

(51) Int Cl.: **A62B 35/04**^(2006.01) **F16G 11/12**^(2006.01)

(22) Date of filing: **05.10.2010**

(74) Representative: **Colò, Chiara**
Bugnion S.p.A.
Via M. Vellani Marchi, 20
41124 Modena (IT)

(54) **A tension indicator for a safety line apparatus**

(57) A tension indicator for a safety line apparatus comprises two rods (2) slidably associated to one another, the rods (2) each exhibiting a first end (2a) and a second end (2b), a tension being applicable between the first ends (2a), the tension coming from a cable of a safety line apparatus, each rod (2) further exhibiting a prevalent longitudinal development axis (B), the prevalent longitudinal development axes (B) being substantially parallel

to one another, the first ends (2a) moving in reciprocal distancing/nearing when the second ends (2b) move respectively in reciprocal nearing/distancing; an elastic element (9) being active between the second ends (2b) to balance the tension applied on the first ends (2a). A dissipating organ (10) is arranged between the second ends (2b) of the rods (2) and is activatable by nearing the second ends (2b) in order to brake a distancing action of the first ends (2a) of the rods (2).

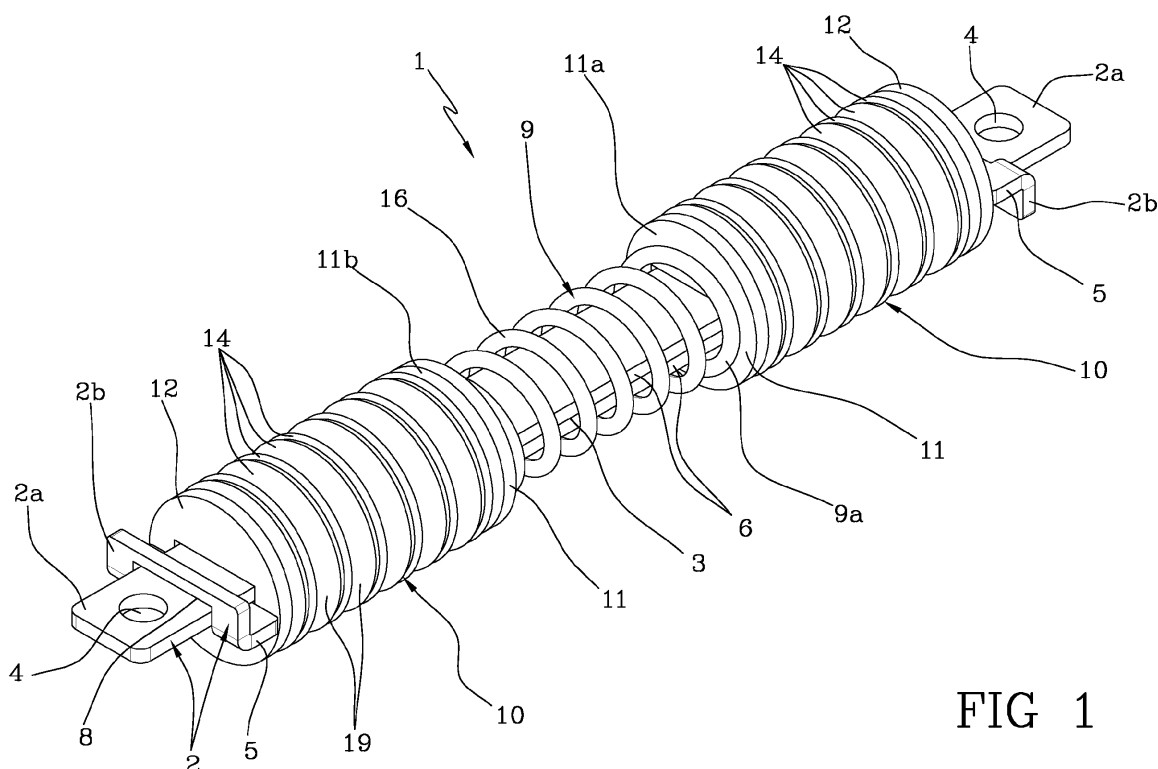


FIG 1

Description

[0001] The invention relates to a tension indicator for a safety line apparatus. In particular, the present invention can be used in measuring tension of safety cables in safety-line apparatus.

