(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 915 737 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
09.09.2015 Bulletin 2015/37

(51) Int Cl.:
B63B 21/66 *(2006.01)*

(21) Application number: **14305327.0**

(22) Date of filing: **06.03.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **ALCATEL LUCENT**
92100 Boulogne-Billancourt (FR)

(72) Inventors:
- **Tossel, David Ivor**
  LONDON, SE3 9AN (GB)
- **Kjeldersgaard, Teit**
  5700 SVENDBORG (DK)

(74) Representative: **Shamsaei Far, Hassan**
Alcatel-Lucent International
148/152 route de la Reine
92100 Boulogne-Billancourt (FR)

(54) **Apparatus for lifting and lowering an object**

(57) An apparatus comprises a housing (110) for carrying a remotely operated vehicle, a support structure (120) and a first pulley mechanism (130) attached to the support structure (120), a second pulley mechanism (140) attached to the housing (110) and moveable relative to the support structure (120), a third pulley mechanism (150) attached to the housing and moveable relative to the support structure (120). The first, second and the third pulleys are configured to cooperate so as to collectively form a first path for supporting a first cable (160) and second path for supporting a second cable (170), the first path and the second path being separate from each other.

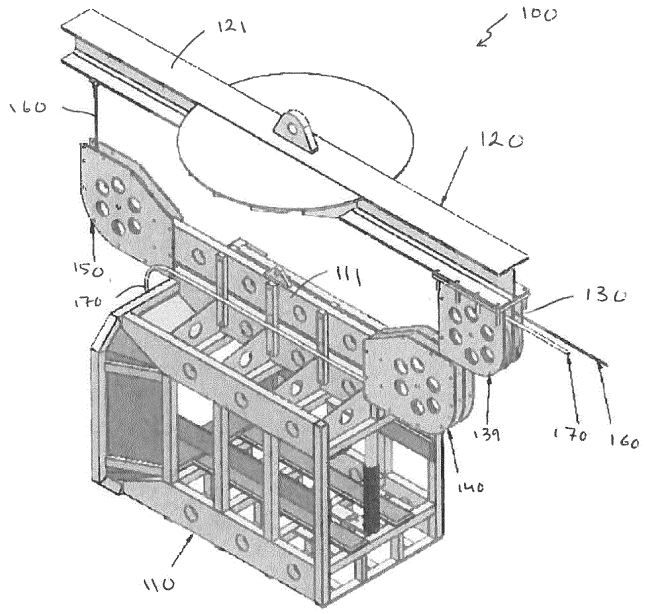

FIG._1a

EP 2 915 737 A1

Description

[0001] The present disclosure relates to an apparatus for launching and recovering modules. In a particular embodiment, the disclosure relates to an apparatus for launching and recovering submergible modules.

BACKGROUND

[0002] As known in the related art, an underwater remotely operated vehicle (ROV) is a vehicle adapted for use underwater, for example in submarine communications or oil and gas industry when undersea installations are involved or underwater extraction, security, survey and scientific research are carried out. ROVs are typically adapted to carry out such undersea operations through control operations exercised remotely by a control center from the surface of the water, a platform or a land station. In such cases, operation commands are transmitted between the control center and the vehicle through transmission cables.

[0003] Such ROVs therefore typically need to be conveniently launched in the water from the board of a vessel, controlled as they operate in the water and recover them once the operation is fulfilled.

SUMMARY

[0004] Embodiments of the disclosure feature an apparatus comprising:

- a housing adapted to contain a remotely operated vehicle;
- a support structure;
- a first pulley mechanism attached to the support structure and comprising first and second pulleys;
- a second pulley mechanism attached to the housing and moveable relative to the support structure and comprising third and fourth pulleys; and
- a third pulley mechanism directly attached to the housing and moveable relative to the support structure and comprising a fifth pulley;

wherein, the first pulley is configured to cooperate with the third pulley and the third pulley is configured to cooperate with the fifth pulley to collectively form a first path for supporting a first cable; and the second pulley is configured to cooperate with the fourth pulley to collectively form a second path for supporting a second cable; and wherein the first path and the second path are separate from each other.

[0005] According to some specific embodiments, the first cable is a wire configured for descending and lifting the housing.

[0006] According to some specific embodiments, the second cable is configured for allowing transmission of command signals between a control station and the remotely operated vehicle.

[0007] According to some specific embodiments, the third pulley mechanism is attached to the second pulley mechanism through a transversal beam comprised in the housing, the transversal beam being configured to allow for passage of the first cable from the second pulley mechanism to the third pulley mechanism. According to some specific embodiments, the first cable is wound over a partial circumference of the first pulley, a partial circumference of the third pulley and a partial circumference of the fifth pulley and is attached at one end to the support structure.

[0008] According to some specific embodiments, the second cable is wound over a partial circumference of the second pulley, a partial circumference of the fourth pulley and is attached at one end to the remotely operated vehicle.

[0009] According to some specific embodiments, the apparatus comprises a plurality of clips wherein each clip is configured to be hooked on the first cable and the second cable such that it encloses the respective width of the first cable and the second cable.

[0010] According to some specific embodiments, the clips have snap-hook configuration.

[0011] According to some specific embodiments, a segment of rope is fastened at one end to a first clip and is fastened at an opposite end to a second clip.

[0012] According to some specific embodiments, a segment of rope is fastened at one end to a casing of the second pulley mechanism and is fastened at an opposite to a clip closest to the second pulley mechanism.

[0013] According to some specific embodiments, the apparatus further comprises a container wherein the support structure is a telescopic.

[0014] According to some specific embodiments, the apparatus is configured for launching and recovering a remotely operated vehicle.

[0015] According to some specific embodiments, the apparatus is configured for submersion in water.

[0016] These and further features and advantages of the present disclosure are described in more detail, for the purpose of illustration and not limitation, in the following description as well as in the claims with the aid of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Figures 1 a and 1b are exemplary schematic representations, in perspective and front views respectively, of some aspects of a launch and recovery system according to some embodiments.

