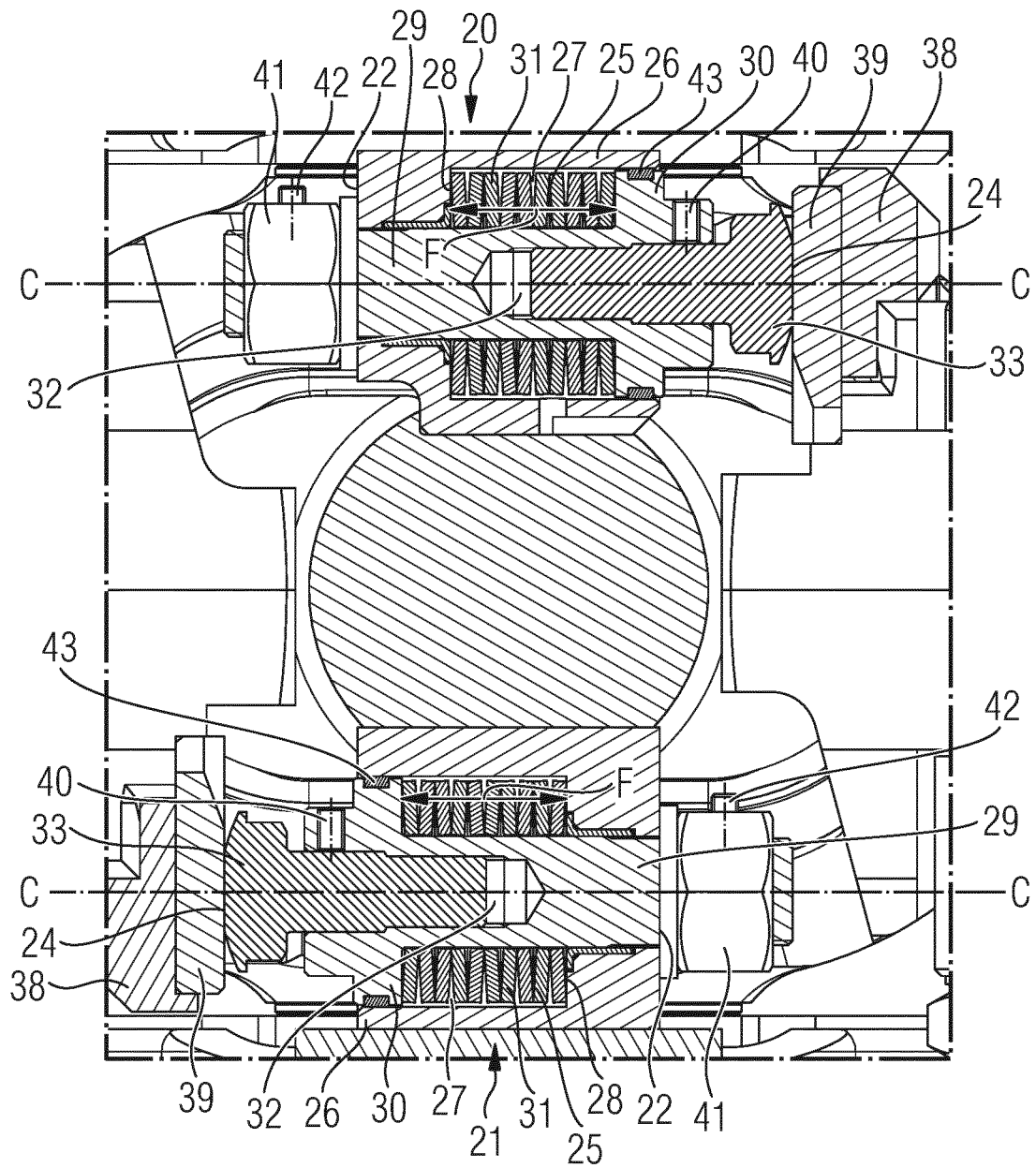


FIG 4

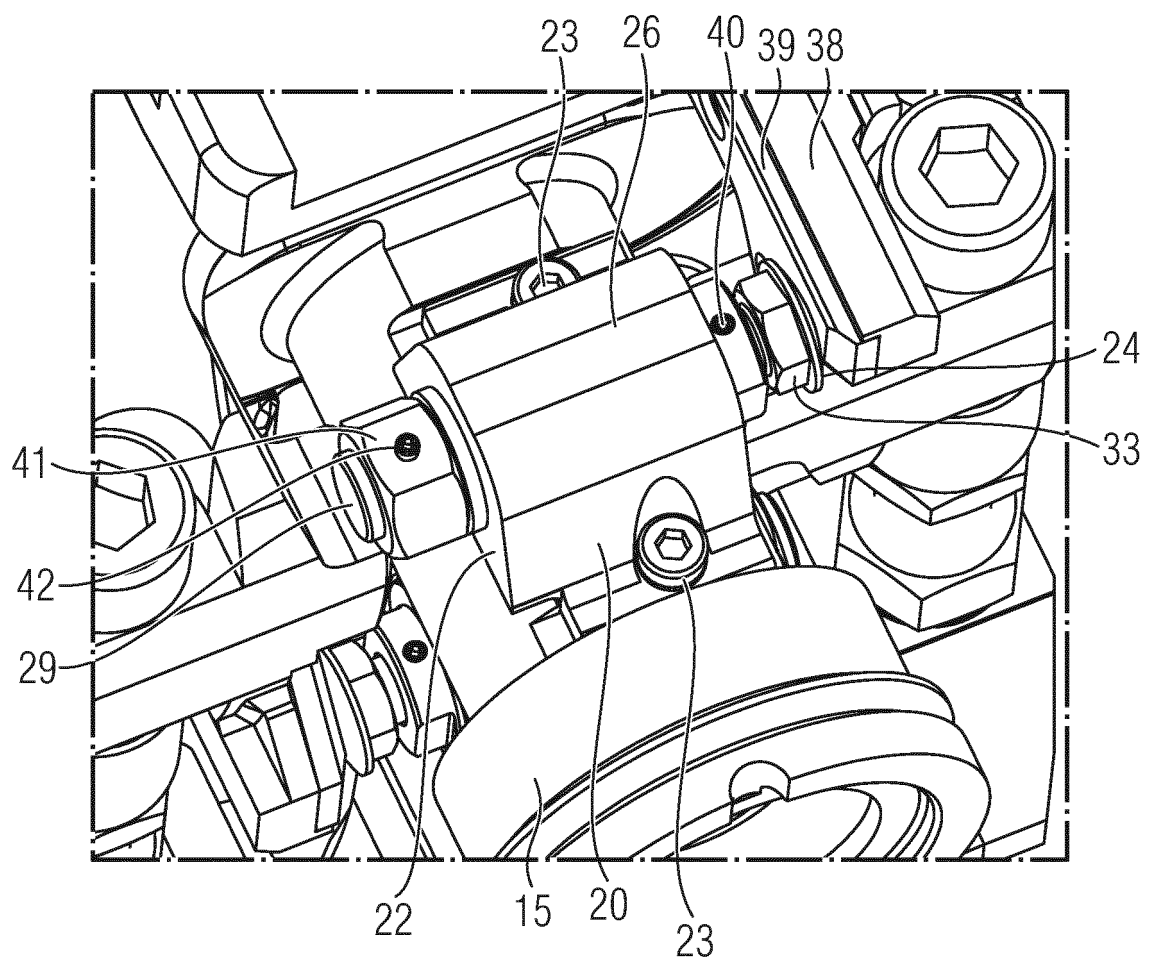
