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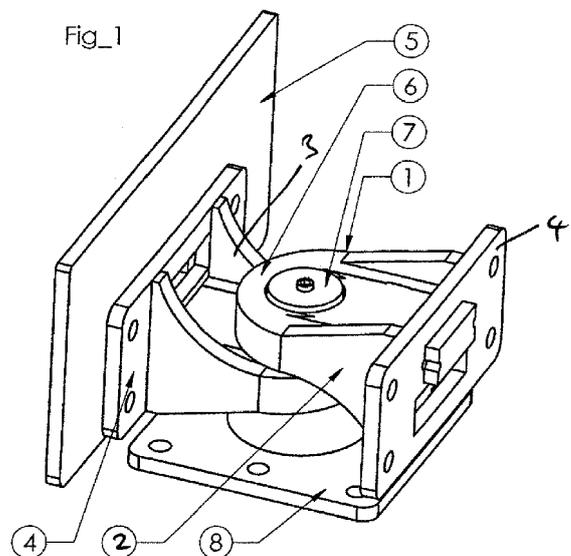
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(54) **Link device suitable for linking a first chassis and a second chassis of a rail - mounted vehicle**

(57) The invention relates to a link device suitable for linking a first chassis and a second chassis of a rail-mounted vehicle, comprising a first link member having a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis, the first link member having a through hole or recess suitable for a joint pin to be held in the through hole or recess, a joint pin, whereby a first section of the joint pin is held in the through hole or recess of the first link member, the first link member having a frame-substructure that forms the second end and extends from the second end towards the first end, the frame-substructure having an inward facing surface at the second end that faces towards the first end and that is in contact with the part of the outer surface of the joint pin that faces towards the second end of the first link member, the inward facing surfaces forming one part of the surface that delimits the through hole or recess, a second link member having a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis, the second link member having a through hole or a recess, a second section of the joint pin being held in the through hole or recess of the second link member, an energy absorption member with a first end and a second end, the first end of the energy absorption member has a contact surface that is in contact with the part of the outer surface of the joint pin that faces towards the first end of the first link member, whereby the contact surface faces the second end of the first link member and forms a further part of the surface that delimits the through hole or recess, the second end of the energy absorption member is in contact with a sup-

port member being arranged closer towards the first end of the first link member than the joint pin or at the first end of the first link member and the frame-substructure having guide surfaces that are arranged in such a manner that they guide the joint pin to travel along the longitudinal axis, if the joint pin is pushed to move from its position where it is being held in the through hole or recess towards the first end of the first link member in a manner that moves the first end of the energy absorption member towards the first end of the first link member while the energy absorption member absorbs energy.



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Description

[0001] The invention relates to a link device, especially an articulated joint suitable for linking a first chassis and a second chassis of a rail-mounted vehicle. The invention also relates to a rail-mounted vehicle comprising two chassis and a link device, especially an articulated joint that links the first chassis and the second chassis.

[0002] From US 2,051,958 an articulated joint is known which has a first link member and a second link member. The first link member is connected to a first chassis of a rail-mounted vehicle, the second link member is connected to a second chassis of a rail-mounted vehicle. The first link member comprises a yoke. The outer end of the yoke is formed with a bearing socket. The second link member is designed to project beyond the end of the second chassis, the projecting end being formed at its underside with a trunnion rotatably engaged within the socket bearing. The first link member has a frame-substructure that is formed around the yoke. The bearing socket formed on the yoke has an inward facing transverse wall. A further wall is arranged opposite the transverse wall formed on the bearing socket. The articulated joint known from US 2,951,958 has a spring member with a first end and a second end. The first end of the spring member is arranged facing the transverse wall formed on the bearing socket. By means of intermediate elements between the first end of the spring member and the transverse wall a force pushing the bearing socket towards the spring member is passed on to the first end of the spring member from the transverse wall via the intermediate elements. The spring member has a second end that is in contact with the wall arranged opposite the transverse wall. The frame-substructure has guide surfaces that are arranged in such a manner that they guide the transverse wall formed on the bearing socket to travel along the longitudinal axis of the first link member, if the trunnion formed at the second link member is pushed to move from a first position towards the spring member in a manner that the transverse wall arranged at the bearing socket that is in contact with the trunnion applies forces to the first end of the spring member that compress the spring member.

[0003] From EP 1 312 527 B1 an articulated joint for linking a first chassis and a second chassis of a rail-mounted vehicle is known comprising a first link member having a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis. The first link member has a through hole suitable for a joint pin to be held in the through hole. The link device known from EP 1 312 527 B1 has a joint pin, whereby a first end of the joint pin is held in the through hole of the first link member. The first link member has a solid substructure that forms the second end and extends from the second end towards the first end. The through hole that holds the first end of the joint pin is delimited completely by inward facing surfaces of the solid substructure, the

through hole thus being arranged in a solid portion of the substructure. Each part of the outer surface of the joint pin is in contact with a surface that is formed as part of the solid substructure to form the through hole. The articulated joint known from EP 1 312 527 B1 has a second link member having a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis. The second link member has a through hole, a middle portion of the joint pin being held in the through hole of the second link member. The articulated joint known from EP 1 312 527 B1 has a destructive energy-dissipating member with a first end and a second end. The first end of the energy absorption member has a contact surface that is in contact with the solid substructure. The second end of the energy absorption member is in contact with a support member being arranged at the first end of the first link member. The solid substructure is guided by guide surfaces of a frame-substructure. The frame-substructure is arranged around the solid substructure. The guide surfaces being arranged in such a manner that they guide the joint pin to travel along the longitudinal axis, if the joint pin is pushed towards the first end of the first link member in a manner that compresses the energy absorption member.

[0004] From WO 2005/023619 A1 an articulated joint for linking a first chassis and a second chassis of a rail-mounted vehicle is known comprising a first link member having a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis. The first link member has a through hole suitable for a joint pin to be held in the through hole. The link device known from WO 2005/023619 A1 has a joint pin, whereby a middle section of the joint pin is held in the through hole of the first link member. The first link member has a solid-substructure that forms the second end and extends from the second end towards the first end. The through hole that holds the middle section of the joint pin is delimited completely by inward facing surfaces of the solid substructure, the through hole thus being arranged in a solid portion of the substructure. Each part of the outer surface of the joint pin is in contact with a surface that is formed as part of the solid substructure to form the through hole. The first link member is a multi-part member, with a first member, which forms the second end being screwed to a second member that forms a plate-type first end by means of bolts. The articulated joint known from WO 2005/023619 A1 has a second link member having a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis. The second link member has a through hole, an end portion of the joint pin being held in the through hole of the second link member. The articulated joint known from WO 2005/023619 A1 has a destructive energy-dissipating member with a first end and a second end. The first end of the energy absorption member is arranged facing, but not contacting

a pressure plate formed on the solid substructure. The second end of the energy absorption member is in contact with a support member being arranged at the first end of the first link member. The solid substructure is guided by guide surfaces of a frame-substructure. The guide surfaces being arranged in such a manner that they guide the joint pin to travel along the longitudinal axis, if the joint pin is pushed towards the first end of the first link member in a manner that breaks the bolts and compresses the energy absorption member.

[0005] The object of the present invention is to reduce at least one of the draw bags of the prior art and to provide an improved link device that is suitable for linking a first chassis and a second chassis of a rail-mounted vehicle.

[0006] This object is solved by a link device according to claim 1 or 8 and by a rail-mounted vehicle as disclosed in claim 10. Preferred embodiments are disclosed in the subordinate claims and the description following here after.

[0007] According to one aspect of the invention, a basic concept of the invention is to provide a link member of the link device with a frame-substructure that is in contact with the joint pin during normal traveling conditions but to allow the joint pin to move away from the inward facing surface of the frame-substructure that is in contact with the joint pin during normal conditions in the conditions of higher load being applied to the link device. The joint pin having parted from the inward facing surface in such a condition of higher load is allowed to travel along guide surfaces formed in the frame-substructure and is allowed to compress an energy absorption member.

[0008] According to a second aspect of the invention, a link member is provided with a frame-substructure that forms the second end of the link member that can be taken up by a recess being formed in a part of the other link member, when the second end of the first link member moves towards the second link member in the situation where the joint pin is pushed to move from its position where it is being held against the inward facing surface of the frame-substructure towards the first end of the first link member. Having the second end of the first link member being taken up by a recess of the second link member allows for a good anti-climb-function of such a link device.