Figure 2 illustrates an exemplary schematic representation of a first pulley mechanism according to some embodiments.

Figure 3 illustrates an exemplary schematic representation of a second pulley mechanism according to some embodiments.

Figure 4 illustrates an exemplary schematic representation of a third pulley mechanism according to some embodiments.

Figure 5 illustrates an exemplary schematic representation of the first pulley mechanism and additional safety measure according to some embodiments.

Figure 6 is an example of a containerized launch and recovery system according to some embodiments.

[0018] It is to be noted that the figures are provided merely for illustrative purposes and are not necessarily to scale.

DETAILED DESCRIPTION

[0019] ROVs, e.g. used in submarine operations, typically need a communication link to allow the exchange of control and command signals between a control center, typically on the surface of the water and the ROV. Such communication link is often a cable, typically called umbilical, which comprises communication medium such as electric wires or optical fibers through which signals are transmitted.

[0020] On the other hand in order to submerge the ROVs and remove them from the water depth, a wire is typically used. This wire, typically made of metal, e.g. steel, is sufficiently strong in order to support the weight of the ROV during the lifting or the lowering (descending) of the ROV from or into the water. Herein, this wire will be referred to as the lifting wire.

[0021] Both the umbilical and the lifting wire are typically long enough to support the submersion of the ROV in deep waters, typically in the range of about 500 meters depth.

[0022] In addition to the lifting and lowering operations, the use of ROVs implies further operations such as housing the ROV on board a ship, deploying it e.g. over the side of the vessel and controlling it while in the water. Similar operations would be required if the ROV was launched from a platform on the surface of the water. These functions are typically provided through a so-called launch and recovery system (LARS).

[0023] However, there are certain problems in managing and operating ROVs using known LARSs. One such problem is that during launching or recovering, the two cables, namely the umbilical and the lifting wire may entangle with each other. This problem becomes even more difficult to address when the vehicle is in deep water.

[0024] Herein the terms lifting wire and umbilical are also generally referred to as cables.

[0025] Figures 1 a and 1b illustrate an exemplary schematic representation, in perspective and front views respectively, of some aspects of a launch and recovery system (LARS) 100 according to some embodiments of the disclosure. The LARS comprises a housing, or cage, 110 and a support structure 120. The housing is adapted to contain in its interior space a ROV (not shown in the figure) and may have any convenient shape and size for the intended purpose.

[0026] The support structure 120, as its name indicates, provides support for the housing and the rest of the elements used in the LARS which will be described in further detail below. The support structure 120 may have any convenient shape and size. For example in figures 1a and 1b, the support structure is shown in the form of an elongated beam 121, however this is only exemplary and other configurations such as properly designed arched-shape structures may also be used. The support structure 120 may be installed in any convenient manner. For example the support structure 120 may be attached to a crane capable of holding the support structure 120 in place or moving it from one place to another. Alternatively, the support structure 120 may be attached to another structure such as a container which may serve as a housing for the entire LARS structure. The LARS 100 further comprises three mechanisms of pulleys. A first pulley mechanism 130 is attached to the support structure 120, a second pulley mechanism 140 is attached to the housing 110 and a third pulley mechanism 150 is also attached to the housing 110 and may be further attached to the second pulley mechanism 140 through an intermediate transversal beam 111. The transversal beam 111, which may be an integral part of the body of the housing 110, may provide additional rigidity and strength to the structure of the housing and also allow for the passage of a wire from the second pulley mechanism 140 to the third pulley mechanism 150 as will be described in further detail below.

[0027] Figure 2 illustrates an exemplary schematic representation of the first pulley mechanism 130. It is to be noted that for simplicity of illustration, only the elements that are relevant for understanding the disclosure are shown. Those of skill in the related art will realize that the pulley mechanism may comprise other elements that are not shown but nevertheless may be present in real-life pulley mechanisms, such as for example a casing in which the pulleys are installed (see for example figure 1 element 139) and a rotation axle or shaft around which the pulleys can rotate. The first pulley mechanism 130 comprises a first pulley 131 and a second pulley 132.

[0028] The first pulley 131 comprises a pair of lateral flanges 133a and 133b and a recess 135 is provided between the lateral flanges 133a and 133b. The recess 135 is adapted to receive a wire or cable which may run around a part of the circumference of the recess 135 and exit the recess and the first pulley 131. In the example of figure 2, it is shown that the lifting wire 160 (as identified in reference to figures 1a and 1b) enters the first pulley 131 in a direction shown by arrow A and after winding around a part of the circumference of the recess 135, exits the first pulley 131 as shown by arrow B.

[0029] Similarly, the second pulley 132 comprises a pair of lateral flanges 134a and 134b and a recess 136 is provided between the lateral flanges 134a and 134b. The recess 136 is adapted to receive a wire or cable which may run around a part of the circumference of the

recess 136 and exit the recess to the outside of the second pulley 132. In the example of figure 2, it is shown that the umbilical cable 170 enters the first pulley 132 in a direction shown by arrow C and after winding around a part of the circumference of the recess 136, exits the first pulley 132 as shown by arrow D.

[0030] It may be appreciated that the direction of the arrows A, B, C and D are all indicative of an overall movement of the lifting wire 160 and the umbilical 170 as they exit the respective first and second pulleys 131, 132 in the direction of gravity illustrated by arrow G. This overall direction facilitates the descending movement of the housing 110 (containing the ROV) which will eventually be submerged into the water. In case the ROV is being removed from the water, the direction of the arrows A, B, C and D will be reversed as in such conditions the housing 110 (containing the ROV) is lifted out of the water (i.e. opposite to the direction of arrow G).

[0031] Each one of the first pulley 131 and second pulley 132 may rotate independently from each other.

