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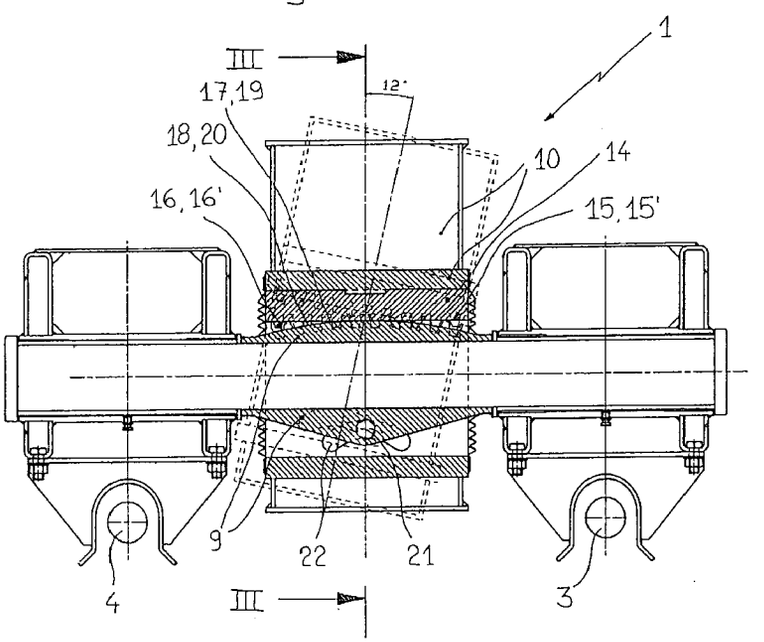
(54) System for a cableway carriage with two carrying cables, for avoiding the separation of the carriage

(57) A system (1) is described for avoiding the separation of a cableway carriage from one (3) of two carrying cables due to the rotation of the carriage (2) around the other (4) carrying cable. The cableway carriage (2) has a first (5) and a second (6) series of roller units, respectively, mobile on a first (3) and a second (4) carrying cable, respectively, and connected reciprocally one to the other at each roller unit (8) by means of connecting elements (9), that are connected to a beam (10) in turn connected to a suspension (12) of a cableway car. The suspension (12) and the beam (10) are connected rigidly together in a direction transversal to that of the carrying cables (3, 4) and the beam (10) is constrained to each of the connecting elements (9) in a manner such that, at each connecting element (9), a surface line (15') of each vertical transversal section of the beam (10) can move, transversally to the direction of the carrying cables (3, 4), locally with an oscillatory motion with respect to a surface line (16') of the corresponding vertical section of the connecting element (9), and the connecting elements (9) are connected rigidly to the roller units (8).

Figure 2



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Description

The object of the present invention is a system for a cableway carriage with two carrying cables, for avoiding the separation of the carriage from one of the carrying cables due to the rotation of the carriage around the other carrying cable. When large loading capacities and thus large passenger capacities are required, cableways are designed with cars having large dimensions, the support of which, in view of the weights under consideration, requires the adoption of two carrying cables for supporting the car. Along the way there are also intermediate pilons, whose purpose is to locally support the carrying cables, thus reducing their deflection.

The car is hung from the cables by means of a cableway carriage, to which it is fastened by means of a suspension. The cableway carriage has roller units, whose rollers roll on the carrying cables due to the motion transmitted to the carriage by a hauling cable. As is known and for the most diverse reasons, cable cars oscillate. It is usual to distinguish such oscillations into longitudinal, when they take place in the plane of the forward motion of the car, and into transversal, when they take place transversally to the direction of the carrying cables.

In the presence of wind the car, in particular the car that is empty or that has a limited load, is subjected to a lateral force, directly proportional to the surface exposed to the wind, that causes it to oscillate transversally. If the car is of a large size and the wind is very strong the force can be so large and constant as to submit the car to a permanent transversal rotation, so that the cabin travels in a rotated position.

