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(54) **PULL AND PUSH DEVICE FOR CONNECTING WAGONS, IN PARTICULAR FREIGHT WAGONS**

ZUG- UND SCHUBVORRICHTUNG ZUM VERBINDEN VON WAGEN, INSBESONDERE GÜTERWAGEN

DISPOSITIF DE TRACTION ET DE POUSSÉE POUR ATTELER DES WAGONS, EN PARTICULIER DES WAGONS À MARCHANDISES

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(56) References cited:  
**DE-A1- 3 321 950 DE-A1- 3 920 344**  
**DE-C- 110 868**

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**Description****Field of technology**

**[0001]** The invention concerns the construction of the pull and push device for connecting wagons by which the two railway wagons are connected into a single whole without need for further buffers or stabilizers absorbing the vibrations between the wagons. The technical solution belongs to the field of rail technology.

**Prior state of the art**

**[0002]** Pull and push devices, for example in form of a rod, are used to connect at least two freight wagons into a single wagon forming a compact whole. The flexibility and freedom of the connecting device, for example the pull and push rod, must be such that it allows, after the connection, for unproblematic ride on the rails with bends with the radius 150 m (or 75 m) and with vertical descent 1:16 (slope of the rail). The existing connecting devices cannot completely ensure the absorption (dampening) of the vibrations, impact loads and cannot completely stabilize the wagons against each other. A use of further compression buffer solutions (Non-Newtonian solutions (fluids) such as nonlinearly viscous solutions where the speed of deformation is proportional to the stress) increases the costs, the weight of the car as well as costs of maintenance and repair of these elements. A use of the semi-solid connecting part which transfers the traction and braking forces, absorbs vibrations and has stabilizing effect, is a solution which complies with the demands for creation of the route for the transfer of cargo when several wagons are used for transfer of the cargo into single destination as well as for the decrease of the costs of transfer, decrease of the weight of the wagons and decrease in the costs of maintenance and repair. Such semi-solid connection components are attached directly on the framework of the wagon pursuant to currently valid connecting dimensions of the produced wagons. There are currently multiple construction solutions which are based on the principle of ball joint, whereby the spring and dampening features of the hitherto used pull and push rods use the system of steel elastic blocks.

**[0003]** Solutions of the pull and push rods are known in the prior art from the documents DE 4118529 A1 with pressing support plates and springs; DE 129900875 U1 with vertical joint bolt; CZ 294052 B6 with ball joint with support bearings; EP 1946988 B1 with support plates placed tiltably, whereby there are dampening members between the plates; SK 287429 B6 with ball joint with inner and outer spring bundles; DE 110868 C with arched leaf springs.

**[0004]** The result of the endeavors of the persons skilled in the art is the construction of the pull and push device for the connection of the wagons without the need for further buffers or stabilizers absorbing or dampening the vibrations between the wagons, as further disclosed

in this invention.

**Essence of the invention**

**[0005]** The deficiencies in the state of the art in field of pull and push connecting devices with a desired dampening are remedied by pull and push device for connecting wagons, mainly freight wagons, which includes two joints allowing for offset of the connected wagons, whereby the joints on one side are connected with the construction of the respective wagon according to this invention which essence lies in the fact that it includes at least one pair of mirror symmetrical arched arms which are on both ends mutually connected and, at the same time, connected to the joints. The arched arms are oriented in such a way that in the middle zone the arches of the arms are distanced from each other and both ends of the arms are brought close into a common knot by which the pull and push forces are transferred to the joint on the respective side of the device. The arched arms form a flexible element which is being elastically deformed during the force transfer, whereby at the given length it achieves a significantly higher flexibility than the common straight metal rod. In order to achieve the desired flexibility while maintaining the solidity a various course of the curve of the arched arm can be desired; preferably, the curve's course will be elliptical, circular or hyperbolic, or a combination of the mentioned curves.

**[0006]** The maximum offset of the central line of the transversal profile of the arm against the common longitudinal axis of the pair of the arms has an effect on the setting of the solidity and strength of the pair of arched arms. The offset affects the bending moment which is derived purely from the pull or push force. Increase of the offset in case of a given arched arm against the longitudinal axis of the pair will range between 5% and 30° of the length of an arched arm. When the push force is transferred the offset of the arched arms increases; the arched arms are loaded for buckling, whereby the overall length of the pull and push device shortens proportionally to this deformation and, on the other hand, during the transfer of the pull force the offset decreases and the overall length of the pull and push device lengthens.

**[0007]** The pair of the arched arms can in preferable arrangement be supplied by the partition or buckle with stops for limiting the maximum allowed deviation of the arched arms. The stops can be set in the direction of pulling and in the direction of pushing, too. In one of the possible realizations the partition is placed in the central transversal plane of the pair of the arched arms and it has outer stops onto which the deforming arches of the arms lean under pressure. At the same time the partition has inner stops onto which the arms lean during pulling. The stops can be set and they can be equipped by the malleable material so that during there is no mechanical wear and tear of the arms during the contact.

**[0008]** Usually the pair of the arched arms will be in horizontal plane or basically in horizontal plane, respec-

tively.

**[0009]** According to the invention, the arched arms are by their ends placed in the joints which are composed of the joint bearings with bearing houses; in one of the preferable arrangements, the bearing houses are secured on their sides by the securing rings against falling out. The joint bearings with the bearing houses are placed in the eyes of the flange which is attached to the wagon's construction. The arched arms are in the vicinity of the eye clasped together by the screws and screw nuts. In this arrangement each end of the arched arm is equipped by the cylindrical pin whose axis is perpendicular onto the longitudinal axis of the pair and the connection of both arched arms creates common cylindrical pins on each end, whereby these are mounted inside the joints. A screw runs through the cylindrical pins, whereby the screw connects the arched arms into a solid pair.

**[0010]** In another preferable arrangement both ends of the arched arms are equipped by the eyes whose axis is perpendicular onto the longitudinal axis of the connected pair and the cylindrical pin runs through these eyes in such a way that it connects the arched arms and at the same time the cylindrical pin is mounted in the joint on the respective end of the device. The cylindrical pin transfers the forces to the ends of both arched arms.

**[0011]** Both abovementioned realizations with the bearing house can be preferably supplied by the flexible pad which is placed between the flange and the construction of the wagon.

**[0012]** Another technical solution has been invented, too, where the pair of arched arms is connected with the sets of flexible blocks on both sides of the device where each set of the flexible blocks produces a joint with the defined angular freedom. Such solution substitutes the joint disclosed in the abovementioned two realizations. Preferably each flexible block includes one central block, whereby inner peripheral block follows upon it from one side in the series. From the other side of the central block the outer block with the flange for the purposes of attachment to the wagon's frame follows in the series. The central block comes in two parts in the central plane and it has a shape of the conical cup with the stem ended by the beveled conical tip. The peripheral inner block is in single piece and it has a shape of the threaded cup and the stem ended by the beveled conical tip. The outer peripheral block is in two parts in the axial plane and it has a shape of the conical cup with the flange for the purposes of attachment to the wagon's frame. The conical tips are inserted into the conical cups whereby the pushing elastic elements are inserted into the front of the conical tips, too, and to the rear of the conical cups the pulling elastic elements are inserted. The two-part central block and the outer peripheral block are connected by screws. The transfer of the push and pull force is ensured by the continuous transfer of the load from the peripheral outer cup through the flexible element onto the other cup and subsequently to the pair of the arched arms. The conical

shape of the cups allows for self-centering during the stress by pulling and pushing. The use of these blocks ensures the movement of the device in two planes.

**[0013]** The outer peripheral cone has a flange for attachment of the device to the frame of the wagon. The inner peripheral cone and each central cone are longitudinally distributed and separated and after the mounting of the elastic elements they are connected by the screw joint. All elastic elements can be longitudinally separated and after they are mounted into cups they form a single conical elastic element. Inside the cups there are thus elastic elements which transfer the pushing and the elastic elements which transfer the pulling. The elastic elements ensure the movement of one cone against another and they absorb the vibrations and shock load and they also have stabilizing effect.

**[0014]** If the actual load of the pulling and pushing elements exceeds the set load, the elastic elements in the flexible blocks can deform into such value that the metal conical cups touch directly. This leads to decrease in the absorption of vibrations and shock stress as well as increased noise. However, in case the acting load does not exceed the strength characteristics of the used materials, the device keeps its basic functionality.

**[0015]** In the state of operation the pull load is transferred in the following order: console on the wagon's frame; outer peripheral cup with the flange; elastic element; central conical cup; elastic element; group of central conical cups with elastic elements; inner peripheral threaded cup; pair of arched arms; inner peripheral threaded cup; group of central conical cups with elastic elements; central conical cup; elastic element; outer peripheral cup with the flange; console on the wagon's frame.