[0032] Therefore, with the first pulley mechanism of figure 2, it becomes possible to run each of the lifting wire and the umbilical through a separate path provided by a separate pulley and as a consequence reduce the possibilities of entanglement between the two cables during operation.

[0033] Figure 3 illustrates an exemplary schematic representation of the second pulley mechanism 140. Here also, similar to the illustration in figure 2, only the elements that are relevant for understanding the disclosure are shown. The second pulley mechanism 140 comprises a third pulley 141 and a fourth pulley 142.

[0034] The structure and operational characteristics of the second pulley mechanism is similar to that of the first pulley mechanism 130 of figure 2 and therefore a detailed description of the similar features is considered not necessary. As shown in figure 3, the second pulley mechanism is configured to receive the lifting wire 160 and the umbilical 170 in the direction of arrows B and D (in conformity with the same arrows shown in figure 2) and after winding around a part of the circumference of the recesses 145 and 146 respectively, exit the second pulley mechanism 140 in the direction of arrows E and F respectively. These directions are indicative of an overall movement of the lifting wire and the umbilical, and as a consequence an overall movement of the second pulley mechanism 140 and the housing 110 attached thereto, in the direction of gravity as shown by arrow G.

[0035] The second pulley mechanism 140 may be configured to cooperate with the first pulley mechanism 130 in a back-to-back arrangement.

[0036] Figure 4 illustrates an exemplary schematic representation of the third pulley mechanism 140. Here also, similar to the illustration in figures 2 and 3, only the elements that are relevant for understanding the disclosure are shown.

[0037] As shown in figure 4, the third pulley mechanism 150 comprises a fifth pulley 151 with a structure and operational characteristics similar to those of first, second, third and fourth pulleys of figures 2 and 3. Therefore a detailed description of the similar features is considered not necessary.

[0038] The third pulley mechanism 150 is configured to receive the lifting wire 160 in the direction of arrow E (in conformity with the same arrow E as shown in figure 3). After running around a part of the circumference of the recess 155, the lifting wire exits the third pulley mechanism 140 in the direction of arrows H. These directions are indicative of an overall movement of the third pulley mechanism 150 and the housing 110 attached thereto in the direction of gravity as shown by arrow G.

[0039] As it can be appreciated, with the above described arrangements of the first, second and third pulley mechanisms, the first pulley cooperates with the third pulley and the third pulley cooperates with the fifth pulley to collectively form a path for supporting the lifting wire.

[0040] Likewise, second pulley cooperates with the fourth pulley to collectively form a second path for supporting the umbilical.

[0041] As it can be appreciated from the figures 2, 3 and 4 the first path and the second path are separate from each other. This separation ensures that the possibility of entanglement between the two cables is eliminated or reduced.

[0042] Referring now back to figures 1 a and 1b, the first pulley mechanism 130 is attached to the support structure 120 such that it does not move relative to the latter and is configured to support the movement of the lifting wire 160 and the umbilical 170.

[0043] The lifting wire 160 may enter into the first pulley mechanism 130 and after winding over a partial circumference of the first pulley 131 of the first pulley mechanism 130 enter into the second pulley mechanism 140 and after winding over a partial circumference of the third pulley 141 of the second pulley mechanism 140 exit the latter. This path is shown in figure 1b by means of a broken line L1 in the first and the second pulley mechanisms 130 and 140. Likewise, the umbilical 170 may enter into the first pulley mechanism 130 and after winding over a partial circumference of the second pulley 132 of the first pulley mechanism 130 enter into the second pulley mechanism 140 and after winding over a partial circumference of the fourth pulley 142 of the second pulley mechanism 140 exit the latter. The broken line L1 in the first and the second pulley mechanisms 130 and 140 may also be considered as illustratively showing the path of the umbilical.

[0044] After exiting the second pulley mechanism 140, the lifting wire 160 travels along the length of the housing toward the third pulley mechanism 150. Preferably in the path between the second pulley mechanism 140 and the third pulley mechanism 150, the lifting wire 160 passes through the interior of the transversal beam 111. Upon reaching the third pulley mechanism 150, the lifting wire winds over a partial circumference of the fifth pulley 151 of the third pulley mechanism 140 and next exits the lat-

ter. This path is shown in figure 1b by means of a broken line L2 in the third pulley mechanism 150. The lifting wire 160 is then fastened at a fixed point 122 to the support structure 120.

[0045] After exiting the second pulley mechanism 140, the umbilical 170 is extended toward a predetermined location where it is made available for providing connection between control center and the ROV. This location may be determined according to the particular design requirements. In the example of figure 1b, this location is shown by reference numeral 112.

[0046] As previously mentioned, the second pulley mechanism 140 and the third pulley mechanism 150 are attached to the housing 110. However, they are moveable relative to the support structure 120. For example during a descent operation, the second and third pulley mechanisms 140 and 150 move away from the support structure 120 towards the water. As the housing moves toward the water, the lifting wire and the umbilical are fed into the first pulley mechanism 130, thereby facilitating such descending movement. Likewise, during a lifting operation, the second and third pulley mechanisms 140 and 150 move toward the support structure 120 and away from the water. As the housing moves toward the support structure 120, the lifting wire and the umbilical are pulled out of the first pulley mechanism 130, thereby facilitating such lifting movement.

[0047] Although the use of two separate, first and second, pulley mechanisms reduces, as described above, the possibility of entanglement between the two cables during operation, the LARS as proposed herein provides an additional safety measure to ensure that the possibility of entanglements or other conflicts between the lifting wire and the umbilical is reduced still further. Such additional safety measure is described with reference to figure 5.

[0048] Figure 5 is an exemplary schematic representation of the second pulley mechanism 140 with an additional safety measure generally represented by reference numeral 190. The second pulley mechanism 140 of figure 5 is identical to the second pulley mechanism of figure 3 where like elements have been provided with like reference numerals.

