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(54) INTERCONNECTION ELEMENT, IN PARTICULAR FOR USE IN NAUTICAL FIELD

(57) An interconnection elastic element 100, in particular for damping jerks, tractions or similar actions acting, for example on cables, ropes, chains or the like, said elastic element 100 comprising an elastic main body 10 adapted to be elastically deformed at least by compression, first and second connection means 20, 30 fixed respectively to the two opposite ends of said elastic main body 10, wherein at least said first connection means 10 are adapted to be connected to at least one of said cables, rope, chains or the like; and wherein said first connection means 10 comprise a first connection component 12 substantially annular and rotatable with respect to said elastic main body 10.

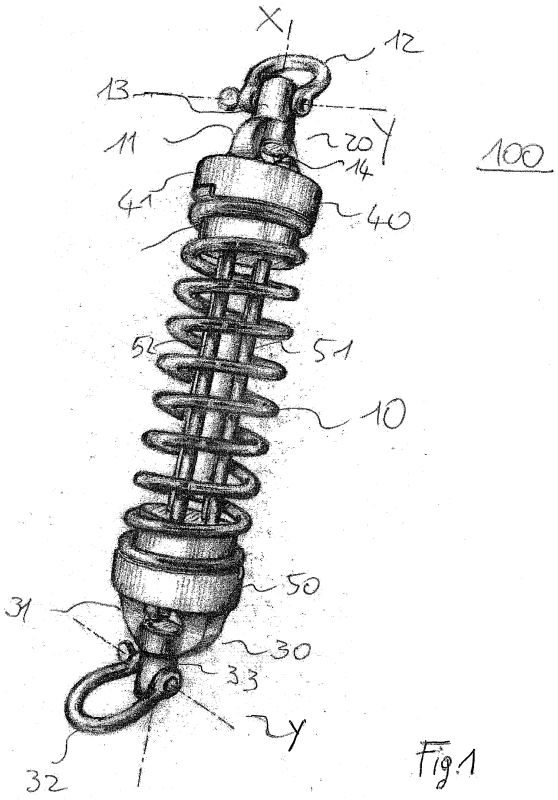

Fig.1

EP 3 196 112 A1

Description

TECHNICAL FIELD OF THE PRESENT INVENTION

[0001] The present invention relates to the nautical field. In particular, the present invention relates to an interconnection element adapted to be interposed between two cables, ropes, chains or the like. In detail, the present invention relates to an interconnection element of the elastic type and thus adapted to damp or compensate for the jerks or loads acting on cables, ropes, or also chains and the like. Even more in detail, the present invention relates to an interconnection element of the aforesaid type adapted to compensate for the torsions acting on cables, ropes, chains etc.

STATE OF THE PRIOR ART

[0002] The use of cables, ropes, e.g. made of cotton or hemp, is widespread in the nautical field for governing boats during navigation and for mooring the boats themselves, e.g. in docking areas.

[0003] Ropes of the most varied features and sizes are particularly widespread in the nautical field for mooring boats, to meet the various needs as much as possible.

[0004] However, the mooring of boats has some mutually different problems, such as, indicatively and non-exhaustively for the sake of brevity, that of guaranteeing reliable mooring, that of limiting boat movements in the mooring area as much as possible, as well as that of avoiding jerks or excessive loads of the moored boat.

[0005] In particular, it is worth noting that the swell in docking areas, in particular due to weather conditions and to contingent dock traffic, causes inevitable movements of the boat, such as, for example, rolling, pitching or the like, which may even cause knocking between adjacent boats (or even between boat and quay) with even serious damage to the boats themselves.

[0006] These movements also very often translate into even violent jerks acting on the mooring ropes and relieved by them, in equally violent manner, onto the boats, which the consequent risk of even severe damage to the boats.

[0007] In order to compensate for the aforesaid jerks or loads as much as possible, interconnection elements of elastic type, and thus adapted to compensate for the jerks themselves by elastic deformation, have been suggested in the recent past. In particular, instead of using cables or ropes of continuous type (and thus substantially inextensible) in particular for mooring boats, the use has caught on to equip each single rope with an elastic element of the aforesaid type, thus making a mooring element formed by two ropes connected to each other by means of an elastic element of the aforesaid type instead of a single rope of continuous type. In this manner, the sudden jerks generated by the movements of the boat are compensated and damped, although partially, by the interconnection element by virtue of the elastic deformation thereof.