**[0016]** In the state of operation the push load is transferred in the following order: console on the wagon's frame; outer peripheral cup with the flange; elastic element; central conical cup; elastic element; group of central conical cups with elastic elements; inner peripheral threaded cup; pair of arched arms; inner peripheral threaded cup; group of central conical cups with elastic elements; central conical cup; elastic element; outer peripheral cup with the flange; console on the wagon's frame.

**[0017]** In another arrangement the joint can be formed by a cardan shaft. Each cardan shaft is formed by two simple cylindrical joints whose axes of rotation are mutually perpendicular. In this case the axis of each cylindrical joint is perpendicular onto the longitudinal axis of the device. The mutual arrangement of the axes is such that it allows for mutual rotation of the central part of the device in two planes in such a way that one cylindrical joint placed by the central part of the device rotates in the horizontal plane and the second placed in the vicinity of the connecting flange rotates in the vertical plane. The flange which connects the device with the frame of the wagon is construed in such a way that it is at the same time the connecting part and the sleeve, casing of the

joint, which allows for rotation in the vertical plane. The pairing fork of the vertical cylindrical joint is produced as part of the sleeve, casing of the vertical cylindrical joint. The cylindrical joint placed in the area of the connecting flange can rotate in the vertical plane. At the same time, each cylindrical joint is composed of the transversal pin with the cross profile which creates the connection of the sleeve and the fork. The fork of the cylindrical joint placed in the area of the connecting flange and the sleeve of the cylindrical joint placed in the area of the center of the device form a single solid whole. The elastic elements are produced from the flexible material and placed in the space between the pin and the inner part of the casing. The inner sleeve, casing, has a rectangular cross-section with protrusions - combs. The combs are placed symmetrically alongside the axis of rotation of the pin. The transversal pin is on both ends attached by the front lid which ensure the mounting of the cylindrical joint and fixes its axial position relative to the sleeve, casing. The lid is connected to the sleeve by means of four screws. It is preferable if the surface of the cross pin and the inner sleeve, casing, have such a roughness of the surface which during the operation does not lead to a significant scraping of the elastic elements. It is preferable if the front lids attached to the pins of the joints have a close, tight contact with the ends of the sleeves, casings, so that the penetration of the abrasive elements and substances, aggressive towards the elastic elements, is prevented. In the state of operation the pull or push forces are transferred in the following order: console on the wagon's frame; horizontal sleeve of the cylindrical joint with the flange of the hitch; flexible element in the inner part of the casing; transversal pin; vertical fork of the cylindrical joint with the horizontal joint casing; transversal pin of the horizontal cylindrical joint; flexible element in the inner part of the casing; horizontal joint sleeve with a connection for the pair of the arched arms; horizontal joint sleeve; flexible element in the inner part of the casing; transversal pin of the cylindrical joint; vertical fork of the cylindrical joint with the horizontal joint casing; transversal pin; flexible element in the inner part of the casing; horizontal sleeve of the cylindrical joint with the flange of the hitch; console on the wagon's frame.

**[0018]** The function of the pull and push device for the connection of wagons with the flexible elements in form of arched arms can be explained in such a way that the pull and push device serves the connection of the railway wagons into a single whole. In this technical solution the absorption of vibrations and shock load or impact load, and stabilizing effect against mutual swinging movement of the wagons, are solved by the system of two joints and pair of arched arms. The produced joint in various realizations allows to eliminate the effect of the bent rail and vertical irregularity, too; the shape and material of the arched arms produces a flexible dampening, absorbing effect. For the purposes of maintenance and repair it is possible to disconnect the device from the frame of the wagon and to mount it back again without further mod-

ifications concerning the original connection of the wagons.

**[0019]** The advantages of the pull and push device for the connection of wagons with the flexible elements in shape of the arched arms according to this invention are obvious from the outwardly manifested effects. The effects and originality of the proposed construction lies in the fact that the device has a unique shape. As opposed to existing solutions, the flexible dampening effects are achieved by flexible deformation of the pair of the bent arched arms. It is simple and constructionally pure solution since, as opposed to hitherto used solutions, it is based on the principle that the bending in the two planes is addressed by means of two coupled arched arms and two joints placed on its edges. The pull and push device is constructionally symmetrical which allows to achieve similar effects in both directions. The pull and push device allows to realize the connection of the wagons on the rails with the radius of 75 meters as well as pass the height differences on the rails (ascents and descents) in slope of 1:16. The pull and push device uses standard flange mounting to the frame of the wagon.

#### Description of drawings

**[0020]** The invention is further disclosed by drawings 1 to 29. The solution with the arched arms according to the example 1 is depicted in figures 1 to 5. The arrangement with the arched arms and the flexible pads pursuant to example 2 is depicted in figures 6 to 10. The solutions with joints in form of flexible serially connected blocks according to figure 3 is disclosed in the figures 11 to 21. The joints in form of cardan shafts pursuant to example 4 are disclosed in figures 22 to 29.

**[0021]** Pull and push devices with flexible elements in form of curved arched arms according to this invention is depicted on the drawings, where fig. 1 is an axonometric view of the complete set of the pull and push device with the flexible elements in shape of the curved arched arms. Fig. 2 is a detailed depiction of the axonometric view of the placement of one side of the curved arched arms in the joint formed by the joint bearing. Fig. 3 is detailed cross-section of the placement of the joint bearing in the eye of the flange. Fig. 4 is top and side view of the complete set of the pull and push device with the flexible elements in shape of the curved arched arms. Fig. 5 is axonometric view of the dismounted set of the pull and push device of the rod with flexible elements in shape of the curved arched arms.

**[0022]** Figure 6 is an exploded spatial view of the second arrangement of the arched arms with the cylindrical pin and flexible pads between the flange and the construction of the wagon. Figure 7 is a side view of the device. Figure 8 is a cross-section of the joint which depicts the connection of the arched arms into a common pair by means of the cylindrical pin with the threaded waist and screw nut. Figure 9 is cross-section of the central plane of the device in a groundplan view. Figure

10 depicts the height difference and deviation available to the device according to example 2.

**[0023]** Fig. 11 is side view of the flexible serially connected blocks. Fig. 12 is top view of the flexible serially connected blocks. Fig. 13 is side view of the flexible serially connected blocks in cross-section. Fig. 14 is top view of the flexible serially connected blocks in cross-section. Fig. 15 is axonometric view of the flexible serially connected blocks. Fig. 16 is axonometric view of the dismantled set with the flexible serially connected blocks. Fig. 17 depicts outer peripheral cup with flange for attachment of the device with the flexible serially connected blocks to the frame of the wagon. Fig. 18 depicts central cup of the flexible serially connected block. Fig. 19 depicts inner peripheral cup. Fig. 20 depicts flexible element which transfers the pushing. Fig. 20 depicts flexible element which transfers the pulling.

**[0024]** Fig. 22 is a side view of the cardan shafts. Fig. 23 is top view. Fig. 24 is axonometric view of the complete set of the cardan shafts. Fig. 25 is axonometric view of the dismantled set of the right part of the joint with the cardan shaft. Fig. 26 depicts the cardan shaft in the cross-section as a single part of the device. Fig. 27 depicts the cardan shaft, rotated by 90°, in the cross-section as a single part of the device. Fig. 29 depicts the elastic elements.

### Examples of realization

**[0025]** It is understood that individual realizations according to this invention are present for illustration only and cannot be interpreted as limitation of technical solutions. The persons skilled in the art will find or will be capable to find by no more than routine experimentation many equivalents of the particular realizations of the solution. Such equivalents will fall within the scope of patent claims.

**[0026]** A person skilled in the art will have no problem in finding the optimal setting of the construction and therefore these features were not addressed in detail.

#### Example 1

**[0027]** In this example of the particular realization of the subject matter of the invention a construction of the pull and push device as depicted on fig. 1 to 5 is disclosed. Pull and push device for connecting wagons consists of two mirror symmetrical arched arms 2 which are on both ends and alongside both sides placed in the joint bearings 8 with bearing houses 3. The joint bearings 8 with bearing houses 3 are placed in the eyes 5 of the flange 1. The bearing houses 3 are secured on their sides by the securing rings 4 against falling out. The arched arms 2 are in the vicinity of the eye 5 clasped together by the screws 6 and screw nuts 7. The joint bearings 8 have grease boxes 9.