[0002] By safety-line apparatus (life-lines), a system is intended for securing an operator to an anchoring point during performance of work on high surfaces, such as for example maintenance activities on a building's roof, the fastening of aerials, cleaning of chimneys and the like.

[0003] In more detail, a safety line apparatus comprises a cable stretched between two anchoring-points; in particular, each head of the cable is connected to a respective anchoring point. A rope is connected to the cable which can slide along the cable; the rope is further connected to a harness worn by the operator. This leaves the operator free to move safely on the whole raised surface and, should he fall, the apparatus prevents him from impacting onto an underlying surface.

[0004] The safety apparatus further comprises a tensioner for keeping the cable stretched by applying a predetermined tension thereon. It is necessary to stretch the cable in order to limit transversal displacements thereof following any operator's falling. It is also, however, equally essential to prevent the cable tension from exceeding a critical value which might cause it to break.

[0005] Specific standards relating to operator safety prescribe a correct value for the tension to be applied to the cable; the tensioner thus enables the tension to be varied, by nearing or distancing two threaded attachments connected respectively to the cable to one of the two anchoring points.

[0006] The safety-line apparatus comprises a tension indicator connected in series to the cable the tensioner in order to measure the tension applied to the cable. In this way, the operator can be provided with a reading of the tension applied; the operator can thus regulate the tensioner on the basis of the reading in order to stretch the cable with a predetermined force.

[0007] In order to enable the operator to perform his activity in conditions of total safety, the safety line apparatus comprises an energy absorber, connected to an end of the cable and to one of the two anchoring points. By energy absorber is meant a device which can absorb or dissipate the operator's kinetic energy in a case in which he falls from the raised surface. The market offers a variety of energy absorbers, which are able to deform plastically such as to brake the possible fall of the operator.

[0008] In the field of safety-line protection apparatus, a tension indicator of known type comprises two rods which slide on each other, each along a respective prevalent longitudinal axis. The prevalent longitudinal axes are arranged parallel to one another.

[0009] Each rod comprises a first end and a second end. The first end of each rod exhibits a hole for connecting the rod to the cable or to one of the two anchoring

points. The rods are orientated such that while the first ends move in a reciprocal nearing direction, the second ends move in a reciprocal distancing direction, and vice versa. In other words, the rods are orientated in such a way that the holes are opposite to a central portion of the whole defined by both the rods.

[0010] A spring is active between the rods and exhibits two ends, each destined to abut on a respective stop fashioned on each rod at the second end thereof. The spring reacts to a traction exerted on the first ends with an elastic thrust which tends to distance the second ends and thus to exert a recall force on the first ends. The known tension indicator further exhibits a graduated scale or an indicator traced on a rod, such as to enable the operator to read the tension applied.

[0011] The known tension indicator exhibits an important drawback inasmuch as in the field of safety lines it is necessary to connect an energy absorber in series in order to be able to guarantee operator safety.

[0012] In this context, the technical task underlying the present invention is to provide a tension indicator for a safety line which obviates the drawbacks of the prior art cited above.

[0013] A particular aim of the present invention is to make available a tension indicator for safety line protection apparatus which is able to dissipate the energy of the operator should he fall.

[0014] The above-set technical objective and the specified aim are substantially attained by a tension indicator for a safety line protection apparatus which comprises the technical characteristics set out in one or more of the accompanying claims of the drawings.

[0015] Further characteristics and advantages of the present invention will more clearly emerge from the non-limiting description that follows of a preferred but not exclusive embodiment of a tension indicator for safety line apparatus, as illustrated in the accompanying figures of the drawings, in which:

figure 1 is a perspective view of tension indicator for a safety line apparatus of the present invention; and figure 2 is a perspective exploded view of the tension indicator for safety line apparatus of figure 1; figure 3 is a portion of a frontal view of the device of figure 1, in a second variant.

[0016] With reference to the figures of the drawings, 1 denotes in its entirety a tension indicator for safety line apparatus of the present invention.

[0017] The tension indicator 1 comprises two rods 2 which are slidably associated to one another. Each rod 2 has an elongate shape and exhibits a respective prevalent longitudinal development axis B. In particular, each rod 2 has at least in part a uniform transversal section. The transversal section is, in the described embodiment, rectangular.