[0008] The elastic interconnection elements of known type, although appreciable (and appreciated) from the point of view of jerk compensation and/or damping, are not entirely free from problems and/or disadvantages. For example, a first disadvantage relates to the impossibility of compensating for the torsions to which the ropes (either one or both) connected to the opposite ends of the interconnection element are inevitably subjected. In practice, by twisting on themselves, the ropes subject the interconnection element to efforts that the interconnection element itself cannot adequately compensate, if not at the risk of breaking of the interconnection element. Furthermore, the non-compensated torsions of the ropes can even cause the twisting of the ropes on the interconnection element, which thus in this case loses its function, representing rather a discontinuity element of the mooring.

[0009] It is thus an object of the present invention that of avoiding the drawbacks mentioned above and found in the solutions known in the prior art.

[0010] In particular, the objects and objectives of the present invention can be summarized as follows.

[0011] It is a first object of the present invention to suggest an interconnection element, in particular for ropes, cables or even chains, in particular for use in the nautical field, configured so as to allow an adequate compensation and/or damping of both the jerks and tensions acting on said ropes (either one or both) and the torsions to which the ropes themselves can be subjected.

[0012] It is a further object to make an interconnection element of the aforesaid type, characterized by high reliability and in that the parts possibly subjected to jerks and possibly to torsions can be replaced by means of simple operations at substantially low cost.

[0013] Furthermore, it is an object of the present invention to suggest an interconnection element of the aforesaid type, characterized by small dimensions and weight, appearance compliant with the destination of use and moreover which can be made at substantially low price.

[0014] It is a further object of the present invention to suggest an interconnection element, in particular adapted for use in the nautical field, which allows the mooring of boats of all type and size, and in particular in docking areas and in open sea, e.g. if applied to the cable of an anchor.

GENERAL DESCRIPTION OF THE PRESENT INVENTION

[0015] The present invention is inspired and emanates from the general consideration according to which an adequate compensation of the torsion of ropes, in particular of mooring ropes, can be guaranteed by using interconnection means which are rotational with respect to the main body of the element to connect the element itself to one or both ropes.

[0016] A further consideration underlying the present invention relates to the fact that an improved compensation of the rope torsions can be obtained by allowing the rotation of the connection elements with respect to multiple rotation axes, in particular with respect to two rotation axes of which one is substantially parallel to the longitudinal direction of extension of the main body of the interconnection element and the second is perpendicular to the first, in particular substantially perpendicular to the direction of extension of the main body of the interconnection element.

[0017] Furthermore, the present invention emanates from and is inspired by the further consideration according to which adequate results in terms of rope torsion compensation can be achieved by providing the connection means (for connecting the element to at least one rope) with a connection joint of the Cardan type.

[0018] On the basis of the general considerations summarized hereto, and of the objects and objectives mentioned and summarized above, the present invention relates to an interconnection elastic element, in particular for damping jerks, tractions or similar actions, acting for example on cables, ropes, chains or the like, said elastic element comprising an elastic main body adapted to be elastically deformed at least by compression, first and second connection means fixed respectively to the two opposite ends of said elastic main body (for connecting the element to a first and to a second rope or the like, respectively), wherein at least said first connection means are adapted to be connected to at least one of said cables, rope, chains or the like, and wherein said first connection means comprise a first connection component, substantially annular and rotatable with respect to said elastic main body.

[0019] According to an embodiment, said first connection component is rotatable with respect to said elastic main body about an axis of rotation substantially perpendicular to the direction of extension of said elastic main body.

[0020] According to a possible embodiment, said first connection component is rotatable with respect to said elastic main body about an axis of rotation substantially parallel to the direction of extension of said elastic main body. Advantageously, said first connection means comprise a rigid bracket, said first annular connection component being rotatable with respect to said rigid bracket.

[0021] Also advantageously, said first connection means may comprise a second connection component rotatable with respect to said bracket, said first connection component being in turn rotatable with respect to said second connection element, said second connection component being able, for example, to comprise a connection stem or pin at least partially and rotatably received in a receiving seat defined by said bracket. According to an embodiment, said first connection means and said second connection means are reciprocally linked to each other so as to either translate or transform the reciprocal moving of said first and second connection means away from each other into a compression of said elastic main body.

[0022] For example, in the scope of the present invention, said first connection means and said second connection means may be reciprocally linked by means of at least one substantially inextensible linkage rod which extends, for example, through said elastic main body.

[0023] Further embodiments of the interconnection element according to the present invention are defined in the claims and/or described in detail hereinafter.

[0024] It is a further object of the present invention an interconnection set, in particular adapted for use in the nautical field, formed by at least one interconnection element of the type specified above and/or described hereinafter, and at least one traction element, such as a cable, a rope, a chain or similar and/or equivalent traction element adapted to be connected to said first connection means of said interconnection element.

[0025] A detailed description of the embodiments of the present invention shown in the drawings will be provided below; in all cases, the present invention is not limited to the embodiments shown on the drawing tables and described hereinafter. Conversely, all the embodiment variants shown on the drawings and described below, which will be clear, apparent and immediate to a person skilled in the art, are included in the scope of the present invention.