When the car is not in the proximity of the intermediate pilons the carrying cables have the possibility of adapting their configuration, by staggering in height, to the rotated situation of the carriage and there is thus no danger of the roller units of the carriage separating from one of the carrying cables as a result of the transversal oscillation or of the transversal rotation of the car. But when the car is in the proximity of the pilons the danger does exist that the roller units of the carriage separate from one of the carrying cables. In fact, due also to the considerable speed at which modern cableway cars travel, when the car that is oscillating or is in the rotated position reaches the pilon, it meets a sudden and violent change in configuration and in deformability of the carrying cables, that are constrained in an aligned and rigid manner to the pilon, so that they are not capable, by staggering, to adapt to the rotated situation of the carriage, which can thus separate from one of the carrying cables by rotating around the other carrying cable.

In order to eliminate this danger a reciprocal transversal rotation is known to be allowed between the cableway carriage and the car, since in this way the permanent oscillation or rotation of the car is not transmitted to the cableway carriage and a rotation of the same with respect to one of the carrying cables is thus not possible.

Currently, cableway carriages have a first and a second series of roller units, respectively, mobile on a first and a second carrying cable, respectively, and connected reciprocally one to the other at each roller unit by means of connecting elements, that are connected to a beam in turn connected to a hauling cable and to a suspension of a cableway car.

According to the known art the suspension of the car is connected by means of a transversal hinge to the beam of the cableway car. Transversal rotations of the suspension with respect to the cableway carriage are thus made possible. In turn, the carriage does not have any parts either articulated or that can rotate and rests with its roller units on the carrying cables. There is also an elastic stabilising element, whose coefficient of elasticity is calculated in a suitable manner so as not to allow relative rotations between the suspension and the beam of the carriage when they are far from the pilons, where the deformability of the carrying cables is present, but only in the proximity of the pilons, where the value of said coefficient of elasticity is such as not to obstruct the necessary and natural relative rotations between the suspension and the beam of the carriage.

However, this known system has the drawback of including said elastic stabilising element, the presence of which is the source of structural complications, of possible breakages as a result of the violent stresses to which it is subjected, of meticulous maintenance and it is also of cumbersome dimensions when oscillations of a substantial amount are to be allowed, for example of 12°.

The essential object of the present invention is that of overcoming the drawbacks mentioned above by making available a system for a cableway carriage with two carrying cables, for avoiding the separation of the carriage from one of the carrying cables due to the rotation of the carriage round the other carrying cable, that is simple in its structure, reliable, of limited maintenance and size, and for which a rotation of the car is the cause of a stabilising moment that tends to take the car back to the initial position.

These and yet other objects are attained with a system for a cableway carriage with two carrying cables, for avoiding the separation of the carriage from one of the carrying cables due to the rotation of the carriage around the other of the carrying cables, according to the present invention, characterised in that the suspension and the beam are connected rigidly together in a direction transversal to that of the carrying cables, without any possibility of reciprocal translations in said transversal direction and/or of reciprocal rotations round said direction of the carrying cables, that the beam is constrained to each of the connecting elements in a manner such that, at each connecting element, a surface line of each vertical transversal section of the beam can move, transversally to the direction of the carrying cables, locally with an oscillatory motion with respect to the surface line of the corresponding section of the connecting element, and that the connecting elements are connected rigidly to the sets of rollers.

In this manner the rotation between car and carriage does not take place any more at the junction between the suspension and the beam but, rather, at the junction between the beam and the roller units, so that the carriage is no longer rigid and can all the better adapt to the curve of the carrying cables. In addition, the fact that the beam is constrained in a manner such that, due to the transversal rotation of the car transmitted by the suspension to the beam, there is an oscillatory motion of the beam with respect to each connecting element, causes a displacement to take place of the point of application of the weight force of the car transmitted on the connecting element by the beam; said points of application of the weight force of the car are no longer in a vertical plane passing through the centre of gravity of the car, and this gives rise to a stabilising moment that opposes the cause that has created it, that is, the transversal rotation of the car.