[0009] According to the first aspect of the invention, a link device suitable for linking a first chassis and a second chassis of a rail-mounted vehicle is suggested comprising:

- a first link member having a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis,
- the first link member having a through hole or recess suitable for a joint pin to be held in the through hole or recess,
- a joint pin, whereby a first section of the joint pin is held in the through hole or recess of the first link

member,

- the first link member having a frame-substructure that forms the second end and extends from the second end towards the first end,
- 5 - the frame-substructure having an inward facing surface at the second end that faces towards the first end and that is in contact with the part of the outer surface of the joint pin that faces towards the second end of the first link member, the inward facing surfaces forming one part of the surface that delimits the through hole or recess,
- a second link member having a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis,
- 10 - the second link member having a through hole or a recess, a second section of the joint pin being held in the through hole or recess of the second link member,
- 15 - an energy absorption member with a first end and a second end,
- the first end of the energy absorption member has a contact surface that is in contact with the part of the outer surface of the joint pin that faces towards the first end of the first link member, whereby the contact surface faces the second end of the first link member and forms a further part of the surface that delimits the through hole or recess
- 20 - the second end of the energy absorption member is in contact with a support member being arranged closer towards the first end of the first link member than the joint pin or at the first end of the first link member,
- 25 - the frame-substructure having guide surfaces that are arranged in such a manner that they guide the joint pin to travel along the longitudinal axis, if the joint pin is pushed to move from its position where it is being held in the through hole or recess towards the first end of the first link member in a manner that moves the first end of the energy absorption member towards the first end of the first link member while the energy absorption member absorbs energy.
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[0010] The first link member and the second link member are claimed to have a first end suitable for being fixed to a chassis of a rail-mounted vehicle. In a preferred embodiment, the respective link member has a plate-type first end with holes allowing the plate-type end to be bolted to a chassis of a rail-mounted vehicle. In a preferred embodiment, the plate-like first end extends in a plane that is defined by the longitudinal axis of the respective link member being the normal vector to this plane. Throughout this description, the term "first end" is not to be understood to be the last part of the first link member when viewing from the second end towards the first end. As shown in Fig. 8 of WO 2005/023619 A1 or Fig. 1 of EP 1 312 527 B1 the part of a link member that connects the link member to a chassis of a rail-mounted vehicle

can have a plate-type member arranged in a plane that has the longitudinal axis as its normal vector and to have further elements, especially further plates for bolting the first link member to the chassis of the rail-mounted vehicle, but also parts of a frame-substructure that extend beyond the plate-type element that is arranged in a plane having the longitudinal axis as its normal vector. For this reason of the connection of the respective link member to the chassis of the rail-mounted vehicle having multiple possibilities of designs, the term "first end" is simply used to describe a different section of the respective link member that is arranged at a different part of the respective link member along its longitudinal axis when starting from the second end.

[0011] The first link member and the second link member are claimed to have a through hole or a recess. The through hole or the recess are respectively provided for taking up a section of the joint pin. As can be seen from Fig. 2 of EP 1 312 527 B1 or Fig. 7 of WO 2005/023619 A1, link members can be arranged in through holes of a first link member and a second link member. The joint pin does, however, not necessarily have to be arranged solely in through holes. It is also possible to provide one link member with a recess, for example a recess with a circular shape, if the link pin has a circular cross section and for the link pin to be resting in this recess.

[0012] The joint pin is claimed to have a first section that is held in the through hole or the recess of the first link member and to have a second section that is being held in the through hole or the recess of the second link member. As can be seen from figure 7 of WO 2005/023619 A1 or figure 2 of EP 1 312 527 B1, one of the links can be arranged with two through holes, each of the respective through holes taking up an end section of the joint pin, while the other link member is arranged with a through hole that takes up a middle section of the joint pin. In a preferred embodiment, the first link member is designed to only have one through hole or recess for taking up one section, preferably an end section of the joint pin, while at the same time the other link member is designed to also only have one through hole or recess to take up a different section of the joint pin, possibly the second end of the joint pin, but possibly also a middle section of the joint pin for cases where the joint pin is designed to extend further beyond the link members and to rest on a base plate at one of its ends.

[0013] The first link member is claimed to have a frame-substructure that forms the second end and that extends from the second end towards the first end. In a preferred embodiment, the frame-substructure extends towards a plate-type element of the first end and is connected to this plate-type element. Preferably the element or the elements respectively of the frame-substructure that form the second end has a rectangular, quadratic, circular or elliptical cross section.

[0014] The frame-substructure is claimed to have in inward facing surface at the second end that faces towards the first end and that is in contact with the part of

the outer surface of the joint pin that faces towards the second end of the first link, the inwards facing surface forming one part of the surface that delimits the through hole or recess. In a preferred embodiment, this inward facing surface has an arch-shape. In a particularly preferred embodiment, the arch is of the type forming an arch that runs through 180°. Such an arch-shaped inner surface is especially used, if the outer surface of the joint pin is also arch-shaped or even in a preferred embodiment cylindrical. Solutions can, however, also be provided, where the inward facing surface of the frame-substructure has a plane surface, for example in cases where the joint pin also has a plane surface, for example a box-shaped design. In a preferred embodiment not only the inward facing surface at the second end is arch-shaped, but the complete second end has the form of a bent arch, especially the form of a bent arch that runs through more than 90°, especially of a bent arch that runs through 180°.

[0015] The inward facing surface is claimed to be in contact with the part of the outer surface of the joint pin that faces towards the second end of the first link. As discussed further below with regard to preferred embodiments, the joint pin is not necessarily a one-piece structure, but can be a multi-piece structure. Likewise, the frame-substructure can be a multi-piece structure. This allows for one element of the frame-substructure to be a ridged element and one element of the joint pin - for example a center pin - to be a ridged structure, while (be it as part of the frame-substructure or be it as part of the joint pin) elements that have higher elasticity can be arranged between such a solid part of the frame substructure and a solid part of the joint pin in order to take up vibrations that occur during the normal running of a rail-mounted vehicle. Claiming the inward facing surface of the frame-substructure to be in contact with the part of the outer surface of the joint pin that faces towards the second end of the first link is therefore not to be misunderstood to claim a ridged part of the frame-substructure to be in direct contact with a ridged part of the joint pin. Designs can also be provided, where a ridged part of the frame-substructure provides the inward facing surface and wherein this inward facing surface is in contact with a more elastic part that forms an outer part of the joint pin and provides the outer surface of the joint pin.

[0016] It is part of one aspect of the present invention that the inward facing surface forms one part of the surface that delimits the through hole or recess. The surfaces that delimit the through hole or recess according to the one aspect of the present invention are therefore not all provided by one functional element of the first link member. As discussed further below further functional elements of the link device, namely a contact surface of the energy absorption member provided as part of the link device also form part of the surface that delimits the through hole or recess. In a preferred embodiment, the members that provide the parts of the surface that form the through hole or recess are designed to brake apart in a situation, where the joint pin is pushed to move from

its position where its being held in the through hole or recess towards the first end of the first link member in a manner that deforms the energy absorption member.

[0017] The link device according to the invention can be provided with a simple second link member, namely a second link member that has a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis and the second link member to have a through hole or recess, a second section of the joint being held in the through hole or recess of the link member. The second link member can thus be used to simply connect the joint pin to the other chassis of the rail-mounted vehicle. In a preferred embodiment, however, the second link member is also provided with an energy absorption member. In a preferred embodiment the first link member and the second link member have the same design and are arranged to be in point symmetry about a center point that is a point of the joint pin. Point symmetry being understood to refer to a geometric design, where every part has a matching part in the same distance from the central point, but in opposite direction.

[0018] The link device according to the first aspect of the invention is claimed to have an energy absorption member with a first end and a second end. This energy absorption member can be of the regenerative-type, for example can be a spring or a rubber element. In a preferred embodiment, however, the energy absorption member is of the destructive type energy absorption member. A destructive-type energy absorption member can for example be a deformation tube that can be reduced in cross section or enlarged in cross section when the joint pin is pushed to move from its position where its being held in the through hole or recess towards the first end of the first link member. Likewise a destructive-type energy absorption member can be a member that is at least partially made up of a honey comb-structure that is destroyed as the joint pin is pushed to move towards the first end of the first link. In a preferred embodiment, the destructive-type energy absorption member is made from high strength steel and/or ultra high tensile steel.

[0019] The first end of the energy absorption member is claimed to have a contact surface that is in contact with the part of the outer surface of the joint pin that faces towards the first end of the first link, whereby the contact surface faces the second end of the first link member and forms a further part of the surface that delimits the through hole or recess. The energy absorption member can be multipart. It is therefore not necessary that, for example, an end surface of a spring member provides the contact surface or that an end surface of a deformation tube provides the contact surface. A design is also possible, where the energy absorption member contains an adapter element at its first end that is provided to provide the contact surface.