[0018] Each rod 2 exhibits a first end 2a and a second end 2b opposite the first end 2a. Each rod 2 also exhibits

a hole 4 at the first end 2a thereof for connecting a cable or an anchorage of the safety line apparatus.

[0019] Each rod 2 comprises a coupling portion 5 at the second end 2b thereof. The coupling portion 5 is preferably L-shaped or C-shaped.

[0020] Each rod 2 further comprises a central body 6 realised in a single piece with the coupling portion 5. In greater detail, the central body 6 develops along the prevalent longitudinal axis of development B of the rod 2 and has a transversal section which is substantially rectangular and uniform. The coupling portion 5 exhibits a greater width than that of the central body 6. The coupling portion 5 exhibits a slit 8 located at an edge of the coupling portion 5. In particular, the slit 8 has a rectangular section. In greater detail, the slit 8 of each rod 2 has a complementary shape to the section of the rod 2 at the first end 2a thereof.

[0021] The prevalent longitudinal axes of development B of the respective rods 2 are substantially parallel to one another. In this way, the respective rods 2 can each slide along its own prevalent longitudinal axis of development B, parallel to one another.

[0022] The first end 2a of each rod 2 is inserted in the slit 8 afforded on the other rod 2 in order to slidably couple the rods 2. In particular, this enables the rod 2 to be retained in the slit 8, thus enabling the rod 2 to slide, though preventing transversal displacements with respect to its own prevalent longitudinal axis of development B.

[0023] The rods 2 each exhibit a respective contact surface 3. In other words, the rods 2 are superposed and in reciprocal contact at the respective contact surfaces 3.

[0024] With reference to the reciprocal arrangement of the rods 2, the second ends 2b are arranged between the first ends 2a. In detail, the first ends 2a of the rods 2 move in a reciprocally distancing direction when the second ends 2b move in reciprocal nearing. Likewise, the first ends 2a of the rods 2 move in a reciprocally nearing direction when the second ends 2b move in a reciprocally distancing direction. In use, a tension originating from the cable of the safety line apparatus is applied between the first ends 2a.

[0025] An elastic element 9 is active between the second ends 2b of the rods 2 such as to balance the tension applied on the first ends 2a. In the described embodiment, the elastic element 9 is a spring 16, preferably a helix spring, and the rods 2 are arranged internally thereof.

[0026] A dissipating organ 10 is arranged between the second ends 2b of the rods 2. In particular, the tension indicator 1 comprises two dissipating organs 10, each located at the second end 2b of a respective rod 2. The elastic element 9 is arranged between the dissipating organs 10 and exhibits two ends 9a, each active on a respective dissipating organ 10.

[0027] Each dissipating organ 10 is able to absorb a quantity of energy and plastically deform. In particular, each dissipating organ 10 is plastically deformable such as to pass from a first configuration in which it exhibits a

maximum length into a second configuration in which it exhibits a minimum length. In greater detail, each dissipating organ 10 is activatable by reciprocal nearing of the second ends 2b in order to brake the sliding of the rods 2. In particular, the dissipating organs 10 and the elastic element 9 are packed between the coupling portions 5 of the rods 2.

[0028] The tension indicator 1 comprises two washers 11, each having a first surface 11a in contact with an end 9a of the elastic element 9 and a second surface 11b in contact with a respective dissipating organ 10. In particular, the first surface 11a and the second surface 11b of each washer 11 are parallel to one another. In other words, the washer 11 is flat. In greater detail the washers 11 have the aim of increasing the available rest surface of the dissipating organ 10 and the ends 9a of the elastic element 9, thus improving the transfer of force between them.

[0029] The tension indicator 1 further comprises two further washers 12, each located between a dissipating organ 10 and a respective coupling organ 5. In particular, each further washer 12 is in contact with an abutting surface 18 of a respective rod 2. This abutting surface 18 is defined on each coupling portion 5, at the connection with the central body 6, where the transversal section of the rod 2 exhibits a variation. In greater detail, the further washers 12 have the aim of increasing the available rest surface of the dissipating organ 10 and the abutting surfaces 18 of the rod 2, thus improving the transfer of the forces between them.

[0030] Each dissipating organ 10 exhibits a through-cavity 15 in which the rods 2 are inserted such that the rods 2 can slide internally thereof. This advantageously enables minimising the size of the dissipating organ 10. The dissipating organ 10 comprises at least a saucer-shaped deformable element 14. In other words, the deformable element 14 is a disc-shaped element, substantially a saucer-shaped element, preferably spherical, such as to define a convex surface 19 and a concave surface 20.