Further features and advantages of the present invention will be made more evident by the following detailed description of an embodiment thereof, illustrated as a purely indicative but non-limiting example in the enclosed drawings, wherein:

Fig. 1 shows a schematic plan view of a cableway carriage having the system that is the object of the present invention;
Fig. 2 shows a vertical sectional view taken along the line II-II of Fig. 1;
Fig. 3 shows a vertical sectional view taken along the line III-III of Fig. 2.

With reference to the enclosed drawings the cableway carriage with two carrying cables 3, 4 has been indicated with 2.

The cableway carriage 2 has a first series 5 and a second series 6 of roller units 8, respectively, movable on a first carrying cable 3 and a second carrying cable 4, respectively, and connected one to the other at each roller unit 8 by means of connecting elements 9. The connecting elements 9 are in turn connected to a beam 10 connected in turn to a hauling cable 11 and to a suspension 12 of a cableway car (not shown).

In order to avoid the separation of the carriage 2 from one, say 3, of the carrying cables due to the rotation of the carriage 2 on the other, 4, of the carrying cables, the following system 1 has been devised.

The suspension 12 and the beam 10 are connected together rigidly in a direction transversal to that of the carrying cables 3, 4, without any possibility of reciprocal translation in said tranversal direction and/or of reciprocal rotations around said direction of the carrying cables 3, 4. In this manner the transversal rotation of a cableway car (not shown) is transmitted integrally to the beam 10 through the suspension 12.

The connecting elements are also connected rigidly to the roller unit 8.

But the beam 10 is constrained to each of the connecting elements 9 in a manner such that, for each of the connecting elements 9, a surface line 15' of each vertical transversal section of the beam 10 can move, transversally to the direction of the carrying cables 3, 4, locally with an oscillatory motion with respect to the surface line 16' of the corresponding vertical section of the connecting element 9. In this way the transversal rotation triggered by the cableway car (not shown) cannot be further transmitted to the cableway carriage 2 any longer and there cannot therefore be any separation of the same from one 3 of the carrying cables 3, 4 as a result of transversal oscillations of the cableway car (not shown).

As can be seen from Fig. 2, in order to accomplish the abovementioned constraint the beam 10 is supported, at each of the connecting elements 9, by a rolling element 14 on the connecting element 9. The rolling element 14 is suitable for rolling with a rolling surfaces 15 thereof on a support surface 16 of the corresponding connecting element 9. In this way at each connecting element 9 the surface line 15', belonging to the rolling surface 15, of each vertical transversal section of the beam 10, and in particular of the rolling element 14, moves with an oscillatory motion on the surface line 16', belonging to the contact surface 16, of the corresponding vertical section of the connecting element 9.

It should also be noted that, while in the absence of oscillations of the car (not shown) the points of application of the weight force of the car to the carriage, that is, the points of contact of the rolling surface 15 on the corresponding contact surfaces 16, lie in a vertical plane passing through the centre of gravity of the car, in the presence of a rolling motion, as a result of an oscillation of the car of the rolling elements 14 on the respective contact surfaces 16, a displacement is determined of the points of application of the weight force of the car transmitted by the rolling element 14, and thus by the beam 10, to the contact surface 16, and thus to the connecting element 9, so that said points of application of the weight force no longer lie in a vertical plane passing through the centre of gravity of the car that will also have moved in the same direction as the points of application. This gives rise to a stabilising moment that opposes the cause that has created it, that is, the rotation of the cableway car (not shown).

In order to ensure a rolling motion without any scraping each of the rolling elements 14 has a series 17 of protrusions and/or recesses at each edge 13, respectively, transversal to the direction of the carrying cables 3, 4, of each of said rolling surfaces 15. These series 17 engage, when the rolling element 14 rolls over the contact surface 16, with two opposite and counter-shaped series 18 of recesses and/or protrusions on each corresponding connecting element 9.

As mentioned in Figs. 2 and 3 the series 17 of protrusions and/or recesses and the series 18 of recesses and/or protrusions can be first 19 and second 20 sets of teeth.

Lastly, in order to avoid the separation of the rolling element 14 from the corresponding connecting element 9 there is a pin 21 arranged slidably inside a curved slot

22. In this manner a reciprocal separation is prevented but not the oscillatory motion performed by the rolling surface 15 on the contact surface 16.