[0020] The second end of the energy absorption member is claimed to be in contact with a support member being arranged closer towards the first end of the first

link member than the joint pin or at the first end. The support member can, for example, be a projection provided on the frame-substructure with the second end of the energy absorption member at least partially resting against this projection. In a preferred embodiment, the support member is designed sufficiently strong to hold the second end of the energy absorption member in place in cases where the joint pin is pushed to move from its position where its being held in the through hole or recess towards the first end of the first link member in a manner that moves the first end of the energy absorption member towards the first end of the first link while absorbing energy. The support member can also be designed of the type that provides a gap through which the energy absorption member is pushed while being deformed and thereby absorbing energy. In a preferred embodiment, the support member is part of a plate-type element of the first end of the first link member. In this case, the support member is not only being arranged closer towards the first end of the first link member, but is arranged at the first end of the first link member when compared to the joint pin.

[0021] The frame-substructure is claimed to have guide surfaces that are arranged in such a manner that they guide the joint pin to travel along the longitudinal axis, if the joint pin is pushed to move from its position where its being held in the through hole or recess towards the first end of the first link member in a manner that moves the first end of the energy absorption member towards the first end of the first link while absorbing energy. These guide surfaces can be arranged in such a manner that they permanently contact the joint pin as it travels along the longitudinal axis. In a different embodiment, the guide surfaces can be arranged at a distance relative to the intended line of travel of the joint pin along the longitudinal axis and are only used as borders to deflect the joint pin back onto its intended path of travel should the joint pin leave this intended path of travel as it moves along the longitudinal axis, if it is being pushed to move from its position where its being held in the through hole or the recess towards the first end of the first link member.

[0022] In a preferred embodiment the energy absorption member has at least one holding element that extends sideways from the energy absorption member and connects the energy absorption member to the frame-substructure, the holding element being of a type that deforms and/or brakes to set the energy absorption member free with regard to the frame-substructure when a force of a certain threshold value is applied to push the part of the energy absorption member that holds the holding member towards the first end of the first link member. Such a holding element can be a shear bolt that shears off, if a force of a certain threshold value is applied. Likewise, the holding element can be a projection arranged as one piece on an energy absorption member. Such a holding element that is designed as one-piece with the energy absorption member can for example be designed

to be deformed inwardly towards the mainbody of the energy absorption member when forces of a certain threshold value are applied. In a preferred embodiment several holding elements are provided. In an preferred embodiment, the threshold value of the force that is applied to push the part of the energy absorption member that holds the holding member towards the first end of the first link member that leads to the holding element to be deformed and/or brake to set the energy absorption member free is of the level of between 800 kN to 1800 kN.

[0023] In a preferred embodiment the link pin is a multi-part structure, having a center pin, a first circular ring member that encompasses a first section of the center pin and forms the first section of the joint pin. In an especially preferred embodiment, the center pin is held in the circular member in a manner allowing the center pin to rotate about its longitudinal axis relative to the first circular member and the center pin having a second section, this second section either forming the second section of the joint pin or a second circular ring member being provided that encompasses the second section of the center pin, whereby this second circular ring member is in this case forms the second section of the joint pin. In a very basic design of the link device, it is possible that the link pin is a single-piece structure, for example a metal rod. Given that the preferred place of use of the link device is for linking a first chassis and a second chassis of a rail-mounted vehicle, the torque applied in this field of technology in order for a first link member to swivel relative to a second link member that is connected to the first link member by means of a joint pin is high. Therefore, a design is feasible, where a single-piece joint pin is held in the through hole or recess of the first link member with one section and held in the through hole or recess of the second link member with a second section and allows the first link member and the second link member to swivel relative to each other simply by relative movement between the outer surface of the single-piece joint pin and the surfaces that delimit the through hole or the recess. In such a design, the surfaces in contact with each other are preferably made up with a low coefficient of friction. As disclosed for example in Fig. 2 of EP 1 312 527 B1, a solid pin can be encompassed by a spherolastic rubber element to enhance the function of the joint pin, especially to take up vibrations that occur during the normal travel of rail-mounted vehicles. The first circular ring provided according to the preferred embodiment discussed here can thus be such a spherolastic rubber element, for example. Likewise, the second circular ring member can be such a spherolastic rubber member. In the embodiment with spherolastic rubber members, the center pin need not necessarily be allowed to rotate relative to such a spherolastic rubber member forming the circular ring member. In a further preferred embodiment, ball bearings are arranged between the first section of the center pin and the first circular member that encompasses the first section of the center pin. In such a design, the first circular ring member and/or the second circular ring member can

be cylindrical rings. They can - of course - also be spherolastic rubber members in this further improved design. In a preferred embodiment, the joint pin is supported against movements along its longitudinal axis by a base plate at one of its ends. As - for example - described in WO 2005/023619 A1 a link device can be used in designs where two chassis are vehicleried by a common Jakobs Bogie. The base plate can be used to connect the link device to such a Jakobs Bogie.

[0024] According to a second aspect of the invention, a link device suitable for linking a first chassis and a second chassis of a rail-mounted vehicle is suggested that comprises:

- 5 - a first link member having a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis,
- the first link member having a through hole or a recess suitable for a joint pin to held in the through hole or recess,
- 20 - a joint pin, whereby a first section of the joint pin is held in the through hole or recess of the first link member,
- 25 - the first link member having a frame-substructure that forms the second end and extends from the second end towards the first end,
- the frame-substructure having an inward facing surface at the second end that faces towards the first end and that is in contact with the part of the outer surface of the joint pin that faces towards the second end of the first link member, the inward facing surfaces forming one part of the surface that delimits the through hole or recess,
- 30 - a second link member having a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis,
- the second link member having a through hole or a recess, a second section of the joint pin being held in the through hole or recess of the second link member,
- 35 - an energy absorption member,
- the energy absorption member being arranged in such a manner that it holds the joint pin in such a manner that the part of the outer surface of the joint pin that faces towards the second end of the first link member contacts the inward facing surfaces of the frame-substructure,
- 40 - the energy absorption member being of a type that can either be compressed to allow the joint pin to travel along the longitudinal axis, if the joint pin is pushed to move from its position where it is being held against the inward facing surfaces of the frame-substructure towards the first end of the first link member or of the type that can break and allow the joint pin to travel along the longitudinal axis, if the joint pin is pushed to move from its position where it
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is being held against the inward facing surfaces of the frame-substructure towards the first end of the first link member,

- a recess being formed in a part of the second link member to take up a part of the second end of the first link member, when the second end of the first link member moves towards the second link member in the situation where the joint pin is pushed to move from its position where it is being held against the inward facing surfaces of the frame-substructure towards the first end of the first link member.

[0025] The recess being formed in a part of the second link member that can take up a part of the second end of the first link member, the second end of the first link member moves towards the second link member in the situation where the joint pin is pushed to move from its position where it is being held against the inward facing surface of the frame-substructure towards the first end of the first link member allows for a good anti-climb-function of such a link device. The first link member thus being held in the second link member prevents the first chassis to be lifted relative to the second chassis. The recess can also be a gap and can, for example form a cut-through the part of the second link member.

[0026] As the recess (gap) that provides the anti-climb-function does not necessarily have to be provided in the second link member, but can also be provided as part of one of the chassis of the rail-mounted vehicle, according to the third aspect of the invention a rail-mounted vehicle is provided comprising:

- a first link member having a first end that is fixed to the first chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis,
- the first link member having a through hole or a recess suitable for a joint pin to held in the through hole or recess
- a joint pin, whereby a first section of the joint pin is held in the through hole or recess of the first link member,
- the first link member having a frame-substructure that forms the second end and extends from the second end towards the first end,
- the frame-substructure having an inward facing surface at the second end that faces towards the first end and that is in contact with the part of the outer surface of the joint pin that faces towards the second end of the first link member, the inward facing surfaces forming one part of the surface that delimits the through hole or recess,
- a second link member having a first end that is fixed to the second chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis,
- the second link member having a through hole or a recess, a second section of the joint pin being held

in the through hole or recess of the second link member,

- an energy absorption member,
- the energy absorption member being arranged in such a manner that it holds the joint pin in such a manner that the part of the outer surface of the joint pin that faces towards the second end of the first link member contacts the inward facing surfaces of the frame-substructure,
- the energy absorption member being of a type that can either be compressed to allow the joint pin to travel along the longitudinal axis, if the joint pin is pushed to move from its position where it is being held against the inward facing surfaces of the frame-substructure towards the first end of the first link member or of the type that can break and allow the joint pin to travel along the longitudinal axis, if the joint pin is pushed to move from its position where it is being held against the inward facing surfaces of the frame-substructure towards the first end of the first link member,
- a recess being formed in a part of the second chassis to take up a part of the second end of the first link member, when the second end of the first link member moves towards the second link member in the situation where the joint pin is pushed to move from its position where it is being held against the inward facing surfaces of the frame-substructure towards the first end of the first link member.