#### Example 2

**[0028]** Realization of the device according to figures 6 to 10 differs from the example 1 in the details of the connection of the arched arms 2 into common pair. Both arched arms 2 have openings on their ends whose axes are perpendicular to the longitudinal axis of the device. Cylindrical pins 10 run through these openings and in this example they have mounting on one side and screw waist on the other. Cylindrical pin 10 runs through the openings of both oppositely placed arched arms 2 and the central part of the cylindrical pin 10 is placed in the joint with bearing 8. Both arched arms 2 are fixedly connected into the symmetrical pair by means of screw nut 7 with washer and screw waist of the cylindrical pin 10. The cylindrical pin 10 transfers the pull and push forces onto the ends of the arched arms 2.

#### Example 3

**[0029]** In this example according to figures 11 to 21 the construction of the joints formed by serially connected flexible blocks 23 with a flange 21 for the attachment of the device to the frame of the wagon is depicted. Each series of the flexible blocks 23 has two central blocks 24 onto which the inner peripheral block 25 connected to the pair of the arched arms 2 follows. From the other side the central block 24 follows upon the peripheral outer block with the flange 21 for the attachment to the wagon's frame. The central flexible blocks 23 are in two parts in the axial plane and they have a shape of the conical cup 26 with the stem 29 ended by the beveled conical tip 30. The inner peripheral block 25 is in one part and it has a shape of the cup with inner thread and the stem 29 ended by the beveled conical tip 30. The outer peripheral block is in two parts in the axial plane and it has a shape of the conical cup with an inner cone. In all cases the conical tips 30 are locked (wedged) into the conical cups 26. The push elastic elements 27 are inserted to the front of the conical tips 30 and the pull elastic elements 27 are inserted to the rear of the conical tips 30. All two-part central blocks 23 and the outer peripheral block are screwed together by screws.

#### Example 4

**[0030]** In this example according to figures 22 to 29 the joint on each side of the device is formed by the cardan shaft. The cardan shaft is formed by two simple cylindrical joints whose axes of rotation are mutually perpendicular. The cylindrical joint placed in the area of the pair of the arched arms 2 is rotational in the horizontal plane and the cylindrical joint placed in the area of the connecting flange with the sleeve 31 is rotational in the vertical plane. Each cylindrical joint is composed of the sleeve and fork which are connected by cross pin 33 with elastic elements 32. The first fork 34 functions as sleeve of the horizontal cylindrical joint placed in the central area of the device

and as the fork of the vertical cylindrical joint. The second fork 36 functions as fork of the horizontal cylindrical joint and serves the purpose of connection of pair of arched arms 2. The pins of the cylindrical joints and the elastic elements 32 are axially attached in the cylindrical joint by front lids 35 by means of four screws.

### Industrial applicability

**[0031]** Pull and push device for connecting wagons with the flexible elements in form of curved arched arms according to this invention is designed for the field of railroad transport and for the eventual customers which include producers and services of the railroad and other rail cars.

### List of symbols

#### [0032]

- 1 - flange
- 2 - arched arm
- 3 - bearing house
- 4 - securing ring
- 5 - eye
- 6 - screw
- 7 - screw nut
- 8 - bearing
- 9 - grease box
- 10 - cylindrical pin
- 11 - flexible pad
- 21 - flange
- 23 - flexible block
- 24 - central block
- 25 - inner block
- 26 - conical cup
- 27 - elastic element
- 29 - stem
- 30 - conical tip
- 31 - sleeve
- 32 - elastic element
- 33 - cross pin
- 34 - first fork
- 35 - lid
- 36 - second fork

### Claims

1. A pull and push device for connecting wagons, mainly freight wagons, which includes two joints allowing for an offset of the connected wagons, whereby the joints are on one side connected with a construction of the respective wagon, whereby it includes at least one pair of arched arms (2) which are on both ends mutually connected, **characterized in that** the arched arms (2) are at the same time connected by these connected ends to the joints,

and two mirror symmetrical arched arms (2) are on both sides placed in joint bearings (8) with bearing houses (3).

2. The pull and push device for connecting wagons, mainly freight wagons, according to the claim 1, **is characterized by the fact, that** a course of a curve of the arched arm (2) is elliptical and/or circular and/or hyperbolic or it is a combination of these curves.
3. The pull and push device for connecting wagons, mainly freight wagons, according to the claim 1 or 2, **is characterized by the fact, that** the offset of one arched arm (2) from a longitudinal axis of the connected arched arms (2) ranges from 5% to 30% of a length of the arched arm (2).
4. The pull and push device for connecting wagons, mainly freight wagons, according to any of the claims 1 to 3, **is characterized by the fact, that** it includes a partition or a buckle with stops which limit maximum allowed deviation of the arched arms (2).
5. The pull and push device for connecting wagons, mainly freight wagons, according to the claim 4, **is characterized by the fact, that** the stop is arranged for the deviation of the arched arm (2) during pulling and/or during pushing.
6. The pull and push device for connecting wagons, mainly freight wagons, according to the claim 4 or 5, **is characterized by the fact, that** the partition with the stops is placed in a transversal central plane of the pair of the arched arms (2).
7. The pull and push device for connecting wagons, mainly freight wagons, according to any of the claims 1 to 6, **is characterized by the fact, that** the bearing houses (3) are secured on sides by securing rings (4), whereby the arched arms (2) are connected together by screws (6) and screw nuts (7); and whereby the joint bearings (8) with the bearing houses (3) are placed in eyes (5) of a flange (1).
8. The pull and push device for connecting wagons, mainly freight wagons, according to any of the claims 1 to 6, **is characterized by the fact, that** both ends of the arched arms (2) are equipped by eyes whose axis is perpendicular onto the longitudinal axis of the connected pair of the arched arms (2) and a cylindrical pin (10) runs through these eyes in such a way that it connects the arched arms (2) and, at the same time, the cylindrical pin (10) is inserted in the joint at a respective end of the device.
9. The pull and push device for connecting wagons, mainly freight wagons, according to any of the claims

- 1 to 8, **is characterized by the fact, that** a flexible pad (11) is placed at least by one flange (1).
10. The pull and push device for connecting wagons, mainly freight wagons, according to any of the claims 1 to 6, **is characterized by the fact, that** the joint is formed by a series of flexible blocks (23) with an outer peripheral cup and a flange (21) for an attachment to a wagon's frame; each series of the flexible blocks (23) has at least one central block (24) onto which an inner peripheral block (25) follows; from the other side of the central block (24) follows the peripheral outer block with the flange (21) for the attachment to the wagon's frame; the central block (24) is in two parts in an axial plane and it has a shape of a conical cup (26) with a stem (29) ended by a beveled conical tip (30); the inner peripheral block (25) is in one part and it has the shape of a cup with the stem (29) ended by the beveled conical tip (30); the outer peripheral block is in two parts in the axial plane and it has the shape of the conical cup (26) with an inner cone, whereby the conical tips (30) are locked in the inner cones, and whereby push elastic elements (27) are inserted in a front of the conical tips (30) and the pull elastic elements (27) are inserted to a rear of the conical tips (30).
11. The pull and push device for connecting wagons, mainly freight wagons, according the claim 10, **is characterized by the fact, that** the two-part central block (24) and the inner peripheral block (25) are screwed together by screws.
12. The pull and push device for connecting wagons, mainly freight wagons, according to any of the claims 1 to 6, **is characterized by the fact, that** the joint is formed by a cardan shaft, whereby each cardan shaft is formed by two simple cylindrical joints whose axes of rotation are mutually perpendicular; the cylindrical joint placed in an area of the device is rotational in a horizontal plane and the cylindrical joint placed in the area of a connecting flange with a sleeve (31) is rotational in a vertical plane; whereby each cylindrical joint has a transversal cross pin (33) and elastic elements (32) which are placed in the sleeve (31) and in first and second fork (34, 36); whereby the first fork (34) of the cylindrical joint placed in the area of the connecting flange forms a single fixed whole with the sleeve (31) of the cylindrical joint placed in the central area of the device.
13. The pull and push device for connecting wagons, mainly freight wagons, according to the claim 12, **is characterized by the fact, that** the cross pins (33) and the elastic elements (32) in the cylindrical joints are covered by the front lids (35).