[0049] However in the scenario of figure 5, during a descent operation as shown by arrow G, a plurality of clips 191 (191 a, 191b, 191c) may be hooked on the two cables (the lifting wire and the umbilical) before they enter inside the corresponding third and the fourth pulleys 141 and 142, such that after hooking, each clip encloses both the width of the lifting wire 160 and the width of the umbilical 170 in its interior as represented in the figure. The clips 191 may engage to the lifting wire 160 and the umbilical 170 in any known manner. For example the clips 191 may have snap-hook configuration using a spring that allows a portion of the body of the clip to open and thereby allow the entry of the lifting wire and the umbilical in the clip and thereafter close to prevent the exit of the lifting wire and the umbilical from the interior of the clip.

[0050] The term clip as used herein is to be understood broadly and may comprise any device capable of performing an enclosure around the lifting wire and the umbilical as described above, including but not limited to hooks or harnesses. The clips may be hooked to the lifting wire 160 and the umbilical 170 in a successive manner. Figure 5 illustrates three clips 191 a, 191b, 191c being successively hooked to the lifting wire and the umbilical. The number of the clips to be hooked may vary case by case. The successive attachment of the clips may be performed in regular length intervals. For example after every certain length of the lifting wire and the umbilical which are fed to the first pulley mechanism to descend the housing (and the ROV), a clip may be hooked to the two cables and this is repeated successively as descending continues. Alternatively the succession of attachments of the clips may be performed irregularly and under other criteria according to each specific use.

[0051] During the lifting operation of the housing (and the ROV), the lifting wire 160 and the umbilical 170 respectively move in the directions opposite to the arrow G. As the lifting wire and the umbilical are recovered, the clips 191 may be removed, also successively to thereby allow the storage of the lifting wire and the umbilical e.g. in corresponding storage reels.

[0052] The clips may be interconnected by rope segments 192 (192a, 192b, 192c). This is done by fastening one end of a segment of a rope 192 to one clip, e.g. 192a, and fastening an opposite end of the rope segment to the next (successive) clip, e.g. 192b, as shown in the figure. The plurality of rope segments 192 in combination provide an overall length of rope which may be as long as the depth in which the housing is intended to be submerged, for example about 500 meters.

[0053] The rope segments 192a, 192b, 192c may have equal lengths, or they may differ in length depending on design requirements.

[0054] A further segment of rope 193 is fastened at one end to the first clip 191 a, i.e. the clip which is closest to the second pulley mechanism 130, and at an opposite end is fastened to a fixed point P located on the casing of the second pulley mechanism 140 which is illustratively shown by reference numeral 149.

[0055] With this arrangement, as the descending operation starts, the second pulley mechanism 140 moves away from the first pulley mechanism 130 (which is stationary and attached to the support structure 120) in the direction of arrow G. At this stage a first clip 191a may be engaged. With the descent of the second pulley mechanism 140, the rope 193 which is fixedly fastened at one end to the casing 149 of the second pulley mechanism tenses and thereby requires the first clip 191a to move along with the lifting wire 160 and umbilical 170 as they descend. At this stage a second clip 191b is engaged. Similarly, as the descent continues the first rope segment 192a tenses and requires the second clip 191 b to move along with the lifting wire 160 and umbilical 170 as they descend. This operation is repeated by engaging the third

191c, and successive clips, during the descending operation.

[0056] The use of rope segments 192 allows for keeping the clips at desired distances from each other and thereby prevents jamming of the clips at one or more points along their lengths, both in descend and lifting operations.

[0057] In the lifting operation, as the lifting wire and the umbilical are pulled out of the water, the rope segments are also pulled up and the clips 191 are successively removed.

[0058] The LARS as proposed herein may be embodied in a variety of manners within the scope of the present disclosure.

[0059] For example the LARS may comprise container with an integrated telescopic arm which can be placed on the side of a vessel. The telescopic arm may then operate as the support structure 120 described with reference to figures 1a and 1b. The containerized LARS may contain all of the instrumentation required to operate the ROV together with space for the ROV pilot, the housing, the ROV itself and a telescopic or horizontal crane arm. Figure 6 is an example of a containerized LARS 200 comprising a container 210 attached to a telescopic arm 220. As can be appreciated, the container provides an interior space 211 sufficient to house the instrumentation required, for example as represented by reference numeral 212, for a complete operation cycle of the LARS as well as the LARS and the ROV. This design enables the LARS to be moved between different installation vessels and is autonomous in launch, recovery and operations.

[0060] Alternatively the LARS may be attached to an A-frame or a crane in a vessel. The A-frame is a known piece of equipment on board cable laying vessels, normally used for deploying a seabed cable plough.

[0061] Although the embodiments provided herein are related to a submerging the housing and the ROV in water, the disclosure is not so limited and the LARS as proposed herein may likewise be used in terrestrial applications.

[0062] It should be appreciated by those skilled in the art that any block diagrams herein represent conceptual views of illustrative circuitry embodying the principles of the disclosure.

Claims

1. An apparatus comprising:

- a housing adapted to contain a remotely operated vehicle;
- a support structure;
- a first pulley mechanism attached to the support structure and comprising first and second pulleys;
- a second pulley mechanism attached to the housing and moveable relative to the support structure and comprising third and fourth pulleys; and
- a third pulley mechanism directly attached to the housing and moveable relative to the support structure and comprising a fifth pulley;

wherein, the first pulley is configured to cooperate with the third pulley and the third pulley is configured to cooperate with the fifth pulley to collectively form a first path for supporting a first cable; and the second pulley is configured to cooperate with the fourth pulley to collectively form a second path for supporting a second cable; and
wherein the first path and the second path are separate from each other.

2. The apparatus of claim 1, wherein the first cable is a wire configured for descending and lifting the housing.

3. The apparatus of any one of the previous claims, wherein the second cable is configured for allowing transmission of command signals between a control station and the remotely operated vehicle.