The pin 21 and the slot 22 are one on the connecting element 9 and the other on the beam 10 or vice versa.

The present invention thus attains the required objects.

Obviously it can also assume in its emobodiments forms and configurations other than those illustrated above without going outside the present scope of protection.

In addition all particulars can be replaced by technically-equivalent elements and the forms, dimensions and materials used can be any at all according to requirements.

Claims

1. System (1) for a cableway carriage (2) with two carrying cables (3, 4), for avoiding the separation of the carriage (2) from one (3) of the carrying cables due to the rotation of the carriage (2) around the other (4) of the carrying cables, said cableway carriage (2) having a first (5) and a second (6) series of roller units, respectively, mobile on a first (3) and a second (4) carrying cable, respectively, and connected reciprocally one to the other at each roller unit (8) by means of connecting elements (9), that are connected to a beam (10) in turn connected to a hauling cable (11) and to a suspension (12) of a cableway car, characterised in that said suspension (12) and said beam (10) are connected rigidly together in a direction transversal to that of the carrying cables (3, 4), without any possibility of reciprocal translations in said transversal direction and/or of reciprocal rotations round said direction of the carrying cables (3, 4), that said beam (10) is constrained to each of the connecting elements (9) in a manner such that, at each connecting element (9), a surface line (15') of each vertical transversal section of the beam (10) can move, transversally to the direction of the carrying cables (3, 4), locally with an oscillatory motion with respect to a surface line (16') of the corresponding vertical section of the connecting element (9), that said connecting elements (9) are connected rigidly to said roller units (8).

2. System for a cableway carriage with two carrying cables according to claim 1, characterized in that said beam (10) is constrained to each of said connecting elements (9) due to the fact that at each of said connecting elements (9) said beam (10) is supported by a rolling element (14) on said connecting element (9), said rolling element (14) being suitable for rolling with a rolling surfaces (15) thereof on a contact surface (16) of the corresponding connecting element (9).

3. System for a cableway carriage with two carrying cables according to claim 2, characterized in that said beam (10) is also constrained to each of said connecting elements (9) due to the fact that each of said rolling elements (14) has at least one series (17) of protrusions and/or recesses for engagement by geometrical coupling, when said rolling element (14) rolls on said contact surface (16) of the corresponding connecting element (9), in at least one opposite and counter-shaped series (18) of recesses and/or protrusions respectively arranged on the corresponding connecting element (9).

4. System for a cableway carriage with two carrying cables according to claim 3, characterized among said series (17) of protrusions and/or recesses there is one arranged at each edge (13), transversally to the direction of said carrying cables (3, 4), at each of said rolling surfaces (15), respectively, and that on each corresponding connecting element (9) there are two opposite and counter-shaped series (18) of recesses and/or protrusions.

5. System for a cableway carriage with two carrying cables according to claim 2, characterized in that said beam (10) is also constrained to each of said connecting elements (9) due to the fact that each of said rolling elements (14) has at least one set of teeth (19) to engage, when said rolling element (14) rolls over said contact surface (16) of the corresponding connecting element (9), with at least one opposite and counter-shaped set of teeth (20) respectively arranged on the corresponding connecting element (9).

6. System for a cableway carriage with two carrying cables according to claim 5, characterized in that of said first set of teeth (19) there is one arranged at each edge (13), transversal to the direction of said carrying cables (3, 4), at each of said rolling surfaces (15), respectively, and that on each corresponding connecting element (9) there are two opposite and counter-shaped second sets of teeth (20).

7. System for a cableway carriage with two carrying cables according to claim 2, characterized in that said beam (10) is also constrained to each of said connecting elements (9) due to the fact that a pin (21) is slidably arranged inside a curved slot (22), said pin (21) and said slot (22) being fitted on said connecting element (9) and the other on said beam (10) or vice versa.

8. System for a cableway carriage with two carrying cables according to the preceding claims and according to what is described and illustrated in the enclosed drawings.