## Patentansprüche

1. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, die zwei Gelenke aufweist, die das Ausrichten der gekuppelten Wagen ermöglichen, wobei die Gelenke auf einer Seite mit dem Aufbau des jeweiligen Wagens verbunden sind, mit mindestens einem Paar von Bogenarmen (2), die an beiden Enden miteinander verbunden sind, **dadurch gekennzeichnet, dass** die Bogenarme (2) mit den verbundenen Enden gleichzeitig zu den Gelenken angeschlossen sind, und die beiden spiegelsymmetrischen Bogenarme (2) auf beiden Seiten in den Gelenklagern (8) mit Lagerhülsen (3) gelagert sind.
2. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, nach Anspruch 1, **dadurch gekennzeichnet, dass** der Verlauf der Kurve des Bogenarms (2) elliptisch und/oder kreisförmig und/oder hyperbolisch oder eine Kombination dieser Kurven ist.
3. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Ausrichten eines Bogenarms (2) von der Längsachse eines Paares der gekuppelten Bogenarme (2) zwischen 5 % und 30 % der Länge des Bogenarms (2) beträgt.
4. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** sie eine Trennwand oder einen Verbinder mit den Anschlängen zur Begrenzung der maximal zulässigen Auslenkung der Bogenarme (2) aufweist.
5. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, nach Anspruch 4, **dadurch gekennzeichnet, dass** der Anschlag zur Auslenkung des Bogenarms (2) beim Zug und/oder Druck angeordnet ist.
6. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, nach Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** die Trennwand mit den Anschlängen in der Quermittalebene eines Paares der Bogenarme (2) angeordnet ist.
7. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** die Lagerhülsen (3) durch Sicherungsringe (4) seitlich gesichert sind, wobei die Bogenarme (2) mit den Schrauben (6) und Muttern (7) miteinander verbunden sind; und wobei die Gelenklager (8) mit den Lagerhülsen (3) in den Laschen (5) von Flansch (1) angeordnet sind.

8. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** beide Enden der Bogenarme (2) mit Laschen versehen sind, deren Achse senkrecht zur Längsachse des gekuppelten Paares der Bogenarme (2) steht, und ein zylindrischer Bolzen (10) durch diese Laschen verläuft, sodass er die Bogenarme (2) kuppelt, wobei der zylindrische Bolzen (10) am jeweiligen Ende der Vorrichtung in ein Gelenk eingelassen ist.
9. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** an mindestens einem Flansch (1) eine elastische Unterscheibe (11) angeordnet ist.
10. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** das Gelenk durch einen Satz elastischer Blöcke (23) mit einer umlaufenden Außenschale und einem Flansch (21) zur Befestigung am Wagenrahmen gebildet ist; jeder Satz von elastischen Blöcken (23) mindestens einen Mittelblock (24) aufweist, auf den auf einer Seite ein innerer Randblock (25) folgt; auf der anderen Seite des Mittelblocks (24) folgt ein äußerer Randblock mit einem Flansch (21) zur Befestigung am Wagenrahmen; der Mittelblock (24) ist in der axialen Ebene zweiteilig und hat die Form einer konischen Schale (26) mit einem Schaft (29), der in einer abgeschrägten konischen Spitze (30) endet; der innere Randblock (25) ist einteilig und hat die Form einer Schale mit einem Schaft (29), der in einer abgeschrägten konischen Spitze (30) endet; der äußere Randblock ist in der axialen Ebene zweiteilig und hat die Form einer konischen Schale (26) mit einem Innenkonus, wobei die konischen Spitzen (30) in den Innenkonen eingeklemmt sind, und wobei in der Stirnseite der konischen Spitzen (30) druckelastische Elemente (27) und in den Stoß der konischen Spitzen (30) zugfeste elastische Elemente (27) eingesetzt sind.
11. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, nach Anspruch 10, **dadurch gekennzeichnet, dass** der zweiteilige Mittelblock (24) und der äußere Randblock (25) durch Bolzen miteinander verschraubt sind.
12. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** das Gelenk durch eine Kardanwelle gebildet ist, wobei jede Kardanwelle zwei einfache zylindrische Gelenke bilden, deren Drehachsen senkrecht zueinander stehen; das zylindrische Gelenk, das sich im Bereich der Mitte der Vorrichtung befindet, in der horizont-

len Ebene drehbar ist, und das zylindrische Gelenk, das sich im Bereich des Verbindungsflansches (31) mit der Muffe befindet, in der vertikalen Ebene drehbar ist, wobei jedes zylindrische Gelenk einen Querszapfen (33) und elastische Elemente (32) aufweist, die in den Ausnehmungen der Hülse (31) und der ersten und zweiten Gabel (34, 36) angeordnet sind, wobei die im Bereich des Verbindungsflansches (31) angeordnete erste Gabel (34) des zylindrischen Gelenks mit der im Bereich der Mitte der Vorrichtung angeordneten Hülse des zylindrischen Gelenks eine einzige starre Einheit bildet.

13. Zug-Schub-Vorrichtung zum Kuppeln von Wagen, insbesondere Güterwagen, nach Anspruch 12, **dadurch gekennzeichnet, dass** die Querszapfen (33) und die elastischen Elemente (32) in den zylindrischen Gelenken durch Endkappen (35) abgedeckt sind.

### Revendications

1. Un dispositif tracteur-pousseur pour attelage des wagons, en particulier des wagons de fret, qui comprend deux articulations permettant un décalage axial des wagons reliés, les articulations étant reliées d'un côté à une structure du wagon respectif et comprenant au moins une paire de bras à arc (2) qui sont connectés l'un à l'autre aux deux extrémités, **caractérisé en ce que** les bras à arc sont en même temps connectés aux articulations par leurs extrémités jointes, et deux bras à arc (2) symétriques inversés en image sont montés des deux côtés dans des paliers à rotule (8) et des paliers à roulement (3).
2. Le dispositif tracteur-pousseur pour attelage des wagons, en particulier des wagons de fret selon la revendication 1 **caractérisé en ce qu'**une courbe du bras à arc (2) est elliptique et/ou circulaire et/ou hyperbolique ou combinaison des courbes précitées.
3. Le dispositif tracteur-pousseur pour attelage des wagons, en particulier des wagons de fret selon la revendication 1 ou 2 **caractérisé en ce que** le décalage d'un bras à arc (2) de l'axe longitudinal de la paire de bras à arc (2) connectés est compris entre 5% et 30% de la longueur du bras à arc (2).
4. Le dispositif tracteur-pousseur pour attelage des wagons, en particulier des wagons de fret selon quelconque des revendications 1 à 3 **caractérisé en ce qu'**il comprend une barre transversale ou une pince « o » avec des butées afin de limiter le déplacement maximal autorisé des bras à arc (2).
5. Le dispositif tracteur-pousseur pour attelage des

- wagons, en particulier des wagons de fret selon la revendication 4, **caractérisé en ce que** la butée est appropriée pour le déplacement du bras à arc (2) à la traction et/ou sous la pression.
6. Le dispositif tracteur-pousseur pour attelage des wagons, en particulier des wagons de fret selon la revendication 4 ou 5, **caractérisé en ce que** la barre aux butées est placée est situé dans un plan médian transversal de la paire de bras à arc (2).
7. Le dispositif tracteur-pousseur pour attelage des wagons, en particulier des wagons de fret selon quelconque des revendications 1 à 6 **caractérisé en ce que** les paliers à roulement (3) sont fixés latéralement par des anneaux de verrouillage (4), tandis que les bras à arc (2) sont reliés entre eux par des vis (6) et des écrous (7) et les roulements à rotule (8) avec palier à roulement (3) sont situés dans les élingues (5) d'une bride (1).
8. Le dispositif tracteur-pousseur pour attelage des wagons, en particulier des wagons de fret selon quelconque des revendications 1 à 6 **caractérisé en ce que** les extrémités des bras à arc (2) sont équipées des élingues dont l'axe est perpendiculaire à l'axe longitudinal de la paire des bras à arc (2) et une goupille cylindrique (10) passe à travers ces élingues de manière à connecter les bras à arc (2) et en même temps la goupille cylindrique (10) est insérée dans l'articulation à l'extrémité correspondante du dispositif.
9. Le dispositif tracteur-pousseur pour attelage des wagons, en particulier des wagons de fret selon quelconque des revendications 1 à 8 **caractérisé en ce qu'**une rondelle élastique (11) est située au moins à la bride (1).
10. Le dispositif tracteur-pousseur pour attelage des wagons, en particulier des wagons de fret selon quelconque des revendications 1 à 6 **caractérisé en ce que** l'articulation est formée par l'ensemble de blocs flexibles (23) à la coupe extérieure périphérique et à une bride (21) pour fixer le châssis du wagon; chaque ensemble de blocs flexibles (23) comprend au moins un bloc central (24) qui continue d'un côté par un bloc intérieur périphérique (25) et de l'autre côté du bloc central (24) il continue par un bloc extérieur périphérique et la bride (21) pour fixer le châssis du wagon; le bloc central (24) est en deux parties dans le plan axial et est en forme d'une coupelle conique (26) avec une tige (29) se terminant par une pointe conique découpée (30); le bloc intérieur périphérique (25) est monobloc et présente la forme d'une coupelle avec une tige (29) se terminant par une pointe conique découpés (30); le bloc périphérique extérieur est en deux parties dans le plan axial et est en forme de la coupelle conique (26) avec un cône intérieur, les pointes coniques (30) étant calées dans les cônes intérieurs, et des éléments élastiques de compression (27) étant insérés à l'avant des pointes coniques (30) et des éléments élastiques de traction (27) étant insérés à l'arrière des pointes coniques (30).
11. Le dispositif tracteur-pousseur pour attelage des wagons, en particulier des wagons de fret selon la revendication 10 **caractérisé en ce que** le bloc central en deux parties (24) et le bloc extérieur périphérique (25) sont vissés ensemble avec des vis.
12. Le dispositif tracteur-pousseur pour attelage des wagons, en particulier des wagons de fret selon quelconque des revendications 1 à 6 **caractérisé en ce que** l'articulation est formée par arbre à cardan, chaque arbre à cardan étant formé de deux articulations cylindriques simples dont les axes de rotation sont perpendiculaires entre eux; l'articulation cylindrique située dans la zone centrale du dispositif est rotative dans le plan horizontal et l'articulation cylindrique située dans la zone d'e la bride de connexion avec un manchon (31) est rotative dans le plan vertical; chaque articulation cylindrique comporte une goupille transversale (33) et des éléments élastiques (32), qui sont montés au manchon (31) et à la première et deuxième fourches (34, 36), la première fourche (34) de l'articulation cylindrique est située dans la zone de la bride de connexion et le manchon (31) de l'articulation cylindrique situé dans la zone central du dispositif forment ensemble une unité solide.
13. Le dispositif tracteur-pousseur pour attelage des wagons, en particulier des wagons de fret selon la revendication 12 **caractérisé en ce que** les goupilles transversales (33) et les éléments élastiques (32) des articulations cylindriques sont recouverts par des capots avant (35).