4. The apparatus of any one of the previous claims, wherein the third pulley mechanism is attached to the second pulley mechanism through a transversal beam comprised in the housing, the transversal beam being configured to allow for passage of the first cable from the second pulley mechanism to the third pulley mechanism.

5. The apparatus of any one of the previous claims, wherein the first cable is wound over a partial circumference of the first pulley, a partial circumference of the third pulley and a partial circumference of the fifth pulley and is attached at one end to the support structure.

6. The apparatus of any one of the previous claims, wherein the second cable is wound over a partial circumference of the second pulley, a partial circumference of the fourth pulley and is attached at one end to the remotely operated vehicle.

7. The apparatus of any one of the previous claims, further comprising a plurality of clips wherein each clip is configured to be hooked on the first cable and the second cable such that it encloses the respective width of the first cable and the second cable.

8. The apparatus of claim 7, wherein the clip has snap-hook configuration.

9. The apparatus of any one of the previous claims 7 or 8, wherein a segment of rope is fastened at one

end to a first clip and is fastened at an opposite end to a second clip.

10. The apparatus of claim 9, wherein a segment of rope is fastened at one end to a casing of the second pulley mechanism and is fastened at an opposite to a clip closest to the second pulley mechanism.

11. The apparatus of any one of the previous claims, wherein the apparatus further comprises a container and wherein the support structure is a telescopic.

12. The apparatus of any one of the previous claims, wherein the apparatus is configured for launching and recovering a remotely operated vehicle.