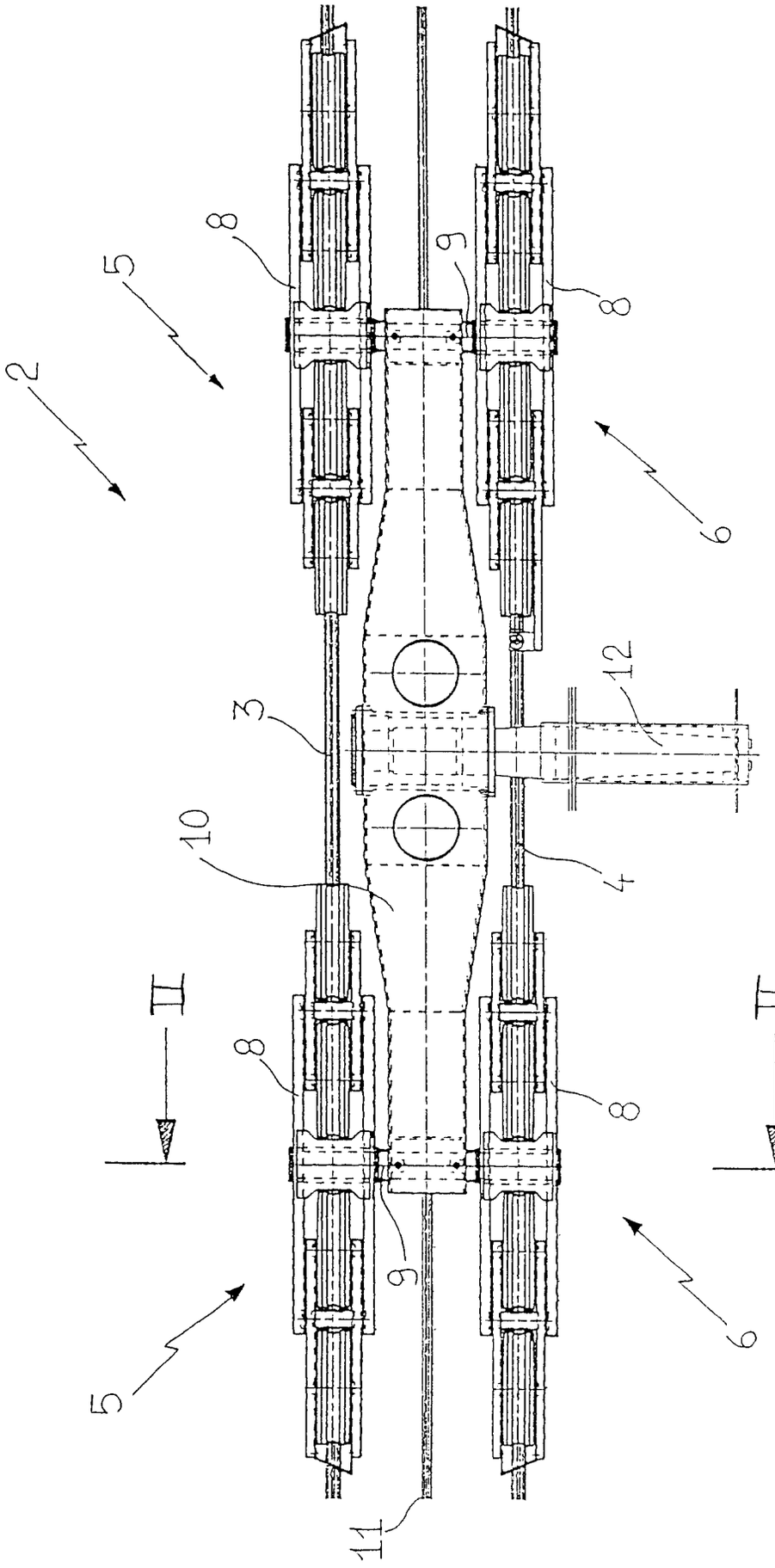