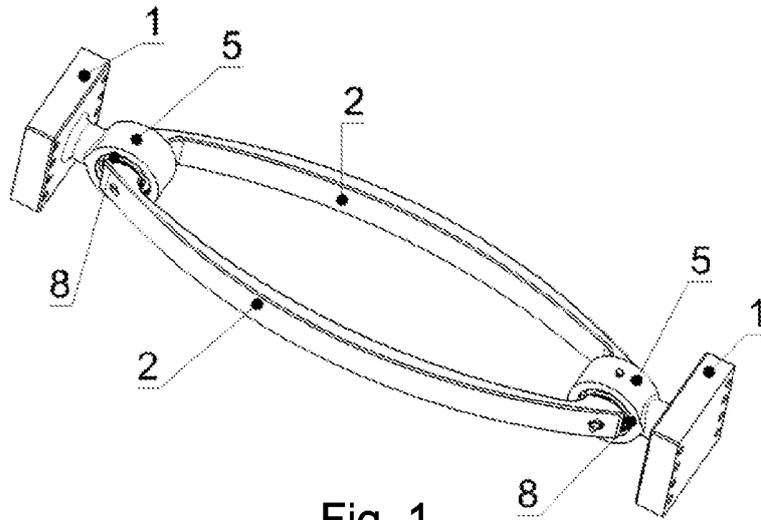


Fig. 1

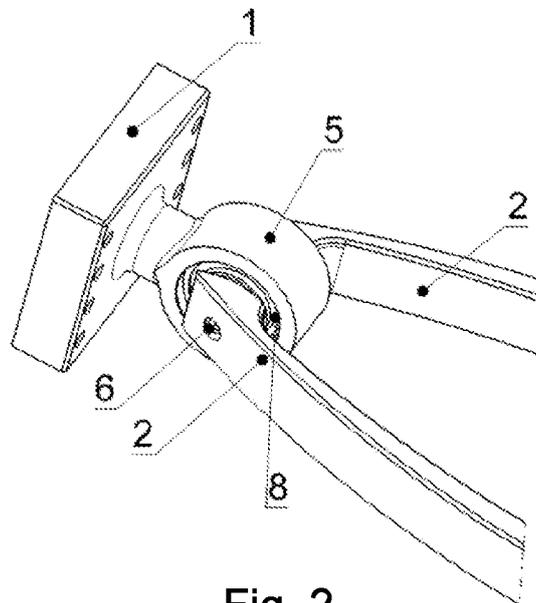


Fig. 2

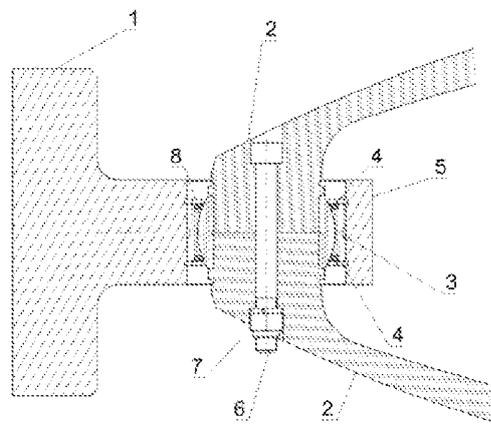


Fig. 3

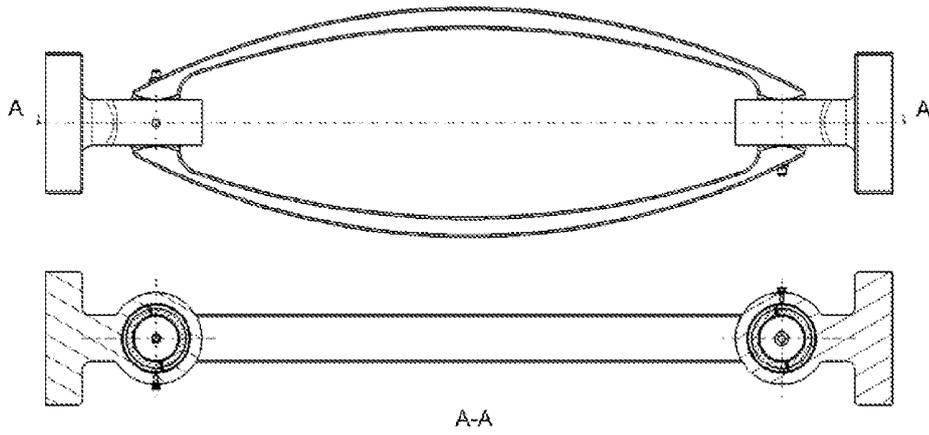


Fig. 4

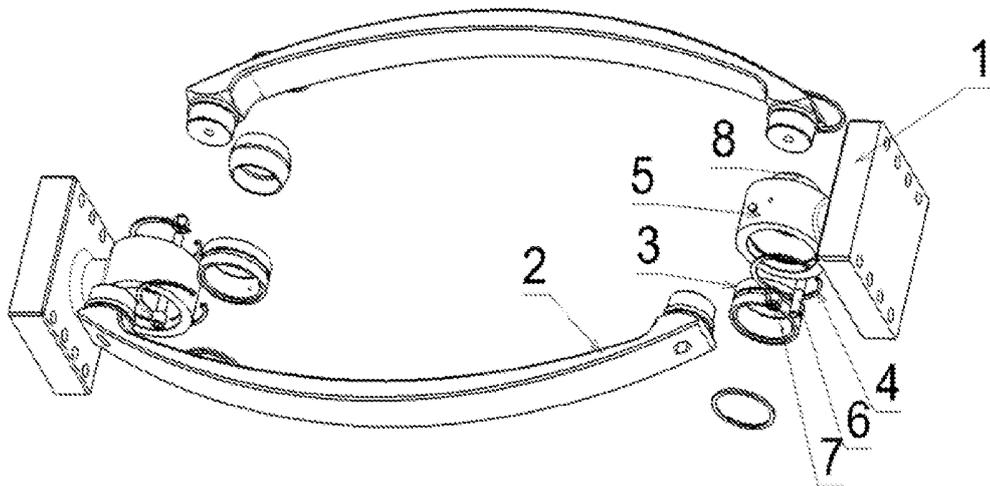


Fig. 5

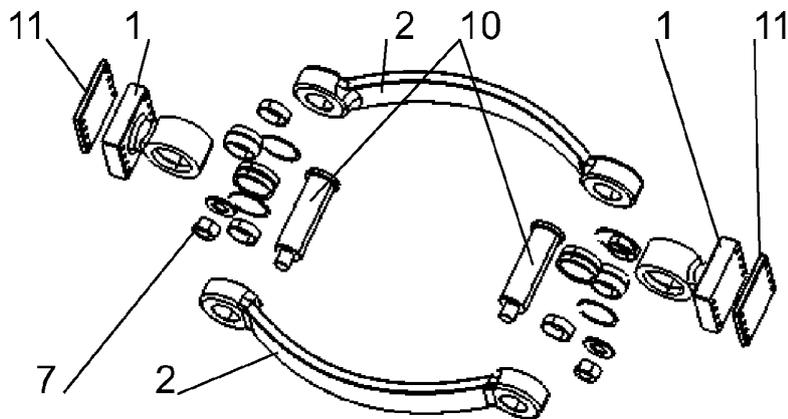


Fig. 6

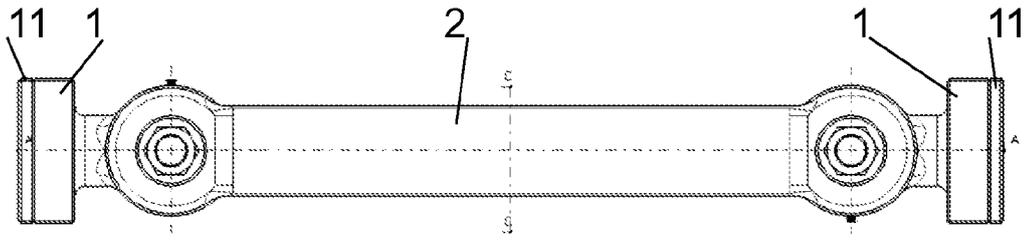


Fig. 7

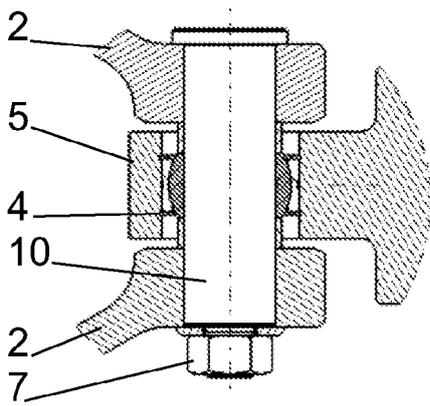