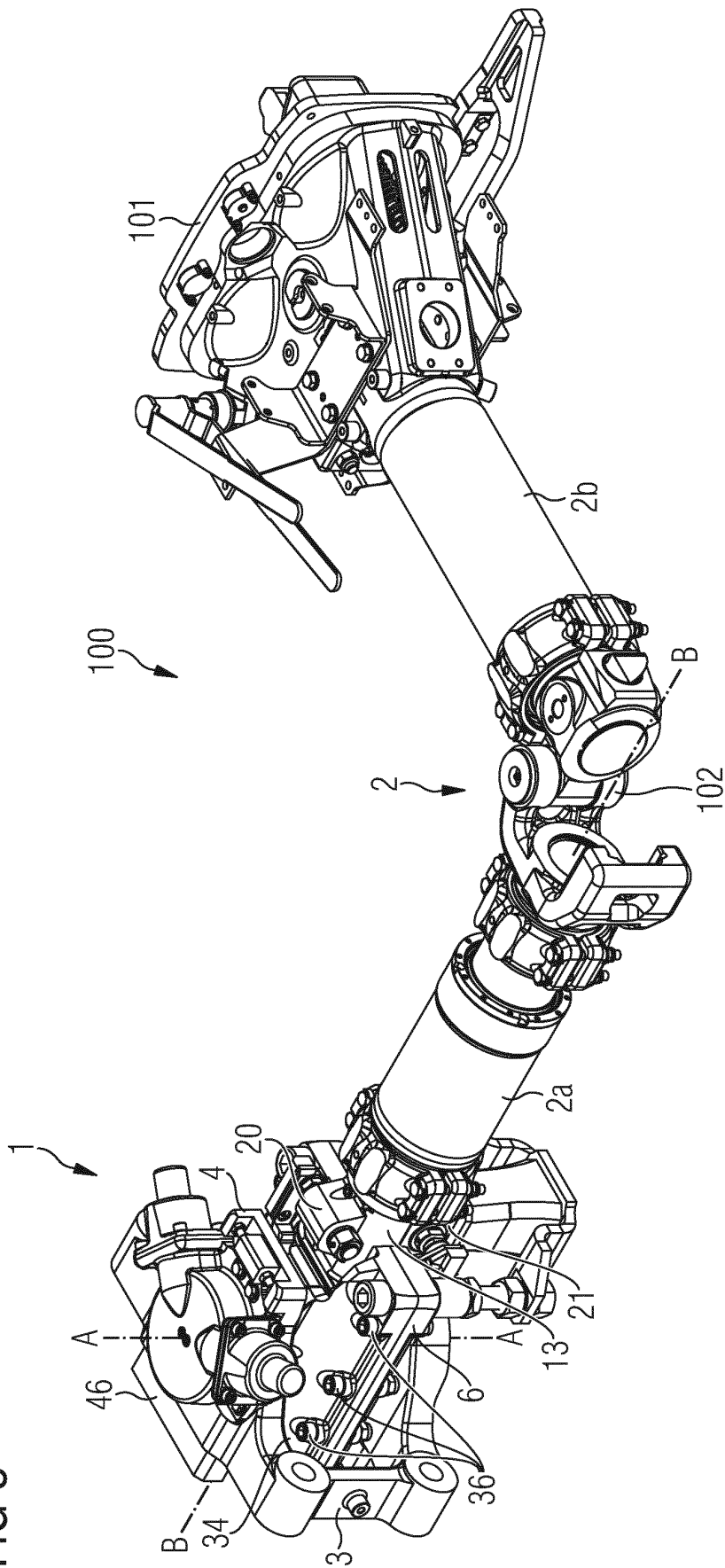


FIG 5





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