[0027] In a preferred embodiment the link device according to the second aspect of the invention or the link device that forms part of the rail-mounted vehicle according to a third aspect of the invention can comprise:

- a first link member having a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis,
- the first link member having a through hole or recess suitable for a joint pin to held in the through hole or recess,
- a joint pin, whereby a first section of the joint pin is held in the through hole or recess of the first link member,
- the first link member having a frame-substructure that forms the second end and extends from the second end towards the first end,
- the frame-substructure having an inward facing surface at the second end that faces towards the first end and that is in contact with the part of the outer surface of the joint pin that faces towards the second end of the first link member, the inward facing surfaces forming one part of the surface that delimits the through hole or recess,
- a second link member having a first end suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the

- direction of a longitudinal axis,
- the second link member having a through hole or a recess, a second section of the joint pin being held in the through hole or recess of the second link member,
 - an energy absorption member with a first end and a second end,
 - the first end of the energy absorption member has a contact surface that is in contact with the part of the outer surface of the joint pin that faces towards the first end of the first link member, whereby the contact surface faces the second end of the first link member and forms a further part of the surface that delimits the through hole or recess
 - the second end of the energy absorption member is in contact with a support member being arranged closer towards the first end of the first link member than the joint pin or at the first end of the first link member,
 - the frame-substructure having guide surfaces that are arranged in such a manner that they guide the joint pin to travel along the longitudinal axis, if the joint pin is pushed to move from its position where it is being held in the through hole or recess towards the first end of the first link member in a manner that moves the first end of the energy absorption member towards the first end of the first link member while the energy absorption member absorbs energy.

[0028] In a preferred embodiment the link device according to the second aspect of the invention or the link device that forms part of the rail-mounted vehicle according to a third aspect of the invention can have the energy absorption member being a destructive type energy absorption member.

[0029] In a preferred embodiment the link device according to the second aspect of the invention or the link device that forms part of the rail-mounted vehicle according to a third aspect of the invention can have the energy absorption member having at least one holding element that extends sideways from the energy absorption member and connects the energy absorption member to the frame-substructure, the holding element being of a type that deforms and/or breaks to set the energy absorption member free with regard to the frame-substructure when a force of a certain threshold value is applied to push the part of the energy absorption member that holds the holding member towards the first end of the first link member.

[0030] In a preferred embodiment the link device according to the second aspect of the invention or the link device that forms part of the rail-mounted vehicle according to a third aspect of the invention can have the link pin being a multi-part structure, having a centre pin, a first circular ring member that encompasses a first section of the centre pin and forms the first section of the joint pin, the centre pin being held in the circular ring member in a manner allowing the centre pin to rotate about its longitudinal axis relative to the first circular ring member and

the centre pin having a second section, this second section either forming the second section of the joint pin or a second circular ring member being provided that encompasses the second section of the centre pin, whereby this second circular ring member in this case forms the second section of the joint pin.

[0031] In a preferred embodiment the link device according to the second aspect of the invention or the link device that forms part of the rail-mounted vehicle according to a third aspect of the invention can have ball bearings being arranged between the first section of the centre pin and the first circular ring member that encompasses the first section of the centre pin.

[0032] In a preferred embodiment the link device according to the second aspect of the invention or the link device that forms part of the rail-mounted vehicle according to a third aspect of the invention can have the joint pin being supported against movements along its longitudinal axis by a base plate at one of its ends.

[0033] In a preferred embodiment the link device according to the second aspect of the invention or the link device that forms part of the rail-mounted vehicle according to a third aspect of the invention can have the first link member and the second link member having the same design and are arranged to be in point symmetry about a centre point that is a point of the joint pin.

[0034] The link device according to the invention can be arranged on a rail mounted vehicle with the longitudinal axis of the joint pin extending in the vertical or in the horizontal direction.

[0035] In a preferred embodiment the link device has an additional energy absorption member, which is arranged at or behind the first end of either one of first link member and the second link member or has two additional energy absorption members, one being arranged at at or behind the first end of of first link member and one being arranged at at or behind the first end of of second link member. This or these additional energy absorption members can be used to additionally take up energy in the situation where the joint pin is pushed to move from its position where it is being held against the inward facing surfaces of the frame-substructure towards the first end of the first or second link member.

[0036] The link device according to the invention is claimed to be suitable for linking a first chassis and a second chassis of a rail-mounted vehicle. The link device according to the invention is, however, not restricted to being used in connection with rail-mounted vehicles. Likewise, the link according to the invention can be used for linking a first part of a bus relative to a second part of a bus. Articulated busses are known. The link device can be used in such an articulated bus. The first link member and the second link member of the link device also do not necessarily need to be fixed directly to a chassis of a rail-mounted vehicle. The term "suitable for being fixed to a chassis of a rail-mounted car" therefore is to be understood also to encompass design solutions, where the first end of the respective link member in question is con-

nected or forms a coupler head that can be connected to a further coupler head and where this further coupler head is then fixed to a chassis of a rail-mounted vehicle. The link device can therefore also be used to connect

[0037] In the following, a preferred embodiment of the invention is described by making use on figures. The design disclosed in this figures is however only one possible design of putting into practise the link device according to the invention.

[0038] The figures show:

Fig. 1: a respective view of the link device according to the invention with elements of a first chassis of a rail-mounted vehicle, a second chassis of a rail-mounted vehicle and a Jakobs Bogie being indicated in a schematic drawing,

Fig. 2: a perspective, schematic view of the link device according to the invention in a normal mode of practise,

Fig. 3: a top view onto the link device according to the invention in the same situation as shown in figure 2,

Fig. 4: a perspective, schematic view of the link device according to the invention in the situation where large forces have been applied to the link device and the energy absorption member has been partially deformed,

Fig. 5: the link device according to the invention in a schematic, perspective view shown in a situation, where the first link member and the second link member have been swivelled relative to each other about the joint pin,

Fig. 6: the link device according to the invention in a schematic, perspective view shown in the embodiment, where the link device is used to connect a coupler head to one chassis of a rail-mounted vehicle and

Fig. 7: a top view onto a portion of the link device as shown in figure 6.

[0039] In Fig. 1, the link device 1 according to the invention is shown. The link device 1 has a first link member 2 and a second link member 3. The first link member 2 has a first end 4 that has a plate-like element. The first end 4 is fixed to a wall 5 of a chassis of a first rail-mounted vehicle. The first link member 2 has a second end 6 arranged opposite to the first end 4 in the direction of a longitudinal axis that is arranged normal to the plate-type element at the first end 4.

[0040] The link device 1 has a joint pin 7. A first section of the joint pin 7 is held in a through hole of the first link member 2. A second section of the joint pin 7 is held by a through hole of the second link member 3. The joint pin 7 is supported against movements along its longitudinal axis by a base plate 8 that can be connected to a Jakobs Bogie. The second link member 3 has a first end 4 that has a plate-type element that is fixed to a wall of a further

chassis.

[0041] As can be seen from Fig. 2, for example, the first link member 2 and the second link member 3 have the same design and are arranged to be in point symmetry about a center point that is a point of the joint pin 7. For this reason, identical elements of the first link member 2 and the second link member 3 have been numbered with same reference numbers.

[0042] As can be seen from Fig. 2, the first end 4 of the second link member 3 is provided with a gap (recess) 9 being formed in a part of the second link member 3 to take up a part of the second end 6 of the first link member 2, when the second end 6 of the first link member 2 moves towards the second link member 3 in the situation where the joint pin 7 is pushed to move from its position where its being held against an inward facing surface of the frame-substructure of the first link member 2 towards the first end 4 of the first link member 2.

[0043] Fig. 2 also shows that the first end 4 of the first link member 2 has a gap, in which is second end 10 of a destructive energy absorption member 11 is held.

[0044] As best seen in Fig. 3, the first link member 2 has a frame-substructure 12 that forms the second end 6 and extends from the second end 6 towards the first end 4. The frame-substructure 12 is connected to the first end 4 directly. Furthermore trapezium-shaped support structures 13 are provided that aid in connecting the frame-substructure 12 to the first end 4. The frame-substructure 12 has an inward facing surface 14 at the second end 6 that faces towards the first end 4 and that is in contact with the part 15 of the outer surface of the joint pin 7 that faces towards the second end 6 of the first link member 2. The inward facing surface 14 forms one part of the surface that delimits the through hole in the first link member 2 that supports the joint pin 7. The second end 6 has the form of a bent arch that runs through 180°.