[0026] Furthermore, the applications of the interconnection element are not limited to ropes for use in nautical field; conversely, the element according to the present invention can be advantageously applied to ropes, cables, chains or similar traction elements intended for any use.

BRIEF DESCRIPTION OF THE FIGURES

[0027] In the figures:

figure 1 shows a perspective view of an interconnection element according to an embodiment of the present invention;
figure 2 shows a perspective and exploded view of a portion of an interconnection element according to an embodiment of the present invention;
figure 3 shows a perspective view of the same interconnection element in figure 2;
figure 4 shows a perspective view of component parts of an interconnection element according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0028] The interconnection element according to the embodiment of the present invention shown in figure 1 is identified by reference number 100. In particular, with reference to figure 1, it can be seen that the element 100 comprises an elastic main body 10, i.e. a helical spring

with circular, and thus substantially cylindrical, section in the particular (not limiting) example shown in the figure.

[0029] First linking means 40 and second linking means 50 (linked to the main body 10 according to methods explained in greater detail below) and first connection means 20 and 30 are provided at the opposite ends of the elastic main body 10. According to the embodiment shown in figure 1, the first linking means 40 and the first connection means 20 are substantially similar respectively to the second linking means 50 and to the second connection means 30 so that a detailed description of the first linking means 40 and of the first connection means 20 will be provided hereinafter, for the sake of brevity. It is worth noting that embodiments with first linking means and first connection means which are respectively different from the second linking means and second connection means are included in the scope of the present invention.

[0030] The first connection means 20 comprise, in particular, a first substantially annular connection component 12 (e.g. a mandrel, as shown in the figure) provided to connect the element 100 to a rope, cable or chain or similar traction element; in particular, for this purpose, it will suffice to insert the end portion of said rope through the first connection component 12 and, for example, make a simple knot. A detailed description is omitted for the sake of brevity as the element 100 can be connected to said rope or cable in many manners and such manners are obvious and immediate for a person skilled in the art.

[0031] The first linking means 40 comprise, in particular, two cylindrical bodies with substantially coinciding longitudinal symmetric axes, in particular a first cylindrical body 41 with diameter substantially coinciding with the outer diameter of the elastic main body 10, and a second cylindrical body with diameter substantially coinciding with the inner diameter of the elastic main body 10, wherein the cylindrical body 42 is housed in the inner space defined by the elastic main body 10, while the cylindrical body 41 comprises a helical surface on which the end of the helical spring 10 is placed in contact. The first linking means 40 and the second linking means 50 are reciprocally linked by means of a plurality of substantially inextensible bars 53, 54, 55 and 56 (e.g. made of metal) which extend, in particular, between the first linking means 40 and the second linking means 50, in the space defined by the elastic main body 10.

[0032] In particular, in figure 2, it can be seen that the first linking means 40 (and thus the second linking means 50) comprise a plurality of through holes (in number equal to that of the linking bars 53, 54, 55 and 56) identified by the reference numbers 43, 44, 45 and 46, respectively, the through holes 43, 44, 45 and 46 being provided for housing the end portions of the linking bars 53, 54, 55 and 56, respectively. The end portions of two of the four linking bars, in particular of the linking bars 53 and 54, are fixed by screwing respectively to tubular portions 63 and 64 with inner threading, which extend from a connection and linking bracket 11 (described in greater detail below which reference to the connection means 20), wherein the two tubular portions 63 and 64, with the interconnection element 100 in completed assembly configuration (see figure 3 or 1) are also accommodated in the through holes 43 and 44, respectively. On the contrary, the end portions of the remaining two linking bars 55 and 56 extend through the through holes 45 and 46, respectively, to protrude outside the linking means 40, in particular from the cylindrical body 41, so as to be positioned on the opposite sides of the bracket 11. Nuts 75 and 76, for example but not necessarily blind, as shown in figures 2 and 3, are engaged on the aforesaid protruding (and threaded) end portions of the linking bars 55 and 56, respectively, by screwing.

[0033] That just described with regards to the first linking means 40, to the first end portions of the linking bars 53, 54, 55 and 56, and with regards to the respective housing seats 43, 44, 45 and 46, to the bracket 11 and to the engaging nuts 75 and 76, obviously also applies to the second linking means 50, to the second end portions (opposite to the first ones) of the linking bars 53, 54, 55 and 56, which will thus be housed in corresponding housing seats of the second linking means 50, two of them being in particular screwed to the corresponding tubular portions of the bracket 31 of the connection means 30, with the remaining two end portions protruding outside the second linking means 50 (arranged on opposite sides of the bracket 31 of the second connection means 30) and engaged by bolts or nuts, e.g. blind.