[0031] The deformable element 14 thus exhibits a variable concavity 13. In particular, the concavity 13 is greatest when the dissipating organ 10 is in the first configuration. Further, the concavity 13 is at its minimum, preferably null, when the dissipating organ 10 is in the second configuration. In other words, the deformable element 14 is plastically compressible such as to pass from an undeformed configuration to a deformed configuration. In still other words, the deformable element 14 flattens when passing from the undeformed configuration to the deformed configuration.

[0032] In greater detail, when the deformable element 14 is in the undeformed configuration, the dissipating organ 10 is in the first configuration. Further, when the deformable element 14 is in the deformed configuration, the dissipating organ is in the second configuration.

[0033] In the described embodiment, the dissipating organ 10 comprises a plurality of deformable elements

14 arranged in series. In particular, the deformable elements 14 are arranged one by a side of another such that the concavity 13 of each deformable element 14 is orientated in an opposite direction to the direction of the concavity 13 of the adjacent deformable element 14.

[0034] In other words, the deformable elements 14 are associated in couples such that the concavities 13 of the deformable elements 14 of each couple face one another. In greater detail, the deformable elements 14 are in reciprocal contact at the respective peripheral edges 14a.

[0035] Further, the deformable elements 14 are also in reciprocal contact at respective central portions 14a thereof.

[0036] With reference to the embodiment of figure 3, each dissipating organ 10 comprises the deformable elements and further flat disc-shaped elements. As illustrated in figure 3, the deformable elements 14 are associated in couples with an interposing of a further flat disc-shaped element 30.

[0037] More specifically, the concavity 13 of each deformable element 14 is facing the flat disc-shaped element 30.

[0038] In this embodiment, the dissipating organ 10 comprises, in series, at least a deformable element 14, with the respective concavity 13, a flat disc-shaped element 30 and an adjacent deformable element 14, with the concavity 13 thereof orientated in an opposite direction to the concavity 13 belonging to the preceding deformable element 14.

[0039] In this configuration, the deformable elements 14 exhibit peripheral edges 14b thereof in contact with the respective flat disc-shaped elements 30 and the central portions 14a in contact with one another.

[0040] Without forsaking the ambit of protection of the present invention, the dissipating organ 10 can also comprise an alternation of the deformable element 14 and the flat disc-shaped element 30.

[0041] Note that it is possible to pile any number of deformable elements 14. This advantageously enables defining the total damping capacity of the dissipating organ 10, by varying the number of deformable elements 14. Each deformable element 14 exhibits a through-hole 4, in which the rods 2 are slidably inserted.

[0042] In greater detail, the hole 4 has a complementary section to the section of the central bodies 6 of the rods 2 when the central bodies 6 are superposed. In particular, the entirety of the holes 4 of the deformable elements 14 at least partly defines the cavity 15 of the dissipating organ 10. In other words, the cavity 15 is at least partly defined by a succession of holes 4 in the deformable elements 14.

[0043] Each deformable element 14 has a thickness comprised between 1 and 5 mm, preferably 3 mm. Each deformable element 14 further has a radius of curvature which is comprised between 80 and 95 mm, preferably 88 mm. Each deformable element 14 further exhibits a plan diagram comprised between 50 and 75 mm, preferably 66 mm. Each deformable element 14 is constituted

by plastically-deformable material; by way of example each deformable element 14 is made of metal or another material.

[0044] The tension indicator 1 exhibits a traced reference on one or both rods 2, in order to enable the operator to read the applied tension. In an embodiment that is not illustrated, this reference can be a graduated scale.

[0045] As mentioned above, in use the first ends 2a of the rods 2 are connected to the anchoring points and to the cable of the safety line apparatus. The first ends 2a are thus subjected to tension in use. The operator is safeguarded by means of a rope attached to the cable.

[0046] If an operator falls, an increase in tension is determined on the first ends 2a of the rods 2 and, as has been demonstrated, this causes reciprocal nearing of the first ends 2a. The dissipating organs 10 are therefore subjected to a compression force which is equal to the tension applied on the first ends 2a of the rods 2.