Fig. 8

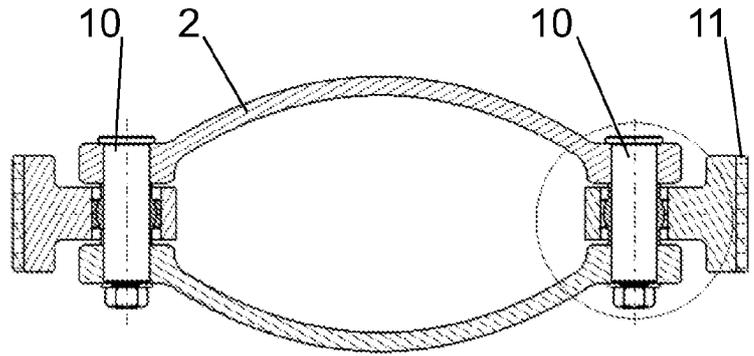


Fig. 9

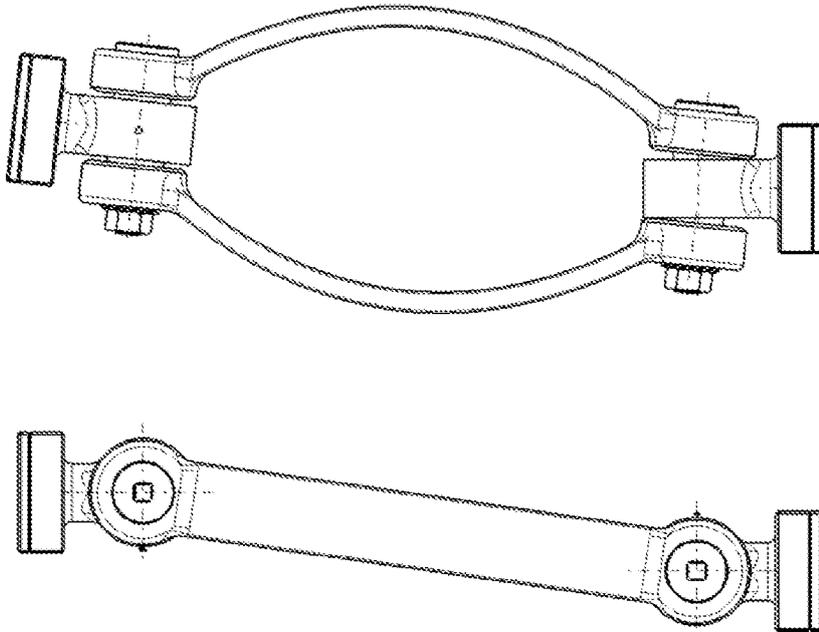


Fig. 10

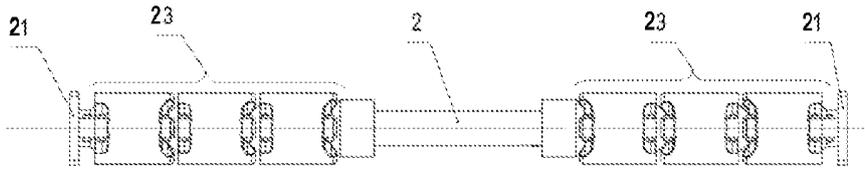


Fig. 11

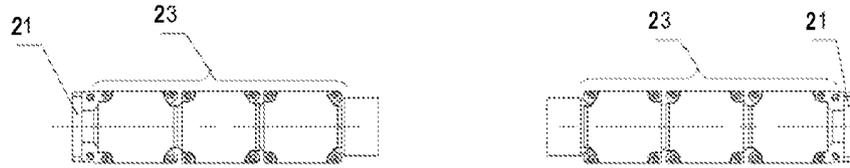


Fig. 12

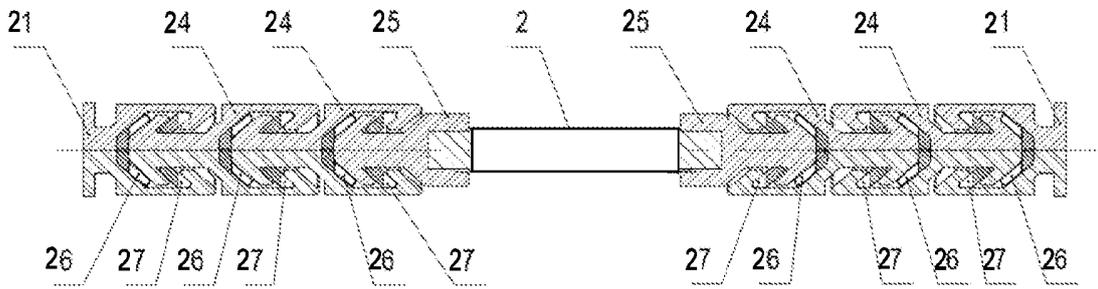


Fig. 13

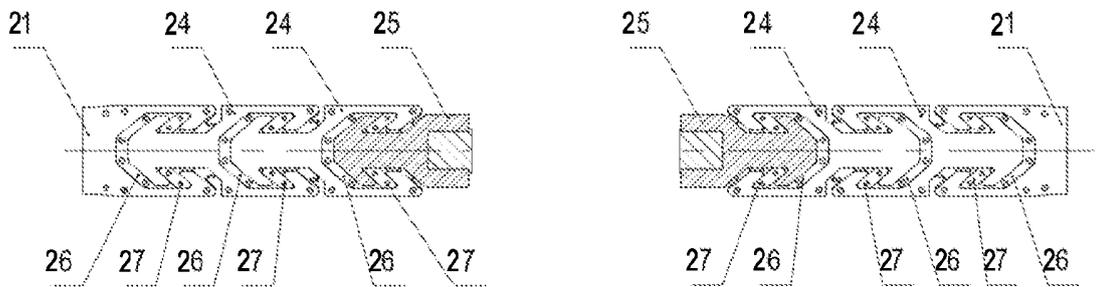


Fig. 14

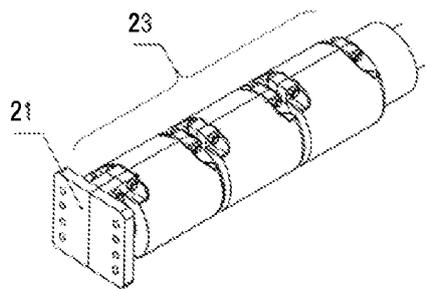