[0034] In light of this description, the operation of the connection element 100 can be appreciated, in particular with regards to the compensation or damping of the jerks acting on the ropes connected to the first connection means 20 and to the second connection means 30, respectively. Indeed, if a first rope (not shown in the figures) is imagined connected to the connection component 12 of the first connection means 20 and a second rope is imagined connected to the first connection component 32 of the second connection means 30, it can be inferred how in presence of tension (in particular, of a jerk) acting on one of the ropes, in particular the one applied to the connection component 12 of the first connection means 20, said tension or jerk will be relieved through the bracket 11 and the linking bars 53 and 54 screwed (or in all cases linked) to it onto the second linking means 50, as well as return, through the bracket 31 and the linking bars 55 and 56 screwed to it, onto the first linking means 40, and thus transformed into a compression force acting on the elastic main body 10, the elasticity of which will allow the damping or compensating of the tension or jerk peak action on one or both ropes. Hereafter, with reference to figures 1 and 4, a further feature of the interconnection element according to the present invention will be described, aimed in particular at compensating the torsions of the ropes (either one or both) applied to the first and/or second connection means of the interconnection element.

[0035] Indeed, it can be inferred from the figures that

the bracket 11 comprises a portion with an arc-shaped development which substantially defines, at the vertex, a housing seat 14 for a second pin-shaped component or connection element 13 partially and rotationally housed in said seat 14. The second connection component 13 is thus rotational about a rotation axis X substantially coinciding with the longitudinal symmetric axis of the elastic main body 10. The first connection element 12 which is substantially annular is linked on the end of the pin 13 opposite to the one housed in the seat 14, the first connection component 12 being in turn rotatable with respect to a rotation axis Y which is substantially perpendicular to the rotation axis X of the second connection component or pin 13. It can thus be inferred that the first connection component 12 and the second connection component 13 together define a connection element of the Cardan joint type.

[0036] In particular, according to the embodiment shown in the figures, the first connection component 12 comprises a horse-shoe-shaped connection portion 73 proper (for connecting a rope or similar traction element), the two opposite end portions of which each comprise a through hole, of which one, the hole 72, has a smooth inner surface, while the other, 71, is provided with inner thread. A linking pin 70 with threaded inner surface extends in succession through the smooth through hole 72 of the horse-shoe-shaped portion 73 and a through hole obtained in the connection 13 to engage by screwing the inner thread of the second, possibly through (or, alternatively, blind) hole 71 of the horse-shoe-shaped portion 73 of the connection element 12.

[0037] It can therefore be inferred that the rotatable link defined by the first connection component 12 and the second connection component 13, rotatable respectively about two substantially perpendicular rotation axes, makes it possible to compensate for the torsions acting on the rope fixed to the component 12. Indeed, also in the case of torsions of the rope, the interconnection element 100 will not be subjected to any torsion and/or rotation because possible rope torsions are compensated by the rotation of one or both connection components 12 and 13. The preceding description related to the first connection means 20 also applies to the second connection means 30, wherein however, according to the present invention, embodiments are possible in which the first and the second connection means are not necessarily similar.

[0038] We have thus demonstrated by means of the preceding detailed description of the embodiments of the present invention shown in the drawings given above that the present invention achieves the predetermined objects. In particular, the interconnection element according to the present invention makes it possible to adequately damp the jerks or sudden tension peaks possibly acting on one or both ropes connected to it, as well as to compensate the rotations to which the ropes may be subjected. The element according to the present invention can also be made according a substantially simple manner, at low price, and respecting appearance criteria conforming to the destination of use.

[0039] Although the interconnection element according to present invention was explained above by means of a detailed description above of the embodiments thereof shown in the drawings, it is worth specifying that the interconnection element according to the present invention is not limited to the embodiments described above and shown in the drawings. Conversely, all the embodiments equivalent to those described above and shown in the drawings which will appear obvious and immediate to a person skilled in the art are included in the scope of the present invention.

[0040] In particular, the interconnection element according to the present invention can be made using common and easily procurable materials, such as plastic or Teflon, for making linking elements 50 and 40, as well as metal, such as for example iron or steel for making the connection means, the elastic main body and the linking bars.

[0041] The aim of the present invention is thus defined by the claims.

Claims

1. An interconnection elastic element (100), in particular for damping jerks, tractions or similar actions acting for example on cables, ropes, chains or the like, said elastic element (100) comprising an elastic main body (10) adapted to be elastically deformed at least by compression, first and second connection means (20, 30) fixed respectively to the two opposite ends of said elastic main body (10), wherein at least said first connection means (10) are adapted to be connected to at least one of said cables, rope, chains or the like; **characterized in that** said first connection means (10) comprise a first connection element (12) substantially annular and rotatable with respect to said elastic main body (10).