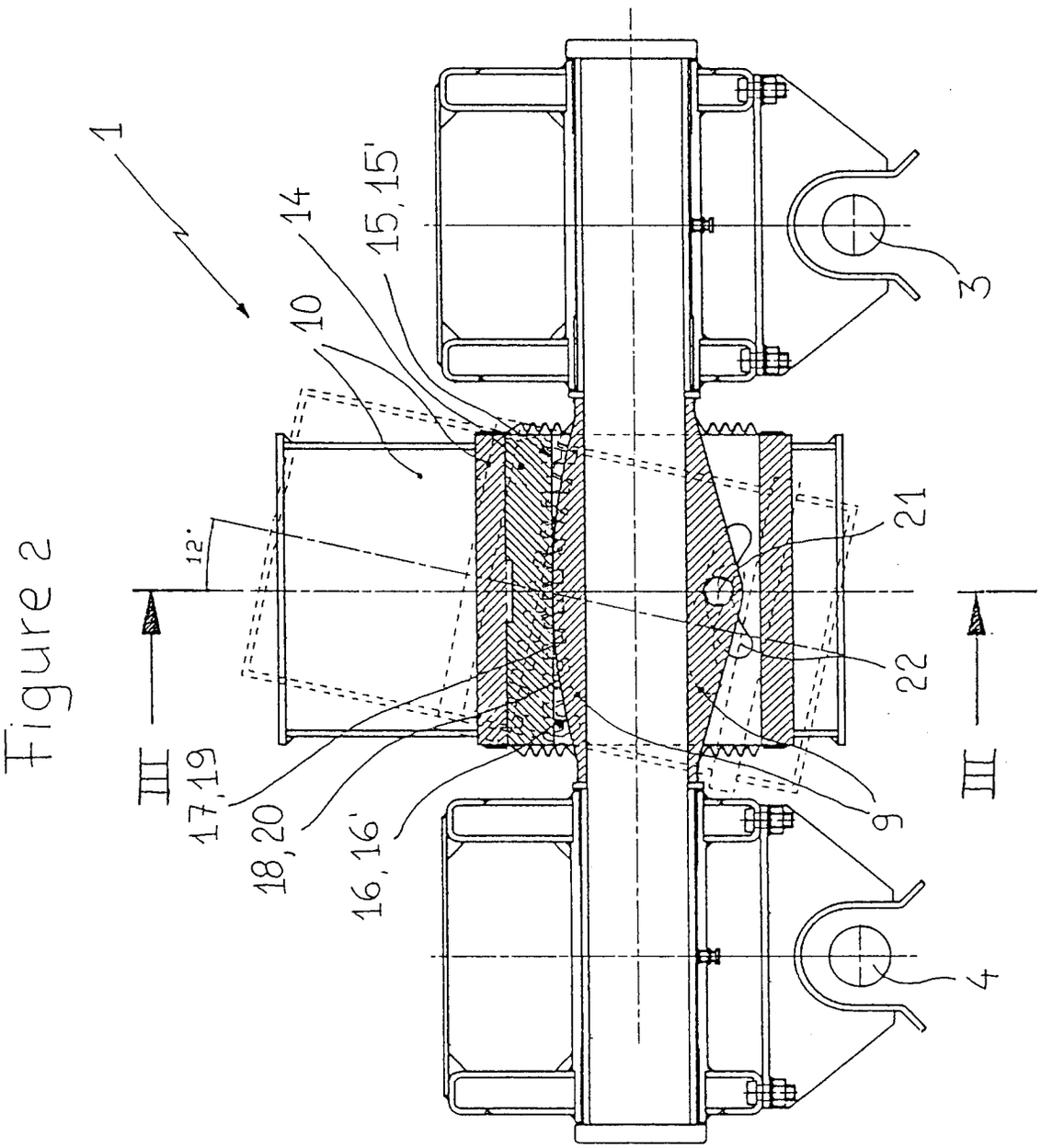