[0045] The link device 1 is provided with an energy absorption member 11. The first end 16 of the energy absorption member 11 has a contact surface 18 that is in contact with the part 17 of the outer surface of the joint pin 7 that faces towards the first end 4 of the first link member 2, whereby the contact surface 18 faces the second end 6 of the first link member 2 and forms a further part of the surface that delimits the through hole of the first link member 2.

[0046] As can be seen in Fig. 3, the energy absorption member 11 is breakable connected to the frame-substructure 12. As indicated by the dotted lines in Fig. 3 the energy absorption member 11 and the frame-substructure 12 are linked to one another, but in a breakable manner. If the joint pin 7 is pushed to move from its position where it is being held in the through hole towards the first end 4 of the first link member 2 with a level of force above a certain threshold, the breakable link between the energy absorption member 11 and the frame-substructure 12 will brake and allow the joint pin to travel towards the first end 4 of the first link member 2 in a manner that moves the first end 16 of the energy absorption member 11 to-

wards the first end 4 of the first link member 2 while absorbing energy.

[0047] As can be seen from Fig. 3 the energy absorption member 11 has two holding elements 19 that are formed one-piece with the energy absorption member 11 and extend sideways from the energy absorption member 11 and connect the energy absorption member 11 to the frame substructure 12. The holding elements are of the type that deform to set the energy absorption member free with regard to the frame substructure 12 when a force of a certain threshold value is applied to push the part of the energy absorption member 11 that has the holding member 19 towards the first end 4 of the first link member 2. The frame substructure 12 has recesses that take up the holding elements 19.

[0048] Fig. 4 shows the link device in a situation where the joint pin has been pushed to move from its position where it is being held in the through hole (see for example Fig. 2 and Fig. 3) towards the first end 4 of the first link member 2 in a manner that moves the first end 16 of the energy absorption member 11 towards the first end 4 of the first link member 2 while absorbing energy. If a force that is larger than a predetermined threshold value is applied to the joint pin 7 onto the joint pin 7 in a direction towards the plate 4 of the first link member 2 the energy absorption member 11 will break away from the frame-substructure 12 at the dotted lines shown in Fig. 3. Also, the holding elements 19 will be deformed to set the energy absorption member 11 free with regard to the frame substructure 12. The energy absorption element 11 will then be pushed by the joint pin 7 towards the plate-tape element that forms part of the first end 4 and through the gap shown in Fig. 2, whereby the energy absorption member 11 will be deformed and will take up energy. In taking up energy, the energy absorption member 11 will reduce the energy that will be introduced into the chassis to which the first link member 2 is connected. Figure 4 shows, how the energy absorption member 11 has broken free at the dotted lines as well as the holding elements 19 having left the recesses provided in the frame-substructure 12 for taking them up. Also, Fig. 4 shows the guide surfaces 22 formed on the frame-substructure for guiding the joint pin 7.

[0049] Fig. 4 shows one basic approach of the present invention, namely to provide a through hole (or in different embodiments: recess) in the link member that is made up from several elements, in this case partially by surfaces from the frame-substructure 12 and partially by surfaces from the energy absorption member 11. In a crash situation, the through hole in the link member is broken up, setting to work the individual elements that bordered the through hole.

[0050] As can be seen in Fig. 4, the second end 6 of the frame-substructure 12 has entered into the gap 9 in the plate-type element of the first end 4 of the second link member 3 and therefore provides for an anti-climb function.

[0051] Fig. 4 also shows that the joint pin 7 is a multi-

part structure having a center pin 20 and a first circular ring member 21 that encompasses a first section of the center pin 20 and forms the first section of the joint pin 7 that is held in the through hole of the first link member 2.

[0052] Fig. 5 shows the link device 1 in a situation where the first link member has been swivelled relative to the second link member 3 around the joint pin 7.

[0053] As shown in Fig. 6, one embodiment of the link device 1 according to the invention can be used for linking a first chassis and a second chassis of a rail-mounted vehicle in a situation, where the chassis of the rail-mounted vehicle are connected to each other by coupler heads. In this embodiment the link device 1 shows a first link member 2 having a first plate-type end 4 suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end 6 opposite to the first end 4 and the direction of a longitudinal axis. The first link member has a through hole suitable for a joint pin 7 to be held in the through hole. A joint pin 7 is provided, which is held in the through hole of the first link member 2. A second link member 3 is provided. This second link member 3 has a first end that is suitable for being fixed to a chassis of a rail-mounted vehicle in the manner that the second link member 3 has a coupler head 30. The second link member 3 is suitable for being fixed to a chassis of a rail-mounted vehicle, because its coupler head 30 can be connected to a further coupler head, which will then be connected to a chassis of a rail-mounted vehicle. Fig. 6 further shows that the second link member 3 has a further damping element 31.

Claims

1. Link device suitable for linking a first chassis and a second chassis of a rail-mounted vehicle, comprising:
 - a first link member (2) having a first end (4) suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end (6) opposite to the first end (4) in the direction of a longitudinal axis,
 - the first link member (2) having a through hole or recess suitable for a joint pin (7) to be held in the through hole or recess,
 - a joint pin (7), whereby a first section of the joint pin (7) is held in the through hole or recess of the first link member (2),
 - the first link member (2) having a frame-substructure (12) that forms the second end (6) and extends from the second end (6) towards the first end (4),
 - the frame-substructure (12) having an inward facing surface (14) at the second end (6) that faces towards the first end (4) and that is in contact with the part (15) of the outer surface of the joint pin (7) that faces towards the second end

- (6) of the first link member (2), the inward facing surfaces (14) forming one part of the surface that delimits the through hole or recess,
- a second link member (3) having a first end (4) suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis,
 - the second link member (3) having a through hole or a recess, a second section of the joint pin (7) being held in the through hole or recess of the second link member (3),
 - an energy absorption member (11) with a first end and a second end (10),
 - the first end of the energy absorption member (11) has a contact surface (18) that is in contact with the part (17) of the outer surface of the joint pin (7) that faces towards the first end (4) of the first link member (2), whereby the contact surface (18) faces the second end (6) of the first link member (2) and forms a further part of the surface that delimits the through hole or recess
 - the second end of the energy absorption member (11) is in contact with a support member being arranged closer towards the first end (4) of the first link member (2) than the joint pin (7) or at the first end (4) of the first link member (2),
 - the frame-substructure (12) having guide surfaces that are arranged in such a manner that they guide the joint pin (7) to travel along the longitudinal axis, if the joint pin (7) is pushed to move from its position where it is being held in the through hole or recess towards the first end (4) of the first link member (2) in a manner that moves the first end of the energy absorption member (11) towards the first end (4) of the first link member (2) while the energy absorption member (11) absorbs energy.
2. Link device according to claim 1, **characterized in that** the energy absorption member (11) is a destructive type energy absorption member.
 3. Link device according to claim 1 or 2, **characterized in that** the energy absorption member (11) has at least one holding element (19) that extends sideways from the energy absorption member (11) and connects the energy absorption member (11) to the frame-substructure (12), the holding element (19) being of a type that deforms and/or breaks to set the energy absorption member (11) free with regard to the frame-substructure (12) when a force of a certain threshold value is applied to push the part of the energy absorption member (11) that holds the holding member (19) towards the first end (4) of the first link member (2).
 4. Link device according to any one of claims 1 to 3, **characterized in that** the link pin (7) is a multi-part structure, having a centre pin (20), a first circular ring member (21) that encompasses a first section of the centre pin (20) and forms the first section of the joint pin (7), the centre pin (20) being held in the circular ring member (21) in a manner allowing the centre pin (20) to rotate about its longitudinal axis relative to the first circular ring member (21) and the centre pin (20) having a second section, this second section either forming the second section of the joint pin (7) or a second circular ring member being provided that encompasses the second section of the centre pin (20), whereby this second circular ring member in this case forms the second section of the joint pin (7).
 5. Link device according to claim 4, **characterized by** ball bearings being arranged between the first section of the centre pin (20) and the first circular ring member (21) that encompasses the first section of the centre pin (20).
 6. Link device according to any one of claims 1 to 5, **characterized by** the joint pin (7) being supported against movements along its longitudinal axis by a base plate (8) at one of its ends.
 7. Link device according to any one of claims 1 to 6, **characterized in that** the first link member (2) and the second link member (3) have the same design and are arranged to be in point symmetry about a centre point that is a point of the joint pin.
 8. Link device suitable for linking a first chassis and a second chassis of a rail-mounted vehicle, comprising:
 - a first link member (2) having a first end (4) suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end (6) opposite to the first end (4) in the direction of a longitudinal axis,
 - the first link member (2) having a through hole or a recess suitable for a joint pin (7) to be held in the through hole or recess,
 - a joint pin (7), whereby a first section of the joint pin (7) is held in the through hole or recess of the first link member (2),
 - the first link member (2) having a frame-substructure (12) that forms the second end (6) and extends from the second end (6) towards the first end (4),
 - the frame-substructure (12) having an inward facing surface (14) at the second end (6) that faces towards the first end (4) and that is in contact with the part (15) of the outer surface of the joint pin (7) that faces towards the second end (6) of the first link member (2), the inward facing surfaces (14) forming one part of the surface