[0047] When this compression exceeds a predetermined value, the deformable elements 14 pass from the initial configuration to the deformed configuration and in this way they progressively absorb the kinetic energy of the operator, braking his fall.

[0048] The present invention attains the set aim.

[0049] As the tension indicator for safety line apparatus comprises a dissipating organ, it is able to absorb the energy of the operator during an eventual fall, preventing him from being injured without its being necessary to install a separate energy absorber.

[0050] An important advantage of the tension indicator of the present invention consists in the functioning and compression of the dissipating organ. This enables slowing the fall of the operator, minimising the risk of breakage of the organ.

[0051] A further advantage of the tension indicator of the present invention consists in the possibility of assembling a more compact safety line protection apparatus, as it is not necessary to insert a separate energy absorber.

Claims

1. A tension indicator for a safety line apparatus, comprising two rods (2) slidably associated to one another, the rods (2) each exhibiting a first end (2a) and a second end (2b), a tension being applicable between the first ends (2a), the tension coming from a cable of a safety line apparatus, each rod (2) further exhibiting a prevalent longitudinal development axis (B), the prevalent longitudinal development axes (B) being substantially parallel to one another, the first ends (2a) moving in reciprocal distancing/nearing when the second ends (2b) move respectively in reciprocal nearing/distancing; an elastic element (9) being active between the second ends (2b) to balance the tension applied on the first ends (2a); **characterised in that** it comprises a dissipating organ

(10) arranged between the second ends (2b) of the rods (2) and being activatable by nearing the second ends (2b) in order to brake a distancing action of the first ends (2a) of the rods (2).

at the second end (2b) thereof, the dissipating organs (10) and the elastic element (9) becoming packed between the coupling portion (5) of the rods (2).

2. The tension indicator of claim 1, **characterised in that** the dissipating organ (10) is plastically deformable such as to pass from a first configuration in which the dissipating organ (20) exhibits a maximum length and a second configuration in which the dissipating organ (10) exhibits a minimum length. 5
10

3. The tension indicator of claim 2, **characterised in that** the dissipating organ (10) comprises a saucer-shaped deformable element (14) exhibiting a variable concavity (13), the concavity (13) being at a maximum thereof when the dissipating organ (10) is in the first configuration thereof and being at a minimum thereof when the dissipating organ (10) is in the second configuration. 15
20

4. The tension indicator of claim 3, **characterised in that** the dissipating organ (10) comprises a plurality of the deformable elements (14) arranged in series. 25

5. The tension indicator of claim 4, **characterised in that** the deformable elements (14) are arranged side-by-side such that the concavity (13) of each deformable element (14) is orientated in an opposite direction to a direction of the concavity (13) of an adjacent deformable element (14). 30

6. The tension indicator of claim 4 or 5, **characterised in that** the deformable elements (14) are associated in pairs such that the respective concavities (13) are facing one another. 35

7. The tension indicator of any one of claims from 3 to 6, **characterised in that** each deformable element (14) exhibits a through-hole (4), the rods (2) being slidably inserted in the through-hole (4). 40

8. The tension indicator of claim 7, **characterised in that** the dissipating organ (10) exhibits a through-cavity (15) at least in part defined by a succession of the through-holes (4) of the deformable elements (14). 45

9. The tension indicator of any one of the preceding claims, **characterised in that** it comprises two dissipating organs (10), each located at the second end (2b) of a respective rod (2), the elastic element (9) being arranged between the dissipating organs (10) and exhibiting two ends (9a), each active on a respective dissipating organ (10). 50
55