2. An element (100) according to claim 1, **characterized in that** said first connection element (12) is rotatable with respect to said main elastic body (10) about an axis of rotation substantially perpendicular to the direction of extension of said elastic main body (10).

3. An element (100) according to claim 1 or 2, **characterized in that** said first connection element (12) is rotatable with respect to said elastic main body (10) about an axis of rotation substantially parallel to the direction of extension of said elastic main body (10).

4. An element (100) according to one of claims 2 and 3, **characterized in that** said first connection means (10) comprise a rigid bracket (11), said first annular connection element (12) being rotatable with respect

to said bracket (11).

5. An element (100) according to claim 4, **characterized in that** said first connection means (10) comprise a second connection element (13) rotatable with respect to said bracket (11), said first connection element (12) being in turn rotatable with respect to said second connection element (11).

6. An element (100) according to claim 5, **characterized in that** said second connection element (13) comprises a connection stem or pin (13) at least partially and rotatably housed in a housing seat (14) defined by said bracket (11).

7. An element (100) according to one of the claims from 1 to 6, **characterized in that** said first connection means (20) and said second connection means (30) are reciprocally linked to each other so as to either translate or transform the reciprocal moving of said first and second connection means (20, 30) away from each other into a compression of said elastic main body (10).

8. An element (100) according to claim 7, **characterized in that** said first connection means (20) and said second connection means (30) are reciprocally linked by means of at least one substantially inextensible linkage rod.

9. An element (100) according to claim 8, **characterized in that** said at least one linkage rod extends through said elastic main body (10).

10. An element (100) according to one of claims 8 and 9, **characterized in that** a first end of said at least one linkage rod is firmly linked to said bracket of said first connection means, wherein the second end of said at least at least one linkage rod is slidingly linked to said second connection means.

11. An element (100) according to claim 10, characterized that said first end of said at least one linkage rod is linked to said bracket by screwing.

12. An element (100) according to one of claims 10 and 11, **characterized in that** the second end portion of said at least one linkage rod extends slidingly through a sliding seat defined by said second connection means.

13. A device according to claim 12, **characterized in that** at least one portion of said second end of said at least one linkage rod extends outside said second connection means and **in that** a limit stop element is rigidly fixed to said outer portion of said at least one linkage rod.

14. An element (100) according to one of the claims from 1 to 13, **characterized in that** said limit stop element is screwed to said outer portion of said second end of said at least one linkage rod.

15. An interconnection set, **characterized in that** it comprises at least one interconnection element according to one of the claims from 1 to 14, and at least one traction element such as a cable, a rope, a chain or similar and/or equivalent traction element adapted to be connected to said first connection means of said interconnection element.