that delimits the through hole or recess,

- a second link member (3) having a first end (4) suitable for being fixed to a chassis of a rail-mounted vehicle and having a second end opposite to the first end in the direction of a longitudinal axis, 5
- the second link member (3) having a through hole or a recess, a second section of the joint pin (7) being held in the through hole or recess of the second link member, 10
- an energy absorption member (11),
- the energy absorption member (11) being arranged in such a manner that it holds the joint pin (7) in such a manner that the part (15) of the outer surface of the joint pin (7) that faces towards the second end (6) of the first link member (2) contacts the inward facing surfaces (14) of the frame-substructure (12), 15
- the energy absorption member (11) being of a type that can either be compressed to allow the joint pin (7) to travel along the longitudinal axis, if the joint pin (7) is pushed to move from its position where it is being held against the inward facing surfaces (14) of the frame-substructure (12) towards the first end (4) of the first link member (2) or of the type that can break and allow the joint pin (7) to travel along the longitudinal axis, if the joint pin (7) is pushed to move from its position where it is being held against the inward facing surfaces (14) of the frame-substructure (12) towards the first end (4) of the first link member (2), 20 25 30
- a recess (9) being formed in a part of the second link member (3) to take up a part of the second end (6) of the first link member (2), when the second end (6) of the first link member (2) moves towards the second link member (3) in the situation where the joint pin (7) is pushed to move from its position where it is being held against the inward facing surfaces (14) of the frame-substructure (12) towards the first end (4) of the first link member (2), 35 40

9. A link device according to claim 8 **characterized by** one or more of the features of any one of the claims 1 to 7. 45

10. Rail-mounted vehicle comprising two chassis and a link device that links the first chassis and the second chassis, comprising: 50

- a first link member (2) having a first end (4) that is fixed to the first chassis of a rail-mounted vehicle and having a second end (6) opposite to the first end (4) in the direction of a longitudinal axis, 55
- the first link member (2) having a through hole or a recess suitable for a joint pin (7) to be held

in the through hole or recess

- a joint pin (7), whereby a first section of the joint pin is held in the through hole or recess of the first link member (2),
- the first link member (2) having a frame-substructure (12) that forms the second end (6) and extends from the second end (6) towards the first end (4),
- the frame-substructure (12) having an inward facing surface (14) at the second end (6) that faces towards the first end (4) and that is in contact with the part (15) of the outer surface of the joint pin (7) that faces towards the second end (6) of the first link member (2), the inward facing surfaces (14) forming one part of the surface that delimits the through hole or recess,
- a second link member (3) having a first end (4) that is fixed to the second chassis of a rail-mounted vehicle and having a second end opposite to the first end (4) in the direction of a longitudinal axis,
- the second link member (3) having a through hole or a recess, a second section of the joint pin (7) being held in the through hole or recess of the second link member,
- an energy absorption member (11),
- the energy absorption member (11) being arranged in such a manner that it holds the joint pin (7) in such a manner that the part (15) of the outer surface of the joint pin (7) that faces towards the second end (6) of the first link member (2) contacts the inward facing surfaces (14) of the frame-substructure (12),
- the energy absorption member (11) being of a type that can either be compressed to allow the joint pin (7) to travel along the longitudinal axis, if the joint pin (7) is pushed to move from its position where it is being held against the inward facing surfaces (14) of the frame-substructure (12) towards the first end (4) of the first link member (2) or of the type that can break and allow the joint pin (7) to travel along the longitudinal axis, if the joint pin (7) is pushed to move from its position where it is being held against the inward facing surfaces (14) of the frame-substructure (12) towards the first end (4) of the first link member (2),
- a recess being formed in a part of the second chassis to take up a part of the second end (6) of the first link member (2), when the second end (6) of the first link member (2) moves towards the second link member (3) in the situation where the joint pin (7) is pushed to move from its position where it is being held against the inward facing surfaces (14) of the frame-substructure (12) towards the first end (4) of the first link member (2),
- a recess being formed in a part of the second chassis to take up a part of the second end (6) of the first link member (2), when the second end (6) of the first link member (2) moves towards the second link member (3) in the situation where the joint pin (7) is pushed to move from its position where it is being held against the inward facing surfaces (14) of the frame-substructure (12) towards the first end (4) of the first link member (2).

11. Rail-mounted vehicle according to claim 10 **characterized by** the link device having one or more of the features of any one of the claims 1 to 7.