10. The tension indicator of claim 9, **characterised in that** each rod (2) comprises a coupling portion (5)

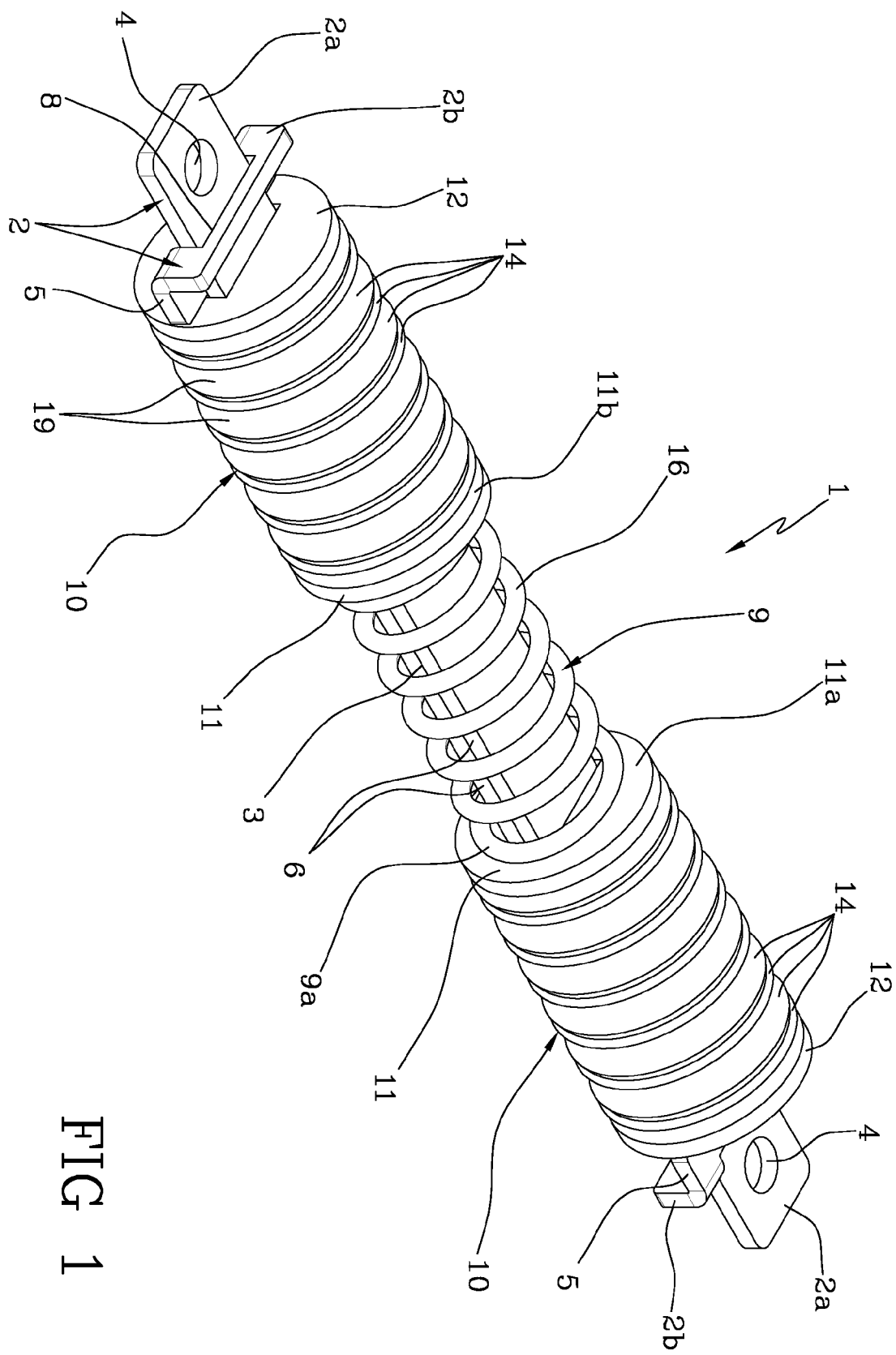
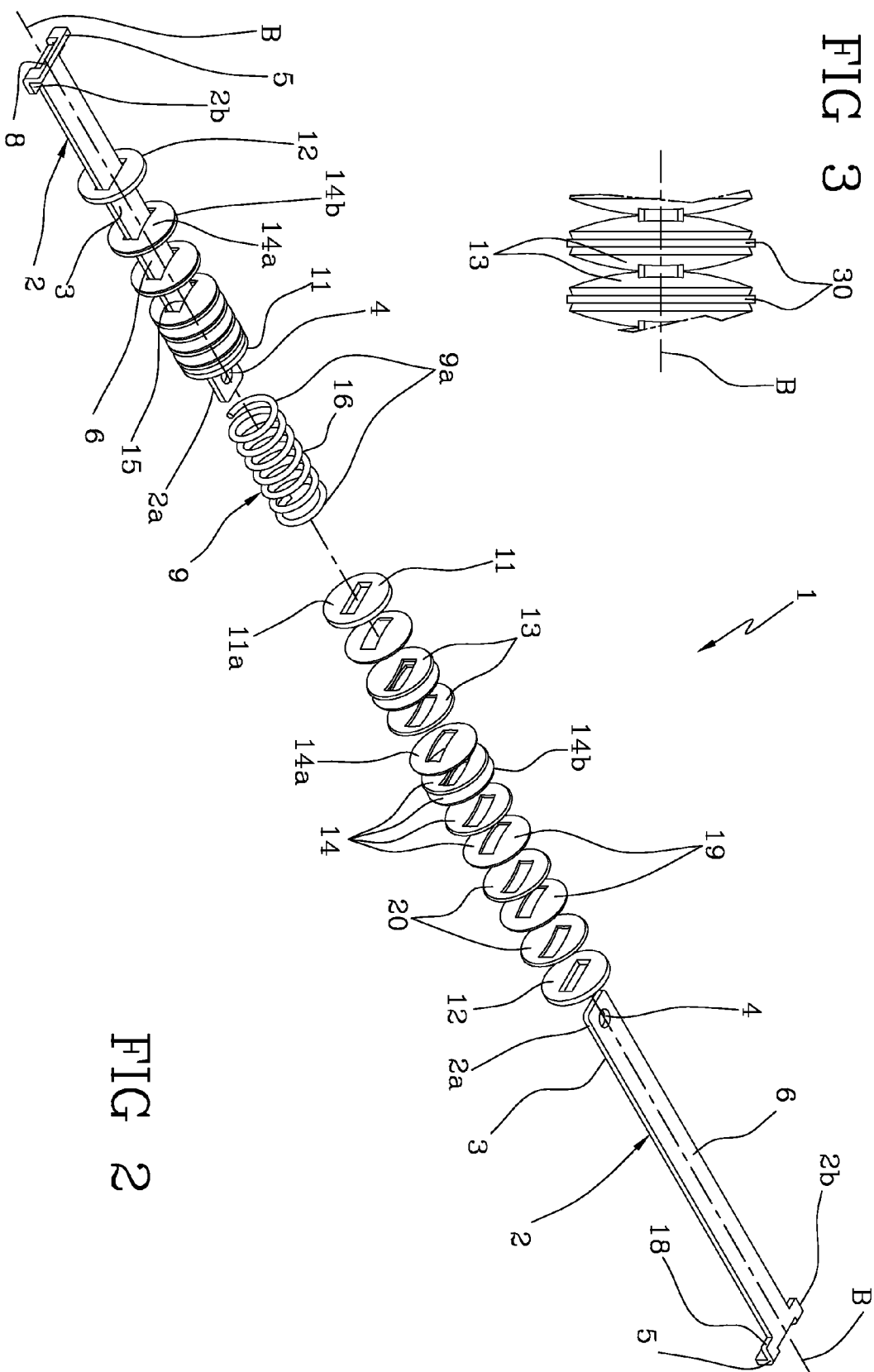