Figure 1

Figure 2



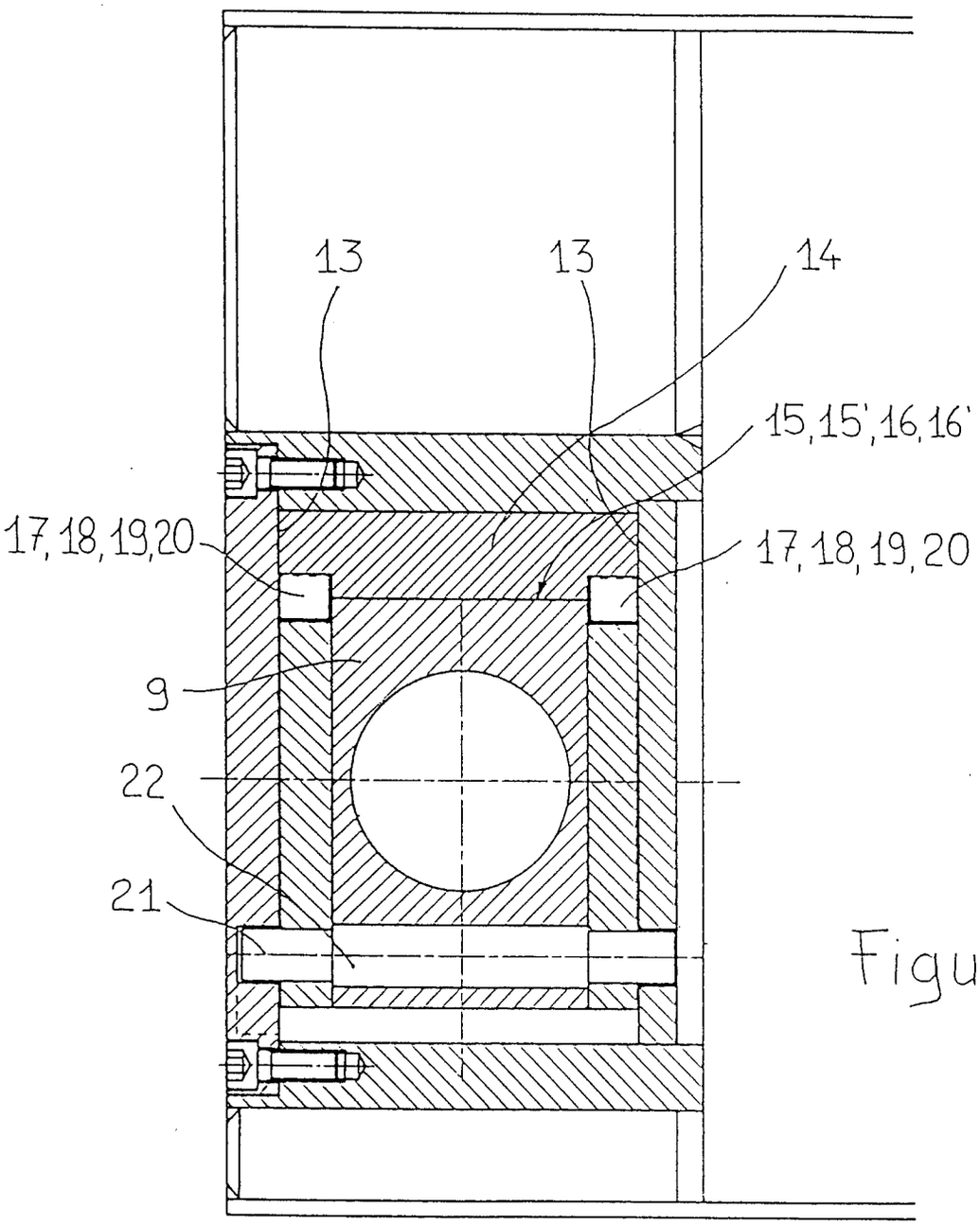


Figure 3

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EUROPEAN SEARCH REPORT

Application Number EP 95201877.8

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 6)
X	DE - C - 466 922 (HECKEL) * Figs. *	1-3	B 61 B 12/02
X	DE - C - 534 220 (HECKEL) * Figs. *	1,2	

TECHNICAL FIELDS SEARCHED (Int. Cl. 6)

B 61 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	10-10-1995	HENGL

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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