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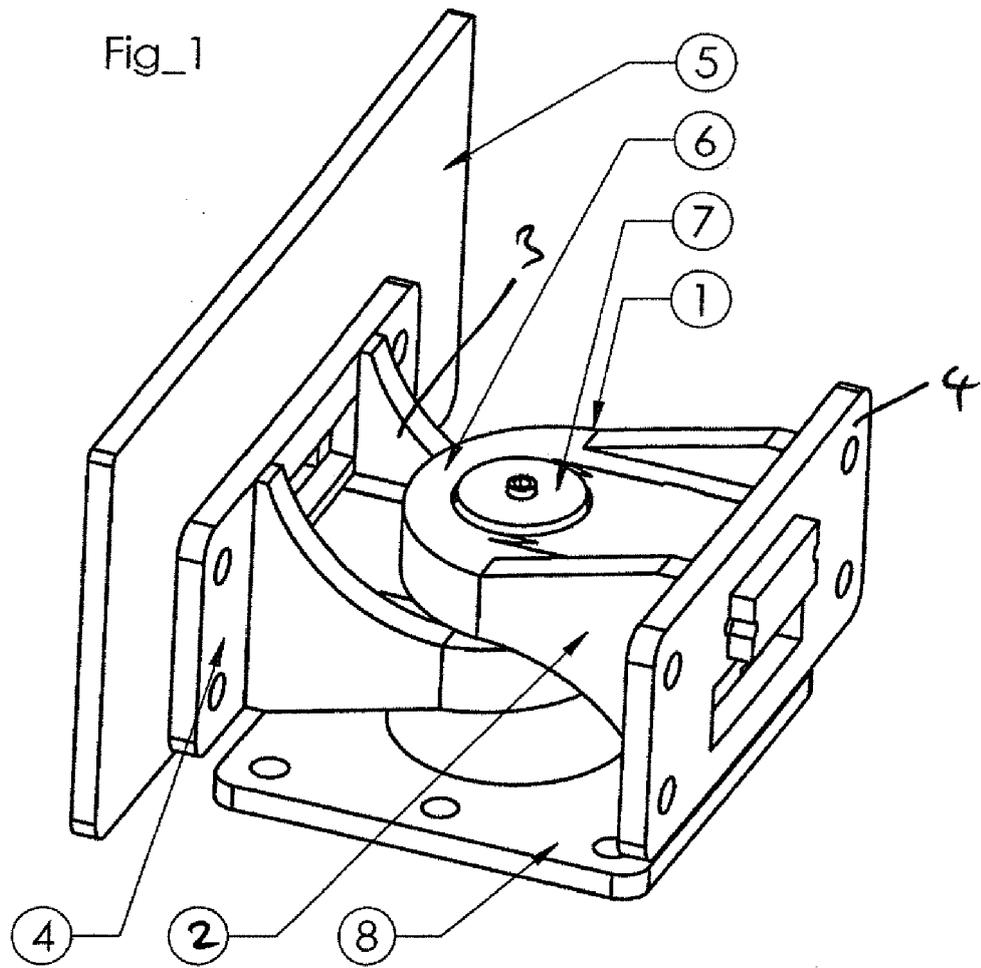
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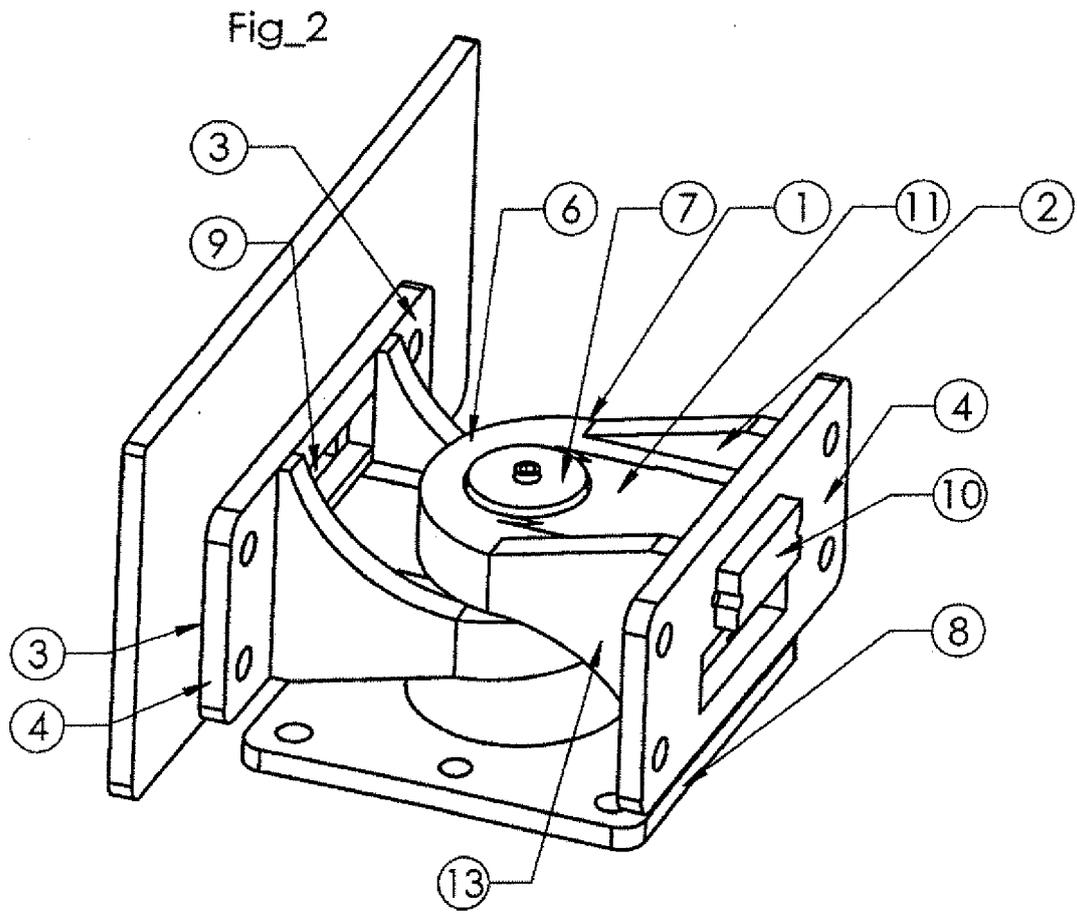
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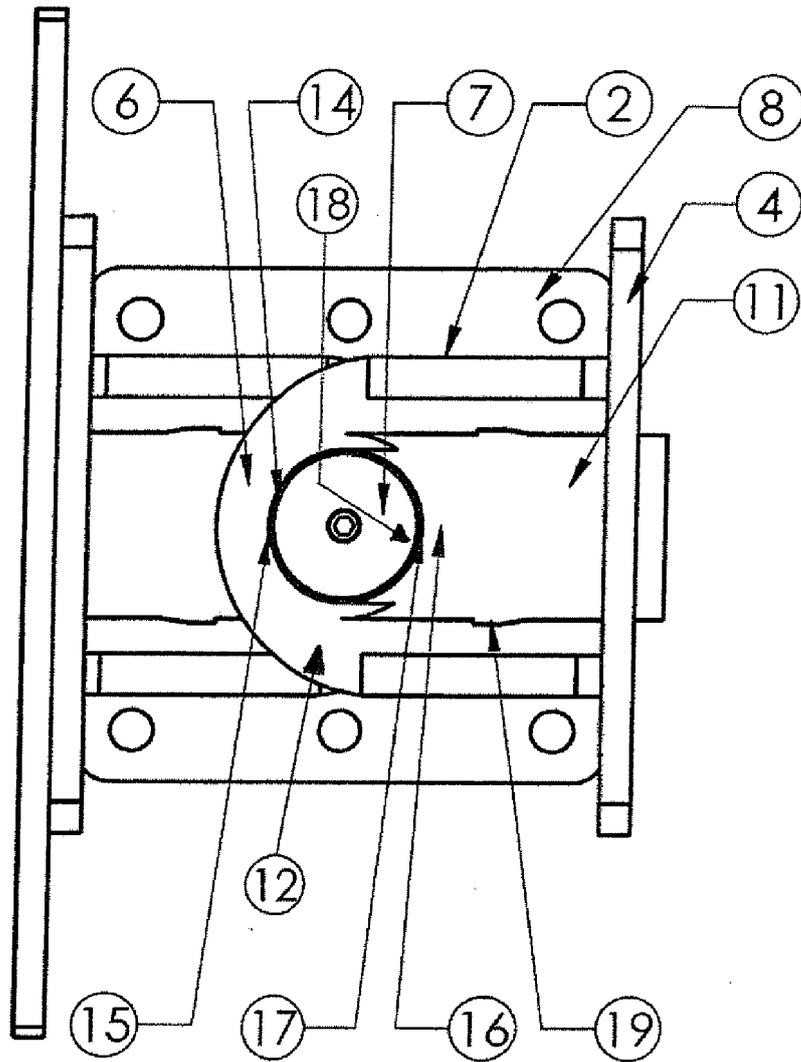
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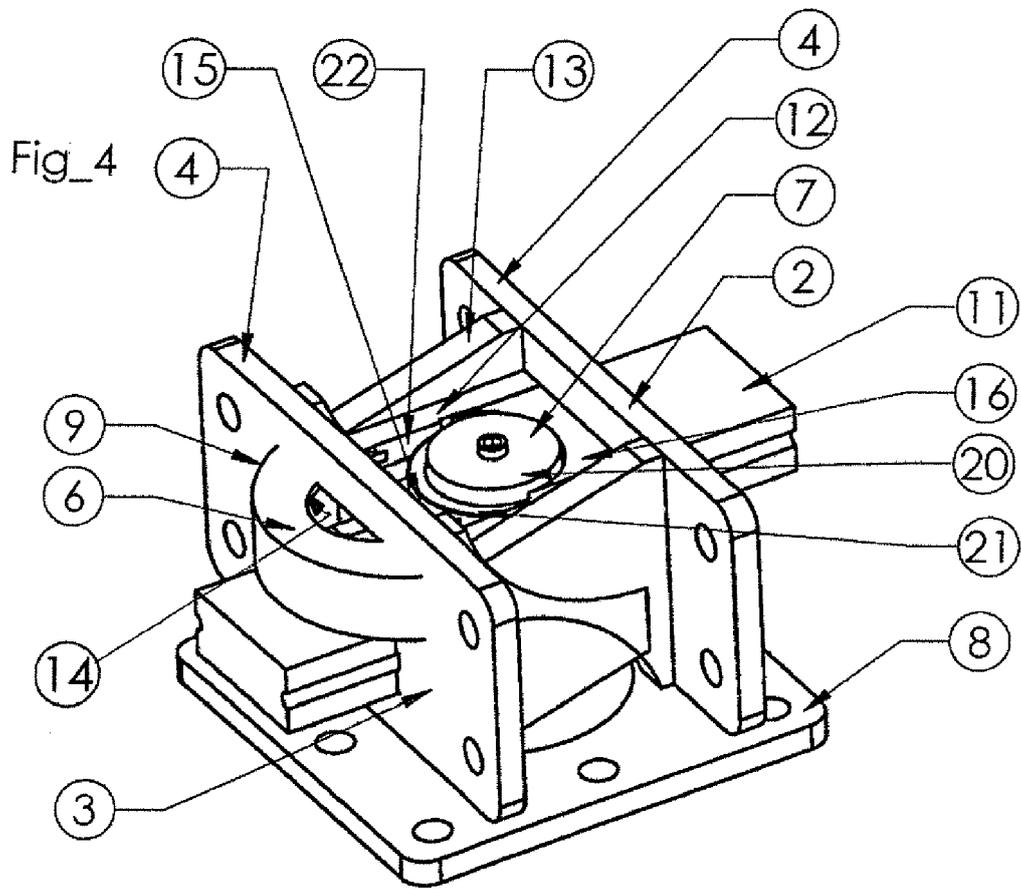
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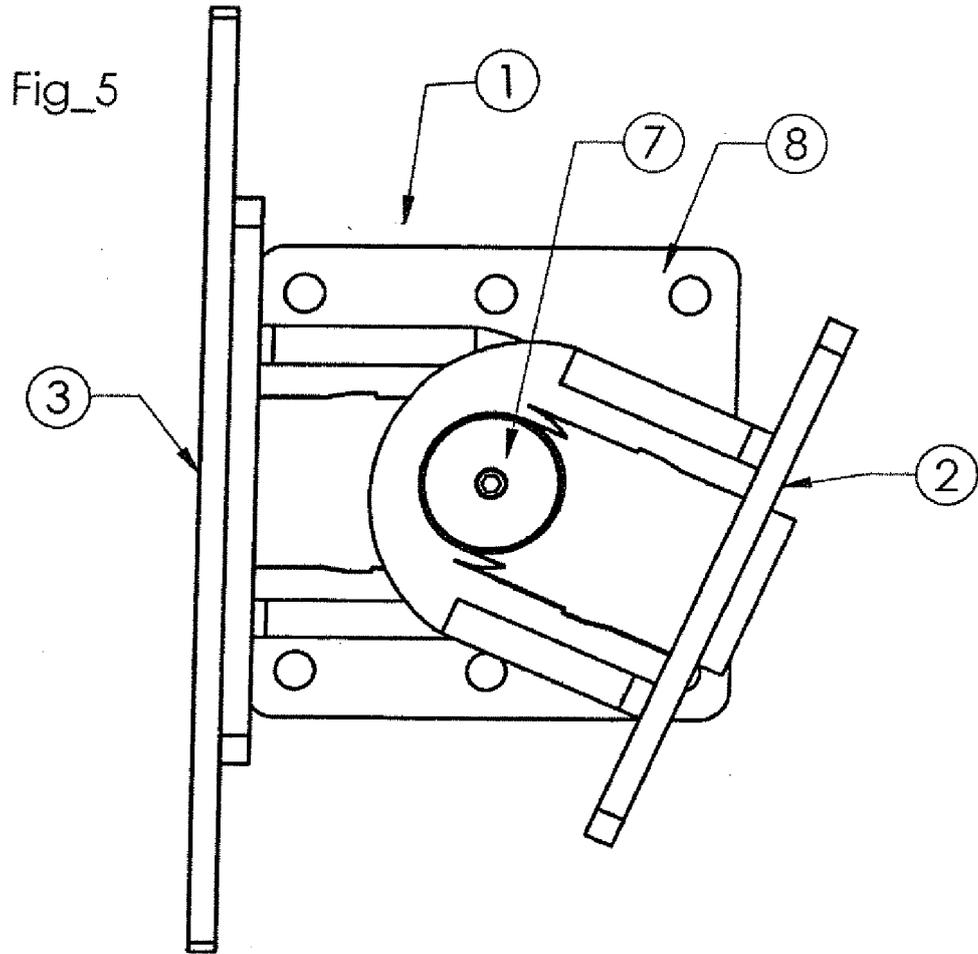