13. The apparatus of any one of the previous claims, wherein the apparatus is configured for submersion in water.

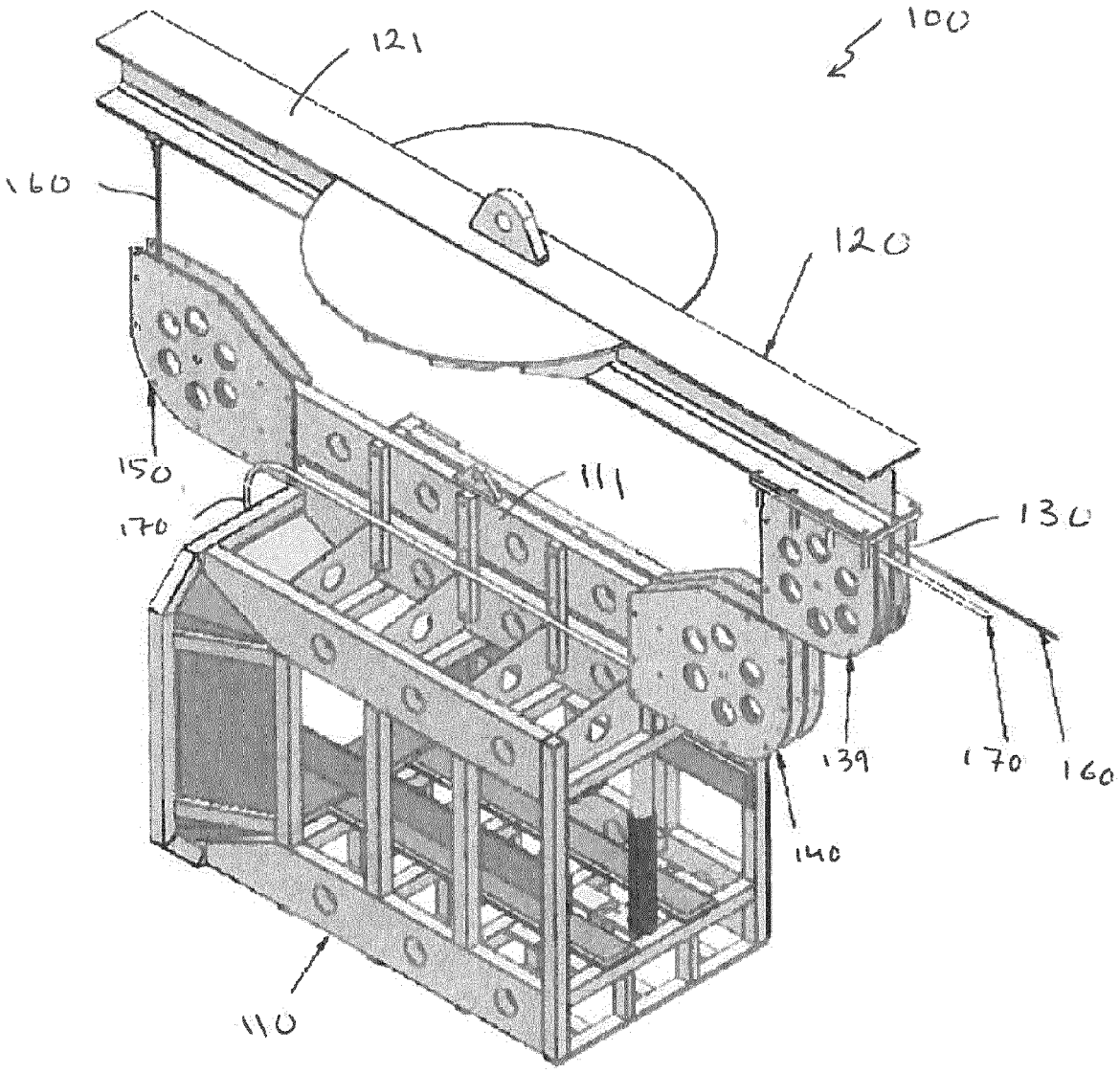

FIG._1a

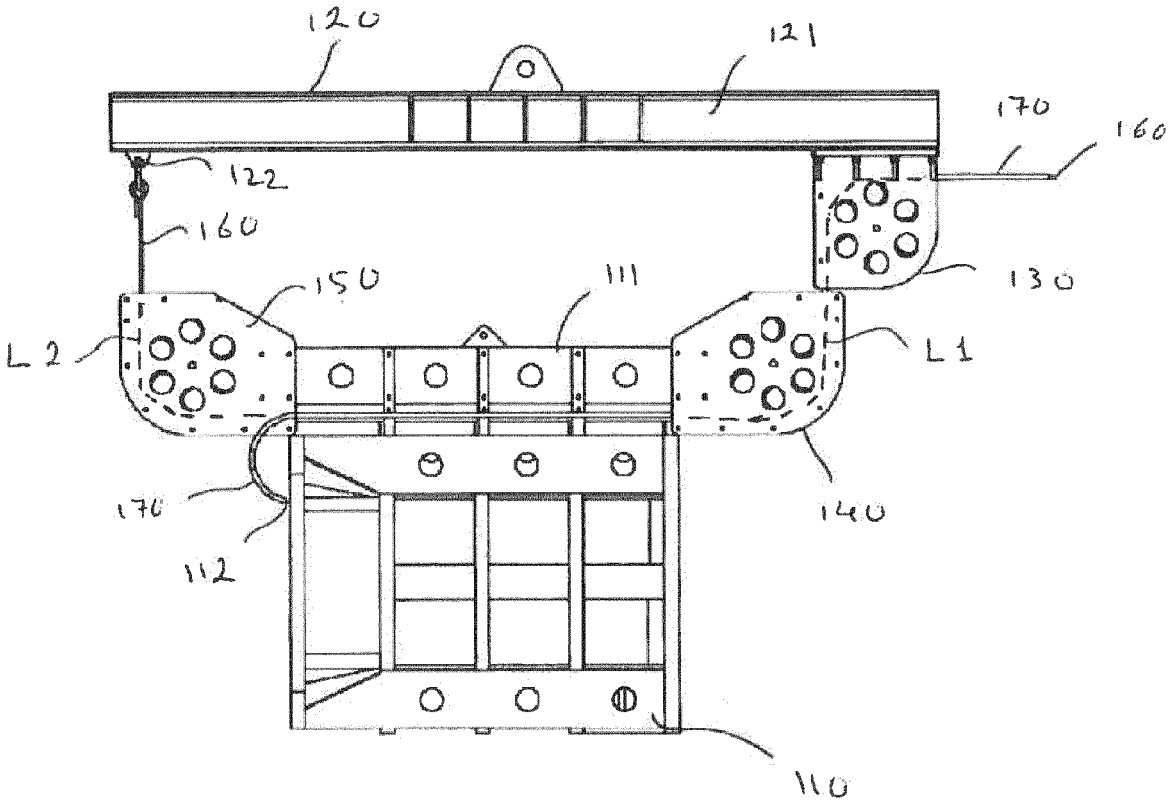

FIG._1b

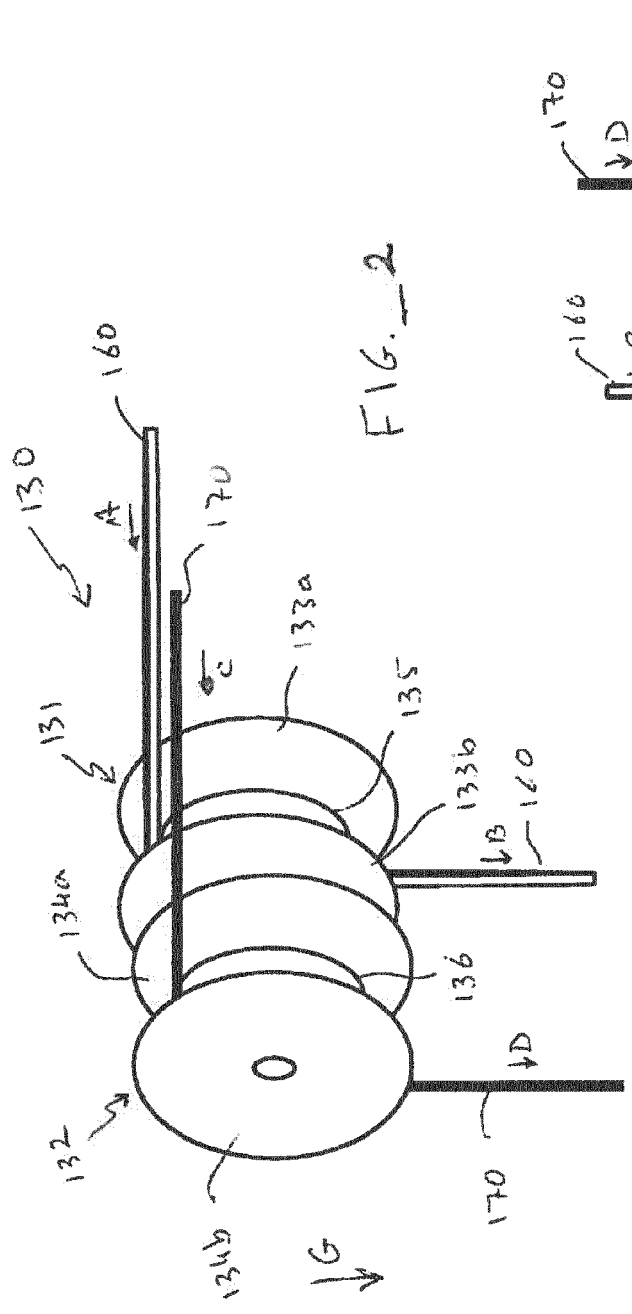