Fig. 15

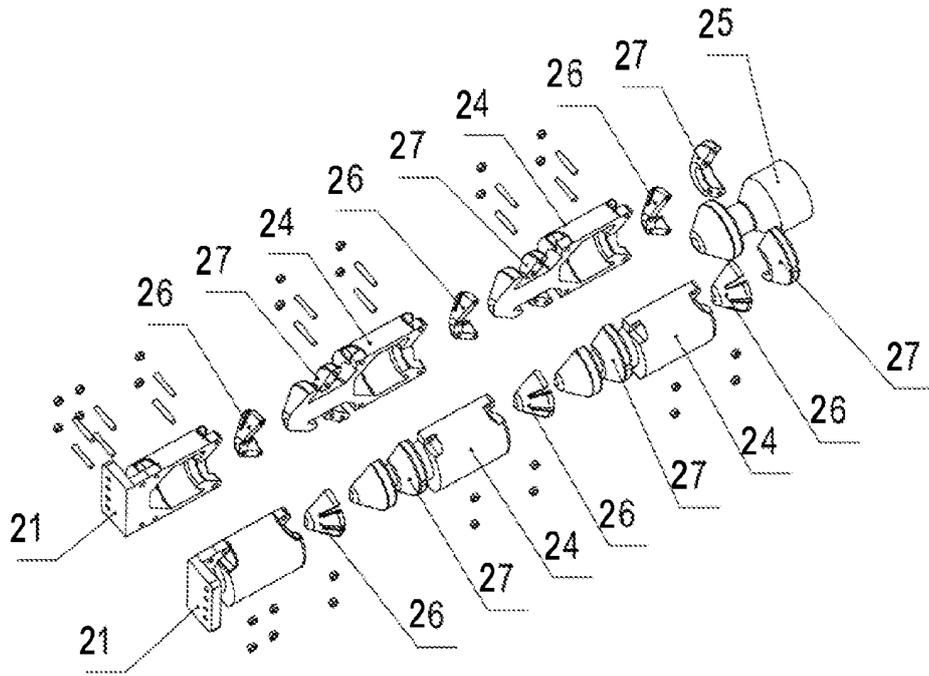


Fig. 16

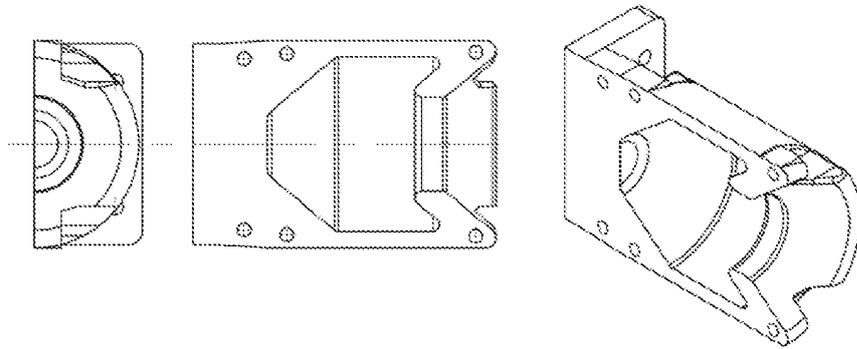


Fig. 17

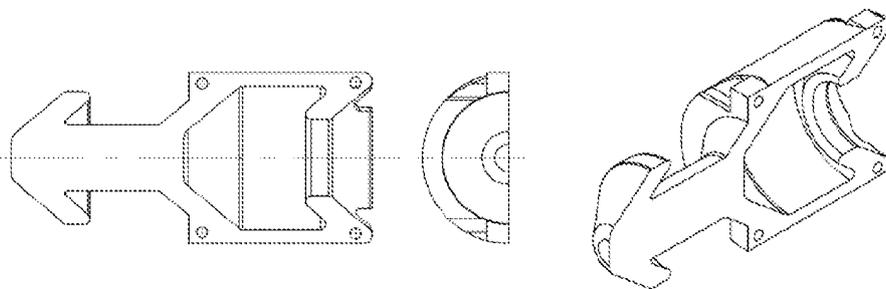


Fig. 18

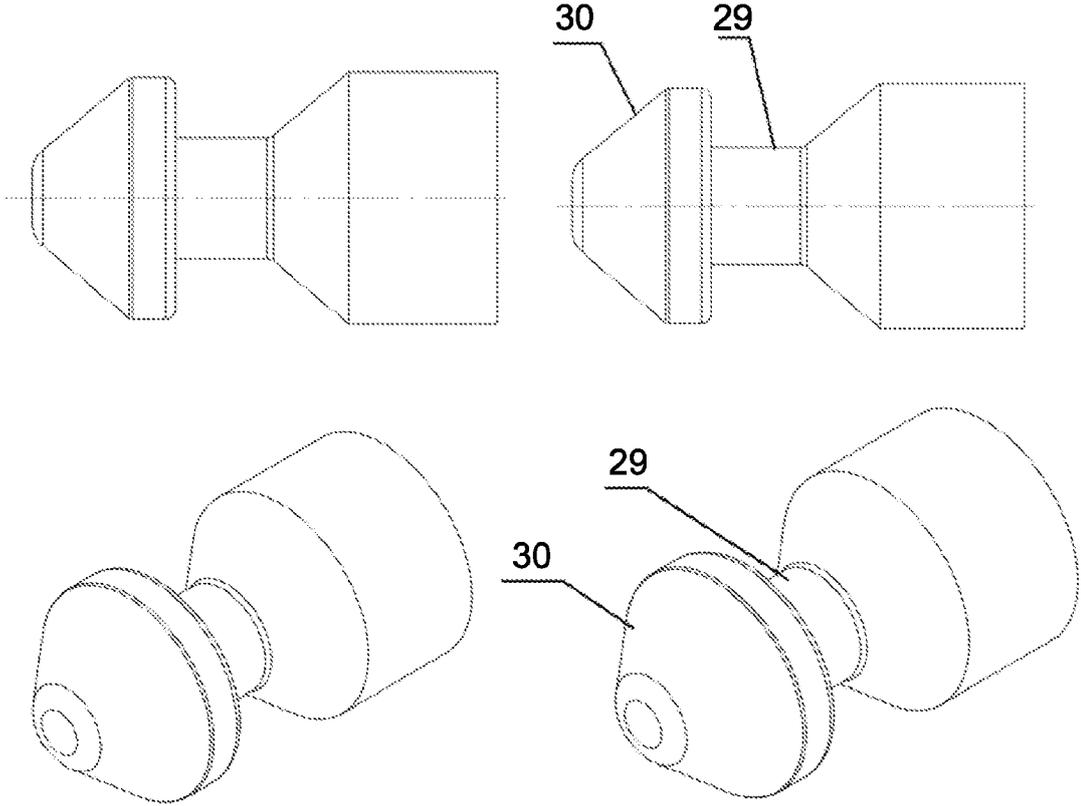


Fig. 19

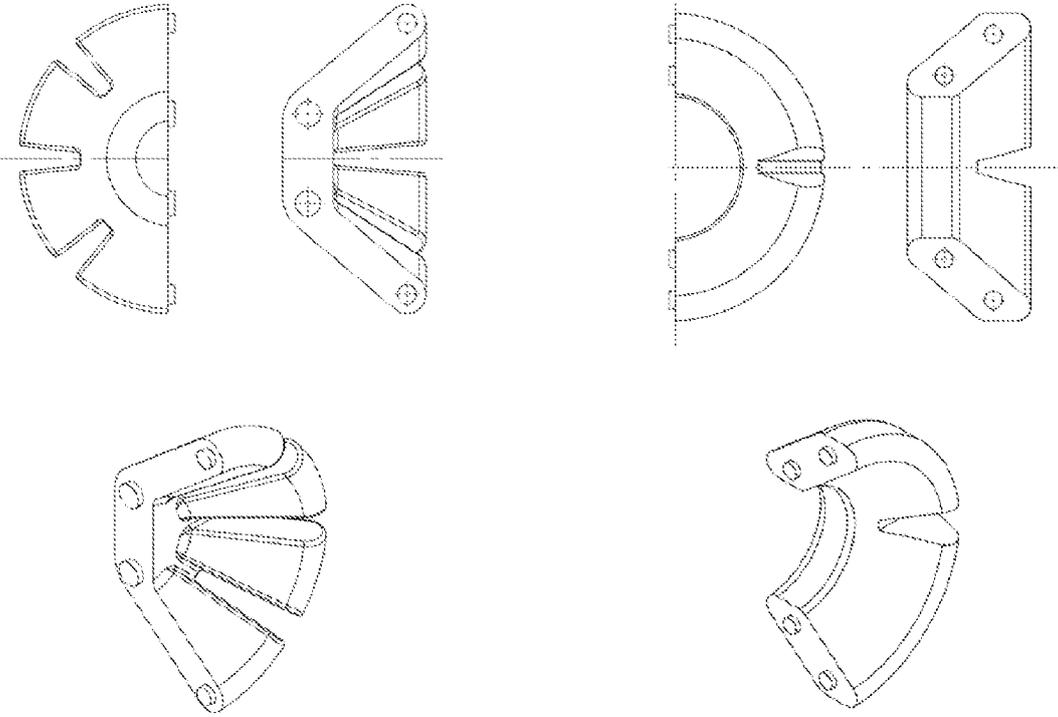


Fig. 20

Fig. 21



Fig. 22

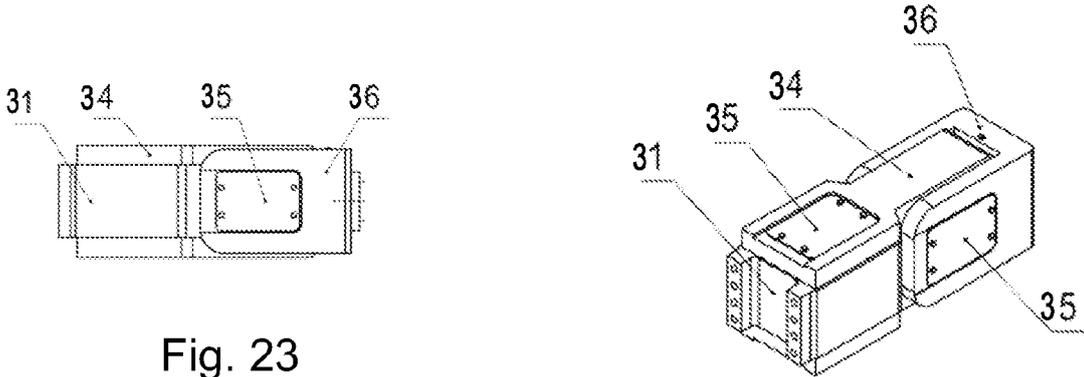


Fig. 23

Fig. 24

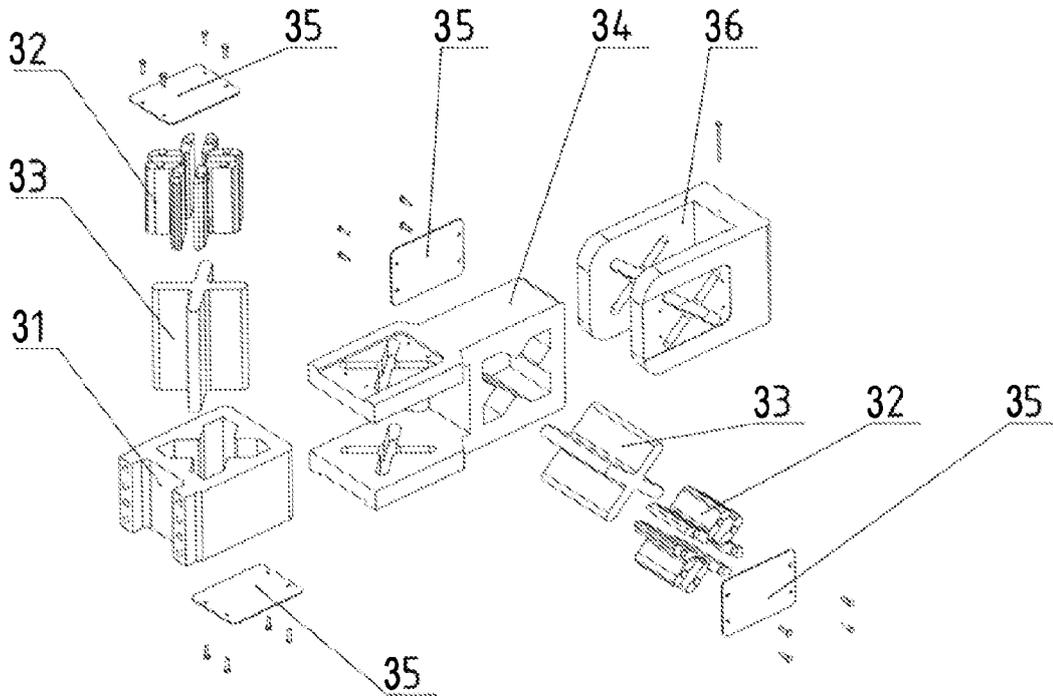