Fig_3







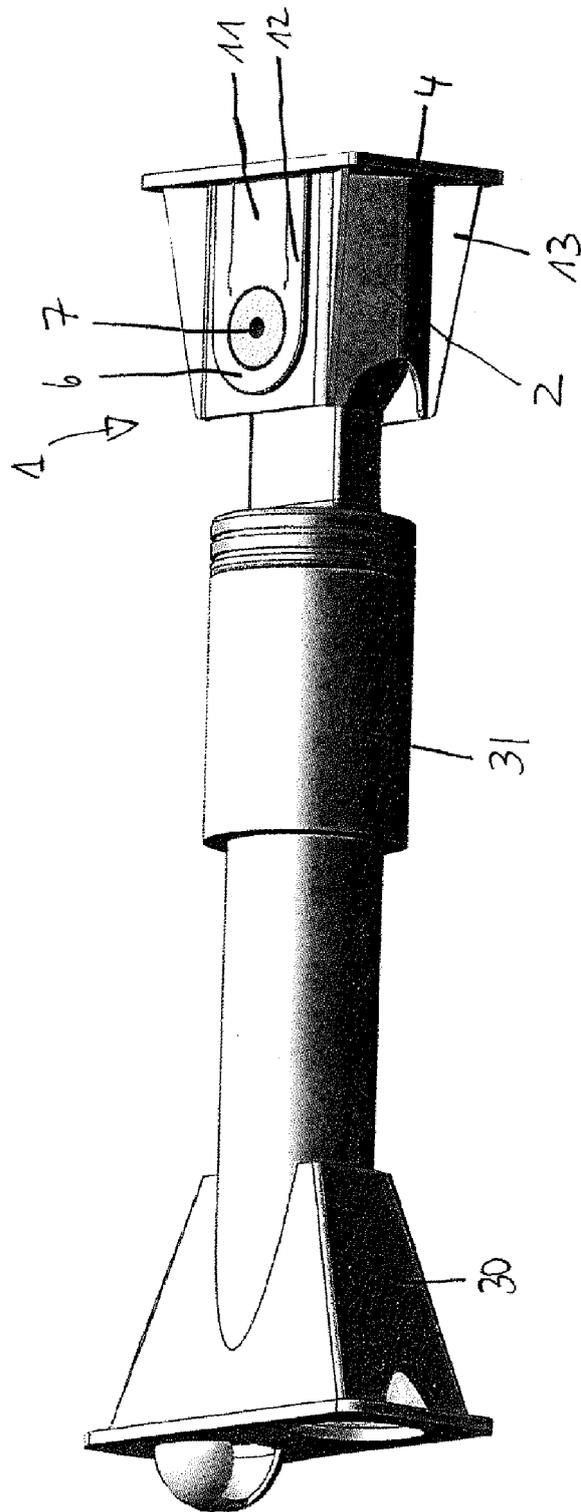
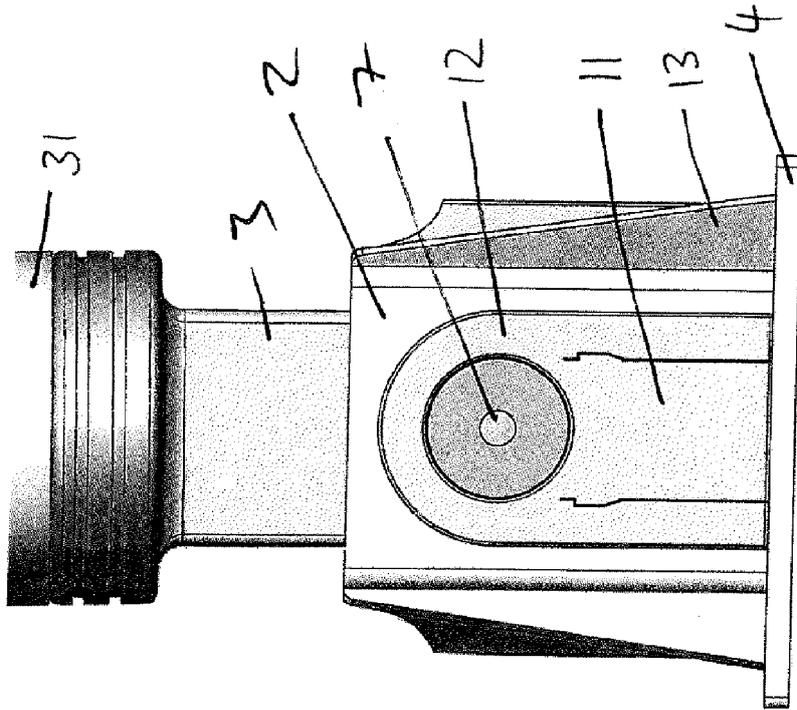


Fig. 6

Fig. 7





EUROPEAN SEARCH REPORT

Application Number
EP 11 46 1529

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 1 312 527 B1 (VOITH TURBO SCHARFENBERG GMBH [DE]) 4 June 2003 (2003-06-04) * paragraph [0025] - paragraph [0031]; figures 1,2 *	1,2,6,8,10	INV. B61G5/02 B61D3/10
A	US 5 615 786 A (HOYON CHRISTOPHE [FR] ET AL) 1 April 1997 (1997-04-01) * column 4, line 13 - column 5, line 57; figures 1-11 *	1,8,10	
			TECHNICAL FIELDS SEARCHED (IPC)
			B61G B61D B61F
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 13 December 2011	Examiner Chlost, Peter
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	

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

EP 11 46 1529

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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