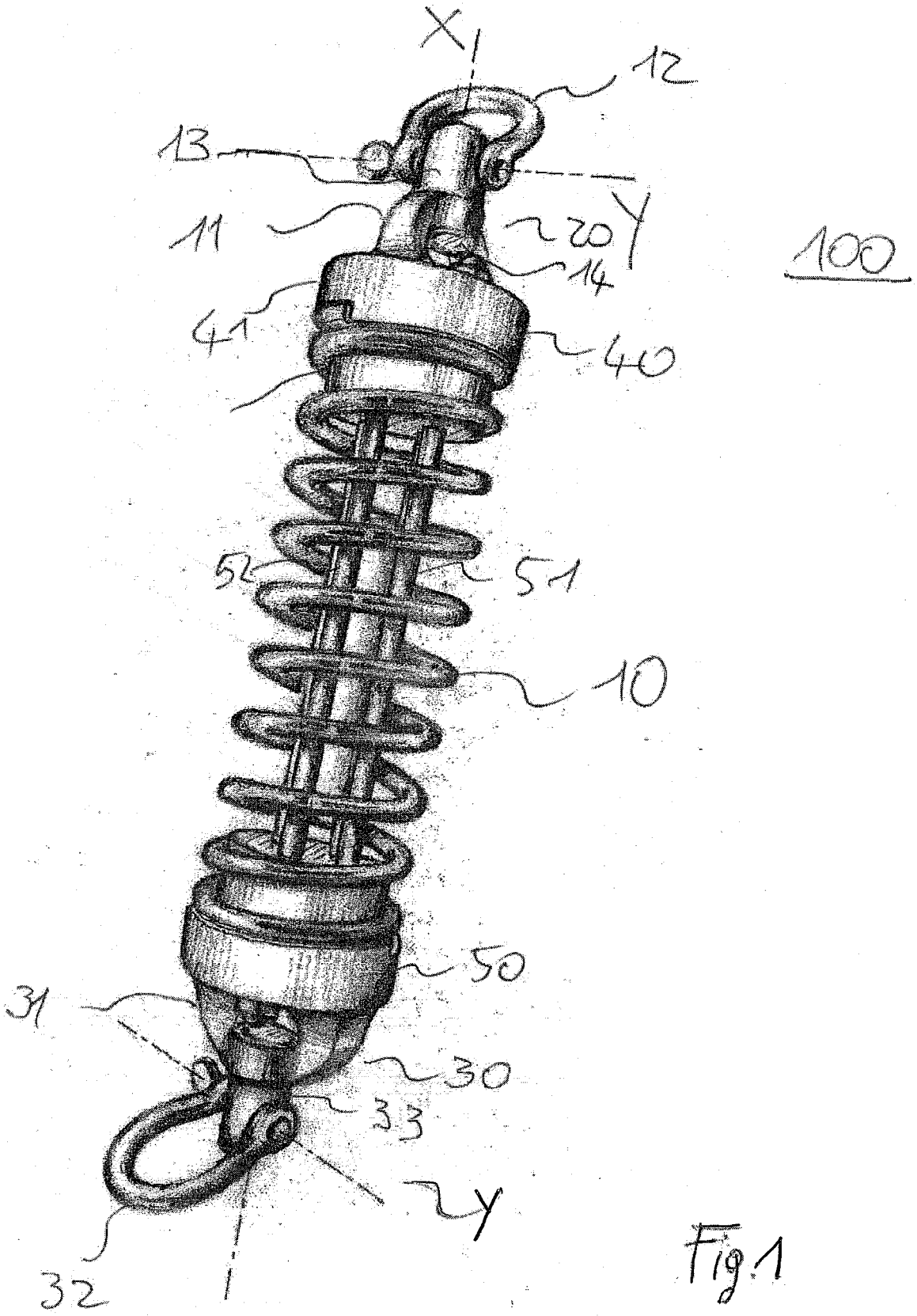

Fig.1

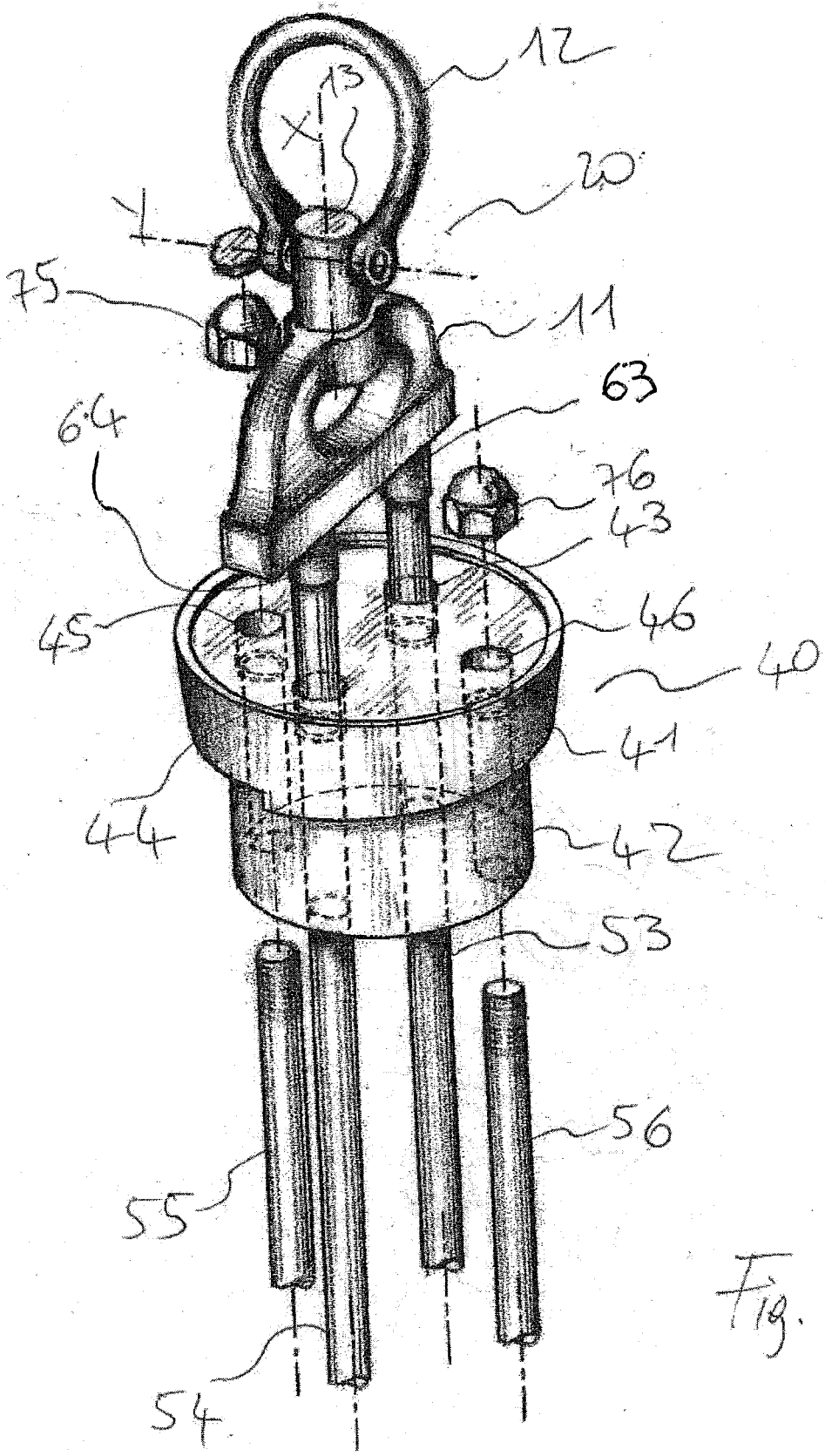

Fig. 2

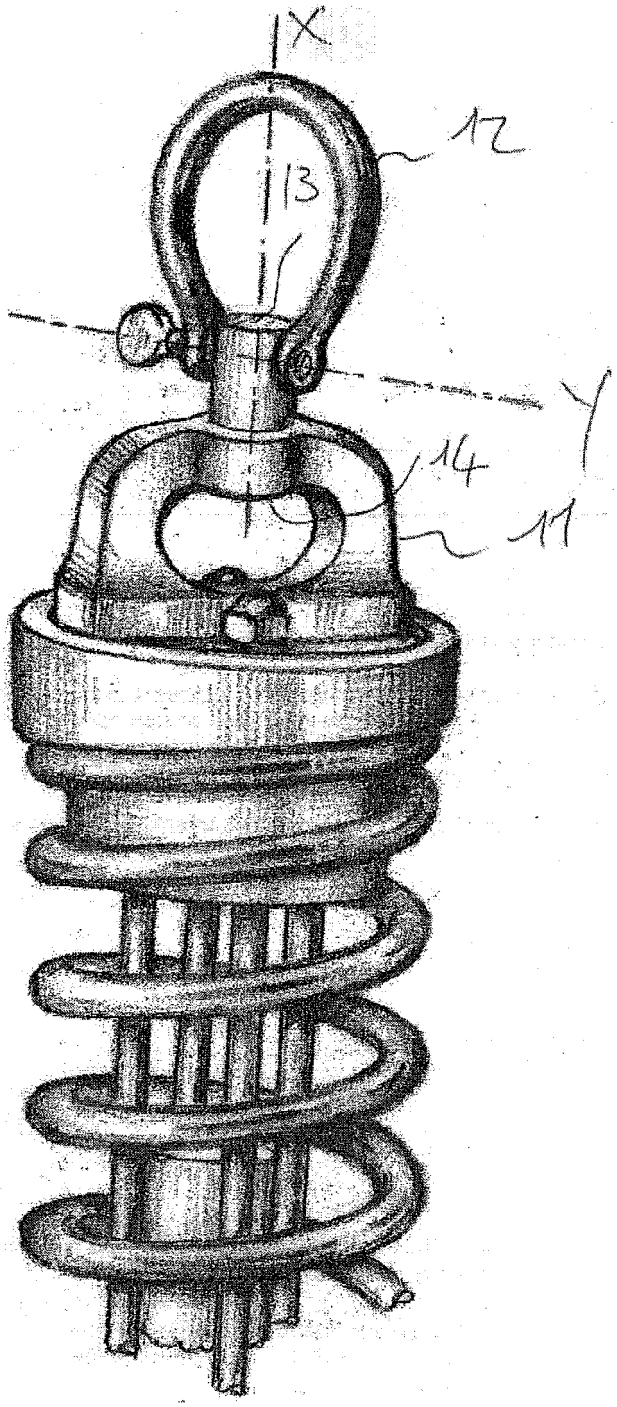

Fig. 3

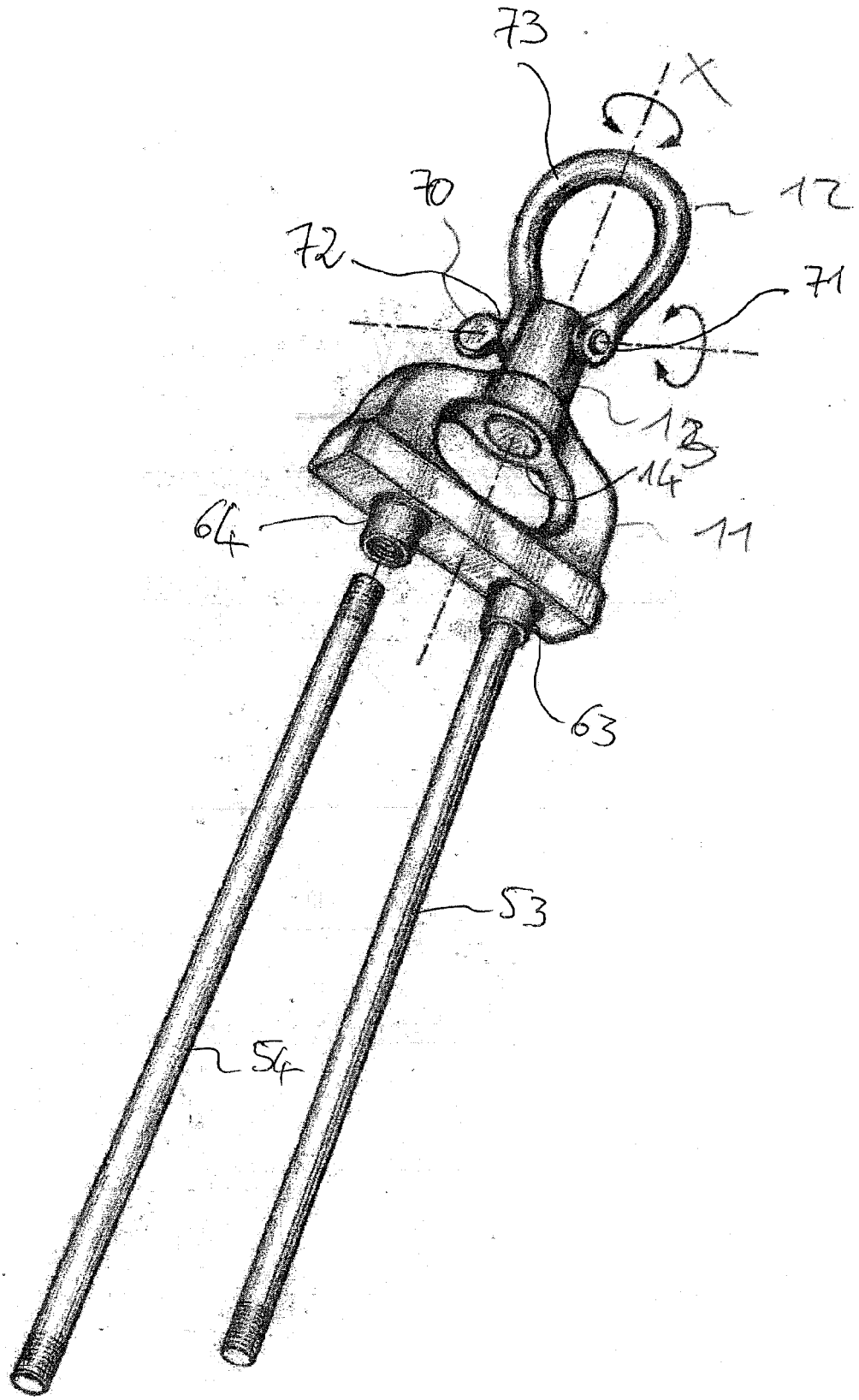

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 17 15 2378

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 847 252 A (CASCIOLA M) 12 November 1974 (1974-11-12) * column 3, line 49 - column 4, line 34 * * column 5, line 42 - line 65 * * figures 1-7 * -----	1-5,7,15	INV. B63B21/20 B63B21/00
X	US 4 681 303 A (GRASSANO VINCENT R [US]) 21 July 1987 (1987-07-21) * column 6, line 11 - column 7, line 7; figures 2,3,7,8 * -----	1-3, 7-10,15	
X A	US 2009/202306 A1 (HUANG YUN PENG [US]) 13 August 2009 (2009-08-13) * paragraph [0025] - paragraph [0029]; figures 11,12,15-23 * -----	1-3,15 8-14	
X	US 7 530 334 B1 (NAPOLITANO DENNIS [US]) 12 May 2009 (2009-05-12) * column 2, line 59 - column 3, line 46; figures 2-4 * -----	1-6,15	
X	US 6 345 583 B1 (THACKSTON WILLIE L [US] ET AL) 12 February 2002 (2002-02-12) * column 4, line 7 - line 8; figures 1-5 * -----	1,7-10, 12,13,15	TECHNICAL FIELDS SEARCHED (IPC) B63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 June 2017	Mauriès, Laurent

CATEGORY OF CITED DOCUMENTS

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