FIG._2

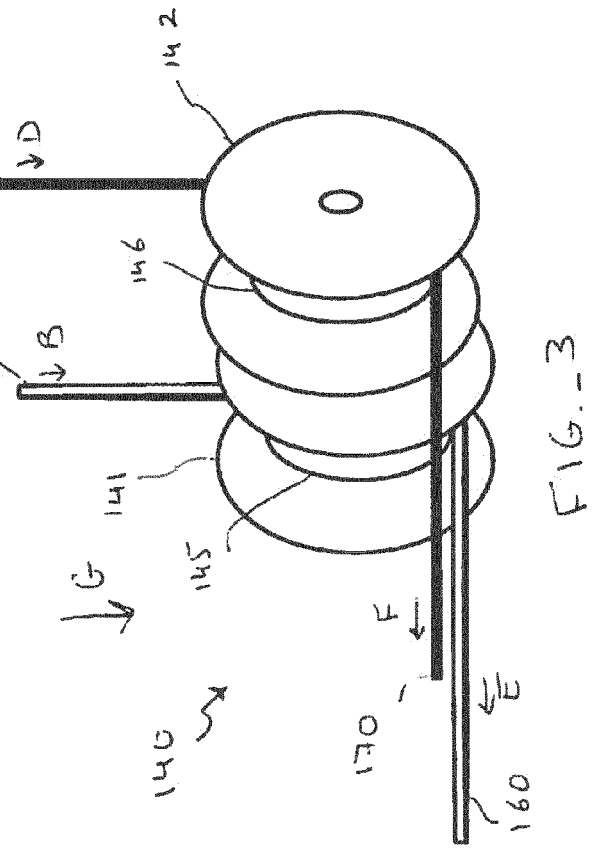

FIG._3

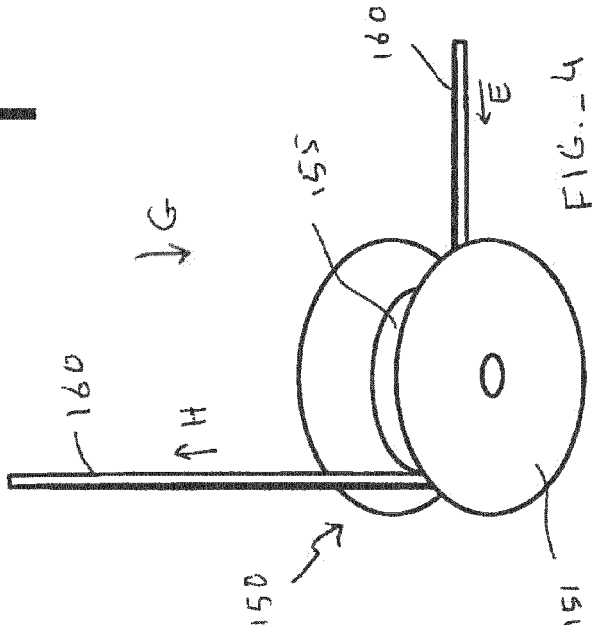

FIG._4

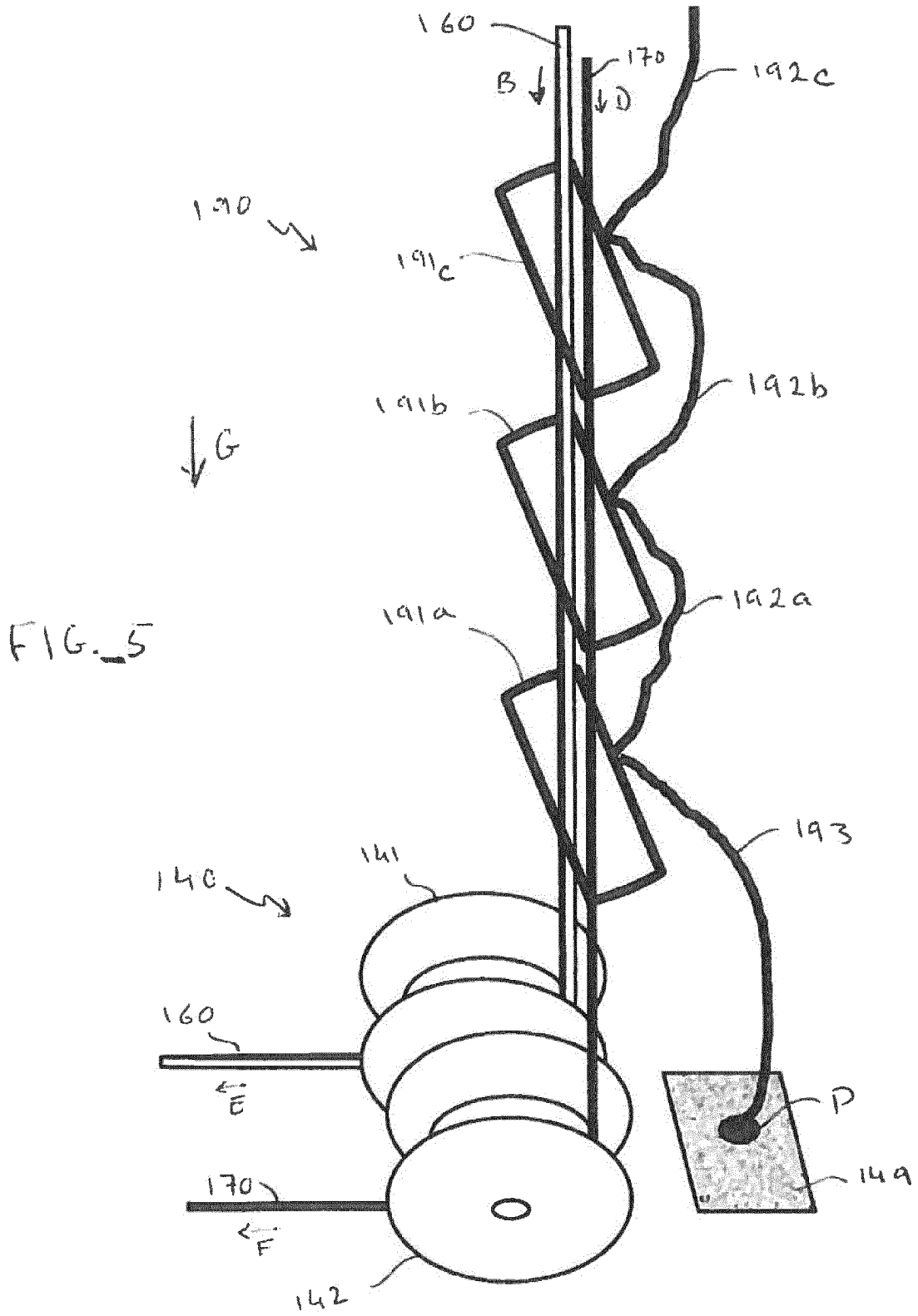
160
170
B
D
192c
190
191c
192b
191b
G
191a
192a
193
141
140
160
E
170
F
142
P
149