FIG 1





EUROPEAN SEARCH REPORT

Application Number
EP 10 18 6587

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 2009/212474 A1 (REEVES ERIC [US]) 27 August 2009 (2009-08-27) * figures 1-3 * * paragraphs [0023], [0024], [0026], [0028] *	1,2	INV. A62B35/04 F16G11/12
X	WO 99/51304 A2 (CHOATE GARY A [US]) 14 October 1999 (1999-10-14) * the whole document *	1,2	
X	DE 20 2005 014359 U1 (SKYLOTEC GMBH [DE]) 17 November 2005 (2005-11-17) * the whole document *	1,2	
X	US 3 584 835 A (WHITE ERVING F ET AL) 15 June 1971 (1971-06-15) * the whole document *	1	
X	WO 94/08658 A1 (ROSE SYSTEMS INC [US]) 28 April 1994 (1994-04-28) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			A62B F16G F16F E04G
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 January 2011	Examiner Paul, Adeline
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)

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

EP 10 18 6587

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

21-01-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009212474 A1	27-08-2009	NONE	
WO 9951304 A2	14-10-1999	NONE	
DE 202005014359 U1	17-11-2005	AT 468890 T EP 1762274 A1	15-06-2010 14-03-2007
US 3584835 A	15-06-1971	DE 2029954 A1 GB 1284825 A	21-01-1971 09-08-1972
WO 9408658 A1	28-04-1994	US 5458214 A	17-10-1995