Fig. 25

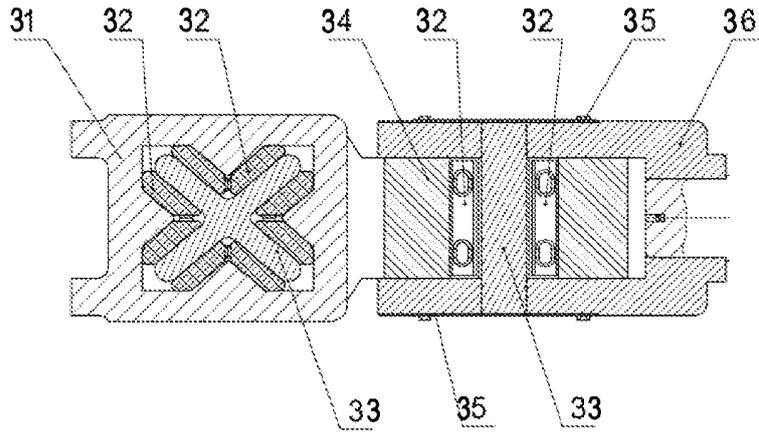


Fig. 26

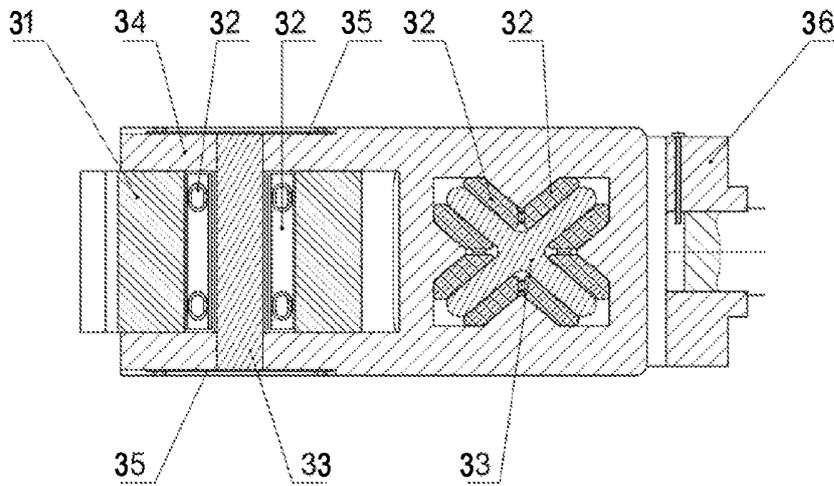


Fig. 27

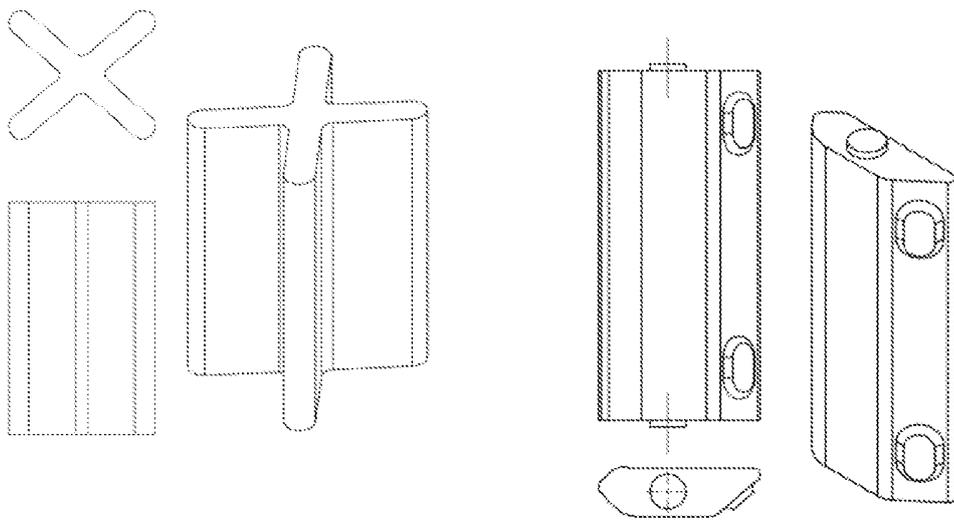


Fig. 28

Fig. 29

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- DE 4118529 A1 [0003]
- DE 129900875 U1 [0003]
- CZ 294052 B6 [0003]
- EP 1946988 B1 [0003]
- SK 287429 B6 [0003]
- DE 110868 C [0003]