FIG. 5

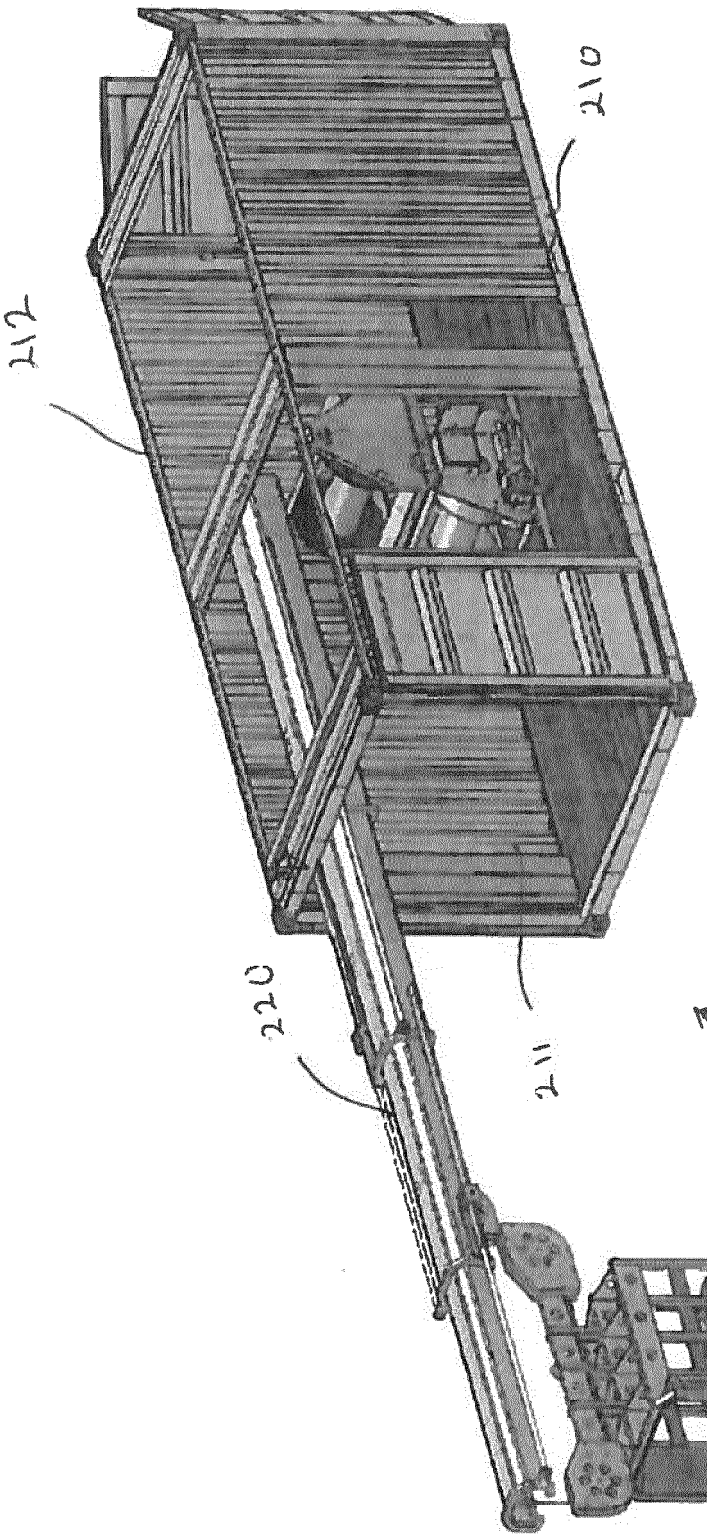

FIG. 6

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 14 30 5327

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 5 253 605 A (COLLINS KENNETH D [US]) 19 October 1993 (1993-10-19) * the whole document *	1-6, 11-13	INV. B63B21/66
A	DE 10 2009 019556 A1 (ATLAS ELEKTRONIK GMBH [DE]) 4 November 2010 (2010-11-04) * the whole document *	1-6, 11-13	
A	EP 2 019 034 A1 (SAAB AB [SE]) 28 January 2009 (2009-01-28) * paragraph [0011]; figures 1-4b *	1	
A	FR 2 783 494 A1 (THOMSON MARCONI SONAR SAS [FR]) 24 March 2000 (2000-03-24) * the whole document *	1	
A	WO 2013/178792 A1 (THALES SA [FR]) 5 December 2013 (2013-12-05) * the whole document *	1	

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	2 September 2014	De Sena Hernandorena

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 30 5327

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.

02-09-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5253605 A	19-10-1993	NONE	
DE 102009019556 A1	04-11-2010	DE 102009019556 A1	04-11-2010
		EP 2425200 A1	07-03-2012
		KR 20120014189 A	16-02-2012
		SG 175231 A1	28-11-2011
		US 2013011196 A1	10-01-2013
		WO 2010124990 A1	04-11-2010
EP 2019034 A1	28-01-2009	EP 2019034 A1	28-01-2009
		US 2010212572 A1	26-08-2010
		WO 2009013288 A1	29-01-2009
FR 2783494 A1	24-03-2000	DE 19940396 A1	11-05-2000
		FR 2783494 A1	24-03-2000
WO 2013178792 A1	05-12-2013	FR 2991284 A1	06-12-2013
		WO 2013178792 A1	05-12-2013

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82